3.7 GEOLOGY AND SOILS

This section contains an analysis of impacts related to geology and soils. The analysis describes seismic hazards, soil conditions, and other geotechnical considerations that could affect people and structures. Paleontological resources are discussed in Section 3.1.8, "Paleontological Resources."

3.7.1 ENVIRONMENTAL SETTING

GEOLOGY

Regional Geology

The project area is within the Coast Range geomorphic province. This province is generally characterized by northwest-trending mountain ranges and intervening valleys that are controlled by right-lateral strike-slip faulting along the San Andreas Fault zone.

During the Cretaceous period of the Mesozoic era (approximately 65–144 million years ago), sequences of lava flows, sand, mud, and siliceous ooze (a fine-grained deposit consisting primarily of the remains of microscopic organisms called radiolarians and diatoms) were deposited on the ocean floor on the Farallon Plate, west of what then was the coast of California. At the same time, sand, mud, and gravel accumulated on the North American Plate, in a trench along the area that was then California's coast (but is now the Central Valley). Movement of the two plates along a convergent boundary caused the Farallon Plate to be dragged beneath (subducted) the North American Plate. As this occurred, the materials that made up the Farallon Plate were jumbled together and crushed, and eventually lithified to form the rocks that make up the Franciscan Formation. Materials along the edge of the Pacific Plate at the subduction zone were scraped off and became lithified to form the rocks that make up the Great Valley sequence. In addition to the Farallon Plate, portions of other crustal plates continued to move past what then was the coast of California. When these plates collided with the coast, portions of them were accreted (became attached to) the edge of the continent.

Scientists have divided the rocks in the Franciscan Formation into at least nine different terranes, each thought to represent a different plate that collided with the edge of the continent. Because of their origins from different plates, the rocks within these terranes have a different composition. The period of accretion of the entire Franciscan Formation spans a period of approximately 150 million years—from early Cretaceous to Eocene time.

The geology of the Coast Ranges is heavily influenced by the San Andreas Fault zone and the Cascadia subduction zone. Approximately 28 million years ago, the convergent plate boundary (where the Farallon Plate was subducted underneath the North American Plate) along the California coast changed to become the right-lateral San Andreas transform boundary (meaning that the plates now were sliding past one another). As the Farallon Plate became subducted, more of the Pacific Plate came into contact with the North American Plate along this transform boundary. The transform boundary, expressed as the San Andreas Fault, moved northward over time and now extends from Cape Mendocino to the Gulf of California.

Near Cape Mendocino, a third plate (the Gorda Plate) is being subducted beneath the North American Plate along the Cascadia subduction zone. The area where these three plates meet is known as the Mendocino Triple Junction. As the plates move past one another, strain develops along the boundary between the plates. This strain results in an energy buildup, which is eventually released in the form of an earthquake. The region surrounding the Mendocino Triple Junction is one of the most seismically active portions of California.

Local Geology

Franciscan rocks in the north and central Coast Ranges generally have been divided into three belts: the Coastal, Central, and Eastern Belts. The project area is in the Coastal Belt. In this belt, the Cretaceous-age Franciscan rocks generally are composed of graywacke sandstone, and micaceous shale and the rock sequences are not as disrupted as they are in other parts of the Franciscan Formation, although they still are highly metamorphosed and deformed. Late Cretaceous to lower Tertiary-age Yager Formation rocks directly overlie the Franciscan rocks to the north. The Yager Formation is dominated by a composition of marine shales and minor sandstone.

In the project vicinity, the Franciscan Formation is composed primarily of marine graywacke sandstone that is dark grey, very hard, brittle, much fractured, and with minor shale interbeds and calcite veins (Dibblee and Minch 2008). The generation area, transmission routes, and the majority of the haul routes generally consist of deeply incised valleys and steep hillsides. The ridges and hillsides where project facilities would be located generally consist of the Franciscan Formation. The operations and maintenance (O&M) facility would sit atop the Yager Formation and Pleistocene alluvium, in addition to the Franciscan Formation.

In the valleys, Holocene-age sediments are present and consist of recent alluvium and river terrace deposits derived from the weathering of the surrounding ridges. Figure 3.7-1 shows the geologic formations associated with the project.

REGIONAL SEISMICITY AND FAULT ZONES

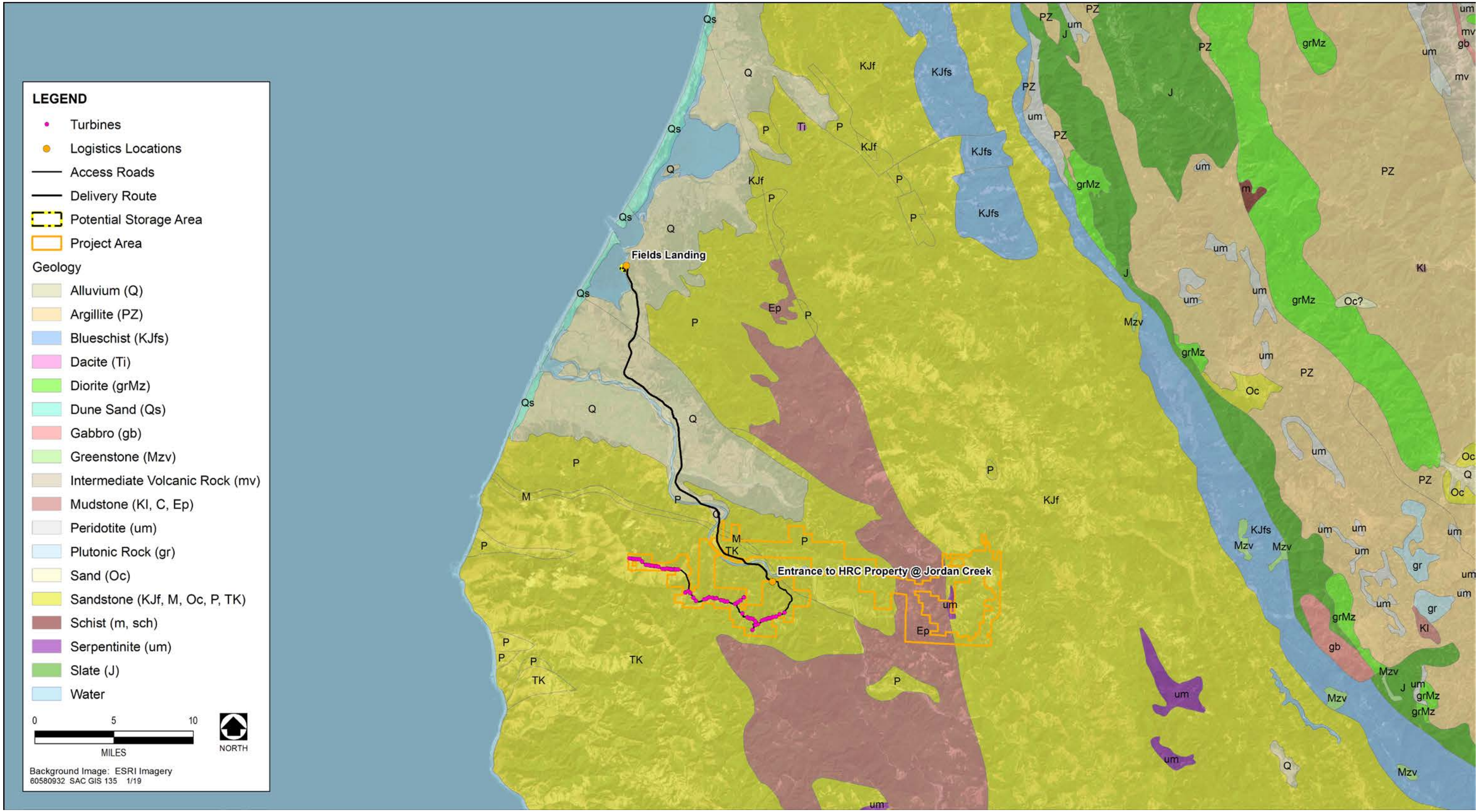
Potential seismic hazards resulting from a nearby moderate to major earthquake generally can be classified as primary and secondary. The primary effect is fault ground rupture, also called surface faulting. Common secondary seismic hazards include ground shaking, liquefaction, and subsidence. Each of these potential hazards is discussed below.

Surface Fault Rupture

Surface rupture is an actual cracking or breaking of the ground along a fault during an earthquake. Structures built over an active fault can be torn apart if the ground ruptures. Surface ground rupture along faults is generally limited to a linear zone that is a few yards wide. The Alquist-Priolo Earthquake Fault Zoning Act (Alquist-Priolo Act) (see Section 3.7.2, “Regulatory Setting”) was created to prohibit the location of structures designed for human occupancy across the traces of active faults, thereby reducing the loss of life and property from an earthquake. The nearest known active fault that is zoned under the Alquist-Priolo Act is the Hydesville Fault (and Little Salmon Fault Traces), approximately 8 miles north of the project site where the turbines would be constructed (per the Hydesville U.S. Geological Survey [USGS] quadrangle maps) (CGS 2018; DOC 2018), as shown in Figure 3.7-2.

