

3.6 Geology, Soils, Minerals, and Paleontology

This section contains a description of the environmental setting, regulatory setting, and potential impacts associated with the construction and operation of the proposed project and alternatives with respect to geology, soils, minerals, and paleontology.

3.6.1 Environmental Setting

The following section presents a discussion of the geology, geologic hazards, soils, mineral resources, and paleontology in the proposed project area. Data collection for this analysis consisted of (1) identifying and collecting readily available geology, soils, mineral resources, and paleontology information from local, state, and federal agency sources; and (2) reviewing readily available aerial images and topographic maps.

3.6.1.1 Geologic Setting

Topography

The topography within the proposed project area in Nevada ranges from an elevation of less than 1,800 feet in the area of the Eldorado Substation to an elevation of approximately 5,000 feet along the redundant telecommunication line where it would cross the McCullough Mountains (California Division of Mines and Geology [CDMG] 1961). Within California, the proposed transmission line route would cross Ivanpah Dry Lake (lowest elevation approximately 2,605 feet), where it would rejoin Alternative C (at elevation approximately 2,620 feet) before continuing to the Ivanpah Substation within the alluvial fans sloping east from the Clark Mountain Range. The Mountain Pass Alternative Telecommunication Route would cross Ivanpah Dry Lake and then extend to the Mountain Pass substation, which has an elevation of just over 5,000 feet (CDMG 1961).

Regional Geology

The proposed project lies mostly within the Mojave Desert geomorphic province (Norris and Webb 1990), which is located primarily in California but extends eastward into Nevada, where it merges with the Basin and Range province (the Great Basin; Figure 3.6-1). In Nevada, the proposed project area lies within the Basin and Range province. A geomorphic province is a naturally defined geologic region with distinct and unique landforms that have developed due to a specific combination of geology units, faults and fault zones, and climate. The Great Basin province is characterized by interior drainage with lakes and playas (dry lake basins) and the typical mountain and valley structure including subparallel, fault-bounded ranges separated by down-dropped basins (California Geological Survey [CGS] 2002). Extensional tectonics (a pulling apart of the earth's crust) is predominant in the Basin and Range province, although some northwest-trending right-lateral strike-slip (mostly horizontal side-to-side motion) faulting is present.

The Mojave Desert geomorphic province is a broad interior region of isolated mountain ranges separated by expanses of desert plains. It has an interior enclosed drainage with playas being common. Fault trends largely control Mojave Desert topography. Mountain ranges in the Mojave Desert geomorphic province are composed of complexly faulted and folded basement rocks that range from pre-Cambrian (greater than 570 million years before present [mybp]) to Mesozoic (66 to 240 mybp). Volcanic and sedimentary rocks deposited in the Cenozoic (less than 66 mybp to present) are common as well. Younger faulting in the eastern half of the Mojave Desert geomorphic province is characterized by generally north- to northwest-trending normal faults associated with regional extension (pulling apart) in the Basin and Range province. Normal faulting is one of the most common types, exhibiting movement along a generally non-vertical ~~plan~~ plane such that the upper part moves downward along the plane causing an offsetting of the geologic unit(s).

1 Geology in the Clark Mountain Range, located along the western extent of the proposed project area and eastward
2 into Nevada, is characteristic of both the Mojave Desert and Basin and Range geomorphic provinces. The Clark
3 Mountain Range is bounded on the west side by the Halloran Hills Detachment Fault (Fowler and Calzia 1999).
4 Although these mountains have been subjected to considerable faulting, the core of the range has remained
5 unaffected by stretching of the crust in this region (regional extension). The adjacent Ivanpah Valley, with a lakebed
6 elevation of 2,605 feet, could be primarily a product of the same relatively recent regional extension and normal
7 faulting. The McCullough Mountains to the east, however, have also been affected by this crustal extension, and very
8 low angle (detachment) faulting that has been dated as Miocene, with an age between 16.5 and 11.0 mybp (U.S.
9 Geological Survey [USGS] 2006). Numerous unconformities (areas where rocks of different compositional types or
10 structural orientations are in direct contact) and major thrust faults (locations where older rocks have been pushed up
11 and over younger rocks) are present in these mountains.

12 13 **Project Site Geology**

14 The geologic units exposed in the proposed project area occur as three types:

- 15
- 16 • Alluvium: sedimentary deposits derived from the physical and chemical breakdown and transport in the
17 flatter valley portions of the desert plains and along the slopes of alluvial fans;
- 18 • Alluvial fans: cone-shaped accumulations of alluvial material along the bases of mountains; and
- 19 • Bedrock: igneous, metamorphic, and sedimentary rock exposed in the mountain areas, typically surrounded
20 by alluvium and alluvial fans.

21
22 Refer to Figure 3.6-1 for a simplified geologic map of the proposed project area.

23
24 Alluvium ranges from modern (Holocene; 0 to 11,000 years old) stream deposits to early- to late-Pleistocene (11,000
25 to 1.8 million years old) alluvial fan deposits usually flanking the mountain ranges. Bedrock is composed of Miocene
26 (5.3 million years before present [mybp] to 23 mybp) volcanic (igneous) rock, and basement rock is Ordovician
27 through Precambrian (greater than 435 mybp to at least 570 mybp) metamorphic rocks.

28
29 Although the alluvial units have been extensively subdivided (Nevada Bureau of Mines and Geology [NBMG] 2006),
30 the approach taken here is to present a more utilitarian summary based on major characteristics rather than minor
31 variations. To this end, a summary of the exposed geologic units in the proposed project area by state is provided in
32 Table 3.6-1 and Figure 3.6-1. The text below provides more data from more detailed data sets than those used to
33 produce Table 3.6-1 and Figure 3.6-1.

34 35 ***Nevada***

36 In Nevada, alluvium ranges from Quaternary to Tertiary (as old as 66 mybp) alluvial and rocky fragments and debris
37 (talus) deposits, alluvial fan deposits, and flat-lying playa deposits. These deposits generally overlie and/or are
38 marginal to bedrock units that include Tertiary (1.6 to 66 mybp) volcanic flows; Paleozoic- to Mesozoic (66 to 570
39 mybp) sedimentary rocks; and Precambrian (greater than 570 mybp) metamorphic rocks.

LABEL	ROCK TYPE
C	limestone
Ca	sandstone
D	limestone
Dc	dolostone (dolomite)
J	orthoquartzite
JTRa	sandstone
K	felsic volcanic rock
Kgr	granodiorite
Mc	limestone
OCc	dolostone (dolomite)
PPc	limestone
Pc	limestone
Psc	sandstone
Q	alluvium
QToa	alluvium
Qa	alluvium
Qp	playa
TRmt	shale
Ta3	andesite
Tba	basalt
Tc	conglomerate
Ti	alkali-granite (alaskite)
Tr	mudstone
Tri	granitoid
Tt3	rhyolite
Tvp	rhyolite
Xm	gneiss
Ygr	granite
pC	gneiss

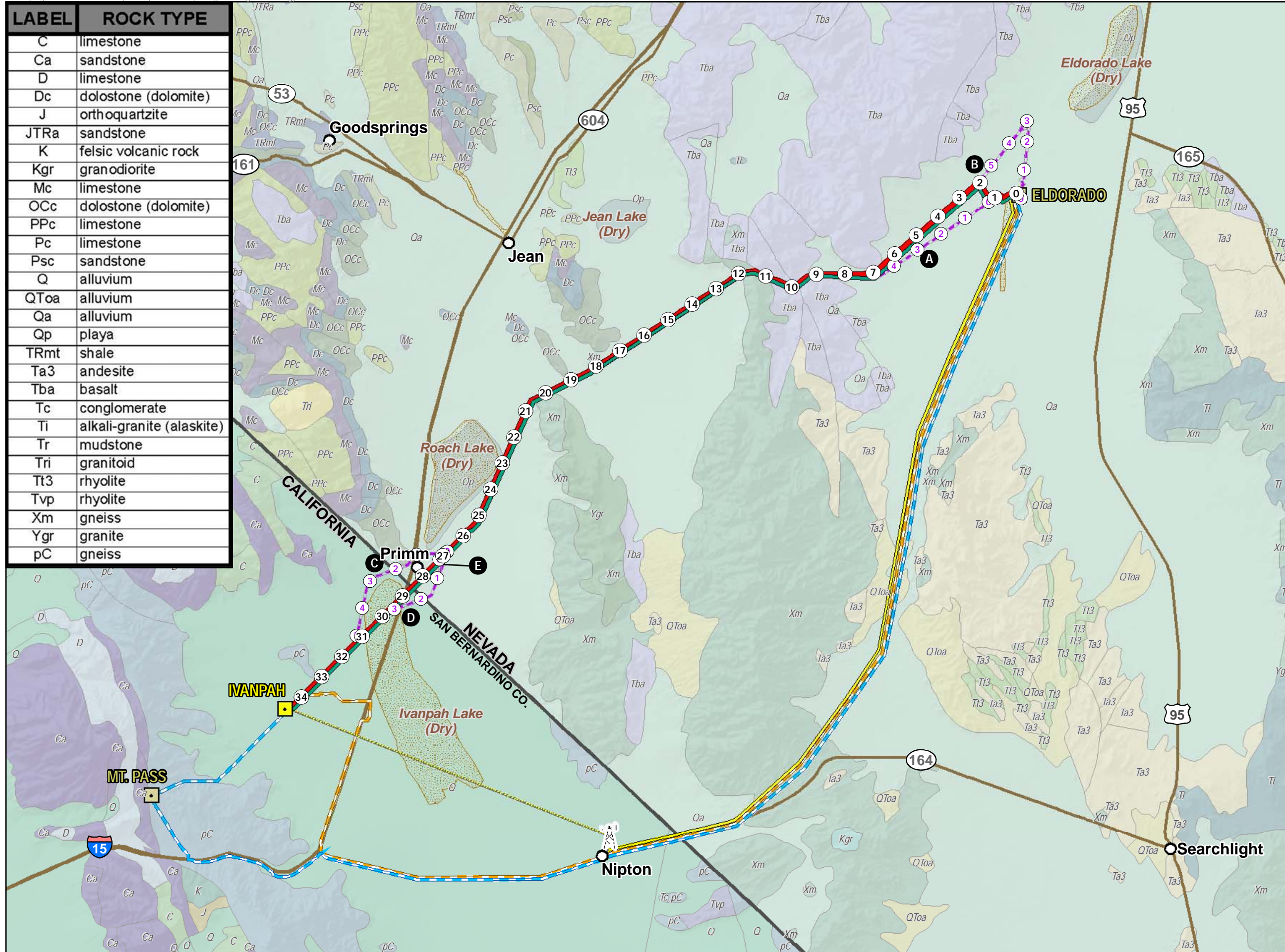
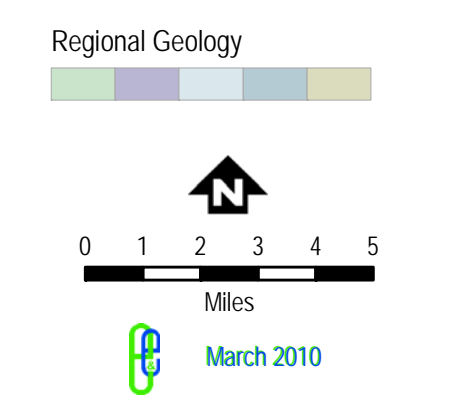


Figure 3.6-1
Eldorado-Ivanpah
Transmission Project
Regional and Project Area
Geologic Map

- PROPOSED PROJECT**
- Transmission Line
 - Telecommunications Line
 - Redundant Telecommunications Line
 - Microwave
- ALTERNATIVES**
- Transmission Line Alternatives
 - Redundant Telecommunications Line - Mountain Pass
 - Redundant Telecommunications Line - Golf Course
- Milepost
 - Proposed Microwave Tower
 - Proposed Substation
 - Existing Substation
 - City
 - Road
 - Dry Lake



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Table 3.6-1 Summary of Surficial and Bedrock Geologic Units

Map Symbol	Age	Formation Description
Nevada		
Qa	Quaternary (Holocene and Pleistocene) [< 1.8 mybp]	<u>Surficial Deposits (undivided)</u> : Mixture of alluvial and broken rock deposits.
QToa	Quaternary–Tertiary (Early Pleistocene to late Miocene) [0.8 to 5 mybp]	<u>Old Alluvium (undivided)</u> : Old alluvial fan deposits.
Tba (Tv)	Tertiary (Late to middle Miocene) [5 to 13 mybp]	<u>Andesite and Basalt Flows</u> : Numerous volcanic rocks.
OEc (MzPzs)	Paleozoic to Mesozoic–(Cretaceous to Cambrian) [66 to 570 mybp]	<u>Old Sedimentary Rocks (undivided)</u>
Xm	Precambrian [>570 mybp]	<u>Metamorphic Rocks</u>
California		
Q	Quaternary (Pleistocene to Holocene) [0 to 1.8 mybp]	<u>Quaternary Alluvium</u>
pC (epC)	Precambrian [>570 mybp]	<u>Earlier Precambrian Metamorphic Rocks</u>

Source: USGS 2005

Key:

mybp = million years before present

1
 2 Alluvial deposits have been mapped to various degrees of detail ranging from a generalized approach (CDMG 1961,
 3 Stewart and Carlson 1978, Miller et al. 1999) to a careful segregation of younger and older, active to inactive units
 4 (NBMG 2006, USGS 2006). Undivided Holocene to Pleistocene Surficial Deposits (Qa/Q) are composed of a mixture
 5 of alluvial and talus deposits consisting of poorly consolidated sand, silt, and gravel. Older young-alluvial deposits are
 6 made up of sand and gravel fragments from granitic sources that weather and are characterized by weakly
 7 developed pavements that generally lack varnish (chemical staining). These pavements are composed
 8 predominantly of gravels from which the wind has removed most of the fine-grained sand and silt, giving an
 9 appearance like a paved surface. Older units are characterized by a covering of varnished desert pavement with a
 10 fairly rough surface topography and have been identified principally in Ivanpah Valley between Clark Mountain and
 11 the Lucy Gray Mountains, although they are likely much more widespread.

12
 13 In the valley bottoms and flat areas, latest Holocene to late Pleistocene playa deposits are characterized as
 14 predominantly playas actively receiving water and sediment from the surrounding areas and include Ivanpah,
 15 Roach, and Jean dry lakes. These deposits are weakly bedded and poorly sorted (exhibit a range of grain sizes from
 16 clay to gravel). The areas are generally flat and prone to flooding and receiving stream flow and standing water, and
 17 are subject to wind-blown accumulation and wind erosion.

18
 19 In summary, approximately 76 percent of the proposed project footprint and alternatives are located on alluvium
 20 (mostly alluvial fans), 46 percent on bedrock, and 17 percent on playa deposits. Less than one percent is located on
 21 land disturbed by human activities.

22
 23 Most alluvial deposits in this region, with the exception of lake deposits, are formed within a larger deposition system
 24 called alluvial fans. Alluvial fans are significant because they are subjected to random flood events, which can be
 25 unpredictable. Early Pleistocene- to late Miocene alluvial fan deposits, identified as undivided Old Alluvium (QToa),
 26 are derived from granitic bedrock sources consisting predominantly of gravel of varying sizes. These deposits are
 27 fairly dense to cemented and of mixed composition, and generally lack visual evidence of older surfaces and/or soil
 28 horizons. These deposits form deeply cut, steep topography with little or no evidence of previous surface topography

1 being retained. These deposits are largely undivided (not segregated into other distinct identifiable geologic units) in
2 terms of how the deposits were accumulated. The only extensive area within the proposed project area where this
3 unit is directly observable is in the valley between the McCullough and Lucy Gray mountains.
4

5 Numerous Tertiary volcanic (andesite and basalt) flows (Tba/Tv) are exposed within the proposed project area and
6 may contain some interbedded sedimentary rocks. Exposures of Paleozoic- to Mesozoic carbonate (limestone and
7 dolomite) and siliclastic (sandstone, mudstone, and conglomerate) rocks are present within the proposed project area
8 and are mapped as dolostone (OEc). These rocks make up the bulk of Sheep Mountain north of the Lucy Gray
9 Mountains, the Bird Spring Range, and the Spring Mountains. At the southern end of the Spring Mountains is a small
10 outcrop of the Goodsprings Dolomite (DC).
11

12 The oldest metamorphic rocks (Xm) exposed in the proposed project area include highly metamorphosed,
13 compositionally-layered, Precambrian rocks that overlie older basement rocks (Miller et al. 1999).
14

15 *California*

16 In California, Quaternary stream and valley alluvium, alluvial fan deposits (both younger and older), and lake and
17 playa deposits are exposed along slopes and low-lying flats and valleys. These deposits generally overlie and/or are
18 marginal to bedrock units that include Tertiary undifferentiated volcanic flows with some interbedded sedimentary
19 rocks and Precambrian metamorphic and granitic rocks.
20

21 Alluvial fan deposits have been mapped mostly as generalized units (CDMG 1961, Miller et al. 1999), with some
22 detailed segregation of younger and older, active to inactive units (USGS 2006). Recent Holocene alluvium (Qal) is a
23 poorly sorted mixture of sand and gravel, typically uncemented, unconsolidated, and easily eroded by water or wind.
24 The surface appears as an undulating topography, with little erosional cutting by stream channels. The alluvial fan
25 deposits associated with this unit are characterized by surfaces and stream channels actively receiving sediments
26 within the last few years or decades from ephemeral streams. These deposits may be prone to flooding in some
27 areas. Unnamed lake and playa deposits in the valley bottoms and low-lying flat areas are identified as Quaternary
28 Lake Deposits (Ql/Q). These deposits are similar to the playa deposits (Qp) mapped in Nevada. Older fan gravels
29 that are characteristically elevated above the adjacent topography and eroded are identified as Middle and Early
30 Pleistocene old alluvial fan deposits (Qoa) consisting of poorly sorted silt, sand, and gravel (CDMG 1971).
31

32 Earlier Precambrian Metamorphic rocks (pC/epC) are exposed within the proposed project area. These contain
33 undifferentiated metamorphic rocks cut by roughly vertical igneous intrusions (dikes). These rocks are exposed in the
34 Clark Mountains at and surrounding the Mountain Pass substation.
35

36 The above-described geological units are located within the proposed project area; however, the proposed routes do
37 not intersect all of the above units. In general, longer routes encounter more geologically different units, although
38 some of the more limited sections and alternatives may encounter a wider range of units as well. Table 3.6-2
39 provides a summary of the proposed routes, alternative routes, and associated geological unit(s).
40

41 In general, the important factors that affect construction in these units are foundation bearing capacity,
42 slope/excavation stability (unit strength and slope angle), surface stability for roads/pads, excavatability (how easily
43 the units can be excavated using standard earth-moving equipment), and chemical reactivity (typically corrosion) with
44 concrete and steel. The cohesion (how well the sediments stick together) and composition (affects how easily the
45 sediments can be made denser) of sediments down to tower foundation depths (20 to 40 feet) will impact foundation
46 stability and excavatability. Material strength and cohesion and slope angles will affect slope stability (the tendency to
47 slide); the steeper the slope and/or the weaker the unit, the more likely that the area is susceptible to landslides.
48 Geologic unit cohesiveness and particle size gradation (a variety of particle sizes versus only one particle size) will
49 impact road surface stability and pier excavation stability. Material type, age, and the natural environment within
50 which the sediments were deposited will affect chemical characteristics, particularly corrosion potential.

Table 3.6-2 Geologic and Surficial Units Associated with the Proposed Project and Alternatives

Alternatives													
				State	Geologic Units								
					XM	pC (epC)	OEc (MzPzs)	Tba	QToa		Qa	Q	
El Dorado–Ivanpah 220-kV Transmission Line – Telecommunication Line	(Proposed)			CA/NV	X			X			X	X	
	A			NV							X		
	B			NV							X		
	C			CA/NV			X				X	X	
	D			CA/NV							X	X	
	E (sub-)			NV							X		
					State	Geologic Units							
Ivanpah Substation					XM	pC (epC)	OEc (MzPzs)	Tba	QToa		Qa	Q	
				CA							X		
				State	Geologic Units								
Section	Alternative Routes	Description			XM	pC (epC)	OEc (MzPzs)	Tba	QToa		Qa	Q	
1		Mountain Pass + Golf Course	NV		X				X		X		
2		Mountain Pass + Golf Course	CA/NV								X		
3	1 + 2	Mountain Pass + Golf Course	CA								X		
3	1	Mountain Pass	CA			X					X		
3	2	Golf Course	CA								X	X	
3A	MW Route		CA								X	X	

Source: USGS 2005

Slope stability issues are most important in the sections of the proposed and alternative transmission line routes where topography is steep and bedrock/basement rock is present (the McCullough Mountains and the hill northwest of the Town of Primm), which is a small portion of the overall project. Since most of the proposed project area is within the alluvial fan deposits, and most is underlain by younger and intermediate-age alluvial fan materials, foundation and excavation stability, chemical characteristics, and surface trafficability (ability of a given vehicle to traverse a specified terrain) are important.

Faulting and Seismicity

Several active (fault rupture within the past 11,000 years) and potentially active (fault rupture within the past 1.6 million years) faults related to regional strike-slip (mostly horizontal side-to-side motion) faulting, as well as to extensional tectonics (a pulling apart of the earth’s crust) in the Great Basin and eastern Mojave Desert are present within 100 miles of the proposed project area (Table 3.6-3). The fault locations can be found on the Fault Activity Map of California (CDMG 1994).