Seismic Ground Shaking

Ground shaking, motion that occurs from energy released during faulting, has the potential to result in the damage or collapse of buildings and other structures, depending on the magnitude of the earthquake, the location of the epicenter, and the character and duration of the ground motion. Other important factors to be considered are the.



Sources: Data from the California Geological Survey, Humboldt County, Stantec, and U.S. Geological Survey

Figure 3.7-1. Geologic Map

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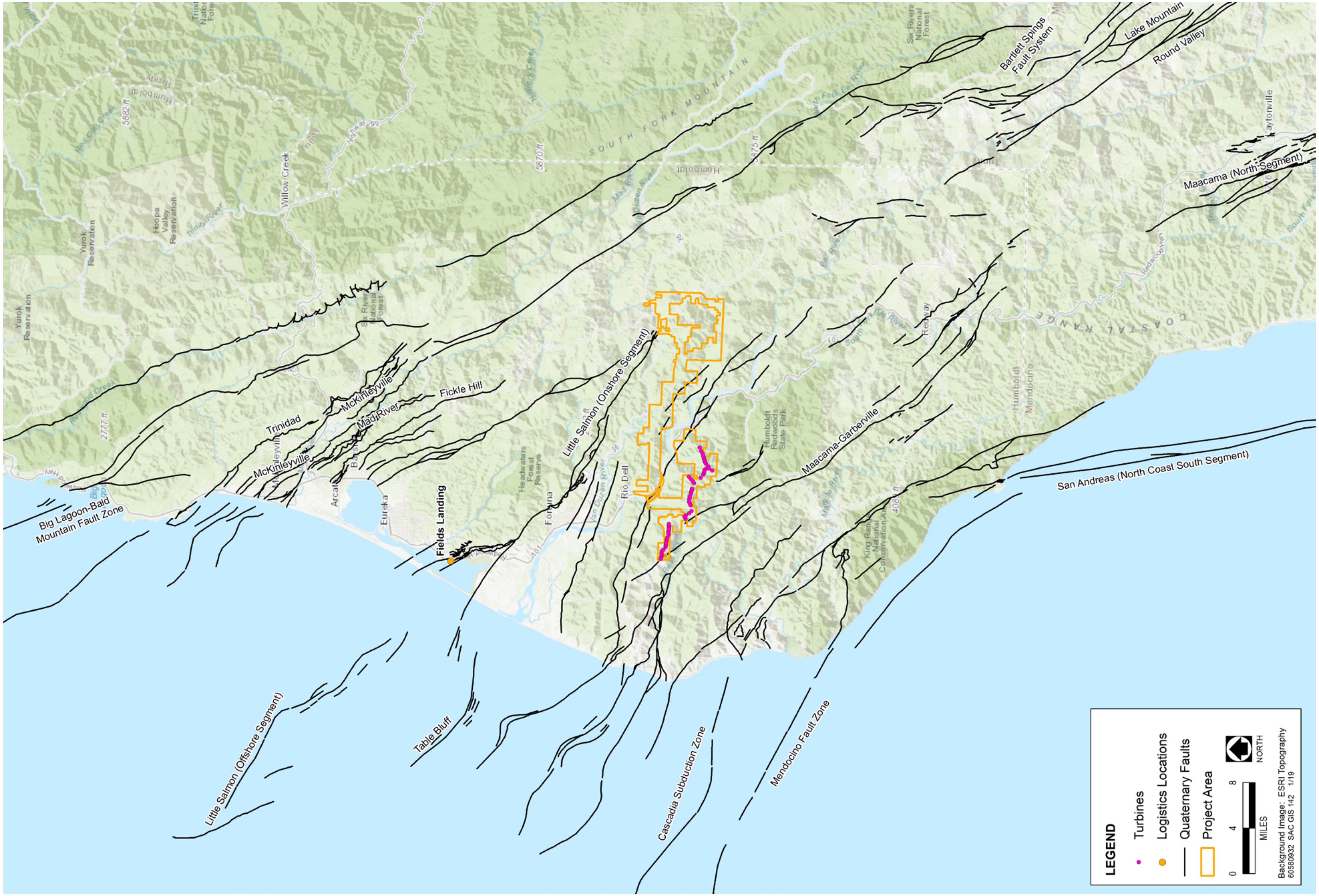

Sources: Data from the California Geological Survey, Humboldt County, Stantec, and U.S. Geological Survey

Figure 3.7-2. Geologic Fault Map

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characteristics of the underlying soil and rock and, where structures exist, the building materials used, and the workmanship of the structures

As described above under “Regional Geology,” the project components would be located in a seismically active region. Along the surface of the Cascadia subduction zone, an area of compression occurs where rocks and sediments are being squeezed as the earth’s crust is deformed. This deformation results in a belt of faults and folds along which earthquakes may occur. Although most of the Cascadia subduction zone is located off the coast of California, a portion of the folds and faults that occur along this belt run onshore into southern Humboldt County, west of the project area. Geologists believe that the Cascadia subduction zone may be capable of producing a large-magnitude earthquake (i.e., maximum moment magnitude 8 or 9) every 300–400 years. Geologic evidence indicates that the last large-magnitude earthquake in the region (approximate moment magnitude 9) occurred in January 1700, along the entire length of the Cascadia subduction zone. Therefore, assuming a 300- to 400-year occurrence level, the region could be subject to a large and potentially destructive earthquake in this century (Mendocino Triple Junction PBO Working Group 2000).

Since the 1870s, more than 15 earthquakes with a magnitude of 6.0 or greater have occurred in the region, including a magnitude 7.2 earthquake in 1923. In 1992, a series of three earthquakes with magnitudes 7.2, 6.5, and 6.7 (USGS 2009) occurred offshore at the southern end of the Cascadia subduction zone. These earthquakes had Modified Mercalli Intensity Scale intensities of VIII and caused substantial damage to older buildings and structures in Ferndale, Petrolia, Fortuna, Rio Dell, and Scotia. In January and February 2010, earthquakes with respective magnitudes of 6.5 and 5.9 occurred approximately 20–40 miles west of the site of the proposed generation facilities (Berkeley Seismological Laboratory 2010; USGS 2011). These two earthquakes resulted in Modified Mercalli Intensity scale intensities of IV in Ferndale, Fortuna, Scotia, and Rio Dell.

The Modified Mercalli Intensity Scale (shown in Table 3.7-1) is a commonly used qualitative measurement of earthquake intensity and is intended to describe the effects of earthquakes on objects and people at the earth’s surface.

A number of the faults in the project vicinity are classified by the California Geological Survey as active (i.e., showing evidence of movement within the last 11,000 years). Table 3.7-2 shows active faults in the region that may pose a potential geologic hazard to project components. Figure 3.7-2 shows the locations of active faults in the project region, along with the Cascadia subduction zone and the Mendocino Triple Junction.

The intensity of ground shaking depends on the distance from the earthquake epicenter to a particular site, the magnitude of the earthquake, site soil conditions, and the characteristics of the source.

Liquefaction

Soil liquefaction occurs when ground shaking from an earthquake causes a sediment layer that is saturated with groundwater to lose strength and take on the characteristics of a fluid, thus becoming similar to quicksand. Factors determining the liquefaction potential are soil type, the level and duration of seismic ground motions, the type and consistency of soils, and the depth to groundwater. Loose sands and peat deposits are susceptible to liquefaction, whereas clayey silts, silty clays, and clays deposited in freshwater environments generally are stable under the influence of seismic ground shaking. Liquefaction poses a hazard to engineered structures. The loss of soil strength can result in bearing capacity insufficient to support foundation loads, increased lateral pressure on retaining or basement walls, and slope instability.

Table 3.7-1. Modified Mercalli Intensity Scale

Intensity	Effect
I	Not felt. Marginal and long period effects of large earthquakes.
II	Felt by persons at rest, on upper floors, or favorably placed.
III	Felt indoors. Hanging objects swing. Vibration like passing of light trucks. Duration estimated. May not be recognized as an earthquake.
IV	Hanging objects swing. Vibration like passing of heavy trucks; or sensation of a jolt like a heavy ball striking the walls. Standing motor cars rock. Windows, dishes, doors rattle. Glasses clink. Crockery clashes. In the upper range of IV, wooden walls and frame creak.
V	Felt outdoors; direction estimated. Sleepers wakened. Liquids disturbed, some spilled. Small unstable objects displaced or upset. Doors swing, close, open. Shutters, pictures move. Pendulum clocks stop, start, change rate.
VI	Felt by all. Many frightened and run outdoors. Persons walk unsteadily. Windows, dishes, glassware broken. Knickknacks, books, etc., off shelves. Pictures off walls. Furniture moved or overturned. Weak plaster and masonry D cracked. Small bells ring (church, school). Trees, bushes shaken (visibly, or heard to rustle).
VII	Difficult to stand. Noticed by drivers of motor cars. Hanging objects quiver. Furniture broken. Damage to masonry D, including cracks. Weak chimneys broken at roof line. Fall of plaster, loose bricks, stones, tiles, cornices (also unbraced parapets and architectural ornaments). Some cracks in masonry C. Waves on ponds; water turbid with mud. Small slides and caving in along sand or gravel banks. Large bells ring. Concrete irrigation ditches damaged.
VIII	Steering of motor cars affected. Damage to masonry C; partial collapse. Some damage to masonry B; none to masonry A. Fall of stucco and some masonry walls. Twisting, fall of chimneys, factory stacks, monuments, towers, elevated tanks. Frame houses moved on foundations if not bolted down; loose panel walls thrown out. Decayed piling broken off. Branches broken from trees. Changes in flow or temperature of springs and wells. Cracks in wet ground and on steep slopes.
IX	General panic. Masonry D destroyed; masonry C heavily damaged, sometimes with complete collapse; masonry B seriously damaged. (General damage to foundations.) Frame structures, if not bolted, shifted off foundations. Frames racked. Serious damage to reservoirs. Underground pipes broken. Conspicuous cracks in ground. In alluvial areas sand and mud ejected, earthquake fountains, sand craters.
X	Most masonry and frame structures destroyed with their foundations. Some well-built wooden structures and bridges destroyed. Serious damage to dams, dikes, embankments. Large landslides. Water thrown on banks of canals, rivers, lakes, etc. Sand and mud shifted horizontally on beaches and flat land. Rails bent slightly.
XI	Rails bent greatly. Underground pipelines completely out of service.
XII	Damage nearly total. Large rock masses displaced. Lines of sight and level distorted. Objects thrown into the air.

Notes:
Masonry A: Good workmanship, mortar, and design; reinforced, especially laterally, and bound together by using steel, concrete, etc., designed to resist lateral forces.
Masonry B: Good workmanship and mortar; reinforced, but not designed in detail to resist lateral forces.
Masonry C: Ordinary workmanship and mortar; no extreme weaknesses like failing to tie in at corners, but neither reinforced nor designed against horizontal forces.
Masonry D: Weak materials, such as adobe; poor mortar; low standards of workmanship; weak horizontally.
Source: Richter 1958, cited in Association of Bay Area Governments 2010

Table 3.7-2. Active Faults in the Project Region

Fault	Approximate Distance from the Proposed Generation Facilities (miles)	Maximum Moment Magnitude[1]	Slip Rate (mm/yr)[2]
Maacama-Garberville	3.7	7.4	N/A
Little Salmon (onshore segment)	4.7	7	>5
Cascadia Subduction Zone	12	8.3	>5
Table Bluff	12.9	7.1	N/A
Mendocino Fault Zone	16.9	7.6	>5
Fickle Hill	18.1	7	>5
San Andreas–1906 Segment	18.6	8	>5
Little Salmon (offshore segment)	23.2	7.2	N/A
Mad River	23.5	7.1	>5
McKinleyville	25.2	7.2	>5
Big Lagoon–Bald Mountain Fault Zone	26.2	7.5	1–5
Trinidad	28.2	7.5	>5
Lake Mountain	30.8	6.7	1–5
Bartlett Springs Fault System	31.6	7.2	1–5
San Andreas (North Coast south segment)	38.6	8	>5
Maacama (north segment)	51.5	7.4	>5
Round Valley	53.3	7	1–5
Cascadia (Segment A11)	110.5	9	1–5

Notes: > = greater than; mm/yr = millimeters per year; N/A = not available

1. The moment magnitude scale is used by seismologists to compare the energy released by earthquakes. Unlike other magnitude scales, it does not saturate at the upper end, meaning no particular value exists beyond which all earthquakes have about the same magnitude, which makes it a particularly valuable tool for assessing large earthquakes.
   (Source: Data derived from the California Department of Transportation Fault Database 2012)
2. The projected “slip rate” is the speed with which one side of the fault moves with respect to the other. For planning purposes, the slip rate can be used as an indicator of the likelihood that a large-magnitude earthquake will occur.

Source: Data compiled by AECOM in 2019 from U.S. Geological Survey Quaternary Fault and Fold Database of the United States

Subsidence

Subsidence of the land surface can be induced by both natural and human phenomena. Natural phenomena that can cause subsidence can result from seismic activity; consolidation, hydrocompaction, or rapid sedimentation; oxidation or dewatering of organic-rich soils; and subsurface cavities. Subsidence related to human activity can result from withdrawal of subsurface fluids (e.g., groundwater pumping). The potential for failure from subsidence is highest in areas where the groundwater table is high, where relatively soft and recent alluvial deposits exist, and where creek banks are relatively high. “Soil bearing capacity” refers to the ability of soil to support the loads applied to the ground. Where the bearing capacity is too low to support proposed structures, subsidence and settlement may occur.

SLOPE STABILITY

A landslide is the downhill movement of masses of earth material under the force of gravity. The factors contributing to landslide potential are steep slopes, unstable terrain, and proximity to earthquake faults. This process typically involves the surface soil and an upper portion of the underlying bedrock. Movement may be very rapid, or so slow that a change of position can be noted only over a period of weeks or years (creep). The size of a landslide can range from several square feet to several square miles. In addition to landslides, debris flows and rock fall also can result in damage to roads and vehicular traffic.

Areas of unstable slopes are located in the project vicinity, and are composed primarily of mélange materials of the Franciscan formation that break down into clay, which tends to slip when wet. The greatest risk from landslides is in areas where the slope would exceed 33 percent. A review of the study corridor indicates that the topography is rugged, with the majority of the land sloping at 30 percent or more (Figure 3.7-3).

In addition, project-related access roads could be constructed across drainages with alluvial material. These drainages are subject to flash flooding with associated debris flow during heavy rainfall events.

Furthermore, a few areas are in the vicinity of the proposed haul routes where rock outcrops or boulders occur on the ground surface, which could represent a hazard to vehicular traffic. Rock falls are most likely to occur during strong earthquakes or during large storms that may loosen boulders on steep slopes that exceed a gradient of 50 percent.