Table 3.6-3 Summary of Active and Potentially Active Faults within 100-mile Radius of Proposed Project Area

Fault Name, Zone, or System	Approximate Distance ^a (miles)	Estimated Maximum Earthquake Event		
		Maximum Earthquake Magnitude (Mw)	Peak Site Surface Acceleration (g)	Estimated Site Intensity (Modified Mercalli Scale)
Stataline Fault System	3^a (28)^b	7.0^c	N/A	VII
Black Hills	34^a (3)^b	6.8	N/A	VI
Death Valley (south)	50	7.1	0.080	VII
Garlock (East)	50	7.5	0.098	VII
Owl Lake	65	6.5	0.047	VI
Pisgah-Bullion Mountain – Mesquite Lake	75	7.3	0.065	VI
Black Mountains	76	N/A	N/A	na
Death Valley (Graben)	78	7.1	0.069	VI
Panamint Valley	80	7.4	0.065	VI
Calico – Hidalgo	83	7.3	0.060	VI
Landers	91	7.3	0.056	VI
Camp Rock-Emerson South – Copper Mountain	92	7.0	0.047	VI
Gravel Hills – Harper Lake	94	7.1	0.050	VI
Blackwater	93	7.1	0.049	VI
Johnston Valley (Northern)	97	6.7	0.039	V
Tank Canyon	98	6.4	0.040	V
Lenwood-Lockhart-Old Woman Springs	99	7.5	0.059	VI

Source: CEC and BLM 2009 (Active fault data modified from Table 2.)

Notes:

^aDistance measured from the Ivanpah substation location

^bDistance measured from the El Dorado substation location

^cGuest et al. (2007)

Key:

Bold Text = Faults that are near or cross the proposed project

N/A = Not available

Potential earthquake-capable (active) faults close to the proposed project area are shown in Figure 3.6-2. One active fault (Black Hills) is located just north of the proposed project on the eastern flank of the McCullough Mountains—~~trending, and trends~~ toward the proposed transmission line route and possibly Transmission Alternative Routes A and B. A second active fault (the Stataline Fault System [SFS]), trending northwest–southeast and parallel to the state line just within California, crosses the proposed transmission line route and Alternative Routes C and D. Earthquake activity on distant (greater than 50 miles), larger-scale active fault zones (e.g., the Garlock, Eastern California Shear Zone, Panamint Valley, Death Valley, and Sevier-Toroweap) and the San Andreas could produce large-magnitude earthquakes that would be felt in the project area.

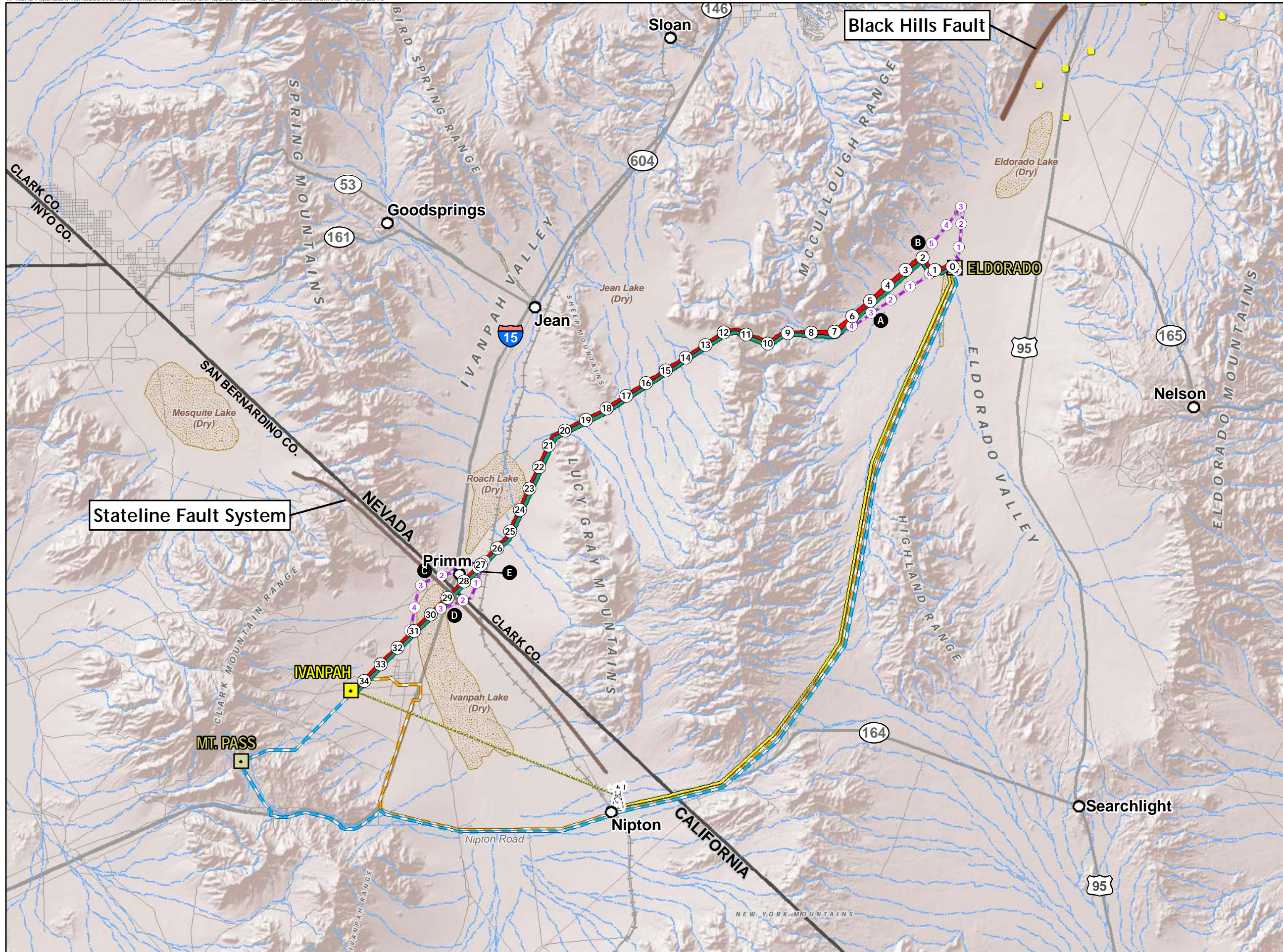
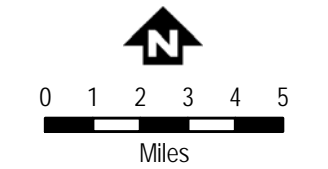


Figure 3.6-2
Eldorado-Ivanpah
Transmission Project
Locally Active and
Potentially Active Faults

- PROPOSED PROJECT
 - Transmission Line
 - Telecommunications Line
 - Redundant Telecommunications Line
 - Microwave
- ALTERNATIVES
 - Transmission Line Alternatives
 - Redundant Telecommunications Line - Mountain Pass
 - Redundant Telecommunications Line - Golf Course
- Milepost
- Proposed Microwave Tower
- Proposed Substation
- Existing Substation
- City
- Road
- Hydrological Feature
- Dry Lake
- Historic Earthquake (Magnitude > 3.0)
- Quaternary Fault
- Fault



March 2010



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1
2 The Black Hills Fault is a complex, northeast–trending, east-dipping (eastward sloping fault beneath the earth’s surface)
3 normal fault zone located in the northern McCullough Range along the western edge of Eldorado Valley that forms the
4 northwestern structural boundary of the Eldorado Basin. A geologic basin is a structural depression in the earth’s surface,
5 a low area often filled with sediments, which may be folded or warped. The Black Hills Fault may be capable of producing
6 a magnitude 6.4 to 6.8 earthquake.¹
7

8 The SFS is the southern segment of the Pahrump Valley Fault Zone. This fault is an active right lateral (right-handed
9 movement) shear zone and includes several previously recognized faults that are inactive, as well as some
10 discontinuously exposed Quaternary faults (Guest et al. 2007). A shear zone is similar to a fault, but (unlike a fault)
11 exhibits movement over a disperse area as opposed to movement that is offset along a distinct fracture. The SFS lies at
12 the northeastern edge of the Eastern California shear zone, an active north–northwest trending, 124-mile-long right-lateral
13 strike-slip shear zone (Guest et al. 2007, USGS 2006) located at the California-Nevada border. The SFS is defined as a
14 continuous zone of faults and shear zones separated into three segments (the Amargosa Valley, Pahrump, and Mesquite
15 segments), with the Mesquite segment passing through the proposed project Area (CDMG 1961, 1994; San Bernardino
16 County 2007). These data suggest that earthquakes on the SFS may be large but infrequent. Although available evidence
17 suggests that earthquakes greater than magnitude 7 occur on the SFS (Menges et al. 2003), recurrence intervals on the
18 SFS have been estimated to be greater than 10,000 years (Anderson 1998, Menges et al. 2003), suggesting a low
19 probability for a large earthquake associated with the fault system (Guest et al. 2007). Other faults in the proposed project
20 area are pre-Quaternary (not active or potentially active based on existing data) and cross or project toward the proposed
21 transmission line route in the McCullough Mountains (Stewart and Carlson 1978). Two of these faults (unnamed) appear
22 to cross the route. It is likely that these faults are represented by highly fractured basement rock (rock beneath the
23 overlying sediments) that may affect engineering qualities of the material and serve as conduits (pathways) for spring
24 flow.
25

26 There are few earthquakes (USGS 2008b) greater than magnitude 3.0 reported within 50 miles of the central portion of
27 the proposed project area (at the north end of the Lucy Gray Mountains). One event of magnitude 6.1 (November 1911)
28 was reported about 40 miles to the southwest of the proposed project area, just north of Baker, California; no specific
29 information was found for this event and its location is considered poorly defined. Approximately 30 to 45 miles to the
30 northeast, four events of magnitude 4.5 to 5.0 occurred just north of Boulder City, Nevada. A cluster of nine magnitude
31 3.0 to 3.9 events occurred west-northwest of the proposed project area on the California side of the border between
32 Pahrump and Mesquite valleys. At least seven magnitude 3.0 to 3.9 events occurred on a northeast to southwest trend
33 from Boulder City to the north end of Eldorado Lake, likely associated with the active Black Hills Fault.
34

35 **Soils**

36 The soils within the proposed project area generally reflect the underlying geologic unit(s). Soil formation depends on the
37 extent of weathering of the unit(s), which is governed by the ground surface slope, the long-term climate, vegetation
38 cover, the degree of human modification, and time. All but a small portion of the proposed project is within close proximity
39 to existing transmission lines towers and roads that pass through otherwise undeveloped land. Small portions are
40 proposed to traverse the east or north edges of Primm, Nevada (proposed transmission line route, Transmission
41 Alternative Routes C and D, and Transmission Sub-Alternative route E), and along State Route (SR) 164 or the Union
42 Pacific Railroad (UPRR) tracks near Nipton. No agricultural or rural residential land is within the proposed project area.
43

44 A summary of the significant characteristics of the major soil associations (National Resources Conservation Service
45 [NRCS] 2008) traversed by the Eldorado–Ivanpah route segments is presented in Table 3.6-4. The soil associations are
46 listed in numerical, rather than geographic, order. There are 19 soil units identified; 14 are in Nevada and five are in

¹ The most common measurements of earthquake magnitude are the moment magnitude (M_w) and Richter (local) magnitude, although sometimes surface wave magnitude or body wave magnitude may be used. Some data sources do not state which is provided, so the original source and further referenced sources should be consulted for more certain indication of which measurement was used.

1 California. Included in the table are the NRCS soil unit identification number, the soil association name, the estimated
 2 expansion potential, and the concrete and steel corrosion potential. The NRCS information is generalized data gathered
 3 at widely spaced locations and should be considered for planning purposes, rather than for site-specific engineering. The
 4 majority of the soils in the proposed project area are sand and gravel-rich and excessively drained to well-drained, which
 5 reduces erosion potential.
 6

Table 3.6-4 Summary of the Significant Characteristics of Major Soil Associations

NRCS Unit ID	Soil Association	Description	Shrink/Swell Potential ¹	Corrosion ²	
				Concrete	Uncoated Steel
Nevada					
140 and 143	Haleburu	Colluvium and/or weathered from volcanic rock; well-drained.	L	L	H
150	Hypoint	Mixed alluvium; somewhat excessively drained.	L	L	H
313	Weiser-Oldspan-Wechech	Alluvium parent material derived from limestone and dolomite; well-drained.	L–M	L	H
380	Tonopah-Arizo	Alluvium parent material derived from mixed sources; excessively well-drained.	L–M	L	H
391	Tipnat-Bluepoint-Hypoint	Mixed alluvium parent material; well-drained.	L–M	H	H
400	Arizo-Cafetal	Mixed alluvium parent material; excessively drained.	L–M	L	H
430	Bluepoint-Tipnat-Grapevine	Eolian (wind blown) sands parent material; excessively drained.	L–M	L	H
450	Arizo	Mixed alluvium parent material; excessively drained.	L	H	H
500	Playa	Lacustrine (lake) deposits parent material; very poorly drained.	M–H	H	H
622	Orwash-Arizo-Lanip	Mixed alluvium parent material derived from granite; somewhat excessively drained.	L	L	H
651	Peskah-Arizo	Alluvium parent material derived from volcanic rock; well-drained	L–M	L	H
754	Haleburu-Hiddensun	Colluvium and/or weathered from volcanic rock; well-drained.	L	L	H
780	Prisonear	Eolian (wind blown) sands over alluvium derived from limestone; well-drained.	L	L	H
California					
3520	Arizo	Alluvium derived from metamorphic and sedimentary rock; excessively well-drained.	L–M	L	H
3650	Weiser	Alluvium parent material derived from limestone and dolomite; well-drained.	L–M	H	L
3660	Colosseum	Alluvium parent material derived from limestone and dolomite; somewhat excessively drained.	L–M	L	H

Table 3.6-4 Summary of the Significant Characteristics of Major Soil Associations

NRCS Unit ID	Soil Association	Description	Shrink/Swell Potential ¹	Corrosion ²	
				Concrete	Uncoated Steel
4180	Peskah-Arizo	Alluvium parent material derived from volcanic rock; well-drained.	L–M	L	H
Playa (see Nevada 500)	Playa	Lacustrine (lake) deposits parent material; very poorly drained.	M–H	H	H

Source: NCRS 2008

Notes:

¹Shrink/swell potential (expansion potential) characteristics are very generally defined as “low = L”, “moderate = M”, or “high = H” based on the NCRS Unified Soil Classification of the soil unit. Shrink/swell characteristic descriptions are general in nature and adequate for planning purposes; the actual expansion coefficient for each soil unit may vary widely depending on site-specific subsurface conditions, which must be determined by site-specific geotechnical sampling, testing, and analysis.

²Corrosion risks for concrete and uncoated steel are generally defined as “low = L”, “medium = M”, or “high = H” based on the NCRS Unified Soil Classification of the soil unit. Corrosion characteristic descriptions are general in nature and adequate for planning purposes; the actual corrosion indices for each soil unit may vary widely depending on site-specific subsurface conditions, which must be determined by site-specific geotechnical sampling, testing, and analysis.

Key:

H = High

L = Low

M = Medium

3.6.1.2 Geologic Hazards

Fault Rupture

A factor considered in the seismic (earthquake) design of project structures is the location of active faults that may cross a transmission line route or affect a substation or other structures. An estimate of the amount and type of potential surface fault displacement (offset) within the proposed project area considers the SFS Mesquite segment and the Black Hills Fault (Figure 3.6-2). There is substantial uncertainty as to the location of these faults. The Mesquite Fault segment crosses the proposed transmission line route and Transmission Alternative Routes C and D along the California-Nevada border at the Town of Primm nearly perpendicular to the proposed transmission line route, at a 20- to 70-degree angle to Alternative Route C and at a 60- to 70-degree angle to Sub-Alternative Route D.

Ground Shaking

The intensity of the seismic shaking (strong ground motion) during an earthquake in the project area would depend on the distance between the area and the epicenter (point at the earth’s surface directly above the initial movement of the fault at depth) of the earthquake, the magnitude (seismic energy released) of the earthquake, and the geologic conditions underlying and surrounding the proposed project area. Earthquakes occurring on faults closest to the project area would most likely generate the largest ground motion.

The USGS provides a uniform estimate of the intensity (strength; not to be confused with magnitude) of earthquake-induced ground motion based on an up-to-date assessment of potential earthquake faults or other sources. A commonly used benchmark is peak horizontal ground acceleration. The probability of occurrence for this peak is given as a fraction of the acceleration of gravity (g; 0.2). The approximate estimated range of peak ground acceleration for a probability of 2 percent (0.02) in 50 years in the proposed project area is presented in Table 3.6-5. Applying the peak ground acceleration shaking map for the 7.3 magnitude Landers earthquake (CISN 2008) to the Mesquite segment of the SFS, the peak ground accelerations would have been similar to those shown in the table. Overall, this estimate of earthquake intensity at the Mesquite segment of the SFS suggests that strong ground shaking would be within the levels experienced in the Landers earthquake area in 1992 and the Hector Mine earthquake in 1999, both in the Mojave Desert region. Electrical transmission lines experienced some damage in each of these earthquakes.

Table 3.6-5 Approximate Estimated Range of Peak Ground Acceleration

Project Facility	Estimate Based on 2% in 50 Years Peak Horizontal Ground Acceleration (g)	Estimate of SFS Earthquake Intensity Based on Magnitude 7.3 Landers 1992 Earthquake (g)
Proposed Transmission Line Route Segments		
Eldorado to McCullough Mountains	0.16 to 0.20	0.20 to 0.25
McCullough Mountains	0.15 to 0.16	0.20 to 0.25
McCullough Mountains to Ivanpah	0.12 to 0.15	0.18 to 0.50
Transmission Alternative/Subalternative Routes		
A	0.16 to 0.17	0.18 to 0.20
B	0.17 to 0.20	0.15 to 0.18
C	0.13	0.40 to 0.50
D	0.13	0.40 to 0.50
E	0.13	0.40 to 0.50
Ivanpah Substation		
Ivanpah Substation	0.12	0.35
Telecommunications Alternatives and Microwave Tower		
Conduit Near Ivanpah Substation	0.13	0.35
Conduit East of Nipton	0.12 to 0.13	0.30 to 0.45
Conduit West of Nipton	0.12 to 0.14	0.30 to 0.45
Microwave Tower	0.12 to 0.13	0.30 to 0.45

Source: USGS 2008a, CISON 2008

Key:

g = Acceleration of gravity

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Liquefaction

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Landslides

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Landslides, rockfalls, and debris flows occur continuously on all slopes; some processes act very slowly, while others occur very suddenly, with potentially disastrous results. Rockfalls and debris flows are examples of earth movements that occur rapidly, often without warning. Landslides do occur rapidly without warning but can also provide signs of movement before the slide moves completely. Most of the proposed project area is in low to moderately sloping topography containing sandy and gravelly alluvium that is not susceptible to landslide effects. About 10 percent of the proposed transmission line route (McCullough Mountains segment) and 20 percent of Transmission Alternative Route C pass through areas with moderately steep to very steep topography containing highly weathered and fractured bedrock/basement rock. These areas may be susceptible to rockfall and rotational (landslide) movement of moderate to

1 large sections of hillslope within or adjacent to the route. Such movements can have damaging effects. No landslides
2 have been designated on maps reviewed for this study; however, rockfall hazards could include blocks from a few feet to
3 over 10 feet in diameter.

4 5 **Subsidence**

6 Subsidence is the settling of the ground surface due to compaction (consolidation) of underlying unconsolidated (loosely
7 packed) sediments. Subsidence is most common in uncompacted soil, thick unconsolidated alluvial material, and
8 improperly constructed artificial fill. Subsidence due to groundwater withdrawal is possible due to substantial pumping;
9 however, there are no known records of such conditions in the proposed project area. Continued and/or increased
10 groundwater withdrawal or dewatering from the Ivanpah and Eldorado valleys may cause an overdraft condition (where
11 groundwater removal exceeds recharge). If that occurs, signs of subsidence could be observed. Many years or decades
12 may be needed for the effects of excessive removal of groundwater to be manifested. Local subsidence in the form of
13 sinkholes has been observed along the northern edge of Ivanpah Dry Lake. While groundwater withdrawal or other
14 factors may cause subsidence, in this case the cause is believed to be from dehydration of clays between the soil surface
15 and the water table due to fluctuations in hydrology. This dehydration can result in a major loss of volume, and thus the
16 collapse of overlying soils (CEC and BLM 2009).

17
18 Earthquake-induced ground cracking may have many causes, but on low to moderate slopes (a few to several degrees)
19 there would be little to no impact expected from ground cracking for transmission line towers with deep foundations.
20 Within the proposed project area, ground cracking potential exists along the McCullough Mountains segment and the
21 bedrock portion of Alternative Route C.

22 23 **Expansive Soil**

24 Expansive soils shrink or swell with changes in moisture content. This characteristic is typically associated with high clay
25 content soils. Changes in soil moisture could result from a number of factors, including rainfall, landscape irrigation, utility
26 leakage, and/or perched groundwater. Expansive soils are typically very fine-grained with high to very high percentages
27 of clay. In Nevada, the soils encountered in the areas of the proposed project and alternative routes exhibit expansion
28 potential that is generally low or low to moderate, with one unit (playa) having a moderate to high potential. In California
29 overall, the potential for expansive soils is generally low to moderate, with one high unit (playa).

30 31 **Collapsible Soils**

32 Collapsible soils are those that decrease in volume and settle when soil structure changes due to wetting of partially
33 saturated subsoil. Typically, collapsible soils occur predominantly at the base of mountains, where Holocene alluvial fan
34 and wash sediments have been deposited during rapid runoff events. Moreover, seismically-induced ground settlement
35 can occur during strong ground shaking in alluvium if deposits have a low relative density and are dynamically compacted
36 and their volume is thereby reduced. Differential settlement can damage structures placed across such susceptible areas.

37 38 **3.6.1.3 Mineral Resources**

39
40 Mineral resources consist of oil and gas and deposits of rock, sand, and gravel. Publically available literature, maps, and
41 online sources were used to evaluate potential impact to mineral resources in the proposed project area. Non-metallic
42 and metallic mineral deposits occur within the general proposed project area and to the west in the Clark Mountains
43 (CDMG 1953). However, no mining of metallic deposits was identified within 1,000 feet of the project components
44 considered herein. Non-metallic deposits within the project area include pumice, feldspar, limestone, and sand and
45 gravel, with sand and gravel potential being the highest along the transmission and telecommunication routes.