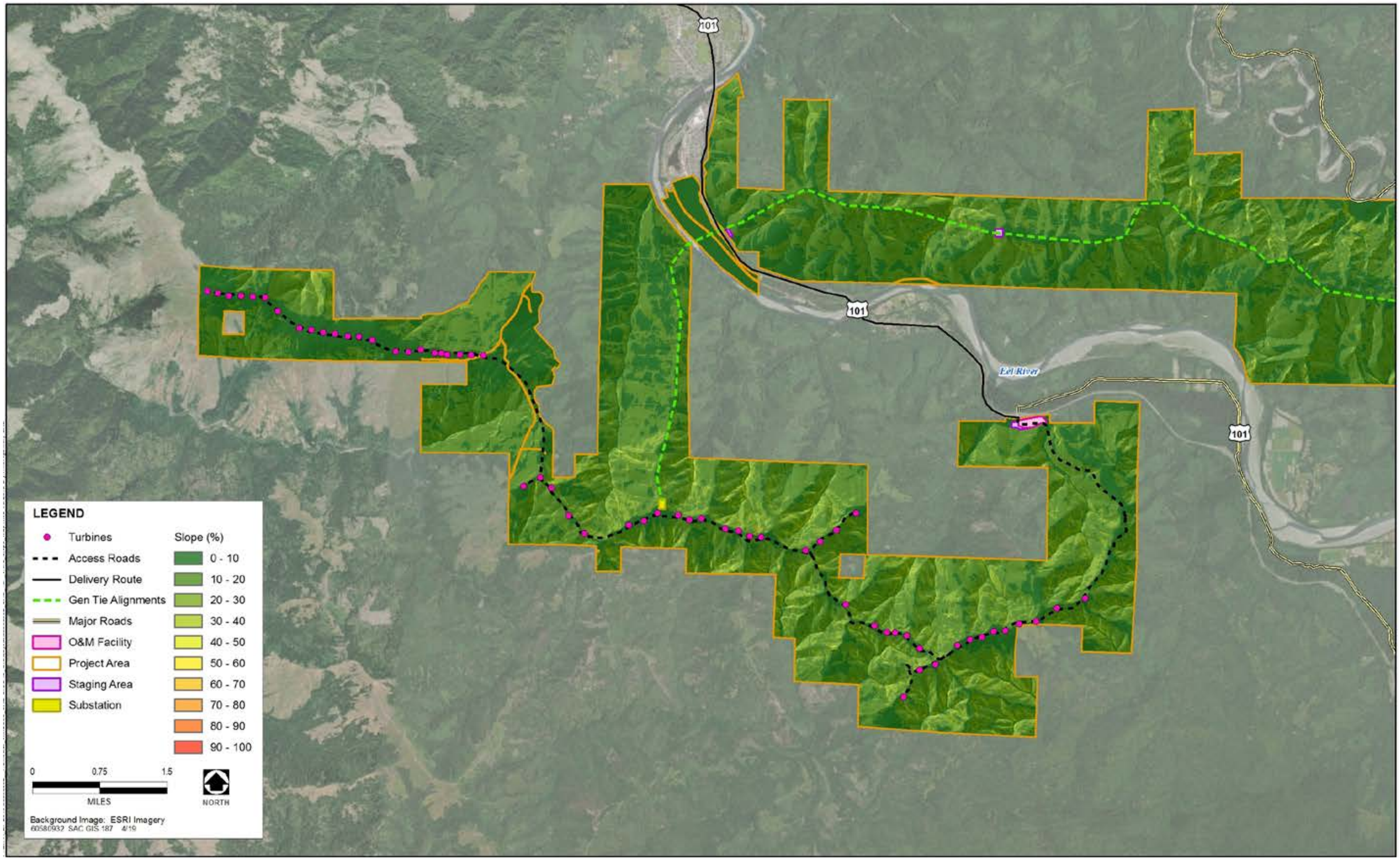
SOILS

Figure 3.7-4 shows the locations of the various soil types in the project area, and Table 3.7-3 summarizes the relevant surface soils based on NRCS soil surveys (NRCS 2019).

Expansive soils are composed mainly of clays, which greatly increase in volume when saturated with water (swell) and shrink when dried. Because of this effect, structural foundations may rise during the rainy season and fall during the dry season, potentially resulting in cracking and distortion of portions of the structure. Wind and water can erode soils as well. As shown in Table 3.7-3, most of the project area soils have a low to moderate shrink-swell potential, a low to medium water erosion hazard, and a low wind erosion potential. In addition, in most areas, the groundwater is close to the surface.

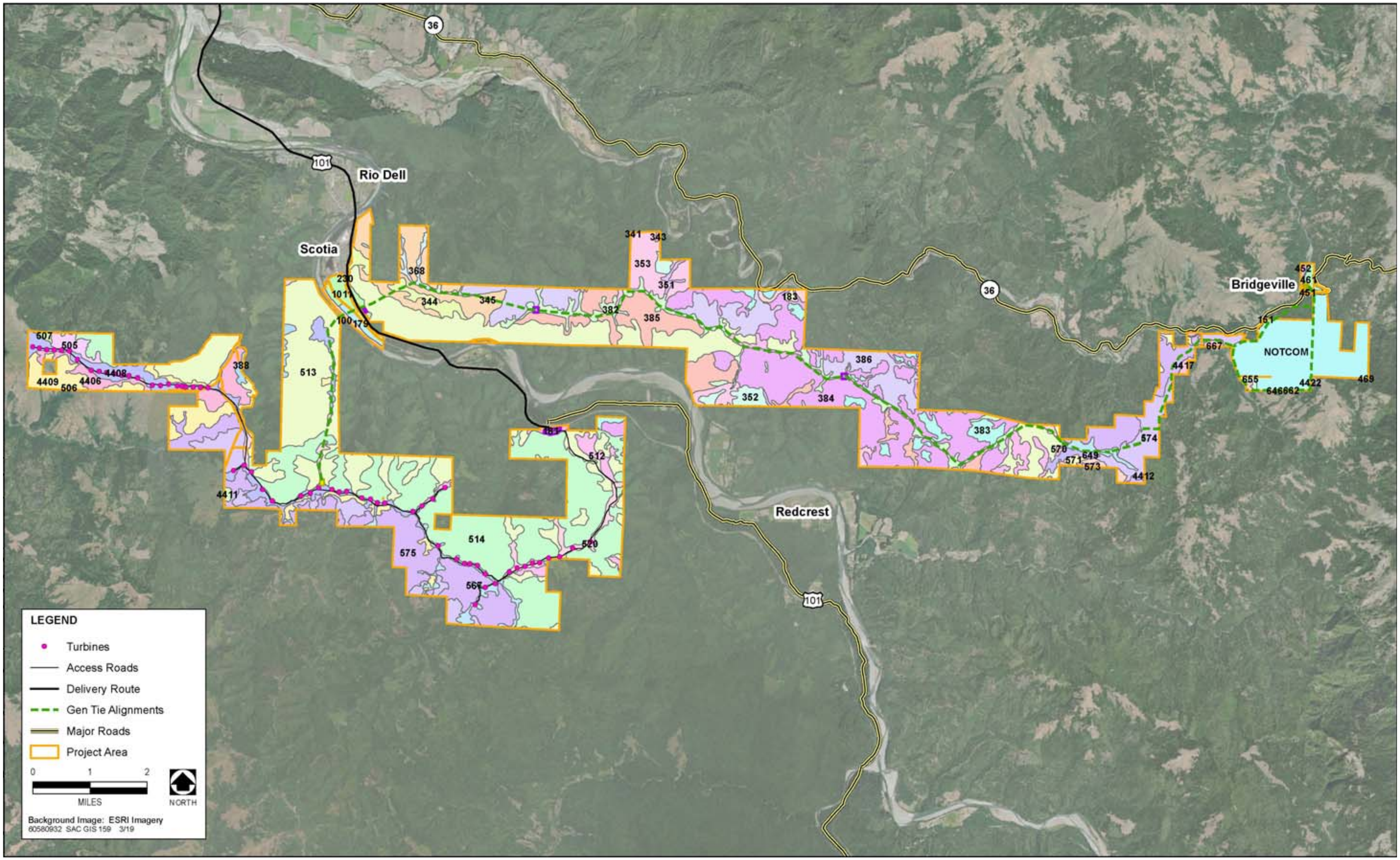
Septic systems are used throughout Humboldt County in areas lacking municipal wastewater. An important factor in septic system design is the characteristics of the soil that will be used to filter and clarify effluent before it reaches surface water or groundwater. To determine septic suitability, soils must have a certain percolation rate, which is determined by conducting an on-site test. The percolation rate is a measure of a soil’s ability to absorb water. The type, size, and specific design characteristics of a septic system are dependent on the percolation rate(s) of on-site soils and expected wastewater load. In addition to the percolation rate, several other important factors must be considered when locating a septic system: depth of groundwater, perched groundwater, and historic groundwater level; depth of bedrock; steepness of topography; presence of soils that could become seasonally saturated during times of intense rainfall; presence of soil types that may act as a barrier to effluent flow; and presence of landslides or other potentially unstable soil conditions.

The Land Use Program of the Humboldt County (County) Department of Health and Human Services’ Public Health Branch governs review and approval of applications to construct septic systems. Determination of the septic suitability of soils is dependent on site-specific conditions and requires a thorough site investigation and analysis of the surface and subsurface characteristics. The O&M facility is the only occupied, plumbed structure associated with the proposed project. An on-site sewage disposal system approved by the County’s Environmental Health Department would need to be installed at that location.



Source: Data compiled by AECOM in 2019

Figure 3.7-3. Slope Map



Source: NRCS 2019

Figure 3.7-4. Soils Map

Table 3.7-3. Soil Types

Map Unit Symbol	Shrink-Swell Potential Value	Shrink-Swell Potential Category	Permeability Value	Permeability Category	Water Erosion Hazard[1]	Wind Erosion Hazard[2]	Approximate Acres	Percent Project Area
513	4.0	Moderate	92.00	High	0.15	Class 1	6,946	18.5%
514	1.5	Low	9.11	Moderate	0.05	Class 1	4,968	13.2%
384	1.5	Low	373.00	Very High	0.43	Class 1	3,354	8.9%
575	1.5	Low	373.00	Very High	0.15	Class 1	2,587	6.9%
574	1.5	Low	28.00	Moderately High	0.24	Class 1	2,026	5.4%
NOTCOM	0.0	Low	0.00	Very Low/ Impermeable	0.00	None—deposition	1,546	4.1%
385	7.5	High	28.23	Moderately High	0.37	Class 1	1,377	3.7%
386	1.6	Low	373.00	Very High	0.32	Class 1	1,349	3.6%
512	4.0	Moderate	28.00	Moderately High	0.20	Class 1	1,072	2.9%
4409	2.0	Low	9.11	Moderate	0.15	Class 1	893	2.4%
4408	1.5	Low	9.11	Moderate	0.20	Class 1	871	2.3%
353	1.5	Low	92.00	High	0.24	Class 1	799	2.1%
345	6.0	High	141.14	High or Very High	0.49	Class 1	789	2.1%
382	4.5	Moderate	373.00	Very High	0.32	Class 1	694	1.8%
571	1.5	Low	28.00	Moderately High	0.49	None—deposition	616	1.6%
572	7.4	High	9.11	Moderate	0.43	Class 1	569	1.5%
4417	2.9	Low	9.11	Moderate	0.15	Class 1	529	1.4%
383	4.0	Moderate	92.00	High	0.43	Class 1	495	1.3%
4406	7.5	High	0.92	Low	0.24	Class 1	433	1.2%
520	9.1	High	92.00	High	0.32	Class 1	408	1.1%
4412	1.8	Low	9.11	Moderate	0.28	Class 1	362	1.0%
405	4.5	Moderate	373.00	Very High	0.32	Class 1	360	1.0%
567	1.0	Low	373.00	Very High	0.15	Class 1	346	0.9%
655	2.9	Low	9.11	Moderate	0.32	Class 1	270	0.7%
451	2.7	Low	28.00	Moderately High	0.49	Class 2	260	0.7%
662	1.5	Low	9.11	Moderate	0.37	Class 1	249	0.7%
402	1.5	Low	92.00	High	0.28	Class 1	242	0.6%
344	1.6	Low	96.00	High	0.32	Class 1	226	0.6%
573	0.5	Low	9.00	Moderate	0.10	Class 1	223	0.6%
352	5.0	Moderate	373.00	Very High	0.32	Class 1	202	0.5%
179	7.5	High	71.00	High	0.43	Class 1	179	0.5%
1011	2.6	Low	9.17	Moderate	0.49	None—deposition	171	0.5%
4411	1.5	Low	9.11	Moderate	0.15	Class 1	158	0.4%
4421	1.5	Low	9.17	Moderate	0.28	Class 1	149	0.4%
407	7.5	High	373.00	Very High	0.24	Class 2	145	0.4%
100	10.4	High	141.00	High	0.37	Class 1	136	0.4%
505	1.5	Low	20.00	Moderately High	0.37	Class 1	130	0.3%
668	6.0	High	9.11	Moderate	0.28	Class 1	115	0.3%
181	4.5	Moderate	423.00	Very High	0.43	Class 1	113	0.3%
671	1.5	Low	9.11	Moderate	0.28	Class 1	105	0.3%
183	17.0	High	92.00	High	0.55	Class 2	105	0.3%
4422	2.0	Low	9.11	Moderate	0.32	Class 1	97	0.3%
570	4.5	Moderate	92.00	High	0.49	Class 1	95	0.3%
368	1.5	Low	373.00	Very High	0.32	Class 1	92	0.2%
388	0.0	Low	373.00	Very High	0.00	Class 1	84	0.2%
649	2.5	Low	9.17	Moderate	0.37	Class 1	81	0.2%
667	1.5	Low	9.11	Moderate	0.20	Class 1	79	0.2%
469	4.5	Moderate	9.11	Moderate	0.24	Class 1	64	0.2%
452	2.0	Low	16.00	Moderately High	0.24	Class 1	64	0.2%
351	4.5	Moderate	91.74	High	0.37	None—deposition	62	0.2%
461	8.0	High	9.00	Moderate	0.32	Class 1	51	0.1%

Table 3.7-3. Soil Types

Map Unit Symbol	Shrink-Swell Potential Value	Shrink-Swell Potential Category	Permeability Value	Permeability Category	Water Erosion Hazard[1]	Wind Erosion Hazard[2]	Approximate Acres	Percent Project Area
722	1.5	Low	28.00	Moderately High	0.37	Class 1	50	0.1%
341	1.5	Low	373.00	Very High	0.43	Class 1	46	0.1%
646	2.0	Low	9.11	Moderate	0.10	Class 1	39	0.1%
343	1.5	Low	141.14	High or Very High	0.20	Class 1	26	0.1%
507	1.5	Low	92.00	High	0.24	Class 1	23	0.1%
4426	0.6	Low	9.17	Moderate	0.05	Class 1	19	0.1%
5508	2.0	Low	9.17	Moderate	0.20	None—deposition	9	0.0%
151	8.5	High	423.00	Very High	0.37	Class 1	6	0.0%
506	1.5	Low	92.00	High	0.10	None—deposition	4	0.0%
643	4.0	Moderate	10.00	Moderate	0.28	Class 1	3	0.0%
230	4.5	Moderate	28.00	Moderately High	0.43	Class 1	2	0.0%
569	0.5	Low	28.23	Moderately High	0.28	Class 1	<1	0.0%

Notes:

1 Water Erosion Hazard: Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and saturated hydraulic conductivity (Ksat). Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

2 Wind Erosion Hazard: A wind erodibility group (WEG) consists of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible.

Source: NRCS 2019

The various components of the proposed project are located on different soil types (Table 3.7-4).

Table 3.7-4. Soils at Locations of the Proposed Project Components

Map Unit Symbol		Acres
Turbines	4406	0.08
	4408	12.00
	512	0.56
	513	0.06
	514	0.73
	520	2.26
	567	2.63
	575	0.00
Substations	151	0.54
	4408	4.96
	461	0.00
	513	0.23
	520	0.11
O&M Facility	181	5.56
Access Roads	181	0.38
	4406	0.71
	4408	22.29
	4409	0.43
	512	2.07
	513	2.75
	514	3.70
	520	9.05
	567	6.99
	574	0.14
	575	0.41

Note: O&M = operations and maintenance
Source: Data compiled by AECOM in 2019

3.7.2 REGULATORY SETTING

FEDERAL PLANS, POLICIES, REGULATIONS, AND LAWS

Earthquake Hazards Reduction Act

In October 1977, the U.S. Congress passed the Earthquake Hazards Reduction Act, to reduce the risks to life and property from future earthquakes in the United States through establishment and maintenance of an effective earthquake hazards reduction program. To accomplish this goal, the act established the National Earthquake Hazards Reduction Program (NEHRP). This program was substantially amended in November 1990 by the National Earthquake Hazards Reduction Program Act (NEHRPA), which refined the description of agency responsibilities, program goals, and objectives.

The mission of NEHRP includes improved understanding, characterization, and prediction of hazards and vulnerabilities; improved building codes and land use practices; risk reduction through post-earthquake investigations and education; development and improvement of design and construction techniques; improved mitigation capacity; and accelerated application of research results. The NEHRPA designates the Federal Emergency Management Agency as the lead agency of the program and assigns several planning, coordinating, and reporting responsibilities. Other NEHRPA agencies include the National Institute of Standards and Technology, National Science Foundation, and USGS.

Soil Conservation and Domestic Allotment Act of 1936

This federal soil conservation law (Title 16, Section 590a of the U.S. Code) permanently provides for the control and prevention of soil erosion and, in turn, preserving natural resources, controlling floods, preventing impairment of reservoirs, maintaining navigability of rivers and harbors, protecting public health and public lands, and relieving unemployment. The purpose of this law is to preserve and improve soil fertility; promote the economic use and conservation of land; diminish exploitation, wasteful, and unscientific use of national soil resources; protect rivers and harbors against soil erosion; and prevent and abate agricultural related pollution.

Sections 2 and 3 of the *National Engineering Handbook* (NRCS 1983) state the standards for soil conservation during planning, design, and construction activities. The proposed project must conform to these standards to limit soil erosion during grading and construction.

Uniform Building Code

The Uniform Building Code (UBC) (1994) specifies acceptable design criteria for structures and excavations related to seismic design and load bearing capacity. The state has adopted these provisions in the California Building Standards Code. Design and construction of infrastructure intended for human occupation, such as the proposed O&M facility, must comply with the UBC.

STATE PLANS, POLICIES, REGULATIONS, AND LAWS

Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Act (California Public Resources Code [PRC] Sections 2621–2630) was passed in 1972, to mitigate the hazard of surface faulting to structures designed for human occupancy. The main purpose of the law is to prevent construction of buildings used for human occupancy on the surface trace of active faults. The law addresses only the hazard of surface fault rupture and is not directed toward other earthquake hazards. The Alquist-Priolo Act requires the State Geologist to establish regulatory zones known as Earthquake Fault Zones around the surface traces of active faults, and to issue appropriate maps. The maps are distributed to all affected cities, counties, and state agencies for use in planning efforts. Before a project can be permitted in a designated Alquist-Priolo Earthquake Fault Zone, cities and counties must require a geologic investigation to demonstrate that proposed buildings would not be constructed across active faults.