46
47 North and south of SR 164, between 6 and 17 miles east of Nipton, in the general proximity of the proposed redundant
48 telecommunications Line (Path 2), there are operations for perlite, gold, silver, lead, molybdenum, copper, fluorite, and
49 feldspar (USGS 2009). The proposed aboveground portion of the Mountain Pass Telecommunications Line (attached to
50 the existing Nipton 33-kV poles) intersects the Molycorp Mine, a large rare-earth mine near Mountain Pass, California,

1 hereafter called the Mountain Pass Mine. This may be the only active mine near the California portion of the project.
2 Proximal to the proposed transmission line route in Jean Valley and the McCullough Mountains are sand and gravel and
3 pumice surface mines. As shown in Figure 3.6-3, there are areas (green squares) within BLM land all along the proposed
4 and alternative routes for which there have been mining claim activity. Based on 1996 claims data, approximately two-
5 thirds of the claims are “closed” (Hyndman and Campbell 1999). Davis (2002) indicated that the “Money Pit” in Jean
6 Valley more than 1 mile north of the proposed transmission line route may be the only active mine near the Nevada
7 portion of the project area. However, the Jean Quarry and Sierra Ready Mix Quarry, which are both listed as active
8 operations, are also located less than 1 mile north of the proposed transmission line route (NBMG 2006). While several
9 other operations and mines are in the general area of the proposed routes, they do not appear to be close enough to
10 experience any impact from the project.
11

12 The USGS Mineral Resource Data System (MRDS) indicates that there are a few past and current mining locations in the
13 vicinity of the proposed project, but none are located within 1,000 feet of either side of the proposed transmission line
14 route or alternative routes. Based on the available data, the proposed project is not expected to impact any mining
15 activities. This is explained further below.
16

17 **Eldorado to McCullough Mountains (Proposed Route)**

18 There are no active mines identified in the USGS MRDS database within 1,000 feet of this segment, and there is no
19 known ongoing mineral resource recovery near this segment. In addition, there is almost no mining claim activity
20 along the segment.

21 **McCullough Mountains (Proposed Route)**

22 While there are mining claims in the general area along the segment, there is no known ongoing mineral resource
23 recovery near or close to this segment that would potentially be impacted, and there are no active mines identified in
24 the USGS MRDS database within 1,000 feet of this segment.

25 **McCullough Mountains to Ivanpah Substation (Proposed Route)**

26 There is substantial mining claim activity several miles to the northwest of this segment in the Spring Mountains.
27 Other activity along this proposed route is recorded, but is typically set back 1 or more miles from the segment. There
28 is no known ongoing mineral resource recovery close to this segment that would potentially be impacted; no active
29 mines are identified in the USGS MRDS database within 1,000 feet of this segment.

30 Alternative Route A (South and West of Eldorado Substation)

31 There is no mining claim activity along this segment and no known ongoing mineral resource recovery near this
32 segment, and no active mines are identified in the USGS MRDS database within 1,000 feet of this segment.

33 Alternative B (North and West of Eldorado Substation)

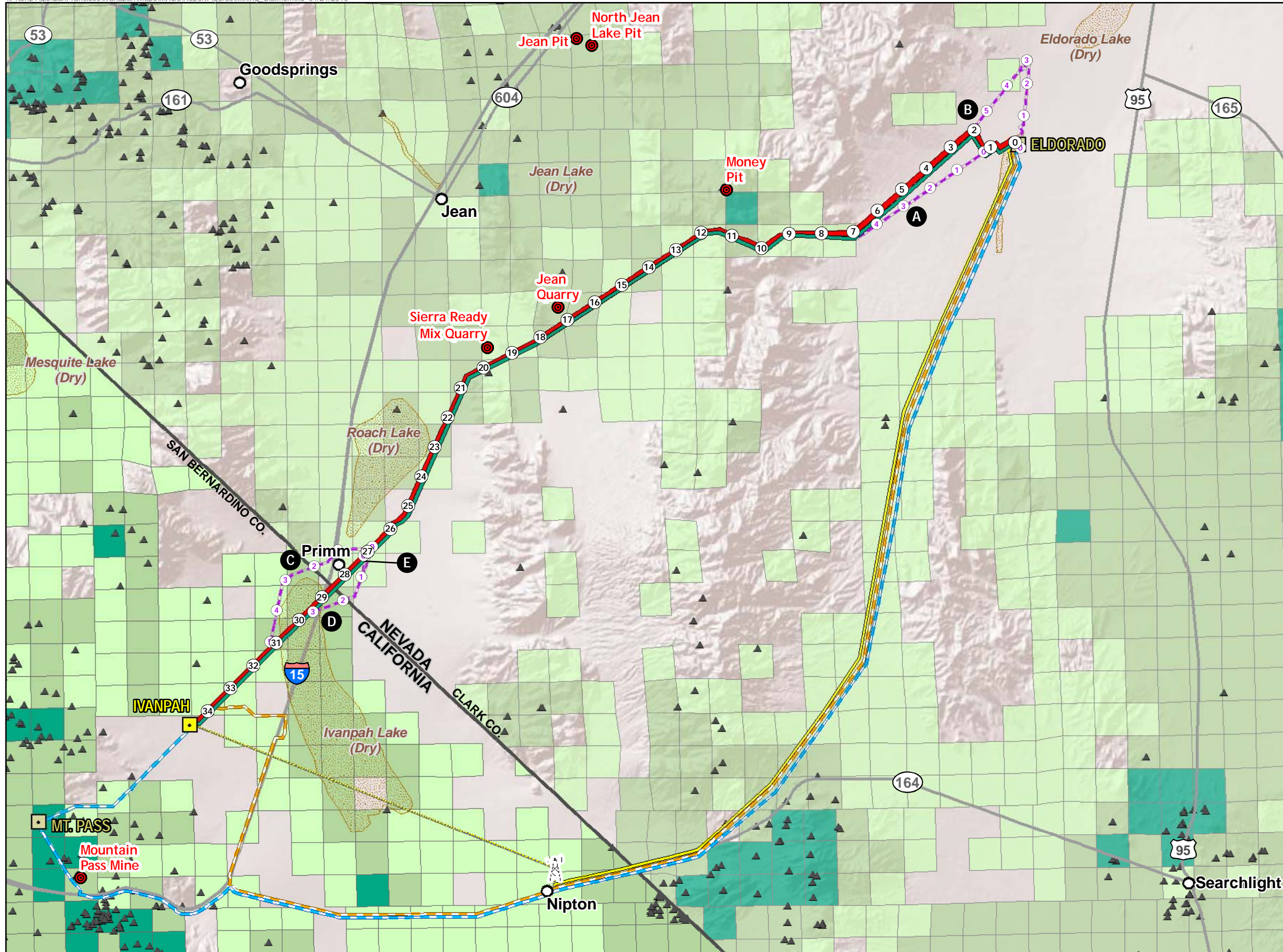
34 There is ~~no~~ some mining claim activity along this segment, no known mineral resource recovery ongoing near
35 this segment, and no active mines are identified in the USGS MRDS database within 1,000 feet of this segment.

36 Alternative Route C (West and Southwest of Primm, Nevada)

37 While there is substantial mining claim activity along this segment, there are no active mines identified in the
38 USGS MRDS database within 1,000 feet of this segment, and there is no known ongoing mineral resource
39 recovery near this segment.

40 Alternative Route D and Subalternative E (South and East of Primm, Nevada)

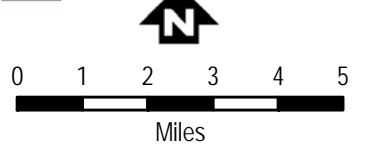
41 There is substantial mining claim activity along this segment; however, there are no active mines identified in the
42 USGS MRDS database within 1,000 feet of this segment and there is no known ongoing mineral resource
43 recovery near this segment.



**Figure 3.6-3
Eldorado-Ivanpah
Transmission Project**

*Mines and Mining
Claim Activity*

- PROPOSED PROJECT
 - Transmission Line
 - Telecommunications Line
 - Redundant Telecommunications Line
 - Microwave
- ALTERNATIVES
 - Transmission Line Alternatives
 - Redundant Telecommunications Line - Mountain Pass
 - Redundant Telecommunications Line - Golf Course
- Milepost
- Proposed Microwave Tower
- Proposed Substation
- Existing Substation
- City
- Road
- Hydrological Feature
- Dry Lake
- Mine
- Active Mine
- Mining Claims
 - 1-50 Claims
 - 51-500 Claims
 - >500 Claims



March 2010



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1 **Ivanpah Substation**

2 The USGS MRDS database indicates no mining claim activity at the substation site, no known ongoing mineral
3 resource recovery near the site, and no active mines identified within 1,000 feet of the site.

4 **Redundant Telecommunication System and the Microwave Tower**

5 Mountain Pass Alternative and Golf Course Alternative

6 There is mining claim activity in the vicinity of this route, which consists of aboveground and underground fiber-
7 optic cable. However, there is ~~these short conduit routes~~, but no known ongoing mineral resource recovery is
8 near ~~these this~~ segments, and no active mines are identified in the USGS MRDS database within 1,000 feet of
9 ~~this~~ segment.

10 Mountain Pass Alternative

11 There is mining claim activity in the vicinity of this route, which consists of aboveground and underground fiber-
12 optic cable. There is ongoing mineral resource recovery in the Mountain Pass portion of this segment, with
13 aboveground fiber-optic cable on existing poles, and active mining is occurring within 1,000 feet of this segment.

14 Microwave Tower Northeast of Nipton

15 There is some mining claim activity in the area of this site, including one operation about one-half mile east of
16 this location and one active mining operation about one-half mile to the northeast, but there are no active mines
17 identified in the USGS MRDS database within 1,000 feet of this site.
18
19

20 **3.6.1.4 Paleontology**

21
22 Since the original administrative draft Draft EIR/EIS was submitted in January published on April 30, 2010 and responses
23 to the document were answered, new information on the paleontological resources of the proposed project has become
24 available. In August 2010, a paleontological resources management plan was submitted to by SCE by from Cogstone
25 Resource Management, Inc., which includes a preconstruction paleontological resources walkover and windshield
26 survey and assessment, and a paleontological resources management plan (Scott and Gust 2010). Figure 3.6-4 shows
27 areas in the proposed project that would require full-time monitoring for paleontological resources during construction.
28

29 **Regional Setting**

30 The proposed project crosses over a number of geologic rock units (Table 3.6-2). The following section describes each
31 geologic unit's extent, rock type, and age, with an emphasis on paleontology and paleontological sensitivity (likelihood of
32 containing scientifically significant fossils). To provide more detailed paleontological data, the geologic unit classifications
33 below are drawn from a different data set than that used to compile Figure 3.6-1. Therefore, not every unit described
34 below is displayed in Figure 3.6-1.
35

36 The BLM's Potential Fossil Yield Classification (PFYC) system is used to classify the paleontological potential of geologic
37 units to yield significant fossils during the construction phase (BLM 2007). The BLM established the PFYC system to
38 quantify the occurrence of paleontological resources on public lands and, rate their paleontological sensitivity and the risk
39 of impacting them, and suggest appropriate mitigation measures. Geologic units are assigned a classification between 1
40 (lowest) and 5 (highest). The PFYC system is used by BLM to assess impacts to paleontological resources and suggest
41 appropriate mitigation measures. For a more detailed description of this classification system see Scott and Gust (2010).
42

43 Table 3.6-6 shows that units in the project area have either a high or a low sensitivity for paleontological resources that
44 may be present on the surface or could be exposed during ground-disturbing construction activities, based on the Society
45 of Vertebrate Paleontology (SVP) guidelines (1995). The BLM PFYC is also included in the table.

Table 3.6-6 Paleontological Sensitivity of the Lithologic Units Underlying Portions of the Proposed Project Area in San Bernardino County, California, and Clark County, Nevada

Lithologic Unit	Paleontological Sensitivity ^a	PFYC ^b
Quaternary alluvium	High	4
Quaternary lake/playa deposits	High	4
Quaternary nonmarine (Quaternary older alluvium)	High	3
Late Tertiary–Quaternary older alluvium	High	3
Tertiary volcanics	Low ^e	2
Paleozoic–Mesozoic sedimentary rocks	Low ^d	3
Precambrian intrusive and metamorphic rocks	Low	1

Notes:

^aSVP 1995

^bBLM 2007

^cHigh, if sedimentary rocks are present

^dHigh, if solution caves and/or vertebrates are present

Key:

PFYC = Potential Fossil Yield Classification (scale of 1–5, with 1 the lowest)

Lithologic Unit	Paleontological Sensitivity ^a	BLM PFYC ^b		
		This Report	Scott & Gust 2010	Potential
Quaternary Alluvium	High	4	2, ^d 3b ^e	Low, Unknown
Quaternary Lake/Playa deposits	High	4	3b	Unknown
Quaternary nonmarine (Quaternary older alluvium)	Low	3	2, 3b ^e	Low, Unknown
Late Tertiary–Quaternary older alluvium	Low	3	2	Low
Tertiary Volcanics	Low	2	1	Very Low
Paleozoic sedimentary rocks – Goodsprings Dolomite	Low ^c	3	2	Low
Precambrian intrusive and metamorphic rocks	None	1	1	Very Low

Notes:

^aSociety of Vertebrate Paleontology Guidelines, 1995

^bBureau of Land Management Potential Fossil Yield Classification (PFYC; BLM 2007) with 5 indicating the highest potential and 1 the lowest.

^cHigh, if solution caves and/or vertebrates are present

^dRevised PFYC rating by Scott and Gust 2010

^eHigher PFYC rating in 1-mile radius around playa dry lakes

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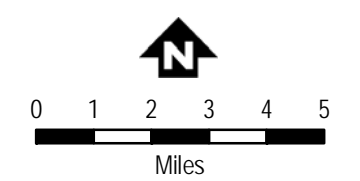
Quaternary alluvium (Qa, Qal)

Quaternary alluvium (late Pleistocene and Holocene) has been mapped at the surface along the length of the project corridor in California and Nevada (Jennings 1961, Longwell et al. 1965, NBMG 2006). Throughout southern California these units have been repeatedly demonstrated to be highly fossiliferous, yielding the remains of large extinct Ice-Age (Pleistocene) mammals such as mammoths, mastodons, camels, sabertoothed cats, tapirs, sloths, and horses as well as amphibians (salamanders, frogs, toads), reptiles, birds, and small mammals (Jefferson 1991a, 1991b; Reynolds et al. 1991e; Woodburne 1991; Springer and Scott 1994; Scott 1997; Springer et al. 1998, 1999, 2007; Anderson et al. 2002) and the Mojave Desert (Jefferson 1989, 1991a, 1991b; Reynolds 1989; Scott 1997; Scott and Cox 2002, 2008). Near the northern end of Ivanpah Dry Lake, for example, large mammal bone fragments were recovered from sediments mapped as Quaternary alluvium identical to that along portions of the proposed route (Longwell et al. 1965). Similarly, surface exposures of Quaternary alluvium near Glendale, Nevada, yielded mammal fossils including a tooth of extinct horse (*Equus* sp.). These sediments would have a high potential to contain significant paleontological resources.



**Figure 3.6-4
Eldorado-Ivanpah
Transmission Project**
*Areas of High
Paleontological Sensitivity*

- PROPOSED PROJECT**
- Transmission Line
- Telecommunications Line
- Redundant Telecommunications Line
- - - Microwave
- ALTERNATIVES**
- - - Transmission Line Alternatives
- - - Redundant Telecommunications Line - Mountain Pass
- - - Redundant Telecommunications Line - Golf Course
- Milepost
- Proposed Microwave Tower
- Proposed Substation
- Existing Substation
- City
- Road
- Dry Lake
- Areas of High Paleontological Sensitivity (Scott and Gust, 2010)



2010



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1 UnderOriginally, the Quaternary alluvium was rated Class 4 (high potential for paleontological resources) under the BLM
 2 PFYC system, the units would be rated Class 4. (BLM 2007), but subsequent studies by Scott and Gust (2010) rated
 3 these sediments as Class 2 (low potential for paleontological resources); that is, this unit is not likely to contain vertebrate
 4 fossils or scientifically significant nonvertebrate fossils (BLM 2007) over most of the project area. Scott and Gust's field
 5 survey indicated that the Quaternary alluvium over most of the project area consists of broad coalescing alluvial fans with
 6 the surrounding mountains as a source area for the fan sediments. Scott and Gust state that the Quaternary alluvium is
 7 considered to be only potentially sensitive for paleontological resources at the distal end of the alluvial fans within 1 mile
 8 of the playas (Ivanpah, Roach, and Eldorado dry lakes) and under the BLM PFYC system rated these sediments as Class
 9 3b (unknown potential for paleontological resources) and recommended full-time monitoring during construction. In his
 10 1920 paper on the groundwater resources of the Ivanpah Valley, Waring presented sections on several wells that were
 11 drilled in the Quaternary alluvium adjacent to the Ivanpah playa. One well (No. 103) was located 2 miles south of the
 12 present lake bed near Murpheys Well. For exact locations of unknown potential sensitivity monitoring areas see Figure
 13 3.6-4. The section from this well has several thick horizons of silt and clay, which are conducive to the preservation of
 14 fossils and maybe older Ivanpah Lake sediments. Away from the playas, the Quaternary Alluvium transitions into the
 15 middle and proximal alluvial fan deposits with an increasing percentage of cobble and boulder clasts. Unlike finer-grained
 16 sediments (sand, silt, clay), these coarse sediments are not conducive to the preservation of fossils. During the course of
 17 the preconstruction field survey for paleontological resources, near Ivanpah Lake playa, a Holocene or late Pleistocene
 18 plant site (2010KMS0809.1) was identified in a small channel in Quaternary alluvial deposits about 1 meter below the
 19 modern surface (Scott and Gust 2010).

20
 21 **Quaternary lake/playa deposits (Ql/Qp)**

22 These flat-lying deposits in Ivanpah and Roach Dry Lakes consist of light gray to light brown silt, clay, and minor sand.
 23 Although modern at the surface, these lake/ playa sediments increase in age with depth, perhaps to the late Pleistocene.
 24 These fine-grained sediments often preserve late Pleistocene and Holocene invertebrates (freshwater clams and snails;
 25 Taylor 1967, Reynolds et al. 1991d, Jefferson et al. 2004), smaller vertebrates (fish, amphibians, reptiles, birds, and small
 26 to medium-sized mammals), and larger extinct vertebrate fossils such as mammoths, mastodons, horses, sloths, and
 27 camels (Jefferson 1991b, Reynolds et al. 1991d, Jefferson et al. 2004). Mifflin and Carlson (1979) in their study of pluvial
 28 (late Pleistocene) lakes of Nevada could not find shoreline features or an overflow channel and interpreted the age of
 29 Ivanpah-Roach Dry Lake basin as recent. However, the Ivanpah-Roach Dry Lake may have been combined into one
 30 larger lake than the present lakebed and possibly present during the late Pleistocene, based on clasts of tufa (fragments
 31 of carbonate-based minerals deposited in a lake environment) from an Ivanpah Lake Dry high stand or shoreline. These
 32 sediments would have a high potential to contain significant paleontological resources. Originally these sediments were
 33 rated Class 4 (high potential for paleontological resources [BLM 2007]), but the subsequent preconstruction field survey
 34 and assessment by Cogstone Resource Management (Scott and Gust 2010) rated the lake/playa sediments as Class 3b
 35 (unknown potential for paleontological resources) and recommended full-time paleontological monitoring during
 36 construction. No paleontological resources were identified during the preconstruction survey (Scott and Gust 2010). These
 37 units/rocks would be rated Class 4 (BLM 2007).

38
 39 **Quaternary non-marine deposits (Qoa/Qc)**

40 Quaternary non-marine deposits (mapped as Quaternary older alluvium) have been mapped at the surface along the
 41 project corridor in the vicinity of the Clark Mountains in California (Jennings 1961). These deposits consist of poorly sorted
 42 debris that range from pebble to boulder in a matrix of brown silt derived from Clark Mountain. Elsewhere, older
 43 Pleistocene sediments throughout southern California (Jefferson 1991a, b; Reynolds and Reynolds 1991e; Woodburne
 44 1991; Springer and Scott 1994; Scott 1997; Springer et al. 1998, 1999, 2007; Anderson et al. 2002) and the Mojave
 45 Desert (Jefferson 1989, 1991a, 1991b; Reynolds 1989; Scott 1997; Scott and Cox 2002, 2008) have been repeatedly
 46 demonstrated to be highly fossiliferous. Where present at the surface or at depth, these sediments have the potential to
 47 contain significant paleontological resources. Originally the Quaternary nonmarine deposits or older alluvium were
 48 assigned Class 3 (moderate potential for paleontological resources [BLM 2007]); however, because of the coarseness of
 49 these sediments, Scott and Gust (2010) rated them as Class 2 (low potential for paleontological resources [BLM 2007])
 50 and recommended spot-check or part-time paleontological monitoring over most of the outcrop area. No paleontological

resources were identified during the preconstruction field survey (Scott and Gust 2010). The units/rocks would be rated Class 3 (BLM 2007).

Quaternary Tertiary Older Alluvium (Qtoa)

These alluvial fan deposits are derived from granitic rocks sources in the vicinity of the McCullough and Lucy Gray mountains and are Late Miocene to early Pleistocene in age. Although these sediments are ~~predominately~~ predominantly coarse grained, that is, sand and gravel, old buried soils (paleosols) are present in several horizons (NBMG 2006). These soil horizons, which could yield significant fossils of vertebrates ~~fossils~~ such as small mammals, were present at the surface or at depth along the proposed project. ~~These sediments would have high potential to contain significant paleontological resources.~~ Originally, the Quaternary Tertiary Older Alluvium (Plio-Pleistocene gravels in Scott and Gust [2010]) were assigned to Class 3 (moderate potential for paleontological resources; BLM 2007). The units would be rated Class 3, but subsequently they were assigned to Class 2 (low potential for paleontological resources) and recommended for spot-check paleontological monitoring during construction, based on observations during the preconstruction field survey, during which no paleontological resources were identified (Scott and Gust 2010).