Seismic Hazards Mapping Act

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

National Pollutant Discharge Elimination System Permit

In California, the State Water Resources Control Board (SWRCB) administers regulations promulgated by the U.S. Environmental Protection Agency (Title 55, Section 47990 of the Code of Federal Regulations), requiring the permitting of stormwater-generated pollution under the National Pollutant Discharge Elimination System (NPDES). In turn, the SWRCB's jurisdiction is administered through nine regional water quality control boards. Under these federal regulations, an operator must obtain a general permit through the NPDES Stormwater Program for all construction activities with ground disturbance of 1 acre or more. The general permit requires implementation of best management practices, to reduce sedimentation into surface waters and control erosion. One element of compliance with the NPDES permit is preparation of a storm water pollution prevention plan (SWPPP) that addresses control of water pollution, including sediment, in runoff during construction (see Section 3.10, "Hydrology and Water Quality," for more information about the NPDES and SWPPPs).

California Building Standards Code

The California Building Standards Commission is responsible for coordinating, managing, adopting, and approving building codes in California. The State of California provides minimum standards for building design. The 2016 California Building Code (CBC) applies to building design and construction in the state and is based on the federal Uniform Building Code, which is used widely throughout the country (generally adopted on a state-by-state or district-by-district basis). The CBC has been modified for California conditions, with numerous more detailed or more stringent regulations. Where no other building codes apply, Chapter 29 of the CBC regulates excavation, foundations, and retaining walls.

The CBC requires that any structure designed for a project site undergo a seismic-design evaluation that assigns the structure to one of six categories, A–F; Category F structures require the most earthquake-resistant design. The CBC philosophy focuses on "collapse prevention," meaning that structures are to be designed to prevent collapse during the maximum level of ground shaking that reasonably can be expected to occur at a site. Chapter 16 of the CBC specifies exactly how each seismic-design category is to be determined on a site-specific basis, based on site-specific soil characteristics and proximity to potential seismic hazards.

Chapter 18 of the CBC regulates excavation of foundations and retaining walls. This chapter regulates preparation of a preliminary soil report, engineering geologic report, geotechnical report, and supplemental ground-response report. Chapter 18 also regulates analysis of expansive soils and determination of the depth to groundwater table. For Seismic Design Category C, Chapter 18 requires analysis of slope instability, liquefaction, and surface rupture attributable to faulting or lateral spreading. For Seismic Design Categories D, E, and F, Chapter 18 requires these same analyses plus an evaluation of lateral pressures on basement and retaining walls, liquefaction and soil strength loss, and lateral movement or reduction in foundation soil-bearing capacity.

Chapter 18 also requires that mitigation measures be considered in structural design. Mitigation measures may include stabilizing the ground, selecting appropriate foundation types and depths, selecting appropriate structural systems to accommodate anticipated displacements, or using any combination of these measures. The potential for liquefaction and soil strength loss must be evaluated for site-specific peak ground acceleration magnitudes and source characteristics, consistent with the design earthquake ground motions. Peak ground acceleration must be determined from a site-specific study, the contents of which are specified in Chapter 18.

Furthermore, Appendix Chapter J of the CBC regulates grading activities, including drainage and erosion control and construction on unstable soils, such as expansive soils and areas subject to liquefaction.

REGIONAL AND LOCAL PLANS, POLICIES, REGULATIONS, AND ORDINANCES

Humboldt County On-site Wastewater Local Agency Management Program

On June 19, 2012, the SWRCB adopted Resolution No. 2012-0032, adopting the Water Quality Control Policy for Siting, Design, Operation, and Maintenance of On-site Wastewater Treatment Systems (OWTS Policy). This policy establishes a statewide, risk-based, tiered approach for the regulation and management of OWTS installations and replacements, and sets the level of performance and protection expected from OWTS. In accordance with Section 13290 et seq. of the Water Code, the policy sets standards for OWTS that are constructed or replaced; that are subject to a major repair; that pool or discharge waste to the surface of the ground; and that have affected or will affect groundwater or surface water to a degree that makes it unfit for drinking water or other uses, or cause a health or other public nuisance condition.

The OWTS Policy also includes minimum operational requirements for OWTS, such as:

- siting, construction, and performance specifications;
- requirements for OWTS located near certain waters listed as impaired under Section 303(d) of the Clean Water Act;
- requirements authorizing implementation by local agencies;
- corrective action requirements;
- minimum monitoring requirements;
- exemption criteria; and

- requirements for determining when an existing OWTS is subject to major repair, and when a conditional waiver of waste discharge requirements is appropriate.

Humboldt County's Local Agency Management Program and its two component documents, the OWTS Regulations and Technical Manual and Title VI, Divisions 1 and 2 of the Humboldt County Code, provide the regulatory framework for oversight of OWTS and ensure compliance with the SWRCB's OWTS Policy. The Local Agency Management Program was approved by the Board of Supervisors in November 2017. The North Coast Regional Water Quality Control Board provided final approval in February 2018.

Humboldt County General Plan

The following goals, policies, and standards of the *Humboldt County General Plan* (General Plan) (Humboldt County 2017) are applicable to the project and the alternatives under consideration:

Goal S-G1: Minimize Loss. Communities designed and built to minimize the potential for loss of life and property resulting from natural and manmade hazards.

Goal S-G2: Prevent Unnecessary Exposure. Areas of geologic instability, floodplains, tsunami run-up areas, high risk wildland fire areas, and airport areas planned and conditioned to prevent unnecessary exposure of people and property to risks of damage or injury.

- **Policy S-P1: Reduce the Potential for Loss.** Plan land uses and regulate new development to reduce the potential for loss of life, injury, property damage, and economic and social dislocations resulting from natural and manmade hazards, including but not limited to, steep slopes, unstable soils areas, active earthquake faults, wildland fire risk areas, airport influence areas, military operating areas, flood plains, and tsunami run-up areas.

- **Policy S-P2: Coastal Zone Hazards.** Development within the coastal zone shall minimize risks to life and property in areas of high geologic, tsunami, flood, and fire hazard; assure stability and structural integrity; and neither create nor contribute significantly to erosion, geologic instability, or destruction of the site or surrounding areas or in any way require the construction of protective devices that would substantially alter natural landforms along bluffs and cliffs.

- **Policy S-P6: Structural Hazards.** The County shall protect life and property by applying and enforcing state adopted building codes and Alquist-Priolo requirements to new construction.

- **Policy S-P9: Earthquake Mitigation Planning.** The potential for a local earthquake in excess of magnitude 9.0 (Richter scale) shall be considered in disaster planning, risk assessment, and pre-disaster mitigation efforts.

- **Policy S-P10: Cascadia Event Disaster Response.** The County shall maintain readiness for a comprehensive response to a major earthquake consistent with the nationwide emergency management hierarchy and the adopted Emergency Response Plan for the Humboldt Operational Area.

- **Policy S-P11: Site Suitability.** New development may be approved only if it can be demonstrated that the proposed development will neither create nor significantly contribute to, or be impacted by, geologic instability or geologic hazards.

- **Policy WR-P10: Erosion and Sediment Discharge.** Ministerial and discretionary projects requiring a grading permit shall comply with performance standards adopted by ordinance and/or conditioned to minimize erosion and discharge of sediments into surface runoff, drainage systems, and water bodies consistent with best management practices, adopted Total Maximum Daily Loads (TMDLs), and non-point source regulatory standards.

- **Policy WR-P42: Erosion and Sediment Control Measures.** Incorporate appropriate erosion and sediment control measures into development design and improvements.

  - **Standard S-S1: Geologic Report Requirements.** Site specific reports addressing geologic hazards and geologic conditions shall be required as part of the review of discretionary development and ministerial permits. Geologic reports shall be required and prepared consistent with land use regulations (Title III, Land Use and Development, Division 3, Building Regulations, Chapter 6—Geologic Hazards.)

  - **Standard S-S2: Landslide Maps.** Utilize California Division of Mines and Geology, North Coast Watersheds landslide mapping as information to assist in review of developments.

  - **Standard S-S3: Alquist-Priolo Fault Hazard Zones.** Utilize California Mines and Geology Board Policies and Criteria for Alquist-Priolo Fault Hazard Zones (Special Publication #42) as standards of implementation within zones.

Humboldt County Grading, Excavation, Erosion, and Sediment Control Ordinance

The County's Grading, Excavation, Erosion, and Sedimentation Control Ordinance (Section 331-12) sets forth rules and regulations to control excavation, grading, and earthwork construction, including fills, embankments, and erosion and sedimentation controls. In addition to providing a plan that identifies the location of the work, applications for grading permits also need to include a site-specific erosion and sediment control plan. The ordinance contains a list of minimum requirements for erosion and sedimentation control. In some cases, an SWPPP may be submitted in lieu of the erosion and sediment control plan. Grading activities also must conform to grading standards, including for cut slope, fill material, setbacks, terracing, and drainage.