Tertiary volcanic rocks (Tba/Tv)

Surface exposures of these rocks have been mapped along the project corridor in the McCullough Range in Nevada (Longwell et al. 1965). Tertiary volcanic rocks in the Mojave Desert have low potential to contain significant fossil resources. However, it is possible to have inclusions of sedimentary rocks within volcanic rocks. These sedimentary inclusions have the potential to contain significant fossil resources; therefore, these volcanic rocks would be assigned a high paleontological sensitivity. To the south near Needles, ash-rich lacustrine sediments within volcanic rocks yielded middle Miocene (15 mybp) flora and fauna consisting of the fossil remains of a sequoia, wood, conifer needles, ostracods, flamingo footprints, a pika, a coyote-sized dog, a bobcat-sized cat, a rodent, an antelope-sized cervoid, two camels, and a rhinohinoceros. ~~The Tertiary volcanic rocks would be were rated Class 2.~~

Paleozoic and Mesozoic sedimentary rocks (OEc/MzPzs)

The Tertiary volcanic rocks were rated Class 2 (low potential for paleontological resources; BLM 2007). Subsequent work by Scott and Gust (2010) agreed with this designation and recommended spot-check paleontological monitoring during construction. No paleontological resources were identified during the preconstruction field survey (Scott and Gust 2010).

Cambrian to Devonian Goodsprings Dolomite (DEG)

Undivided Paleozoic and Mesozoic rocks have been mapped at the surface along the proposed project corridor in the Clark Mountain vicinity, California (Jennings 1961, NBMG 2006). Because of mapping difficulties, Paleozoic-Mesozoic carbonate rocks such as limestone and dolomites, and terrigenous rocks such as ~~sandstones, mudstones, and conglomerates~~ silty shale, have been placed in this broad rock unit. This unit, which includes the Bonanza King Formation, the Nopah Formation, the Pogonip Group, and the Ely Springs Dolomite (Gans 1970, 1974) ranges from 443 to 513 million years in age. In this area, some of these rocks were deposited in ancient shallow seas and generally yield a wide variety of marine fossil invertebrates such as sponges, brachiopods (primitive clams), gastropods (snails), pelecypods (advanced clams), trilobites, graptolites (marine kelp-like animals), and echinoderm crinoids (related to starfish, sand dollars, and sea urchins; Dames and Moore 1992). Invertebrate Fossils of this nature are abundant and widespread throughout the southern Nevada and eastern California region, to such a degree that ~~these fossils~~ they are not generally considered to have high paleontological significance. ~~Near Stateline, California, paleontology monitors on the Intermountain Power Project found many marine invertebrates in rocks of the Mississippian Monte Cristo Formation (Hewitt 1931, Reynolds 1986, Moore 1991). Also, during construction on the Kern River Pipeline project, marine invertebrates (clams, snails, corals) were collected from rocks of the Bird Spring Formation (Pennsylvanian) and Kaibab Limestone (Dames and Moore 1992). Time diagnostic invertebrates from these limestone rocks have somewhat higher significance, but are still relatively common in the region. Elsewhere, middle to late Paleozoic limestone in this area has the potential to yield teeth and bones of early bony fishes and sharks. For example, just north of the City of Las Vegas, fossil shark teeth were collected from the surfaces of Mississippian limestone of the Battleship Wash Formation in the~~

1 Arrow Canyon Range (Langenheim et al. 1962). Also, during construction of the Kern River Pipeline project, the first fossil
 2 bony fish remains (teeth) were recovered from the Mississippian Monte Cristo Formation and Kaibab Limestone in
 3 Nevada (Dames and Moore 1992). Any However, any vertebrate remains (shark, fish) recovered from Paleozoic or
 4 Mesozoic sedimentary rocks would be highly significant. There is a potential for vertebrate fossils and trackways in the
 5 Mesozoic sedimentary rocks. Recently, fossil dinosaur and pterosaur (flying reptiles) tracks have been reported from the
 6 early middle Jurassic Aztec Sandstone of the nearby Mescal Range in eastern San Bernardino County (Reynolds 2005,
 7 Reynolds 2006a, 2006b, Reynolds and Michelson 2006).

8
 9 The undivided Paleozoic and Mesozoic rocks of the Goodsprings Dolomite have a low potential to contain significant
 10 paleontological resources, but in limestone and marble, there is a potential for solution caves that contain significant
 11 fossils. In the past, these caves were often open at the surface, and accumulated bones of various kinds of animals from
 12 raptors and other predators dropping remains into the opening, or from the remains of animals that inhabited the cave.
 13 Other animals such as pack rats built nests and also collected bones from around the cave entrance. Many of these
 14 caves are older than 10,000 years and elsewhere in the Mojave Desert have yielded the remains of large, extinct, late
 15 Pleistocene mammals such as camel, horse, and sloth (Mead and Murray 1991, Reynolds et al. 1991a, Whistler 1991,
 16 Gromney 2003, Jefferson et al. 2004, Museum of Paleontology, University of California, Berkeley 2009) as well as smaller
 17 mammals, amphibians, reptiles, and birds (Goodwin and Reynolds 1989; Force 1991; Reynolds et al. 1991a, 1991b,
 18 1991c; Jefferson et al. 2004). If cave deposits were encountered during construction at depth anywhere along the
 19 proposed project, they would be considered scientifically significant. Originally the Paleozoic sedimentary rocks of the
 20 Goodsprings Dolomite were rated Class 3 (moderate potential for paleontological resources; BLM 2007), but subsequent
 21 information provided by Scott and Gust (2010) classified these rocks as Class 2 (low potential for paleontological
 22 resources) and recommended spot-check paleontological monitoring during construction. During the preconstruction
 23 paleontological resources field survey, a single outcrop identified as Goodsprings Dolomite near Primm, Nevada, was
 24 inspected. Although no paleontological resources were observed (Scott and Gust 2010), paleontological monitoring
 25 during construction consisting of spot checks for caves and woodrat middens was recommended. The Paleozoic-
 26 Mesozoic sedimentary rocks would be rated Class 3 (BLM 2007).

27
 28 **Earlier Precambrian intrusive and metamorphic rocks, undivided (pC/ePE) in California and**
 29 **Ancient intrusive and metamorphic rocks (Xm) (undivided Proterozoic) in Nevada**

30 Two similar metamorphic (rocks that have been altered by heat and pressure) basement rocks occur in the southern
 31 McCullough Range in Nevada and in the Clark Mountain in California. Earlier Precambrian metamorphic rocks in the
 32 Clark Mountains (Jennings 1961, Longwell et al. 1965) and the ancient intrusive and metamorphic rock (NBMG 2006)
 33 undivided (Proterozoic) in the McCullough Range in the proposed project area consist of granite, granite gneiss, schist,
 34 granitic augen gneiss, quartz monzonite, marble, and schist. Due to the heat and pressure associated with the formation of
 35 igneous and metamorphic rocks, these rocks have low potential to contain significant paleontological resources (SVP
 36 1995). Originally, these Precambrian rocks were rated Class 1 (very low potential for paleontological resources; BLM
 37 2007) and subsequent work by Scott and Gust (2010) agreed with this designation. No fossils were observed during the
 38 preconstruction paleontological resources field survey, and spot checks were recommended for caves/ woodrat middens
 39 during the construction phase of the project (Scott and Gust 2010). The rocks would be rated Class 4 (BLM 2007).

40
 41 **Records Search**

42 The Regional Paleontological Locality Inventory at the San Bernardino County Museum (SBCM) shows that several
 43 paleontological resource localities are recorded within 1 mile of the proposed project. The applicant-prepared PEA stated
 44 that the nearest paleontological resource locality (SBCM 1.2.5) is located on the California-Nevada border approximately
 45 300 feet northwest of the proposed route (Scott 2008). This locality yielded indeterminate large mammal bone fragments
 46 from sediments mapped as Quaternary alluvium by Longwell et al. (1965). Additionally, localities SBCM 1.2.1 through
 47 1.2.4 near the proposed route in Sections 35 and 36 of T 17N, R 14E have produced fossil remains of tortoise (*Gopherus*
 48 sp.), kangaroo rat (*Dipodomys* sp.), wood rat (*Neotoma* sp.), and other small vertebrates, as well as a partial hackberry
 49 seed (*Celtis* sp.) and clasts of tufa from the high stand of Ivanpah Dry Lake. Fossil hackberry seeds are abundant in
 50 nearby cave deposits which contain Pleistocene vertebrate faunas (Reynolds et al. 1991b). Tufa is common at the top of

1 the sedimentary section at several Pleistocene lakes in San Bernardino County, including Piute Valley and Cadiz.
2 However, none of the localities near Ivanpah Dry Lake has yielded temporally diagnostic fossil remains. For this reason, a
3 Pleistocene age for these faunas can be suggested, but not demonstrated.

4
5 The online records search for microfossil, plant, invertebrate (clams and snails), and vertebrate (animals with backbones)
6 localities conducted at the Museum of Paleontology, University of California, Berkeley (Museum of Paleontology,
7 University of California, Berkeley 2009) indicated no previously recorded paleontological resources within a mile of the
8 proposed project area.

9
10 A search of the data base of Late Pleistocene vertebrate localities for California (Jefferson 1991a, 1991b) and for Nevada
11 (Jefferson et al. 2004), which included institutional records and published references, indicated no known paleontological
12 resource localities are recorded within a mile of the proposed project.

13 14 **3.6.2 Applicable Laws, Regulations, and Standards**

15
16 Geologic resources and hazards are governed primarily by local jurisdictions. The conservation elements and seismic
17 safety elements of city and county general plans contain policies for protection of geologic features and avoidance of
18 hazards, but do not specifically address transmission line construction projects. Local grading ordinances establish
19 detailed procedures for construction. The following section provides a summary of federal, state, and local laws,
20 regulations, and standards that govern geology, soils, minerals, and paleontology in the project area.

21 22 **3.6.2.1 Federal**

23 24 **National Environmental Policy Act of 1969, as amended**

25 The National Environmental Policy Act (NEPA; 42 USC 4321 et seq.) was signed into law on January 1, 1970. NEPA
26 establishes national environmental policy and goals for the protection, maintenance, and enhancement of the
27 environment and it provides a process for implementing these goals within the federal agencies. The NEPA process
28 consists of an evaluation of the environmental effects of a federal undertaking. It includes an evaluation of alternatives.
29 There are three levels of analysis depending on whether an undertaking could significantly affect the environment. From
30 least to greatest complexity, these are (1) categorical exclusion determination, (2) preparation of an Environmental
31 Assessment/Finding of No Significant Impact, and (3) preparation of an EIS.

32
33 Under NEPA, the terms "effects" and "impacts" are used synonymously. Direct or primary impacts are those caused on
34 site by the project itself, and that occur at the same time and place as the project. Indirect impacts can be reasonably
35 foreseen to be caused by the project but that occur later or further away. Under NEPA, indirect impacts also may be
36 referred to as secondary effects. The potential effects on geological, soil, mineral, and paleontological resources from
37 construction and operation of the proposed project are considered in this analysis. The BLM is responsible for NEPA
38 analysis for this project.

39 40 **International Building Code**

41 The 2006 International Building Code (IBC) is a model building code developed by the International Code Council (ICC).
42 The IBC sets rules specifying the minimum acceptable level of safety for constructed objects such as buildings. It has
43 been adopted throughout most of the U.S. The IBC has no legal status until it is adopted or adapted by government
44 regulation, which it has been by both California and Nevada. The IBC was developed to consolidate existing building
45 codes into one uniform code that provides minimum standards to ensure the public safety, health, and welfare insofar
46 as they are affected by building construction and to secure safety to life and property from all hazards incident to the
47 occupancy of buildings, structures, or premises. The IBC replaced the Uniform Building Code (UBC) in 2000.

1 **Federal Land Policy and Management Act of 1976, as amended**

2 The Federal Land Policy and Management Act (FLPMA) established policies and goals to be followed in the
3 administration of public lands by the BLM. The intent of the FLPMA is to protect and administer public lands within the
4 framework of a program of multiple-use and sustained yield, and to maintain environmental quality. Particular emphasis is
5 placed on protection of the quality of scientific, scenic, historic, ecological, environmental, air and atmospheric, water
6 resources, and archeological values. The FLPMA dictates how BLM regulates mineral resources extraction on BLM land.
7

8 **Bureau of Land Management**

9 The BLM, an agency within the U.S. Department of the Interior, administers 261 million surface acres of public lands,
10 located primarily in 12 western states. The BLM's mission is to sustain the health, diversity, and productivity of the public
11 lands for the use and enjoyment of present and future generations. The public lands provide myriad opportunities for
12 commercial activities. Commercially valuable natural resources include energy and mineral commodities, forest products,
13 grazing forage, and special uses such as rights-of-way (ROWs) for pipelines and transmission lines. The BLM is
14 responsible for managing commercial energy and mineral production from the public lands in an environmentally sound
15 and responsible manner, including leasing related to oil and gas and geothermal minerals. Geothermal resources include
16 all products and byproducts capable of producing geothermal energy. The BLM is also responsible for supervising the
17 exploration, development, and production operations of these resources on both federal and Native American lands. The
18 BLM is responsible for maintaining viable national policies and processes for solid mineral resources under federal
19 jurisdiction.
20

21 **Classification and Multiple Use Act of 1964**

22 Authorized the Secretary of the Interior to classify and manage BLM land for retention or disposal and for multiple use,
23 including specification of dominant uses and preclusion of inconsistent uses in an area.
24

25 **Mining and Mineral Policy Act of 1970**

26 This act declared that the federal government policy is to encourage private enterprise in the development of a sound and
27 stable domestic mineral industry and in orderly and economic development of mineral resources, research, and
28 reclamation methods.
29

30 **California Desert Conservation Area Plan**

31 The California Desert Conservation Area (CDCA) plan defines multiple-use classes for BLM-managed lands in the CDCA,
32 which includes the land area encompassing the proposed project location in California. With respect to geological
33 resources, the CDCA plan aims to maintain the availability of mineral resources on public lands for exploration and
34 development.
35

36 **Paleontological Resources Preservation Act of 2009**

37 The Paleontological Resources Preservation Act calls on the Secretary of the Interior to protect vertebrate paleontological
38 resources on federal lands by allowing only permitted and qualified researchers to collect vertebrate fossils and
39 scientifically important fossils.
40

41 **Federal Antiquities Act of 1906**

42 The Antiquities Act was the first law enacted to specifically establish that archaeological sites on public lands are
43 important public resources, and it obligated federal agencies that manage public lands to preserve the scientific,
44 commemorative, and cultural values of such sites (National Park Service [NPS] 2007). This act does not refer to
45 paleontological resources specifically; however, the act does provide for protection of "objects of antiquity" (understood to
46 include paleontological resources) by various federal agencies, including the BLM and the NPS.
47

1 **3.6.2.2 State**

2
3 **California**

4
5 **California Building Code (2007)**

6 The California Building Code (CBC 2007) includes a series of standards that are used in project investigation, design, and
7 construction (including grading and erosion control). The 2007 CBC edition is based on the 2006 IBC (excluding Appendix
8 Chapter 1) as published by the ICC, with the addition of more extensive structural seismic provisions. Chapter 16 of the
9 CBC defines seismic sources and outlines the procedure used to calculate seismic forces on structures. Design of the
10 proposed project should follow the requirements of that CBC chapter because the route lies within a seismic zone (UBC
11 Seismic Zone 3).

12
13 **Alquist-Priolo Earthquake Fault Zoning Act, Public Resources Code Sections 2621–2630**

14 The Alquist-Priolo Earthquake Fault Zoning Act of 1972 (formerly the Special Studies Zoning Act) is documented in the
15 Public Resources Code (PRC). It regulates development and construction of buildings intended for human occupancy, to
16 avoid hazards from surface fault rupture. This act mitigates against surface fault rupture of known active faults beneath
17 occupied structures. It requires disclosure to potential buyers of existing real estate and a 50-foot setback for new
18 occupied buildings. While this act does not specifically regulate overhead transmission lines, it does help define areas
19 where fault rupture is most likely to occur. This act categorizes faults as active, potentially active, and inactive. The
20 proposed project area (in California) is not located within a designated Alquist-Priolo fault zone.

21
22 **Seismic Hazards Mapping Act, PRC Sections 2690–2699**

23 The Seismic Hazards Mapping Act of 1990 (PRC Chapter 7.8, Division 2) directs the California Department of
24 Conservation, Division of Mines and Geology (now called California Geological Survey) to delineate seismic hazard
25 zones. The purpose of the act is to reduce the threat to public health and safety and to minimize the loss of life and
26 property by identifying and mitigating seismic hazards. These include identified areas that are subject to the effects of
27 strong ground shaking, such as liquefaction, landslides, tsunamis, and seiches (waves in confined bodies of water
28 resulting from seismic activity). City, county, and state agencies are directed to use seismic hazard zone maps developed
29 by CGS in their land use planning and permitting processes. The act requires that site-specific geotechnical investigations
30 be performed prior to permitting most urban development projects within seismic hazard zones.

31
32 **PRC Chapter 1.7, Sections 5097.5, 5097.9, and 30244**

33 This section of the PRC regulates the removal of paleontological resources from state lands, defines unauthorized
34 removal of fossil resources as a misdemeanor, and requires mitigation of disturbed sites. Since the EITP would be
35 located on federal lands, this code would not apply.

36
37 **Warren-Alquist Act, PRC Sections 25527 and 25550.5(i)**

38 The Warren-Alquist Act requires the California Energy Commission (CEC) to “give the greatest consideration to the need
39 for protecting areas of critical environmental concern, including, but not limited to, unique and irreplaceable scientific,
40 scenic, and educational wildlife habitats; unique historical, archaeological, and cultural sites....” With respect to
41 paleontological resources, the CEC relies on guidelines from the SVP.

42
43 **California Surface Mining and Reclamation Act**

44 The State Mining and Geology Board implements state policy and regulations for reclamation of mined lands and
45 conservation of mineral resources. The Surface Mining and Reclamation Act of 1975 (PRC Sections 2710–2796) set forth
46 these policies in the California Code of Regulations, Title 14, Division 2, Chapter 8, Subchapter 1, and requires local
47 governments within California to regulate mining operations and to develop planning policies that balance mineral

1 production with maintenance of environmental quality. Since the EITP would be located on federal lands, this act would
2 not apply.

3 4 ***Nevada***

5 6 **Mining**

7 There is no single agency that regulates the use of mineral resources within Nevada. The Nevada Division of Minerals is
8 responsible for permitting oil and gas and geothermal leases. The Division of Environmental Protection, Bureau of Mining
9 Regulation and Reclamation is responsible for issuing permits for mining. The NBMG is a research and public service unit
10 of the University of Nevada and is the state geological survey organization. NBMG scientists conduct research and
11 publish reports on mineral resources, engineering geology, environmental geology, hydrogeology, and geologic mapping.
12 NBMG cooperates with numerous state and federal agencies in conducting research and providing geologic and resource
13 information, including information on mining claims and mineral leases.

14 15 **Building Code**

16 The State of Nevada has no statewide building code. All building standards and regulations for structures are deferred to
17 counties and cities, which rely primarily on the IBC.

18 19 **Nevada Revised Statutes**

20 The Nevada Revised Statutes are the state laws that apply to a project's impacts on cultural resources. Nevada Revised
21 Statutes Sections 381.195– 381.227 and 383.400–383.440 apply the term “prehistoric site” to paleontological sites
22 (including fossilized footprints and other impressions) as well as archaeological sites, ruins, deposits, petroglyphs,
23 pictographs, habitation caves, rock shelters, natural caves, burial grounds, and sites of religious or cultural importance to
24 a tribe.

25 26 **3.6.2.3 Regional and Local**

27 28 ***California***

29
30 Most counties and cities in California have regulations that address geologic, seismic, and soils hazards, as well as
31 mineral resources. For hazards that could impact construction projects, these regulations generally adopt the state
32 building standards, which for California are embodied in the 2007 CBC, and follow the geologic and seismic hazards
33 mapping and investigation protocols discussed above. Projects requiring county approvals are permitted by the San
34 Bernardino County Building and Safety Division. Transmission line construction projects are not specifically addressed.

35 36 **San Bernardino County General Plan**

37 The Safety Element of the San Bernardino County General Plan (2007) provides for mitigation of geologic hazards through a
38 combination of engineering, construction, land use, and development standards. The plan addresses the geologic hazards
39 present within the county, including fault rupture, ground shaking, liquefaction, seismically generated subsidence, inundation
40 from seiches or dam breaches, landslides/mudslides, non-seismic subsidence, erosion, and volcanic activity. The county has
41 prepared Hazard Overlay Maps to address fault rupture, liquefaction hazards, and landslide hazards. Special consideration,
42 including possible engineering/geologic evaluation, is required for development of sites designated on the maps.

43 44 **San Bernardino County 2007 Development Code**

45 The County of San Bernardino (Development Code §82.20.030) requires that paleontologic mitigation programs include
46 site evaluation for paleontological resources in the county including not limited to preliminary field surveys; monitoring
47 during construction; specimens recovery; preparation, identification, and curation of specimens; and report of findings.
48 Also defines qualifications of professional paleontologists.

1
2 **Nevada**

3
4 **Clark County Building Code**

5 The Building Code of Clark County, Nevada, consists of the 2006 IBC with Southern Nevada Amendments (County Code
6 Chapter 22.04) that regulate residential and commercial construction in Clark County under the Building Services Division
7 of the Development Services Department (Clark County Code Chapter 22.04). Transmission line construction projects are
8 not specifically regulated by the county.
9

10 **3.6.3 Impact Analysis**

11
12 This section defines the methodology used to evaluate impacts for geologic, soil, mineral, and paleontological resources,
13 including CEQA impact criteria. The definitions are followed by an analysis of each alternative, including a joint
14 CEQA/NEPA analysis of impacts. At the conclusion of the discussion is a NEPA impact summary statement and CEQA
15 impact determinations. For mitigation measures, refer to Section 3.6.4.
16

17 **3.6.3.1 NEPA Impact Criteria**

18
19 The NEPA analysis determines whether direct or indirect effects to geology, soils, mineral, and paleontological resources
20 would result from the project, and explains the significance of those effects in the project area (40 CFR 1502.16).
21 Significance is defined by Council on Environmental Quality regulations and requires consideration of the context and
22 intensity of the change that would be introduced by the project (40 CFR 1508.27). Impacts are to be discussed in
23 proportion to their significance (40 CFR 1502.2[b]). To facilitate comparison of alternatives, the significance of
24 environmental changes is described in terms of the temporal scale, spatial extent, and intensity.
25

26 Geologic resources that were evaluated included the geologic setting, geologic hazards, and unique geologic features
27 within the proposed project area. Geologic effects are assessed in two distinct ways: 1) project development's potential to
28 affect a sensitive soil or geologic unit; or 2) project development's potential to increase the risk associated with geologic
29 hazards by installing project components impose additional risk or damage to people or the environment. The impact
30 analysis considered the likelihood of physical alteration, damage, or destruction of geologic features that would result
31 from the project. The analysis also considered the amount of access/activity where scientifically important paleontological
32 resources are present. The analysis evaluated damage to the project components and subsequent risk to humans and
33 the environment that could result from seismic-related activity, and also evaluated other unique geological phenomena.
34 The potential of the project to restrict or remove from access potential sources of salable mineral resources was also
35 evaluated.
36

37 Compliance with the laws, ordinances, regulations, and standards associated with the project components and location
38 were considered during the evaluation process. Impacts resulting from the proposed project and its alternatives, whether
39 direct or indirect, were identified and the associated feasible, reasonable, and practical mitigation measures to avoid or
40 minimize those identified impacts are proposed in this document.
41

42 **3.6.3.2 CEQA Impact Criteria**

43
44 Under CEQA, the proposed project would have a significant impact if it would:

- 45
46 a. Expose people or structures to potential substantial adverse effects, including the risk of loss, injury or death
47 involving (i) rupture of a known earthquake fault; (ii) strong seismic ground shaking; (iii) seismic-related ground
48 failure, including liquefaction; or (iv) landslides;
49
b. Result in substantial soil erosion or 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 onsite or offsite landslide, lateral spreading, subsidence, liquefaction, or collapse;
- d. Be located on expansive soil as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property;
- e. Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state;
- f. Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan; or
- g. Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature.

3.6.3.3 Methodology

The geology, soils, minerals, and paleontology impacts of the proposed project are discussed below under subheadings corresponding to each of the significance criterion presented in the preceding section. The analysis describes the impacts of the proposed project related to geologic hazards, soils, minerals, and paleontological resources for each criterion. The analysis also determines whether implementation of the project would result in significant impacts by evaluating effects of construction and operation against the affected environment described above in Section 3.6.1.

The potential impact to the geology, soils, minerals, and paleontological resources resulting from the project was evaluated in two ways. First, geologic hazards were assessed that could impact the proper functioning of the proposed facility and create life/safety concerns. Second, the potential impacts of the proposed facility on existing geologic, mineralogical, and paleontological resources in the area were evaluated. Available published resources including books, journals, maps, and government websites were reviewed. This information was evaluated within the context of the applicable federal, state, and local regulations. In addition, information in the Final Staff Assessment/Draft Environmental Impact Statement (FSA/DEIS) prepared for the proposed ISEGS project located near the proposed Ivanpah Substation was also evaluated. Published geologic maps and reports provided information on regional and project-specific geology. Geologic maps used included quadrangles at various scales from 1:50,000 to 1:250,000 and state-wide maps at a scale of 1:750,000. The geologic units identified in the geologic mapping were not consistent either between Nevada and California or by mapped scale. For example, some maps identified only surficial units, while others indicated both surficial units and bedrocks. Mapping of the surficial units also varied in level of detail and segregation. This analysis tended more to generalizing (grouping) the numerous alluvial surficial units while maintaining the unique identity between units of different genesis. Other important sources were government websites, including databases maintained and updated by both federal and state governmental agencies providing information on topics such as seismic hazards, faulting, and soil classification.

To evaluate potential paleontological impacts due to construction of the transmission lines, substation, and other facilities, the BLM's PFYC system was used. This system rates the potential of each geologic unit to yield significant fossils. The BLM established the PFYC system to quantify the occurrence of paleontological resources on public lands and the risk of impacting them. Geologic units are assigned a classification between 1 (lowest) and 5 (highest). The PFYC system is used by the BLM to assess impacts to paleontological resources and suggest appropriate mitigation measures.

Additionally, a paleontological records and literature search was conducted. Pertinent published literature and unpublished manuscripts on the geology and paleontology of eastern California (San Bernardino County) and southern Nevada (Clark County) were reviewed. These included published articles on late Pleistocene vertebrate localities of California (Jefferson 1991a and 1991b) and Nevada (Jefferson et al. 2004). An online records search was conducted at the Museum of Paleontology, University of California, Berkeley (Museum of Paleontology, University of California, Berkeley, 2009 and 2010, in Scott and Gust [2010]) and through the database of the Invertebrate Paleontology Section of the Natural History Museum of Los Angeles County (Scott and Gust 2010). Also, persons with knowledge of the geology and paleontological resources of the proposed project area were consulted.

1 **3.6.3.4 Applicant Proposed Measures**
2

3 The applicant would implement the applicant proposed measures (APMs) described below to reduce adverse effects to
4 geologic, soil, minerals, and paleontological resources and reduce impacts from geologic hazards.
5

6 **APM GEO-1: Geotechnical Engineering and Engineering Geology Study.** Prior to final design of substation
7 facilities and transmission and subtransmission line tower foundations, a combined geotechnical engineering and
8 engineering geology study would be conducted to identify site-specific geologic conditions and potential geologic
9 hazards in sufficient detail to support sound engineering practices.

10 **APM GEO-2: Recommended Practices for Seismic Design of Substations.** For new substation construction,
11 specific requirements for seismic design would be followed based on the Institute of Electrical and Electronics
12 Engineers Standard 693, "Recommended Practices for Seismic Design of Substations," which includes probabilistic
13 earthquake hazard analysis. Other project elements would be designed and constructed in accordance with the
14 appropriate industry standards, as well as good engineering and construction practices and methods.

15 **APM GEO-3: Project Construction Stormwater Pollution Prevention Plan Protection Measures Regarding Soil**
16 **Erosion/Water Quality.** Transmission line and substation construction activities would be conducted in accordance
17 with the soil erosion/water quality protection measures to be specified in the project construction stormwater pollution
18 prevention plan (SWPPP). New access roads would be designed to minimize ground disturbance from grading. They
19 would follow natural ground contours as closely as possible, and would include specific features for road drainage.
20 Measures could include water bars, drainage dips, side ditches, slope drains, and velocity reducers. Where
21 temporary crossings would be constructed, they would be restored and repaired as soon as possible after completion
22 of the discrete action associated with construction of the line in the area.

23 **APM PALEO-1: Retention of Paleontologist and Preparation of a Paleontological Resource Management**
24 **Plan.** Prior to construction, a certified paleontologist would be retained by SCE to supervise monitoring of
25 construction excavations and to produce a Paleontological Resource Management and Monitoring Plan (PRMMP) for
26 the proposed project. This PRMMP would be prepared and implemented under the direction of the paleontologist and
27 would address and incorporate APMs PALEO-2 through PALEO-8. Paleontological monitoring would include
28 inspection of exposed rock units and microscopic examination of matrix to determine whether fossils are present. The
29 monitor would have authority to temporarily divert grading away from exposed fossils in order to recover the fossil
30 specimens. More specific guidelines for paleontological resource monitoring could be found in the PRMMP.

31 **APM PALEO-2: Pre-construction Paleontological Field Survey.** The paleontologist and/or his or her designated
32 representative would conduct a pre-construction field survey of the project area underlain by Tertiary rock units and
33 older alluvium. Results of the field inventory and associated recommendations would be incorporated into the
34 PRMMP.

35 **APM PALEO-3: Worker Environmental Awareness Program (see BIO-6, CR-2b, W-11).** A Worker Environmental
36 Awareness Program would be provided to construction supervisors and crew for awareness of requirements
37 regarding the protection of paleontological resources and procedures to be implemented in the event fossil remains
38 are encountered by ground-disturbing activities.

39 **APM PALEO-4: Construction Monitoring.** Ground-disturbing activities would be monitored on a part-time or full-
40 time basis by a paleontological construction monitor only in those parts of the project area where these activities
41 would disturb previously undisturbed strata in rock units of moderate and high sensitivity. Quaternary alluvium,
42 colluvium, and Quaternary landslide deposits have a low paleontological sensitivity level and would be spot-checked
43 on a periodic basis to ensure that older underlying sediments were not being penetrated. Monitoring would not be
44 implemented in areas underlain by younger alluvium unless these activities had reached a depth 5 feet below the
45 present ground surface and fine-grained strata were present. Ground-disturbing activities in areas underlain by rock
46 units of low sensitivity would be monitored on a quarter-time basis or spot-checked if fine grained strata were
47 present.

1 **APM PALEO-5: Recovery and Testing.** If fossils were encountered during construction, construction activities
2 would be temporarily diverted from the discovery and the monitor would notify all concerned parties and collect matrix
3 for testing and processing as directed by the project paleontologist. In order to expedite removal of fossil-bearing
4 matrix, the monitor may request heavy machinery to assist in moving large quantities of matrix out of the path of
5 construction to designated stockpile areas. Construction would resume at the discovery location once the necessary
6 matrix was stockpiled, as determined by the paleontological monitor. Testing of stockpiles would consist of screen
7 washing small samples to determine if important fossils were present. If such fossils were present, the additional
8 matrix from the stockpiles would be water screened to ensure recovery of a scientifically significant sample. Samples
9 collected would be limited to a maximum of 6,000 pounds per locality.

10 **APM PALEO-6: Monthly Progress Reports.** The project paleontologist would document interim results of the
11 construction monitoring program with monthly progress reports. Additionally, at each fossil locality, field data forms
12 would record the locality, stratigraphic columns would be measured, and appropriate scientific samples would be
13 submitted for analysis.

14 **APM PALEO-7: Analysis of and Preparation of Final Paleontological Resource Recovery Report.** The project
15 paleontologist would direct identification, laboratory processing, cataloging, analysis, and documentation of the fossil
16 collections. When appropriate, and in consultation with SCE, splits of rock or sediment samples would be submitted
17 to commercial laboratories for microfossil, pollen, or radiometric dating analysis. After analysis, the collections would
18 be prepared for curation (see APM PALEO-8). A final technical report would be prepared to summarize construction
19 monitoring and present the results of the fossil recovery program. The report would be prepared in accordance with
20 SCE, Society of Vertebrate Paleontology guidelines, and lead agency requirements. The final report would be
21 submitted to SCE, the lead agency, and the curation repository.

22 **APM PALEO-8: Curation.** Prior to construction, SCE would enter into a formal agreement with a recognized
23 museum repository, and would curate the fossil collections, appropriate field and laboratory documentation, and final
24 Paleontological Resource Recovery Report in a timely manner following construction.
25

26 **3.6.3.5 Proposed Project / Proposed Action**

27 **Construction**

28 **Eldorado–Ivanpah Transmission Line**

29
30 The potential to expose people to adverse effects due to fault rupture during construction of the transmission line would
31 be negligible, localized, and short term. Fault rupture can result in structural failure that poses a risk to people. The
32 Mesquite segment of the SFS crosses the proposed transmission line route along the California-Nevada border at the
33 Town of Primm nearly perpendicular to the proposed transmission line route, although there is substantial uncertainty
34 about the location of this fault. No other faults within the proposed project area known to have the potential for earthquake
35 ground rupture cross the transmission line route. Due to the infrequent nature of movement along the SFS relative to the
36 construction period, fault rupture resulting in impact to construction of the transmission line would be unlikely. Therefore,
37 the impact to people due to fault rupture would be less than significant without mitigation.
38

39 The potential impact on people and structures by exposing them to adverse effects due to seismic ground shaking during
40 construction would be negligible, localized, and short term. Ground movement associated with earthquakes can cause
41 structural damage that poses a risk to human safety. Earthquakes occurring on faults closest to the transmission line
42 would most likely generate the largest ground motion. Applying the Landers earthquake peak ground acceleration data to
43 the Mesquite segment of the SFS, an approximate ground acceleration ranging from 0.12 g to 0.50 g can be expected
44 along the transmission line route, with the higher value possible at the location where this fault crosses the transmission
45 line route. Overall, strong ground shaking would be within the levels experienced in the Landers earthquake area in 1992
46 and the Hector Mine earthquake in 1999, both in the Mojave Desert region and where electrical transmission lines
47 experienced some damage in each of these earthquakes. Due to the short duration of construction and infrequent nature
48 of significant ground shaking in the project area, potential adverse effects to people associated with seismic ground
49 shaking during construction would be less than significant without mitigation. Additionally, design measures would reduce

1 the impact of risk to people associated with a considerable ground shaking event to less than significant without
2 mitigation.

3
4 Seismic-related ground failure is not expected over most of the transmission line route due to the general lack of shallow
5 groundwater. Liquefaction typically occurs primarily in saturated, loose, fine- to medium-grained soils in areas where the
6 groundwater table is within approximately 50 feet of the ground surface; soils may temporarily lose their shear strength
7 during strong ground shaking. Neither the San Bernardino County General Plan Safety Element nor the Clark County
8 Comprehensive Plan indicates liquefaction potential within the project area. The most likely exceptions could be at the
9 playa fringes, where sand layers could be saturated with perched water. In this case, the potential for negligible impact to
10 human safety would be localized and short term; therefore, less than significant impact without mitigation would be
11 expected.

12
13 | Slope stability (e.g., potential for landslides and rockfall) effects are assessed in two distinct ways: 1) project
14 development could destabilize a soil or geologic unit and induce a landslide; or 2) project components could be
15 transported in a landslide and introduce additional risk or damage to people or the environment. Construction activities,
16 including service roads, may cause minor adverse conditions suitable for landslides at locations where geologic
17 conditions are susceptible to this type of hazard. These geologic conditions along the transmission line route would be
18 expected to occur in areas on or adjacent to hill slopes. About 10 percent of the proposed transmission line route (in the
19 McCullough Mountains) passes through areas with moderately steep to very steep topography containing highly
20 weathered and fractured bedrock/basement rock. These areas may be susceptible to rockfall and rotational movement of
21 moderate to large sections of hillslope within or adjacent to the route. Such movements can have potentially damaging
22 effects. MM GEO-2 requires the applicant to complete a geotechnical analysis to assess site-specific geologic conditions
23 and hazards and adjust engineering and design practices accordingly. Although these conditions would be local in extent,
24 their potential for impact may extend over a long period of time but would be less than significant with mitigation.

25
26 Activities associated with construction of access road and tower footings along the transmission line route would disturb
27 the existing ground surface and natural drainage(s), causing minor adverse erosion-related adverse impacts at these
28 locations. This adverse impact would be localized and expected to act over the entire construction period. As required by
29 law, the applicant would adhere to a SWPPP (APM GEO-3). MM W-1 (Erosion Control Plan and Compliance with Water
30 Quality Permits) would further reduce potential adverse impacts related to soil erosion. Therefore, this impact would be
31 less than significant with mitigation.

32
33 Construction of the transmission line route in areas of unstable geologic units or expansive soil could result in further
34 destabilization of geologic units and/or structural failure of the towers. The adverse impacts of construction in these areas,
35 ranging from negligible to minor over most of the transmission line route, could be localized to extensive, depending on
36 conditions and type of impact. For example, the impact to existing surface topography related to subsidence due to
37 groundwater withdrawal would be possible if substantial pumping were to occur related to development in the region; the
38 continued and/or increased groundwater withdrawal from the Ivanpah and Eldorado valleys may cause an overdraft
39 condition resulting in settling of the ground surface due to compaction of underlying unconsolidated sediments, resulting
40 in unsafe changes in surface topography could result. For example, the dehydration of clays between the soil surface
41 and the water table could result in local sinkholes due to these potential fluctuations in hydrology. Impact to towers due to
42 earthquake-induced ground cracking would be negligible to non-existent for transmission line towers with deep
43 foundations. Expansive soils, which shrink or swell with changes in moisture content and can affect the stability of
44 foundations, could be encountered. Soils along the transmission line route in Nevada exhibit expansion potential that is
45 generally low or low to moderate, with one unit rated as moderate to high (playa). In the California portions of the
46 project area, the potential for expansive soils is generally low to moderate, with one unit rated as high (playa). MM GEO-2
47 requires the applicant to complete a geotechnical analysis to assess site-specific geologic conditions and hazards and
48 adjust engineering and design practices accordingly. MM GEO-4 requires the applicant to expand on the geotechnical
49 analysis to mitigate specifically for expansive soils. These potential impacts from expansive soils on project structures
50 would be less than significant with mitigation.

1 Numerous non-metallic and metallic mineral deposits occur along or near the transmission line route. No mining of
2 | metallic deposits was identified within 1,000 feet of the proposed transmission line project area. ~~Non-metallic and non-~~
3 | metallic deposits within the general project area include rare earth minerals from the MolyCorp Mine, pumice, feldspar,
4 | limestone, and sand and gravel, with sand and gravel potential being the highest along the routes. There are a few past
5 | and current mining locations in the vicinity of the proposed project, but none identified in the USGS database as located
6 | within 1,000 feet of either side of the proposed transmission line route or alternative routes. Any adverse impacts to the
7 | availability of currently -identified mineral resources would be negligible; the potential resource is area-wide but would be
8 | only locally developed. The development of mineral deposits within the proposed project area would result in a less than
9 | significant impact to no impact without mitigation.

10
11 Construction of the transmission line could cause direct impacts to buried paleontological resources due to ground-
12 | disturbing activities. The potential for direct impacts to paleontological resources during construction of the transmission
13 | line would be adverse, negligible, area-wide, and short term. Preconstruction ground-disturbing activities (augering and
14 | trenching) as part of geotechnical investigations of transmission tower locations might impact buried paleontological
15 | resources in underlying sedimentary formations of high paleontological sensitivity. During tower construction, ground-
16 | disturbing activities such as augering and trenching for support footings and grading for tower pads, service roads, and
17 | staging areas might impact paleontological resources in areas where underlying formations have high paleontological
18 | sensitivity. The rock units of ~~high~~unknown paleontological sensitivity (see Table 3.6-6) along the proposed line route are
19 | Quaternary alluvium, ~~or (Qa/Qal (within a mile of the Quaternary Lake/Playa deposits [Ql/Qp]), and Quaternary~~
20 | lake/playa deposits (Ql/Qp). ~~All other underlying rock units present along the proposed transmission line, including~~
21 | ~~ancient~~The Quaternary Older Alluvium (Qoa) and Tertiary volcanic (Tba) rocks are of low paleontological sensitivity.
22 | Ancient intrusive and metamorphic rocks (Xm; undivided Proterozoic) and Tertiary volcanic (Tba) rocks are of very low
23 | paleontological sensitivity. However, as part of construction of the proposed project, the applicant would implement APMs
24 | PALEO-1 through PALEO-8. These measures (provision of a project paleontologist to oversee potential impacts; pre-
25 | construction surveys; construction worker awareness programs; construction monitoring; and recovery, testing, and
26 | curation of any significant paleontological findings) would prevent significant impacts. Therefore, possible impacts would
27 | be less than significant without mitigation.

28 29 **Ivanpah Substation**

30 The potential impact on people and structures by exposing them to adverse effects of fault rupture during construction of
31 | the Ivanpah Substation would not be expected since known faults do not cross the site. However, the potential does exist
32 | for exposure of people to adverse effects of seismic ground shaking during construction. Although considered minor and
33 | negligible, earthquakes occurring on SFS would most likely generate the largest ground motion (up to 0.35 g), similar to
34 | the motion that would be experienced by the transmission line route. Any impact experienced would be short term and
35 | localized, although an earthquake event would affect a larger region. Due to the infrequent nature of movement along the
36 | SFS relative to the short duration of the construction period, the impact of fault rupture on people would be less than
37 | significant without mitigation.

38
39 Seismic-related ground failure is not expected in the substation area due to the general lack of shallow groundwater.
40 | Construction activities related to the substation would not be expected to cause temporary conditions suitable for
41 | landslides, nor would service roads expose people or structures to adverse landslide effects, because the topography
42 | slopes gently at this location.

43
44 Construction associated with access roads and the substation would disturb the existing ground surface and natural
45 | drainage(s), causing a minor, adverse impact of erosion or loss of topsoil that would be localized but could act over a long
46 | term. Grading at the substation location would be permitted as part of the ISEGS project. MM W-6 requires the applicant
47 | to submit the ISEGS Drainage, Erosion, and Sedimentation Control Plan (DESCP) and SWPPP to CPUC. Implementation
48 | of proper engineering control measures outlined in the DESCP and SWPPP, this impact would be less than significant
49 | with mitigation.