Humboldt County Geologic Hazards Ordinance

The Geologic Hazards Ordinance (Sections 336-1 through 336-5) is intended to reduce risks to life and property in moderate and high geologic hazard areas, and avoid contributing further to erosion, geologic instability, or destruction of development sites and surrounding areas. The ordinance identifies the type or extent of engineering geologic or soil engineering reports that may be required, based on the type of development and type of geologic hazards present at a project site. The ordinance addresses geologic hazards related to earth shaking, fault rupture, slope stability, and liquefaction. Development projects located in an Alquist-Priolo Fault Hazard Zone have additional report and review standards. The Alquist-Priolo Fault Hazard Zone regulations apply to lands that contain the "G" combining zone designation on the County zoning maps, and that are within Special Studies Zones delineated on maps by the State Geologist. Project sites or issues of concern that require additional engineering or avoidance would be identified in the reports.

3.7.3 ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

THRESHOLDS OF SIGNIFICANCE

The following thresholds of significance are based on the environmental checklist in Appendix G of the State CEQA Guidelines, as amended. Implementing the project would result in a significant impact related to geology and soils if it would:

- directly or indirectly cause potential substantial adverse impacts, including the risk of loss, injury, or death involving:
  - rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault;
  - strong seismic ground shaking;
  - seismic-related ground failure, including liquefaction; or
  - landslides;
- result in substantial soil erosion or the loss of topsoil;
- be located on a geologic unit or soil that is unstable, or that would become unstable because of the project, and potentially result in an on-site or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse;
- be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property; or
- have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for disposal of wastewater.

ANALYSIS METHODOLOGY

The evaluation of potential geologic and soil impacts was based on consideration of project components and a review of documents pertaining to the project site, including published geologic literature and maps. The information obtained from these sources was reviewed and summarized to establish existing conditions and identify potential environmental impacts, based on the standards of significance presented in this section.

ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

IMPACT 3.7-1	**Surface Rupture Along a Known Earthquake Fault.** *The project would not be constructed over the surface traces of any active faults. This impact would be* ***less than significant****.*

The wind turbines and associated infrastructure (e.g., transmission lines) would not be within or adjacent to a designated Alquist-Priolo Earthquake Fault Zone. Although other known faults would be in the vicinity of the wind turbines, they are not considered active (i.e., no evidence of fault movement within the last 11,000 years) (Jennings 2006), and therefore have a low potential for surface fault rupture, and are not zoned under the Alquist-Priolo Act. Likewise, although the Cascadia subduction zone is considered capable of producing a large-magnitude earthquake, it is not zoned under the Alquist-Priolo Act. Furthermore, the impacts of surface fault rupture are generally limited to a linear zone a few yards wide, and the proposed wind turbines would not be structures intended for human habitation.

Location of the O&M facility within an Alquist-Priolo Earthquake Fault Zone could subject the structure and employees to hazards from surface fault rupture. The facility would be designed and constructed in accordance with the seismic design requirements of the 2016 CBC and Alquist-Priolo Fault Hazard regulations. The CBC standards require the design of structures to consider seismic hazards present at the site and the intended use, or nature of occupancy, of the structure. The Alquist-Priolo Act requires that no buildings intended for human occupancy be allowed on or within 50 feet of an active fault trace.

Because compliance with the Alquist-Priolo Act would be enforced, preventing construction of structures intended for human occupancy over the surface traces of faults that are designated as active by the California Geological Survey, the impact from surface fault rupture would be **less than significant**.

The expansion of the Bridgeville Substation would not place habitable structures in an earthquake fault zone, nor has any fault been identified near the expansion site. Therefore, this impact of substation expansion would be **less than significant**.

IMPACT 3.7-2	Possible Risks to People and Structures Caused by Strong Seismic Ground Shaking. *The project site is in an area of high seismic activity, within a region that contains known active faults; therefore, proposed structures and employees could be subject to hazards from strong seismic ground shaking. However, given project compliance with California Building Code requirements, this impact would be* ***less than significant****.*

As described in detail in Section 3.7.1, "Environmental Setting," the proposed generation components would be located in a seismically active area. The Cascadia subduction zone and the San Andreas Fault, associated with the Mendocino Triple Junction along with other known active faults listed in Table 3.7-2, have the potential to produce large-magnitude earthquakes that could result in strong seismic ground shaking at the site of the proposed generation components.

The Safety Element of the General Plan contains policies that would lessen the potential effects from the rupture of a known earthquake fault, strong seismic ground shaking, seismic-related ground failure, and tsunami. Policy S-P6, Structural Hazards, would apply, and compliance with state-adopted building codes and Alquist-Priolo Earthquake Fault Zone requirements for new construction would be enforced, to protect life and property. Through Policy S-P10, Cascadia Event Disaster Response, the County would maintain readiness for a comprehensive response to a major earthquake, consistent with the nationwide emergency management hierarchy and the adopted emergency response plan for the Humboldt Operational Area. Furthermore, through Policy S-P11, Site Suitability, new development may be approved only if it could be demonstrated that the proposed development would neither create nor substantially contribute to geologic instability or geologic hazards.

Standard S-S1, Geologic Report Requirements, specifies that reports must be prepared consistent with County building regulations to address geologic hazards and geologic conditions, and these reports must be submitted for review of discretionary development and ministerial permits. Adherence to this standard would lessen potential environmental effects related to surface fault rupture, strong seismic ground shaking, and landslides. However, the possibility remains that strong seismic ground shaking could create risks to people or structures.

In association with the building permit issued for the project, a site-specific, design-level geotechnical report must be prepared by a licensed geotechnical engineer, per CBC requirements. This report is a final, design-level geotechnical subsurface investigation report that includes subsurface testing of soil and groundwater conditions to identify site-specific geology and soil characteristics that the final engineering design should take into account during preparation of grading and building plans. Recommendations of the geotechnical engineering report are incorporated into the plans submitted for grading and building permits. The geotechnical engineering report is subject to review by and approval of the County's Planning & Building Department. The final geotechnical engineering report would address and make recommendations on:

- site preparation;
- soil bearing capacity;
- appropriate sources and types of fill;
- potential need for soil amendments;
- road, pavement, and parking areas;
- structural foundations, including retaining-wall design;
- appropriate foundation designs that are consistent with grading practices in the current version of the CBC;
- soil corrosion of concrete and steel;
- erosion/winterization;
- seismic ground shaking;
- liquefaction;
- expansive soils; and
- unstable soils (including landslides).

The project applicant would provide an engineering inspection and certification that earthwork has been performed, in conformance with the recommendations contained in the geotechnical report.

Because the CBC already provides for adequate protection to reduce the exposure of people and structures to the adverse effects of surface fault rupture, this impact would be **less than significant**.

The expansion of the Bridgeville Substation would be consistent with current codes providing adequate protection to reduce the exposure of people and structures to the adverse effects of surface fault rupture. Therefore, this impact of substation expansion would be **less than significant**.

IMPACT 3.7-3	**Possible Risks to People and Structures Caused by Seismic-Related Ground Failure, Liquefaction, and Landslides.** *Project construction activities could occur in areas subject to liquefaction, which could pose a hazard to people and structures. However, given project compliance with existing state and local regulatory requirements, this impact would be **less than significant**.*

Soil liquefaction and associated ground failure occurs when ground shaking from an earthquake causes a sediment layer saturated with groundwater to lose strength and take on the characteristics of a fluid, thus becoming similar to quicksand, or when a seismic event causes the underlying soil to become unstable. The loss of soil strength can result in bearing capacity insufficient to support foundation loads, increased lateral pressure on retaining or basement walls, and slope instability. A combination of factors contributes to the potential for seismically induced liquefaction, such as the intensity of ground shaking, the soil type and density, and the depth to groundwater.

Sediments in the valleys where Rio Dell and Ferndale are located consist of younger Pleistocene- and Holocene-age alluvium. The exact depth to groundwater in these areas presently is unknown, but according to the NRCS soil maps, groundwater is shallow in these areas (NRCS 2019). Seasonal shallow groundwater is commonly encountered in valley drainages. Also, active seismic sources are close to the location of the proposed O&M facility. These factors indicate that the potential exists for the exposure of structures to liquefaction hazards. A geotechnical investigation would be needed to determine site-specific liquefaction potential pursuant to the CBC.