1 The proposed location of the substation is in an area that may be susceptible to subsidence caused by removal of
2 groundwater, to sinkholes due to dehydration of clays between the soil surface and the water table, and to in an area of
3 expansive soil. Construction in such an area may result in negligible to minor impacts of local extent; subsidence could
4 occur over a more extensive area with the impact to the proposed project being localized to the substation. Expansive
5 soils shrink or swell with changes in moisture content, affecting the stability of foundations. Either impact would have a
6 long-term effect on the project. MM GEO-2 requires the applicant to complete a geotechnical analysis to assess site-
7 specific geologic conditions and hazards and adjust engineering and design practices accordingly. With the
8 implementation of proper engineering control measures, this impact would be less than significant with mitigation.
9

10 Non-metallic mineral deposits occur near the proposed substation area. Any currently identified adverse impacts to the
11 availability of mineral resources would be negligible; the potential resource is area-wide but would be only locally
12 developed. The development of mineral deposits within the proposed project area would result in a less than significant
13 impact to no impact on the availability of currently-identified mineral resources. Non-metallic deposits within the general
14 project area include rare earth minerals from the Molycorp Mine, pumice, feldspar, limestone, and sand and gravel, with
15 sand and gravel potential being the highest. There are a few past and current mining locations in the vicinity of the
16 proposed project, but none located within 1,000 feet of the substation. Any adverse impacts are negligible; the potential
17 resource is area-wide but would be only locally developed. The development of mineral deposits within the proposed
18 project area would result in a less than significant impact or no impact.
19

20 Construction of the Ivanpah Substation could cause direct impacts to buried paleontological resources due to ground-
21 disturbing activities. The potential for direct impacts to paleontological resources during construction of the Ivanpah
22 Substation would be adverse, negligible, localized, and short term. Preconstruction ground-disturbing activities (augering
23 and trenching) as part of geotechnical investigations of substation foundation(s) might impact buried paleontological
24 resources in underlying sedimentary formations of high paleontological sensitivity. Ground-disturbing activities such as
25 grading and trenching the substation foundation(s), attendant facilities, and utilities could impact paleontological
26 resources in areas where underlying formations have high paleontological sensitivity. ~~The rock~~Rock units of high/low
27 paleontological sensitivity (see Table 3.6-6) within the substation footprint are Quaternary non-marine or older alluvium
28 (Qc/Qoa) and Quaternary alluvium (Qa/Qal). However, as part of construction of the proposed project, the applicant
29 would include APMs PALEO-1 through PALEO-8. These measures (provision of a project paleontologist to oversee
30 potential impacts; pre-construction surveys; construction worker awareness programs; construction monitoring; and
31 recovery, testing, and curation of any significant paleontological findings) would prevent significant impacts. Therefore,
32 impacts would be less than significant without mitigation.
33

34 **Telecommunications Line**

35 The potential impact to people and structures by exposing them to adverse effects due to fault rupture during construction
36 of the telecommunications line would be non-existent since the proposed route does not cross any active faults. However,
37 the potential to expose people to adverse effects due to seismic ground shaking during construction would be negligible,
38 localized, and short term. Earthquakes occurring on faults closest to the telecommunications line route would most likely
39 generate the largest ground motion, with expected approximate ground acceleration ranging from 0.12 g to 0.45 g.
40 Overall, strong ground shaking would be within the levels experienced in the Landers earthquake area in 1992 and the
41 Hector Mine earthquake in 1999, both in the Mojave Desert region, where some damage in each of these earthquakes
42 was experienced. Design considerations can be implemented so the impact would be less than significant without
43 mitigation.
44

45 Seismic-related ground failure is not expected in the project area due to the general lack of shallow groundwater along
46 the proposed route. Construction activities, including service roads, may cause temporary conditions suitable for
47 landslides at locations where geologic conditions are susceptible to this type of hazard. These geologic conditions along
48 the telecommunications line route would be expected to occur in areas on or adjacent to hill slopes. About 10 percent of
49 the proposed telecommunications line route (along the southern end of the McCullough Mountains) passes through areas
50 with moderately steep to very steep topography containing highly weathered and fractured bedrock/basement rock. These
51 areas may be susceptible to rockfall and rotational movement of moderate to large sections of hillslope within or adjacent

1 to the route. Such movements can have potentially damaging effects. These conditions would be local in extent, but their
2 potential for impact on the project could extend over a long period of time. MM GEO-2 requires the applicant to complete
3 a geotechnical analysis to assess site-specific geologic conditions and hazards and adjust engineering and design
4 practices accordingly. The impact of these conditions would be less than significant with mitigation.

5
6 Activities associated with the construction of access roads and tower footings along the proposed telecommunications
7 line route would disturb the existing ground surface and natural drainage(s), causing minor adverse erosion-related
8 impact at these locations. This impact would be localized but expected to act over the entire construction period.
9 However, with the implementation of proper engineering control measures such as those outlined in the SWPPP, this
10 impact would be less than significant with mitigation.

11
12 Construction of the proposed telecommunications line route in areas of unstable geologic units or expansive soil could
13 result in further destabilization of geologic units and/or structural failure of the towers. The adverse impacts of
14 construction in these areas, ranging from negligible to minor over most of the telecommunications line route, could be
15 localized to extensive, depending on conditions and type of impact. For example, the impact to existing surface
16 topography related to subsidence due to groundwater withdrawal would be possible if substantial pumping were to occur
17 related to construction of the proposed project; continued and/or increased groundwater withdrawal from the Ivanpah and
18 Eldorado valleys may cause an overdraft condition resulting in settling of the ground surface due to compaction of
19 underlying unconsolidated sediments resulting in unsafe changes in surface topography. Impact to telecommunication
20 structures due to earthquake-induced ground cracking would be negligible to no impact for towers with deep foundations.
21 Expansive soils, which shrink or swell with changes in moisture content and can affect the stability of foundations, could
22 be encountered. Soils along the telecommunications line route in Nevada exhibit expansion potential that is generally low
23 or low to moderate, with one unit rated as moderate to high (playa). In the California portions of the project area, the
24 potential for expansive soils is generally low to moderate, with one unit rated as high (playa). MM GEO-2 requires the
25 applicant to complete a geotechnical analysis to assess site-specific geologic conditions and hazards and adjust
26 engineering and design practices accordingly. MM GEO-4 requires the applicant to expand on the geotechnical analysis
27 to mitigate specifically for expansive soils. These potential impacts from expansive soils on project structures would be
28 less than significant with mitigation.

29
30 Numerous non-metallic and metallic mineral deposits occur along or near the telecommunications line route. No mining of
31 metallic deposits was identified within 1,000 feet of the proposed project area, except that the aboveground portion of the
32 Mountain Pass Telecommunication Alternative would go through the Molycorp Mine. Non-metallic deposits within the
33 general project area include rare earth minerals, pumice, feldspar, limestone, and sand and gravel, with sand and gravel
34 potential being the highest along the routes. There are a few past and current mining locations in the vicinity of the
35 proposed project, but other than the Molycorp Mine, none would be located within 1,000 feet of either side of the
36 proposed telecommunications line route or alternative routes. Any adverse impacts to the availability of currently-identified
37 mineral resources would be negligible; the potential resource is area-wide but would be only locally developed. The
38 development of mineral deposits within the proposed project area would result in a less than significant impact to no
39 impact.

40
41 Construction of the redundant telecommunication system (partially underground) could cause direct impacts to buried
42 paleontological resources due to ground-disturbing activities associated with trenching and tower placement. The
43 potential for direct impacts to paleontological resources during construction of the redundant telecommunication system
44 would be adverse, moderate, area-wide, and short term. Preconstruction ground-disturbing activities (augering and
45 trenching) performed as part of geotechnical investigations along the route of the telecommunications line could impact
46 buried paleontological resources in underlying sedimentary formations of high paleontological sensitivity. During
47 construction, ground-disturbing activities such as trenching for installation and burial of the line could impact
48 paleontological resources in areas where underlying formations have high paleontological sensitivity. The rock
49 of high unknown paleontological sensitivity (see Table 3.6-6) along the proposed telecommunication line route are
50 Quaternary alluvium (Qa/Qal) within a mile of the playas and Quaternary lake/playa deposits (Ql/Qp). All other underlying
51 rock units present along the proposed transmission line that include Ancient intrusive and metamorphic rocks (Xm;

undivided Proterozoic) and Tertiary volcanic (Tba) rocks are of low paleontological sensitivity. However, as part of construction of the proposed project, the applicant would implement APMs PALEO-1 through PALEO-8. These measures (provision of a project paleontologist to oversee potential impacts; pre-construction surveys; construction worker awareness programs; construction monitoring; and recovery, testing, and curation of any significant paleontological findings) would prevent significant impacts. Therefore, possible impacts would be less than significant without mitigation.

Because the primary -telecommunication line would be above ground and strung along the transmission towers, construction would not result in any additional impacts to buried paleontological resources. These possible impacts would be less than significant.

Operation & Maintenance

Eldorado–Ivanpah Transmission Line

The potential impact to people and structures by exposing them to adverse effects due to fault rupture and/or seismic ground shaking during the operation and maintenance would be negligible during the life of the proposed project. Fault rupture, although unlikely due to movement on the SFS or the Black Hills fault, can result in structural failure that poses a risk to people. Although the probability of some occurrence of seismic ground shaking increases as longer time periods are considered, the likelihood of exposing people to adverse effects still remains negligible. Seismic-related ground failure such as liquefaction would not be expected in the project area due to the general lack of shallow groundwater, although areas in the valley bottoms (old lake deposits and playas) could pose a negligible impact; therefore, the impact would be less than significant without mitigation.

Maintenance of service roads could expose people or structures to minor adverse slope stability (e.g., landslides and rockfall) landslide-effects over the life of the proposed project. In addition, operation and maintenance activities could expose people and structures to landslide hazards during the life of the project. Geologic conditions along the transmission line route favorable to landslides would be expected to occur in areas on or adjacent to hill slopes (in the McCullough Mountains and the hills west of the Town of Primm), particularly where access roads have been built. Although these landslide-prone conditions would be local in extent, their potential for impact could extend over a long period of time. The impact of landslide conditions on the project would be less than significant with mitigation. Operation and maintenance of service roads would cause continued ground disturbance that would result in sites of potential erosion, particularly in areas of hill slopes. These activities would continue to disturb the existing ground surface and natural drainage(s), causing minor adverse erosion-related impact. This impact would be localized but would act over the entire life of the proposed project. However, with the implementation of proper engineering control measures, this impact would be less than significant without mitigation.

The proposed transmission line could experience adverse negligible to minor impacts during operation and maintenance due to subsidence related to potentially unstable geologic units or expansive soil causing structural failure of the towers. These impacts could be localized to extensive, depending on geologic conditions and degree of subsidence. For example, subsidence due to groundwater withdrawal would be possible due to substantial pumping; continued and/or increased groundwater withdrawal from the Ivanpah and Eldorado valleys may cause an overdraft condition, resulting in settling of the ground surface due to compaction of underlying unconsolidated sediments. As part of MM GEO-1, the applicant will contact the California Department of Water Resources and the Nevada Division of Water Resources on an annual basis to determine if groundwater withdrawals in the area are causing ground subsidence or sinkholes. If subsidence or sinkholes are found and threatens any project facility, the applicant will develop a mitigation plan to prevent damage to structures. However, with the implementation of proper engineering control measures, this impact from subsidence on project structures would be less than significant with mitigation.

Numerous non-metallic and metallic mineral deposits occur along or are near the transmission line route; however, no mining of these deposits was identified within 1,000 feet of the proposed project area. Any adverse impacts to the availability of currently-identified mineral resources would be negligible; the potential resource is area-wide but would be

1 only locally developed. The development of mineral deposits within the proposed project area would result in less than
2 significant impacts.

3
4 Operation and maintenance of the proposed project would not result in additional ground disturbance beyond the areas
5 disturbed during construction. Areas where fossils are located would be identified during preconstruction surveys and
6 construction monitoring. Therefore, there would be no additional potential impacts to paleontological resources during
7 operation and maintenance.

8 9 **Ivanpah Substation**

10 The potential impact to people and structures by exposing them to adverse effects due to fault rupture during operation
11 and maintenance of the substation would not be expected, since known faults do not cross the site. However, the
12 potential does exist for the negligible exposure of people and structures to adverse effects due to seismic ground shaking
13 during the operation and maintenance of the substation. Earthquakes occurring on faults closest to the substation (such
14 as the SFS) would most likely generate the largest ground motion (up to 0.35 g), similar to that experienced by the
15 transmission line route. Any impact experienced would be short term and localized, although the causative event would
16 affect a larger region. However, design considerations (APM GEO-2 Recommended Practices for Seismic Design of
17 Substations) would be implemented so the impact would be less than significant without mitigation.

18
19 Operation and maintenance activities associated with the substation and access roads would disturb the existing ground
20 surface and cause minor adverse erosion impacts that would be localized in extent but could be long term. Erosion could
21 result from re-directed stormwater and wind. However, with the implementation of proper engineering control measures,
22 this impact would be less than significant without mitigation.

23
24 The proposed location of the substation is in an area that may be susceptible to subsidence caused by the removal of
25 groundwater and in an area of expansive soil. This could cause a negligible to minor adverse impact to the project during
26 its operation and maintenance. Although expected to be of local extent; subsidence could occur over a more extensive
27 area. The long-term impact on the project; however, with the implementation of proper engineering control measures,
28 would be less than significant with mitigation.

29
30 Numerous non-metallic and metallic mineral deposits occur along or are near the proposed substation; however, no
31 mining of these deposits was identified within 1,000 feet of the proposed project. Any adverse impacts to the availability of
32 currently-identified mineral resources would be negligible; the potential resource is area-wide but would be only locally
33 developed. The development of mineral deposits within the proposed project would result in less than significant impacts.

34
35 Operation and maintenance of the proposed project would not result in additional ground disturbance beyond the areas
36 disturbed during construction. Areas where fossils are located would be identified during preconstruction surveys and
37 construction monitoring. Therefore, there would be no additional potential impacts to paleontological resources during
38 operation and maintenance.

39 40 **Telecommunications Line**

41 Operation and maintenance of the telecommunications line would result in impact conditions consistent with the operation
42 and maintenance of the transmission line.

43
44 The potential impact to people and structures by exposing them to adverse effects of fault rupture and/or seismic ground
45 shaking during operation and maintenance would be negligible during the life of the proposed telecommunications line.
46 | Fault rupture, although unlikely due to movement on the SFS or the Black Hills fault, could ~~can~~ result in structural failure
47 that poses a risk to people. Although the probability of an occurrence of seismic ground shaking increases as longer
48 periods of time are considered, the likelihood of exposing people to adverse effects still remains negligible. Seismic-
49 related ground failure such as liquefaction is not expected in the project area due to the general lack of shallow

1 groundwater, although areas in the valley bottoms (old lake deposits and playas) may pose a negligible potential for a
2 highly localized impact.

3
4 Maintenance of service roads could expose people or structures to minor adverse landslide slope stability (e.g., landslides
5 and rockfall) effects over the life of the proposed telecommunications line. In addition, operation and maintenance
6 activities could expose people to landslide hazards during the life of the project. Geologic conditions along the
7 telecommunications line route favorable to landslides would be expected to occur in areas on or adjacent to hill slopes (in
8 the McCullough Mountains and the hills west of the Town of Primm), particularly where access roads have been built.
9 Although these landslide-prone conditions would be local in extent, their potential for impact may extend over a long
10 period of time. The impact of these conditions on the project would be less than significant with mitigation. Operation and
11 maintenance of service roads would lead to continued ground disturbance that would result in sites of potential erosion,
12 particularly in areas of hill slopes. These activities would continue to disturb the existing ground surface and natural
13 drainage(s) over the entire life of the proposed project, causing minor adverse erosion-related impacts. However, with the
14 implementation of proper engineering control measures, this impact would be less than significant with mitigation.

15
16 The proposed telecommunications line may experience adverse negligible to minor impacts during the operation and
17 maintenance period due to subsidence related to potentially unstable geologic units or expansive soil causing structural
18 failure of the towers. The impacts from subsidence or expansive soil to the towers could be localized to extensive,
19 depending on geological conditions and degree of subsidence. Subsidence due to groundwater withdrawal is possible
20 due to substantial pumping and due to dehydration of clays between the soil surface and the water table; continued
21 and/or increased groundwater withdrawal from the Ivanpah and Eldorado valleys could cause an overdraft condition
22 resulting in the settling of the ground surface due to compaction of underlying unconsolidated sediments. As part of MM
23 GEO-1, the applicant will contact the California Department of Water Resources and the Nevada Division of Water
24 Resources on an annual basis to determine if groundwater withdrawals in the area are causing ground subsidence. If
25 subsidence threatens any project facility, the applicant will develop a mitigation plan to prevent damage to structures.
26 However, with the implementation of proper engineering control measures, this impact on project structures would be less
27 than significant with mitigation.

28
29 Numerous non-metallic and metallic mineral deposits occur along or are near the telecommunications line route; however,
30 no mining of these deposits was identified within 1,000 feet of the proposed project area. In the region, the potential
31 resource is area-wide but would be only locally developed. The development of mineral deposits within the proposed
32 project area would result in less than significant impacts without mitigation.

33
34 Operation and maintenance of the proposed project would not result in additional ground disturbance beyond the areas
35 disturbed during construction. Areas where fossils are located would be identified during preconstruction surveys and
36 construction monitoring. Therefore, there would be no additional potential impacts to paleontological resources during
37 operation and maintenance.

38 **NEPA Summary**

39
40 The proposed project would result in direct negligible to minor geology- and soils-related impacts due to the construction
41 of the transmission line, substation, and telecommunications line. The impacts would be local in extent for most of the
42 proposed project, but could be extensive to area-wide. The impacts would occur over either short- or long-term time
43 spans. Impacts associated with operation and maintenance of the transmission line, substation, and telecommunications
44 line would mostly be related to the occasional presence of people engaged in maintaining the facilities during the life of
45 the project, and would be potentially due to changing geologic conditions including seismic events (fault rupture and
46 ground shaking), subsidence, and/or liquefaction.

47
48 The proposed project would result in direct negligible impacts to paleontological resources during construction of the
49 transmission line, substation, and telecommunications line. However, as part of construction of the proposed project, the
50 applicant would include APMs PALEO-1 through PALEO-8. These measures (provision of a project paleontologist to
51 oversee potential impacts; pre-construction surveys; construction worker awareness programs; construction monitoring;

1 and recovery, testing, and curation of any significant paleontological findings) would prevent significant impacts.
2 Therefore, possible impacts would be less than significant. Operation and maintenance of the proposed project would not
3 result in additional ground disturbance beyond the areas disturbed during construction. Therefore, there would be no
4 impacts to paleontological resources during operation and maintenance.

5
6 **CEQA Significance Determinations**

7 **IMPACT GEO-1: Rupture of Earthquake Fault Across the Transmission Line Route**
8 *Less than significant without mitigation*
9

10 The proposed project would result in impacts related to the potential for damage to transmission line towers resulting from
11 the rupture of an earthquake fault that crosses the transmission line route. The potential for exposure of people to fault
12 rupture during construction of the transmission line is very low. The Mesquite segment of the SFS crosses the proposed
13 transmission line route along the California-Nevada border at the Town of Primm nearly perpendicular to the proposed
14 transmission line route, although there is substantial uncertainty as to the location of this fault. No other faults within the
15 proposed project area known to have the potential for earthquake ground rupture cross the transmission line route, and
16 APM GEO-1 states that the applicant would complete a geotechnical engineering and engineering geology study to
17 identify site-specific geologic conditions and potential geologic hazards prior to final engineering. MM GEO-2 strengthens
18 APM GEO-1 by stating that the applicant will use the findings of the geotechnical analysis to guide engineering and
19 design. Therefore, the impact would be less than significant with mitigation.
20

21 The potential for exposing people to adverse effects of fault rupture during operation and maintenance is also unlikely
22 during the life of the proposed project. Although the probability of an earthquake occurring increases as longer time
23 periods are considered, the likelihood of exposing people to adverse effects still remains negligible. Given the relative lack
24 of active faults in the project area and the fact that the applicant would conduct preconstruction geotechnical engineering
25 and engineering geology studies, the impact would be less than significant without mitigation.
26

27 **IMPACT GEO-2: Exposure of People or Structures to Potential Adverse Effects Due to Seismic Ground**
28 **Shaking**
29 *Less than significant without mitigation*
30

31 The project could impact people and structures by exposing them to adverse effects due to seismic ground shaking
32 during construction. Earthquakes occurring on faults closest to the transmission line and substation facility would most
33 likely generate the largest ground motion experienced at that location. Estimated approximate ground accelerations range
34 from 0.12 g to 0.50 g for the transmission line route, could be up to 0.35 g for the substation facility, and range from 0.12
35 g to 0.45 g along the telecommunications route. Due to the short nature of construction and infrequent nature of
36 significant ground shaking in the project area, potential adverse effects to people associated with seismic ground shaking
37 during construction would be less than significant without mitigation. Additionally, design measures would reduce the
38 impact of risk to people associated with a considerable ground shaking event to less than significant without mitigation.
39 Design considerations outlined in APM GEO-2 (Recommended Practices for Seismic Design of Substations) would
40 further lessen the potential for adverse effects due to seismic ground shaking at the substation to less than significant
41 levels without mitigation.
42

43 The potential exists to expose people and structures to adverse effects of seismic ground shaking during operation and
44 maintenance of the facilities. Earthquakes occurring on faults closest to the proposed project would most likely generate
45 the largest ground motion experienced by the transmission line route, substation, and telecommunications line. However,
46 although the probability of an occurrence of seismic ground shaking increases as longer time periods are considered, the
47 likelihood that people would be exposed to adverse effects is limited; structures would be more likely to experience an
48 impact. Any impact would be short term and localized for the proposed project, although the causative event would affect
49 a larger region. Design considerations outlined in APM GEO-2 would lessen the potential for adverse effects due to
50 seismic ground shaking at the substation to less than significant levels without mitigation. MM GEO-1 requires the
51 applicant to design structures to withstand site-specific geologic conditions. With this mitigation measure in place,

1 potential adverse effects to people and structures associated with ground shaking would be reduce to less than significant
2 levels with mitigation.

3
4 **IMPACT GEO-3: Exposure of People or Structures to Potential Adverse Effects Due to Seismic-Related**
5 **Ground Failure**

6 *Less than significant without mitigation*
7

8 The proposed project would result in impacts on people and structures due to seismic-related ground failure only for those
9 areas where conditions are potentially conducive to ground failure. Areas within the proposed project area that may be
10 susceptible to seismic-related ground failure during construction include structures located at or near playa fringes, where
11 sand layers could be saturated with perched water. In this case, the potential for negligible impact would be highly
12 localized. For most of the proposed project area, seismic-related ground failure is not expected, due to the general lack of
13 shallow groundwater. In addition, neither the San Bernardino County General Plan Safety Element nor the Clark County
14 Comprehensive Plan indicates liquefaction potential within the proposed project area.

15
16 The potential exists for exposure of people or structures to seismic-related ground failure during operation and
17 maintenance of the proposed project. Areas within the proposed project near playa fringes where sand layers could be
18 saturated with perched water are the most likely places for this impact to occur. For most of the proposed project area,
19 seismic-related ground failure would not be expected due to the general lack of shallow groundwater. In addition, neither
20 the San Bernardino County General Plan Safety Element nor the Clark County Comprehensive Plan indicates liquefaction
21 potential within the proposed project area. APM GEO-1 states that the applicant would complete a geotechnical
22 engineering study to identify site-specific geologic conditions and potential geologic hazards prior to final engineering;
23 therefore, the impact would be less than significant without mitigation.
24

25 **IMPACT GEO-4: Exposure of People or Structures to Adverse Effects Due to Landslides**

26 *Less than significant without mitigation*
27

28 The proposed project would result in impacts on people or structures along the access roads for the transmission line and
29 telecommunication line routes during construction. Installing, upgrading, or re-grading access roads could lead to
30 landslides at locations where geologic conditions are conducive to this type of hazard. Such geologic conditions occur in
31 areas on or adjacent to hill slopes. About 10 percent of the proposed transmission line route (in the McCullough
32 Mountains) and the telecommunications line route (along the southern end of the McCullough Mountains) passes through
33 areas with moderately steep to very steep topography containing highly weathered and fractured bedrock/basement rock.
34 These areas may be susceptible to rockfall and rotational movement of moderate to large sections of hillslope within or
35 adjacent to the route. Such movements can have potentially damaging effects. Although these conditions would be local
36 so the impact from construction-caused landslides on people or structures would be localized, the potential for these
37 impacts could extend over a long time.
38

39 In addition, operation and maintenance activities could expose people and structures to landslide hazards during the life
40 of the project. Geologic conditions along the transmission line and telecommunications line routes favorable to landslides
41 would occur in areas on or adjacent to hill slopes, particularly where access roads have been built and maintained.
42 Although these conditions would be local so the impact from operation- or maintenance-caused landslides on people or
43 structures would be localized, the potential for these impacts could extend over a long time. APM GEO-1 states that the
44 applicant would complete a geotechnical engineering study to identify site-specific geologic conditions and potential
45 geologic hazards prior to final engineering. MM GEO-2 requires the applicant to complete a incorporate the results of the
46 geotechnical analysis to assess site-specific geologic conditions and hazards and adjust engineering and design
47 practices accordingly. Therefore, the impact would be less than significant with mitigation.
48

1 **IMPACT GEO-5: Erosion of Soil at Towers and the Substation and Along Access Roads**

2 *Less than significant with mitigation*

3
4 The proposed project would impact soil by resulting in erosion at the transmission and telecommunication towers, at the
5 substation, and along the access roads. Construction of access roads and tower footings along the transmission line and
6 telecommunications line routes would disturb the existing ground surface and natural drainage(s), causing minor adverse
7 erosion-related impacts on soil at these locations. This impact would be localized but would act over the entire
8 construction period.

9
10 Operation and maintenance of transmission and telecommunication line service roads would lead to continued ground
11 disturbance that would result in sites of potential erosion, particularly in areas of hill slopes. These activities would
12 continue to disturb the existing ground surface and natural drainage(s), causing minor adverse erosion-related impacts on
13 soil and water resources (further discussed in Section 3.8, "Hydrology and Water Resources"). Erosion associated with
14 the substation could result from re-directed stormwater and wind. This impact would be localized (hilly areas and
15 substation area) but could act over the life of the proposed project. Although a SWPPP would be followed (APM GEO-3),
16 impacts soil conditions due to construction and operation of the project could be significant. With the implementation of
17 MM W-1, however, impacts under this criterion would be less than significant.

18
19 **IMPACT GEO-6: Structural Failure of Towers and Substation Facility Due to Unstable Soil Conditions**
20 **Resulting in Subsidence or Collapse**

21 *Less than significant with mitigation*

22
23 Ground subsidence or collapse due to groundwater withdrawal or dehydration of clays between the soil surface and the
24 water table could lead to the structural failure of the transmission line and telecommunication line towers and substation
25 facility. This adverse impact on the project, ranging from negligible to minor, could be localized to extensive, depending
26 on the degree to which continued and/or increased groundwater withdrawal from the Ivanpah and Eldorado valleys
27 causes an overdraft condition or dehydration resulting in settling of the ground surface due to compaction of underlying
28 unconsolidated sediments. The likelihood of this impact could increase over time with continued and/or increased
29 groundwater withdrawal. Although prior to final design a geotechnical engineering study would be performed (APM GEO-
30 1), impacts on proposed project facilities could still be significant. With the implementation of MM W-2, MM GEO-1 and
31 MM GEO-2, however, impacts under this criterion would be less than significant.

32
33 **IMPACT GEO-7: Structural Failure of Towers or Substation Facility Due to Expansive Soils**

34 *Less than significant with mitigation*

35
36 Building on expansive soils could lead to the structural failure of the transmission line and telecommunication line towers
37 and substation facility. Expansive soils shrink or swell with changes in moisture content, affecting the stability of
38 foundations. Soils encountered along the transmission line route in Nevada exhibit expansion potential that is generally
39 low and low to moderate, but the expansion potential along the route is moderate to high in one unit (playas). In
40 California, the potential for expansive soils is generally low to moderate, but also is high in one unit (playas). The areas
41 most prone to experience expansive soils lie within or adjacent to playas or old lake deposits with clay rich sediments.
42 Although prior to final design a geotechnical engineering study would be performed (APM GEO-1), impacts on proposed
43 project facilities could be significant. With the implementation of MM GEO-4, however, impacts under this criterion would
44 be less than significant.

45
46 **IMPACT MR-1: Loss of Mineral Resource of Value to Region and the Residents of the State**

47 *Less than significant without mitigation*

48
49 Numerous non-metallic and metallic mineral deposits occur along or near the telecommunications line route. No mining of
50 metallic deposits was identified within 1,000 feet of the proposed project. Non-metallic deposits within the general project
51 area include rare earth minerals from the Molycorp Mine, pumice, feldspar, limestone, and sand and gravel, with sand

1 and gravel potential being the highest along the routes. There are a few past and current mining locations in the vicinity of
2 the proposed project, but none, except the aboveground portion of the Mountain Pass Telecommunications Alternative,
3 would be ~~are~~ within 1,000 feet of either side of the proposed telecommunications line route. The Molycorp Mine would be
4 within 1,000 feet of the Mountain Pass Telecommunications line ~~or~~ alternative routes. Proposed future activities at mines
5 can easily avoid the proposed project area. Any identified adverse impacts at current mines are negligible. The potential
6 for mineral resources in the project vicinity is area-wide. However, since no specific locations for valuable mineral
7 resources have been identified within the project area, there would be no loss of availability of a known mineral resource
8 as a result of the proposed project. Impacts under this criterion would be less than significant without mitigation.
9

10 **NO IMPACT. Loss of Locally Important Mineral Resource Recovery Site Delineated on a Local General Plan,**
11 **Specific Plan, or Other Land Use Plan.** The proposed project would have no impact under this criterion because there
12 are no identified mineral resources delineated on a local general plan, specific plan, or other land use plan that would
13 result in loss of availability due to the construction, operation, or maintenance of the proposed project.
14

15 **IMPACT PALEO-1: Direct or Indirect Damage or Destruction of Paleontological Resources**
16 *Less than significant without mitigation*
17

18 The proposed project would include ground disturbance that could impact buried and undiscovered paleontological
19 resources. Various actions would help reduce impacts on paleontological resources discovered during the preconstruction
20 and construction phases of the proposed project. These actions include APMs PALEO-1 through PALEO-8. These
21 measures (provision of a project paleontologist to oversee potential impacts; pre-construction surveys; construction
22 worker awareness programs; construction monitoring; and recovery, testing, and curation of any significant
23 paleontological findings) would prevent significant impacts. Therefore, impacts would be less than significant without
24 mitigation.
25

26 **3.6.3.6 No Project / No Action Alternative**
27

28 In the No Project/No Action Alternative, the proposed action would not be undertaken. The BLM land on which the project
29 is proposed would continue to be managed within BLM's framework of a program of multi-role use, sustained yield, and
30 maintenance of environmental quality [43 USC 1781 (b)] in conformance with applicable statutes, regulations, policy, and
31 land use plans.
32

33 Under the No Project / No Action Alternative, the impacts of the proposed project would not occur. However, except for
34 the Ivanpah Substation, the land on which the project is proposed would not become available to other uses that are
35 consistent with BLM's land use plan. The No Project / No Action Alternative would leave the proposed project area in its
36 current use and would therefore have no additional effect on existing geologic or paleontological resources in the area
37 other than to maintain their availability for potential future development. No impacts would occur.
38

39 **3.6.3.7 Transmission Alternative Route A**
40

41 Transmission Alternative Route A is similar to the proposed transmission line route in that it is located in similar geology,
42 soils, and mineralogical materials. It is also similar in topography. Several direct impacts would be associated with this
43 alternative route. Negligible localized short-term impacts would include those associated with seismic ground shaking and
44 seismic-related ground failure. With the implementation of APMs GEO-1 and GEO-2, the impacts would be less than
45 significant without mitigation. A minor localized long-term impact to soils from erosion would occur. With the
46 implementation of MM GEO-3, this impact would be less than significant with mitigation. A minor extensive long-term
47 impact on the structures of the alternative route would be associated unstable geologic units (subsidence). With the
48 implementation of MMs GEO-1 and GEO-2, this impact would be less than significant with mitigation. A negligible
49 localized long-term impact would be associated with expansive soil. With the implementation of MM GEO-4, this impact
50 would be less than significant with mitigation. A negligible area-wide long-term impact would be associated with non-
51 metallic mineral resources. However, this impact would be less than significant without mitigation.

1
2 Construction of the Transmission Alternative Route A may cause direct impacts to buried paleontological resources due
3 to ground-disturbing activities. Potential direct impacts to paleontological resources during construction of Transmission
4 Alternative Route A would be adverse, negligible, localized, and short term. Preconstruction ground-disturbing activities
5 (augering and trenching) as part of geotechnical investigations along the route of Alternative Route A could impact buried
6 paleontological resources in underlying sedimentary formations of high paleontological sensitivity. During later tower
7 construction, ground-disturbing activities such as augering and trenching for support footings and grading for tower pads,
8 service roads, and staging areas could impact paleontological resources in areas where underlying formations have high
9 low paleontological sensitivity. The rock unit of high low paleontological sensitivity (see Table 3.6-6) along Transmission
10 Alternative Route A is Quaternary alluvium (Qa/Qal). However, as part of construction of the proposed project, the
11 applicant would implement APMs PALEO-1 through PALEO-8. These measures (provision of the project paleontologist to
12 oversee potential impacts; pre-construction surveys; construction worker awareness programs; construction monitoring;
13 and recovery, testing, and curation of any significant paleontological findings) would prevent significant impacts.
14 Therefore, impacts would be less than significant without mitigation.

15 16 **3.6.3.8 Transmission Alternative Route B**

17
18 Transmission Alternative Route B is similar to the proposed transmission line route in that it is located in similar geology,
19 soils, and mineralogical materials. It is also similar in topography. The direct impacts and mitigation associated with this
20 alternative route are similar to those for Alternative Route A.

21 22 **3.6.3.9 Transmission Alternative Route C**

23
24 Transmission Alternative Route C would relocate a portion of the proposed transmission line to the west of the proposed
25 project route, a portion of which crosses near the southern tip of the Spring Mountains near Milepost 2. This route is
26 similar to the proposed transmission line route in this area in that it is located in similar geology, soils, and mineralogical
27 materials. It is also similar in topography. However, the exposed geologic unit at the southern tip of the Spring Mountains
28 includes exposures of Paleozoic- to Mesozoic carbonate (limestone and dolomite) and siliclastic (sandstone, mudstone,
29 and conglomerate) bedrock (MzPzs).

30
31 Several direct impacts are associated with this alternative route. The Mesquite segment of the SFS crosses the
32 Transmission Alternative Route C along the California-Nevada border at the Town of Primm nearly perpendicular to the
33 proposed route. This impact to people and structures associated with fault rupture would be negligible and localized, and
34 would be short term relative to construction but long term with respect to operations and maintenance. With the
35 implementation of APM GEO-1, this impact would be less than significant without mitigation. Negligible localized short-
36 term impacts related to this alternative route include those associated with seismic ground shaking and seismic-related
37 ground failure. With the implementation of APMs GEO-1 and GEO-2, impacts would be less than significant without
38 mitigation. A minor localized long-term impact on soils would be associated with erosion. With the implementation of MM
39 GEO-3, this impact would be less than significant with mitigation. A minor extensive long-term impact would be
40 associated with unstable geologic units (subsidence). With the implementation of MMs GEO-1 and GEO-2, this impact
41 would be less than significant with mitigation. A negligible, localized, long-term impact on project structures would be
42 associated with expansive soil. With the implementation of MM GEO-4, this impact would be less than significant with
43 mitigation. The project could result in a negligible, area-wide, long-term impact to the availability of currently-identified
44 non-metallic mineral resources. However, since no specific locations for valuable mineral resources have been identified
45 within the project area, there would be no loss of availability of a known mineral resource as a result of the proposed
46 project. This impact would be less than significant without mitigation.

47
48 Construction of the Transmission Alternative Route C could cause direct impacts to buried paleontological resources from
49 ground-disturbing activities. Potential direct impacts to paleontological resources during construction of Transmission
50 Alternative Route C would be adverse, negligible, localized, and short term. Preconstruction ground-disturbing activities
51 (augering and trenching) as part of geotechnical investigations along the route could impact buried paleontological

resources in underlying sedimentary formations of high paleontological sensitivity. During later tower construction, ground-disturbing activities such as augering and trenching for support footings and grading for tower pads, service roads, and staging areas could impact paleontological resources in areas where underlying formations have high unknown and low paleontological sensitivity. The rock units of high unknown paleontological sensitivity (see Table 3.6-6) along Transmission Alternative Route C are is Quaternary alluvium (Qa/Qal) which is within a mile of the Quaternary lake/playa deposits (Ql/Qp) and Quaternary alluvium (Qa/Qal). Another underlying rock unit present along Alternative Route C is composed of Paleozoic and Mesozoic sedimentary rocks (the Goodspring Dolomite (DEgPzMzs), which is of low paleontological sensitivity. As part of construction of the proposed project, the applicant would implement APMs PALEO-1 through PALEO-8. These measures (provision of a project paleontologist to oversee potential impacts; pre-construction surveys; construction worker awareness programs; construction monitoring; and recovery, testing, and curation of any significant paleontological findings) would prevent significant impacts. Therefore, impacts would be less than significant with mitigation.

3.6.3.10 Transmission Alternative Route D and Subalternative E

With the exception of crossing a portion of Paleozoic- to Mesozoic bedrock at the southern tip of the Spring Mountains, Transmission Line Alternative Route D and Subalternative E are both similar to the proposed Transmission Line Alternative Route C and the proposed project route. They both are located in similar geology, soils, and mineralogical materials. The alternative routes are also similar in topography. The direct impacts and mitigation associated with these alternative and subalternative routes are similar to those in Alternative Route C.

3.6.3.11 Telecommunication Alternative (Golf Course)

The Golf Course Telecommunication Alternative is similar to the proposed route, except it does not cross the SFS Mesquite segment. This route extends along an alluvial apron (fan) from the Clark Mountains near Mountain Pass, and is parallel to the I-15 ROW. The Golf Course Telecommunication Alternative is located in similar geology, soils, and mineralogical materials. Negligible, localized, short-term impacts related to this alternative would include those occurring to the project from seismic ground shaking and seismic-related ground failure. With the implementation of APMs GEO-1 and GEO-2, those impacts would be less than significant without mitigation. The project would result in a minor, localized, long-term impact on soils due to erosion. With the implementation of MM GEO-3, this impact would be less than significant with mitigation. A minor, extensive, long-term impact on the project would be associated with unstable geologic units (subsidence). With the implementation of MMs GEO-1 and GEO-2, this impact would be less than significant with mitigation. A negligible, localized, long-term impact on the project would be associated with expansive soil. With the implementation of MM GEO-4, this impact would be less than significant with mitigation. The project would result in a negligible, area-wide, long-term impact on non-metallic mineral resources. However, since no specific locations for valuable mineral resources have been identified within the project area, there would be no loss of availability of a known mineral resource as a result of the proposed project. This impact would be less than significant without mitigation.

Construction of the Golf Course Telecommunication Alternative could cause direct impacts to buried paleontological resources due to ground-disturbing activities associated with positioning the line underground along Nipton Road. Potential direct impacts to paleontological resources during construction of the Golf Course Telecommunication Alternative would be adverse, negligible, localized, and short term. Preconstruction ground-disturbing activities (augering and trenching) as part of geotechnical investigations along the route of the Golf Course Telecommunication Alternative could impact buried paleontological resources in underlying sedimentary formations of high paleontological sensitivity. During later tower construction, ground-disturbing activities such as augering and trenching for support footings and grading for tower pads, service roads, and staging areas could impact paleontological resources in areas where underlying formations have high unknown and low paleontological sensitivity. The rock units of high unknown paleontological sensitivity (see Table 3.6-6) along the proposed Golf Course Telecommunication Alternative are Quaternary Tertiary older alluvium (QT0a), Quaternary non-marine (Qc/Qoa), Quaternary alluvium (Qa/Qal), and within a mile of the Quaternary lake/playa deposits (Ql/Qp). Quaternary Tertiary Older Alluvium (QT0a), Quaternary non-marine (Qc/Qoa) and Quaternary alluvium (Qa/Qal) are of low sensitivity. Another underlying rock unit present along the Golf

1 | Course Telecommunication Alternative is Ancient intrusive and metamorphic rocks (Xm), which are of very low
2 paleontological sensitivity. As part of construction of the proposed project, the applicant would implement APMs PALEO-1
3 through PALEO-8. These measures (provision of a project paleontologist to oversee potential impacts; pre-construction
4 surveys; construction worker awareness programs; construction monitoring; and recovery, testing, and curation of any
5 significant paleontological findings) would prevent significant impacts. Therefore, impacts would be less than significant
6 with mitigation.

8 **3.6.3.12 Telecommunication Alternative (Mountain Pass)**

10 The Mountain Pass Telecommunication Alternative is located in similar geology, soils, and mineralogical materials as
11 Transmission Alternative Routes C and D and Subalternative E in the lower elevations, but also includes earlier
12 Precambrian metamorphic bedrock of the Clark Mountains. The topography ranges from relatively flat low-lying valley
13 bottoms and playa to moderately steep hill slopes of the Clark Mountains in the area of Mountain Pass substation.

15 Several direct impacts are associated with this alternative route. Negligible, localized, short-term impacts include those
16 associated with seismic ground shaking and seismic-related ground failure. With the implementation of APMs GEO-1 and
17 GEO-2, the impacts would be less than significant without mitigation. Minor, localized, long-term impacts of the project
18 could result from both landslides and erosion. With the implementation of MMs GEO-2 and GEO-3 these impacts would
19 be less than significant with mitigation. A minor, extensive, long-term impact to project structures could result from
20 unstable geologic units (subsidence). With the implementation of MMs GEO-1 and GEO-2, this impact would be less than
21 significant with mitigation. A negligible, localized, long-term impact to people and structures could result from building in
22 expansive soil. With the implementation of MM GEO-4, this impact would be less than significant with mitigation. The
23 project could result in negligible, area-wide, long-term impact to the availability of currently identified non-metallic mineral
24 resources. However, since no specific locations for valuable mineral resources have been identified within the project
25 area, there would be no loss of availability of a known mineral resource as a result of the proposed project. This impact
26 would be less than significant without mitigation.

28 A portion of the Mountain Pass Telecommunication Alternative would go through the MolyCorp Mine. Negligible to minor,
29 short-term, adverse impacts from construction, operation, and maintenance of the project on mining operations are
30 anticipated. Contaminated soils from the mine could be encountered during project construction. If that were to happen,
31 the project could result in adverse impacts to water quality in local streams and spreading of contamination. As part of
32 APM GEO-1, the applicant would identify contaminated soils along this alternative. Careful planning of soil segregation
33 and treatment along the Mountain Pass Telecommunication Alternative route would minimize these impacts.

35 Construction of the Mountain Pass Telecommunication Alternative could cause direct impacts to buried paleontological
36 resources due to ground-disturbing activities. Potential direct impacts to paleontological resources during construction of
37 the Mountain Pass Telecommunication Alternative would be adverse, negligible, localized, and short term.
38 Preconstruction ground-disturbing activities (augering and trenching) as part of geotechnical investigations along the
39 route of the Mountain Pass Telecommunication Alternative could impact buried paleontological resources in underlying
40 sedimentary formations of high paleontological sensitivity. During later tower construction, ground-disturbing activities
41 such as augering and trenching for support footings and grading for tower pads, service roads, and staging areas could
42 impact paleontological resources in areas where underlying formations have high unknown to low paleontological
43 sensitivity. The rock units of high low paleontological sensitivity (see Table 3.6-6) along the proposed Mountain Pass
44 Telecommunication Alternative are Quaternary Tertiary older alluvium (Qtoa), Quaternary non-marine (Qc/Qoa), and
45 Quaternary alluvium (Qa/Qal). Another underlying rock unit present along the Mountain Pass Telecommunication
46 Alternative is undivided Earlier Precambrian intrusive and metamorphic rocks (epC), which are of very low paleontological
47 sensitivity. As part of construction of the proposed project, the applicant would implement APMs PALEO 1 through
48 PALEO 8. These measures (provision of a project paleontologist to oversee potential impacts; pre-construction surveys;
49 construction worker awareness programs; construction monitoring; and recovery, testing, and curation of any significant
50 paleontological findings) would prevent significant impacts. Therefore, impacts would be less than significant with
51 mitigation.

3.6.4 Mitigation Measures

MM GEO-1: Monitor and Mitigate Damage to Tower Structures. SCE will contact the California Department of Water Resources and the Nevada Division of Water Resources on an annual basis to determine if groundwater withdrawals pose a potential for threatening to are threatening to cause ground subsidence within the project area. If physical evidence proves groundwater withdrawals are threatening tower locations, If subsidence threatens tower locations, SCE will develop a plan, following their operations and maintenance policies, to mitigate potential damage to tower structures using standard foundation remediation techniques available.

MM GEO-2: Geotechnical Engineering Study. The applicant will prepare a geotechnical engineering study prior to the final project design to identify site-specific geological conditions and potential geologic hazards. The data collected from the study will be used to guide sound engineering practices and to mitigate potential geologic hazards.

MM GEO-3: Preparation and Implementation of SWPPP. The applicant will prepare a SWPPP for review and approval by the Lahontan Regional Water Quality Control Board (Region 6) and the Clark County Stormwater Quality Management Committee that addresses construction and post-construction project-related ground disturbances and associated erosion. The plan will provide the necessary engineering controls and procedures to minimize impact to the ground surface caused by construction, operation, and maintenance activities. A copy of the approved plan will also be submitted to the CPUC.