Both historic and recent landslides have occurred in the project area. Areas of unstable slopes are located in the project vicinity and are composed primarily of mélange materials of the Franciscan formation that break down into clay, which tends to slip when wet. The greatest risk from landslides is in areas where the slope would exceed 33 percent. Grading for the planned access road would require cutting into slopes that exceed 30 percent grade as the access route extends from the Jordan Creek staging area and heads up Demonstration Forest Road Right. In addition, project-related access roads could be constructed across drainages with alluvial material. These drainages are subject to flash flooding and associated debris flow during heavy-rainfall events. Furthermore, in a few areas within the vicinity of the proposed haul routes, rock outcrops or boulders occur on the ground surface, which could represent a hazard to vehicular traffic. Rock falls are most likely to occur during strong earthquakes or large storms that may loosen boulders on steep slopes that exceed a gradient of 50 percent. Therefore, the potential exists for landslides (seismically induced or otherwise) to occur in the project area.

The proposed project would comply with existing state and local regulatory requirements to conduct a site-specific geotechnical investigation and implement the recommendations of the study during project design and construction. Such compliance would prevent structures and people from being exposed to landslide hazards by limiting cut and fill slope angles to produce grossly and surficially stable slopes; incorporating benches at a set interval; and requiring placement of fill slope keyways into dense, native bedrock materials where necessary. Incorporating engineering design measures would reduce the risk of slope instability, thus removing the potential for exposure of people and structures to the adverse effects of seismic-related ground failure, liquefaction, or landslide hazards. Therefore, this impact would be **less than significant**.

The expansion of the Bridgeville Substation would be consistent with current codes providing adequate protection to reduce the exposure of people and structures to the adverse effects of seismic-related ground failure, liquefaction, or landslide hazards. Thus, this impact of substation expansion would be **less than significant**.

IMPACT 3.7-4	Erosion during Project Construction and Operation. *Construction activities during project implementation would involve grading and earth movement in soils subject to wind and water erosion hazards, and on steep slopes. Furthermore, if not constructed properly, new haul routes in steep areas could result in substantial erosion during project operations. However, given project compliance with existing state and local regulatory requirements, this impact would be* **less than significant***.*

Project-related construction activities would occur in soils that have low to medium potential for wind and water erosion hazards (NRCS 2019). Earth-moving activities would temporarily disturb soil and expose disturbed areas to winter storm events. Rain of sufficient intensity could dislodge soil particles from the soil surface. If the storm is large enough to generate runoff, localized erosion could occur. On the steeper slopes, severe erosion could occur during both project construction and operations. After development has been completed, slopes that are not effectively contoured, compacted, or revegetated may also be susceptible to erosion. In addition, soil disturbance from construction activities could result in soil loss because of wind erosion. Indirect impacts from soil erosion, such as sediment transport and potential loss of aquatic habitat, are evaluated in Section 3.5, “Biological Resources,” and Section 3.10, “Hydrology and Water Quality,” respectively.

The General Plan contains policies to protect soils and avoid erosion. Policy WR-P10, Erosion and Sediment Discharge, and Policy WR-P42, Erosion and Sediment Control Measures, in the Water Resources Element specify that erosion and sediment control measures should be incorporated into development design as appropriate. Standard S-S1, Geologic Report Requirements, requires preparation of site-specific reports addressing geologic hazards for both discretionary and ministerial projects. The Humboldt County Grading and Erosion Control Ordinance requires a site-specific erosion and sediment control plan.

To comply with existing state and local regulatory requirements, a grading and erosion control plan must be prepared for the project. The project applicant must retain a California-registered Civil Engineer who will prepare a grading and erosion control plan meeting the requirements outlined in the County Code. The grading and erosion control plan must contain the information listed in the County’s Grading and Erosion Control Ordinance, including the location, implementation schedule, and maintenance schedule of all erosion and sediment control measures; a description of measures designed to control erosion and dust and stabilization of the construction sites and permanent erosion control measures for project components after construction; and a description of the location and methods of storage and disposal of construction materials.

Erosion and sediment control measures can include the use of detention basins, berms, swales, wattles, and silt fencing, and covering or watering of stockpiled soils to reduce wind erosion. Permanent erosion stabilization on steep slopes can include construction of retaining walls and reseeding with vegetation after construction. Stabilization of construction entrances to minimize trackout (control dust) can be achieved by installing filter fabric and crushed rock to a depth of approximately 1 foot. The project’s grading and erosion control plan would be subject to review and approval by the County Planning & Building Department before any grading permits are issued for new development. The plan would be consistent with the state’s NPDES permit.

Timber harvesting conducted between October 15 and May 1, which is considered the wet period, must operate according to the requirements outlined in a winter operation plan that would be part of the timber harvest plan filed for review by the California Department of Forestry and Fire Protection. The winter operation plan would identify the actions undertaken to avoid or substantially lessen erosion, soil movement into watercourses, and soil compaction from timber operations, consistent with the Forest Practice Rules.

The proposed project would comply with existing state and local regulatory requirements to reduce erosion risks. These regulations require establishing setbacks from drainages, using structural and treatment controls during grading and other construction activities, and monitoring the effectiveness of erosion control measures throughout the construction period. Further, the project would implement Mitigation Measure 3.10-1, "Implement Wet-Weather BMPs Consistent with Humboldt Redwood Company's Habitat Conservation Plan" (see Section 3.10, "Hydrology and Water Quality"), which requires water quality monitoring and reporting to the County Department of Public Works as part of the erosion control plan. Given this compliance with state and local regulations and implementation of Mitigation Measure 3.10-1, this impact would be **less than significant**.

The expansion of the Bridgeville Substation would not occur on steep slopes and would involve only minor grading to cap the site. Therefore, this impact of substation expansion would be **less than significant**.

IMPACT 3.7-5	Potential Geologic Hazards Related to Construction in Expansive Soils. *Construction of the project's generation and haul components could occur in soils that have the potential to expand when wet, and thus, may result in damage to structures or foundations. However, given project compliance with existing state and local regulatory requirements, this impact would be* less than significant*.*

Expansive soils have high clay content; they shrink and swell because of moisture change. Over time, these volume changes can result in damage to building foundations, underground utilities, and other subsurface facilities and infrastructure, if not designed and constructed appropriately to resist damage associated with changing soil conditions. Volume changes of expansive soils can also result in consolidation of soft clays following the lowering of the water table or the placement of fill. Placing buildings or constructing infrastructure on or in unstable soils can result in structural failure.

As shown in Table 3.7-3, most project site soils have a low to moderate shrink-swell potential (NRCS 2019). However, because of the large area and wide variety of soil types where construction of project components would occur, the conservative assumption for this assessment is that project components could be installed in areas where the expansion potential is moderate to high.

To reduce effects on project site soils, the proposed project would comply with state and local regulations that require preparation of site-specific geotechnical investigations and implementation of all recommendations during project design and construction. The project would incorporate recommendations such as removing existing soils and replacing them with engineered fill, treating soils with lime, or installing post-tensioned slab foundations. These measures have been used successfully to reduce the potential for structural damage from expansive soils. Construction would be monitored in the field by a geotechnical or soils engineer to ensure that earthwork is performed as specified in the plans. Given project compliance with these state and local regulatory requirements, this impact would be **less than significant**.

The expansion of the Bridgeville Substation would follow the recommendation of the geologist in developing the anchoring of the substation. Thus, this impact of substation expansion would be **less than significant**.

IMPACT 3.7-6	Potential Insuitability of Soils for Use with Septic Systems. *Wastewater for the O&M facility would be treated by an appropriately sized septic system that would be installed. This impact would be* ***less than significant****.*

The project would generate wastewater from sanitary facilities in the O&M facility, such as sinks and toilets. Wastewater for the O&M facility would be treated by an appropriately sized septic system that would be installed. The suitability of a property for on-site disposal would depend on many variables, including topography, type and thickness of appropriate soils, percolation rate, and depth to groundwater and bedrock; but according to the NRCS system, the soil suitability is very limited (NRCS 2019). Existing County regulations require new development to demonstrate that soils on the site are suitable for the use of a standard septic system. Such systems must be sited, designed, and constructed in accordance with applicable local requirements and the SWRCB's OWTS Policy, and must seek approval from the County Department of Health and Human Services, Environmental Health Division. Sites with inadequate soils and other unfavorable site characteristics must use alternative septic systems, such as mound and pressurized systems, or may not be allowed to have on-site disposal systems.

The determination of the suitability of soils would be dependent on site-specific conditions and would require a thorough site investigation and analysis of surface and subsurface characteristics. However, project compliance with the permitting requirements discussed above would ensure that septic systems would be sited, designed, and constructed in accordance with applicable SWRCB and local requirements. This impact would be **less than significant.**

The expansion of the Bridgeville Substation would not involve generation of any septic system effluent. Thus, **no impact** related to insuitability of soils for a septic system would result from the substation expansion.