MM GEO-4: Expansive Soils Mitigation. The applicant will prepare a geotechnical study of the areas of expansive soil(s) identified in APM GEO-1 to develop appropriate design and mitigation measures prior to construction.

3.6.5 Whole of the Action / Cumulative Action

~~Below is a brief summary of information related to geology, mineral, and paleontological resources in the ISEGS FSA/DEIS prepared by the CEC and the BLM. This section focuses on differences in the ISEGS setting and methodology compared with the setting and methodology discussed above for the EITP. This section also discloses any additional impacts or mitigation imposed by the CEC for ISEGS.~~

Information on geology, mineral, and paleontological resources related to the ISEGS project is summarized below. The setting for the ISEGS project is described, followed by methodologies used and summaries of the impact conclusions presented in the CEC's FSA, Addendum, and Final Decision and the BLM's Final EIS. Required mitigation measures and conditions of certification are listed.

3.6.5.1 ISEGS Setting

~~The ISEGS project would be constructed in a moderately active geological area on the west side of Ivanpah Valley. Existing conditions forat the ISEGS project site are primarilyin most respects consistent with the EITP asthose described for the EITP in Section 3.6.1. Any discrepancies between the ISEGS project site and the EITP site (above); differences are described below.~~

Project Site Geology

~~The three ISEGS power plant sections (from south to north, Ivanpah 1, 2, and 3) would be located on a broad alluvial slope of coalescing alluvial fans along the eastern flank of the Clark Mountain Range. These alluvial fans may be relatively thin near the margins where carbonate and metamorphic rock are exposed, and there is only limited data on its thickness away from these margins.~~

The three ISEGS sections (Ivanpah 1, 2, and 3, from south to north) would occupy a gently sloping area with coalescing alluvial fans on the eastern flank of the Clark Mountains.

1 **Geologic Hazards**

2 **Fault Rupture**

3 No active faults have been identified crossing the boundary of new construction on the proposed ISEGS site or in the
4 vicinity of the proposed gas pipeline. The potential for surface rupture on a fault at any of the three power plant sites
5 (Ivanpah 1, 2, and 3) is very low since no faults are known to have ruptured the ground surface of the proposed ISEGS
6 location.

7
8 **Groundshaking**

9 The intensity of seismic shaking expected in the area of the Ivanpah Substation site is consistent with the EITP site. Due
10 to the uncertainty in the uppermost soil profile, a design-level geotechnical investigation is proposed as part of the
11 Condition of Certification (GEO-1) to further evaluate this potential hazard and provide appropriate seismic design
12 parameters.

13
14 **Liquefaction**

15 The potential for liquefaction in the area of the Ivanpah Substation is consistent with the EITP site and is low within the
16 ISEGS project area based on a soil boring in one of the power plant sites (Ivanpah 2). Due to the uncertainty of the
17 liquefaction potential in the other two power plant sites (Ivanpah 1 and 3), a geotechnical investigation is proposed as part
18 of the Condition of Certification (GEO-1) to further evaluate this potential hazard.

19
20 **Landslides**

21 The landslide potential at the ISEGS site is negligible since ISEGS is located on a broad, gently east sloping alluvial fan.

22
23 **Expansive Soils**

24 The potential for expansive soils within the ISEGS project area is uncertain, although the soil encountered in the boring in
25 power plant site Ivanpah 2 were not expansive. There are no data for the other two (Ivanpah 1 and 3) power plant areas.
26 Due to the lack of expansion testing in power plant site Ivanpah 2, and the uncertainty of the expansion potential in the
27 other two power plant sites (Ivanpah 1 and 3), a geotechnical investigation is proposed as part of the Condition of
28 Certification (GEO-1) to further evaluate this potential hazard.

29
30 **Collapsible Soils**

31 The potential for collapsible soils within the ISEGS project area is uncertain, although the soils encountered in the boring
32 in power plant site Ivanpah 2 were not susceptible to either dynamic compaction or hydrocompaction, due to their medium
33 dense to very dense granular composition. There are no soil composition data for the other two (Ivanpah 1 and 3) power
34 plant areas; a geotechnical investigation is proposed as part of the Condition of Certification (GEO-1) to further evaluate
35 this potential hazard.

36
37 **Mineral Resources**

38 There are a variety of active mining operations in the general area near the ISEGS project location, but no active
39 operations occur within the proposed ISEGS project boundaries. In addition, the general area is considered to have low
40 potential for leasable minerals such as oil and gas. The applicant may need to move sand and gravel off site, or between
41 different units of the facility, which would require compliance with BLM regulations (40 CFR Part 3600). Other adjacent
42 claims along the western boundary, Limestone Hill, have two active locatable minerals claims with underground workings;
43 the current extent is unknown, and there is no indication that these would become active economic commercial
44 operations. The ISEGS project area is currently not used for mineral production, nor is it under claim, lease, or permit for
45 the production of locatable, leasable, or salable minerals.

Paleontological Resources

The ISEGS project area is underlain by two surficial geologic units (Quaternary alluvium and Quaternary older alluvium). These are alluvial fan deposits developed on the base of the Clark Mountain Range. Because of the coarseness and youth of Quaternary alluvium and Quaternary older alluvium, the ISEGS FSA/DEIS rates paleontological sensitivity of this rock unit as low. Because fossil resources were found in Quaternary older alluvium in adjacent areas, the EITP DEIS rated paleontological sensitivity of this rock unit high at the Ivanpah Substation. The ISEGS FSA/DEIS notes that there would be the potential to encounter geologic units with a higher paleontological sensitivity below the alluvium during construction and site grading. The Staff rates these units (Quaternary lacustrine sediments and Paleozoic carbonate rock) as having high paleontological sensitivity. The pre-Cambrian to Cambrian metamorphic rocks have been rated as having negligible paleontological sensitivity. No paleontological resources were identified by the paleontological record searches conducted for the ISEGS project area.

Geologic hazards were investigated for the ISEGS project. Several active and potentially active faults are present within 100 miles of the ISEGS project area, but no active faults are known to cross the boundary of proposed new ISEGS construction or to exist in the vicinity of the proposed gas pipeline, and the potential for surface rupture on a fault at the site is low. Ground acceleration related to the Stateline Fault 4.5 miles northeast of the site could be fairly high. The landslide potential in the ISEGS project area is negligible. The strong ground shaking potential in the ISEGS project area is expected to be similar to expectations for the EITP site. The potential for liquefaction at Ivanpah 2 is low, based on two exploratory soil borings there. Soil encountered in the borings at Ivanpah 2 was not expansive, and was not susceptible to either dynamic compaction or hydrocompaction. Subsidence may be caused by petroleum or groundwater withdrawal and can result in collapse of overlying soils; it has been observed along the northern edge of Ivanpah Dry Lake and elsewhere in the region, but coarse-grained soils such as those from the Ivanpah 2 boring are not highly sensitive to the surcharge loading that can lead to subsidence. The CEC's conditions of certification (below) propose a geotechnical investigation (GEO-1) to address uncertainty of the potential for liquefaction, expansive soils, collapsible soils, or subsidence at Ivanpah 1 and 3.

The ISEGS project area is currently not used for mineral production, nor is it under claim, lease, or permit for the production of locatable, leasable, or salable minerals. Two active locatable minerals claims exist along the ISEGS project's western boundary (on Limestone Hill) and are explored sporadically, but commercial production is not apparent. No active mining operations occur within the ISEGS project boundaries. The general area does contain active mines, but has low potential for leasable minerals such as oil and gas and no active oil or gas operations exist in the immediate project vicinity. Sand and gravel (salable resources) are present at the site and elsewhere in the region.

No paleontological resources have been documented on the ISEGS plant sites or proposed laydown area. The BLM and CEC rated paleontological sensitivity of surficial Quaternary alluvium and Quaternary older alluvium rock units at the site as low. However, the EITP DEIS rated paleontological sensitivity of Quaternary older alluvium as high at the Ivanpah Substation, because fossil resources were found in this rock unit in adjacent areas. Quaternary lacustrine sediments and Paleozoic carbonate rock of high paleontological sensitivity could exist below the alluvium. Pre-Cambrian to Cambrian metamorphic rocks northeast of Ivanpah 2 were rated as having negligible paleontological sensitivity.

Applicable Laws, Regulations, and Standards

Due to the variation in Because ISEGS and EITP project components and location between EITP and ISEGS, locations are different, some different laws, regulations, and standards would apply to ISEGS than those listed in Section 3.6.2. Since ISEGS would be developed entirely within California on BLM land, the Nevada regulations associated with the EITP would not apply Table 3.6.7 identifies the laws.

Laws, regulations, and standards that are applicable to the ISEGS project but not the EITP, are:

- Federal
 - Natural Gas Pipeline Safety Act of 1968

- State
 - CEQA, PRC Sections 15000 et seq., Appendix G (mandates that public and private entities identify the potential impacts on the environment during proposed activities)
 - CPUC General Order 112-E (establishes requirements for design, construction, and other parameters related to safety and public welfare, and provides for maintenance of adequate gas utility service)
- Local
 - San Bernardino County Ordinance Code, Title 3, Division 3, Chapter 8, Waste Management, Article 5, Liquid Waste Disposal (regulates the new septic tank and leach field)
 - San Bernardino County Ordinance Code, Title 6, Division 3, Chapter 3, Uniform Plumbing Code (regulates the new septic tank and leach field)

Table 3.6-7 Laws, Regulations, and Standards Applicable to the ISEGS Project

Law, Regulation, or Standard	Description	Project Component
Federal		
The Natural Gas Pipeline Safety Act of 1968	The Natural Gas Pipeline Safety Act of 1968 as amended through March 2006 (Title 49 Section VIII USC Chapter 601) specifies, among others, the minimum safety standards for designing, installing, constructing, initially inspecting, and initially testing a new natural gas pipeline facility. These standards include the characteristics of the material used in constructing the facility, design factors for specific locations, and the public safety factors, particularly its ability to prevent and contain a natural gas spill. The design standards for specific locations reflect site-specific geological, topographical, seismic, and soils conditions.	Natural gas pipeline
State		
CEQA, PRC Sections 15000 et seq., Appendix G	CEQA mandates that public and private entities identify the potential impacts on the environment during proposed activities. Appendix G outlines the requirements for compliance with CEQA and defines significant impacts.	Geological, soil, mineral, and paleontological resources
CPUC General Order 112-E	CPUC General Order 112-E establishes minimum requirements for the design, construction, quality of materials, locations, testing, operations and maintenance of facilities to safeguard life or limb, health, property, and public welfare and to provide that adequate service will be maintained by gas utilities operating under the jurisdiction of the CPUC.	Natural gas pipeline
Local		
San Bernardino County Ordinance Code, Title 3, Division 3, Chapter 8, Waste Management, Article 5, Liquid Waste Disposal	This ordinance requires the following compliance for all liquid waste disposal systems: (1) compliance with applicable portions of the Uniform Plumbing Code and the San Bernardino County Department of Environmental Health (DEHS) standards; (2) approval by the DEHS and building authority with jurisdiction over the system; or (3) for alternative systems, approval by the DEHS, the appropriate building official of this jurisdiction, and the appropriate California Regional Water Quality Control Board.	New septic tank and leach field
San Bernardino County Ordinance Code, Title 6, Division 3, Chapter 3, Uniform Plumbing Code	This ordinance describes the installation and inspection requirements for locating disposal/leach fields and seepage pits.	New septic tank and leach field

3.6.5.2 ISEGS Methodology

In the ISEGS FSA/DEIS, BLM and CEC staff (Staff) reported on existing conditions and assessed impacts to geology, mineral, and paleontological resources in the same section. In addition, staff evaluated the potential of the ISEGS project to restrict or remove from access potential sources of salable mineral resources. Staff considered compliance with the laws, ordinances, regulations, and standards associated with the project components and location. Staff also considered whether there would be a significant impact under CEQA using the impact criteria described in Section 3.6.3.

CEC FSA Methodology

The CEC followed the 2006 CEQA guidelines to analyze potential impacts to the ISEGS project and resulting from the project. Guidelines specific to this section were those addressing whether the project would:

- Destroy a unique paleontological resource or site or a unique geological feature
- Expose people or structures to geologic hazards
- Affect mineral resources

The California Building Standards Code and the 2007 CBC guidelines related to geotechnical investigations were followed to evaluate the potential of each hazard to impact design or construction of the facility. Resource maps and site-specific information from the applicant were reviewed, with a focus on effects of groundwater extraction and grading; proposed operating procedures were also reviewed. The Potential Fossil Yield Classification (PYFC) system was used to assess impacts to paleontological resources.

BLM FEIS Methodology

The FEIS followed the CEQA guidelines that were used for the FSA analysis. Like the FSA, the FEIS used guidance from California building codes and consulted resource maps, reports, and related data as well as information provided by the applicant.

3.6.5.3 ISEGS Impacts

The Staff determined that construction, operation, and decommissioning of the ISEGS project could impact geologic, mineralogical, or paleontological resources. Where impacts were identified, the Staff proposed mitigation measures (Conditions of Certification) to reduce impacts to less than significant levels.

The CEC and BLM have published the following impacts related to geology, soils, minerals, and paleontological resources for the ISEGS project:

The CEC FSA states that “the potential for significant adverse impacts to the project from geologic hazards, and to potential geologic, mineralogical, and paleontological resources from the proposed project, is low.” Similarly, the BLM FEIS indicates that, with mitigation, geologic conditions would not present hazards to the ISEGS project, and the project would not impact development of geologic or mineral resources.

CEC Impact Conclusions

The FSA states that the ISEGS project could be designed and built so that public safety and environmental quality would be protected. The CEC determined that impacts related to potential geologic hazards could be mitigated to a less than significant level through facility design based on the geotechnical report required by the 2007 CBC and Conditions of Certification GEO-1, GEN-1, GEN-5, and CIVIL-1. The FSA states that the ISEGS project “should not have significant NEPA or CEQA impact on” availability of sand and gravel and that impacts to any paleontological resources encountered could be mitigated by Conditions of Certification PAL-1 through PAL-7.

1
2 The FSA Addendum indicates that for geology, paleontology, and minerals, the project (1) complies with LORS, (2) fully
3 mitigates direct and indirect impacts, and (3) fully mitigates cumulative impacts. The Final Decision states that “the parties
4 did not dispute any matters related to this topic [these resources].”

5 6 **BLM Impact Conclusions**

7 **Construction Impacts**

8 Geologic hazards have been identified associated with the ISEGS project area and include strong ground shaking,
9 liquefaction, settlement due to compressible soils, subsidence associated with shrinkage of clay soils, hydrocompaction
10 (or dynamic compaction), and the presence of expansive clays.

11
12 The ISEGS project would directly remove approximately 4,072.5 acres from potential use for sand and gravel production
13 under BLM's salable mineral program. The ISEGS FSA/DEIS states that this removal is not expected to have any
14 significant impact since it represents a small fraction of the total sand and gravel resource available within the valley. In
15 addition, the applicant may need or desire to move sand and gravel either off site or between the different units of the
16 facility. Should this occur, the applicant would be required to comply with BLM regulations in 43 CFR Part 3600, which
17 regulates the production and use of sand and gravel from public lands. Use of sand and gravel or other mineral materials
18 within the boundaries of an authorized ROW is permitted; however, removal of these materials from an authorized ROW
19 would require payment to the U.S. of the fair market value of those materials. The ISEGS project would not have any
20 direct or indirect impact on the production of locatable or leasable minerals outside of the ISEGS project boundaries. The
21 only potential conflict would occur if the claimant or another person located a new claim, for locatable minerals
22 underneath the proposed project, within the project boundaries. This could occur, as the proposed project location has not
23 been withdrawn from mineral entry. The potential for this scenario is expected to be low. If it did occur, conflicts between
24 the surface use of the land for solar energy production and access to the subsurface minerals would be addressed in
25 accordance with appropriate regulations. Therefore, the ISEGS FSA/DEIS states that the ISEGS project would not impact
26 any current or reasonably foreseeable development of mineral resources.

27
28 The ISEGS FSA/DEIS states that paleontological resources are known to exist in the region but that no paleontological
29 resources have been documented on the ISEGS site. If they were encountered, potential impacts to them from
30 construction activities would be minimized through worker training and monitoring by qualified paleontologists. The ISEGS
31 project would include grading, foundation excavation, utility trenching, and possibly drilled shafts. The ISEGS FSA/DEIS
32 considers the probability of encountering paleontological resources to be generally high on portions of the site, particularly
33 the west side of Ivanpah 3, based on the soils profile, SVP assessment criteria, and the near surface occurrence of the
34 sensitive geologic units. The potential for encountering fossils hosted in Quaternary lake bed sediments will increase with
35 the depth of cut. Excavations for ancillary facilities and new pipelines and onsite excavations deeper than 5 feet may have
36 a higher probability of encountering potentially high sensitivity materials, although sensitive materials could occur nearer
37 the surface.

38
39 Based on the literature and archives search, field surveys, and compliance documentation for the ISEGS, the applicant
40 has proposed monitoring and mitigation measures (Conditions of Certification) to be followed during the construction of
41 the ISEGS project. The ISEGS FSA/DEIS states that the facility can be designed and constructed to minimize the effect
42 of geologic hazards at the site during project design life and that impacts to vertebrate fossils encountered during
43 construction of the power plant and associated linear projects would be mitigated to a level of insignificance.

44
45 The FEIS states that the required geotechnical investigation and GEO-1 should mitigate potential geologic hazards
46 through design considerations. Locatable or leasable minerals outside project boundaries would not be impacted.
47 Although project land would be unavailable for sand and gravel production, no adverse impact should result because
48 sand and gravel are widely available in the region. The ISEGS project would not impact any current or reasonably
49 foreseeable development of mineral resources.

1 The FEIS concluded that a high potential exists to encounter sensitive paleontological resources, especially during
2 excavation in the western portion of Ivanpah 3, but this impact could be mitigated by worker training and monitoring (PAL-
3 1 through PAL-7). The FEIS indicated a potential net gain to paleontology from the project because fossils might be
4 discovered that otherwise would not have been. Paleontologically sensitive sediments are unlikely to exist at depths that
5 would be affected by grading and trenching. Removal of 433 acres for the Mitigated Ivanpah 3 Alternative would eliminate
6 the most intense disturbance and thus reduce disturbance impact by more than the 12.5% acreage reduction.

7 8 **Operational Impacts**

9 The ISEGS FSA/DEIS states that operation of the ISEGS project facilities would not have any adverse impact on
10 geologic, mineralogical, or paleontological resources. The ISEGS FSA/DEIS also states that the potential geologic
11 hazards, including strong ground shaking; liquefaction; settlement due to compressible soils, subsidence associated with
12 shrinkage of clay soils, hydrocompaction, or dynamic compaction; and the presence of expansive clay soils could be
13 effectively mitigated through facility design such that these potential hazards should not affect operation of the facility.

14
15 Geologic conditions including seismicity, subsidence, and landslides could impact ISEGS operations, but impacts would
16 be mitigated through compliance with building codes, and low occupancy would result in low risk to human life and safety.
17 The ISEGS project would not impact the two active locatable minerals claims on Limestone Hill. As for construction, sand
18 and gravel availability in the region should not be affected by operations. Overall, the FEIS stated that ISEGS plant
19 operation “should not have any adverse impact on geologic, mineralogical, or paleontological resources considering
20 GEO-1 and CEC’s GEN-1, GEN-5, and CIVIL-1.”

21 22 **Decommissioning Impacts**

23 The ISEGS project would be decommissioned at the end of its 50-year life by removing all facilities to 3 feet below grade,
24 restoring original contours, and revegetating the site. The ISEGS FSA/DEIS states that this removal should not negatively
25 affect geologic, mineralogical, or paleontological resources since the majority of the ground disturbed during plant
26 decommissioning and closure would have been already disturbed, and mitigated as required, during construction and
27 operation of the project. Facility closure would make land occupied by the proposed project once again available for
28 potential future development of geologic or mineralogical resources within the former project borders.

29
30 The FEIS states that adverse impacts from decommissioning would not occur because ground disturbance would have
31 already occurred during construction.

32 33 **3.6.5.4 ISEGS Mitigation Measures / Conditions of Certification**

34
35 The ISEGS FSA/DEIS recommends that the following Conditions of Certification be required by the CEC and the BLM to
36 lessen impacts to related to geology, paleontology, and mineral resources if the project is approved. This document
37 presents a summary for the ISEGS Conditions of Certification. For the complete language of the Conditions of
38 Certification, refer to the ISEGS FSA/DEIS. Since the ISEGS document presented geology, mineral, and paleontological
39 resources in one section, the Conditions of Certification listed below apply to these resource areas. The ISEGS
40 documents presented soil and water resources in one chapter. The applicable Conditions of Certification for soil
41 resources are presented in Section 3.8, “Hydrology and Water Quality.”

42 43 **CEC Conditions of Certification**

44 CEC Conditions of Certification GEO-1 and PAL-1 through PAL-7 (designed to mitigate potential impacts to
45 paleontological resource to less than significant levels) are summarized as BLM Mitigation Measures in the BLM section
46 below. Conditions of Certification GEN-1, GEN-5, and CIVIL-1 (provided in full in the Facility Design section of the FSA
47 and also in Appendix C of the FEIS), proposed to mitigate geologic hazard impacts to a less than significant level, are
48 summarized below.

1 GEN-1 requires the project owner to design, construct, and inspect the project in accordance with the 2007 California
2 Building Standards Code (CBSC). The project owner must ensure that all contracts clearly specify that all work performed
3 and materials supplied must comply with the applicable codes.

4
5 GEN-5 requires the project owner to assign California-registered engineers from specific disciplines to the project, and
6 stipulates their responsibilities and the notification/approval requirements if an engineer is replaced.

7
8 CIVIL-1 requires the project owner to submit to the CBO for review and approval (1) a drainage design and a grading
9 plan, (2) an erosion and sedimentation control plan, (3) related calculations and specifications, and (4) soils, geotechnical,
10 or foundation investigations reports required by the 2007 CBC.

11 **BLM Mitigation Measures**

12
13 **GEO-1** requires the ISEGS project applicant to prepare a Soils Engineering Report required that meets Section 1802A of
14 the 2007 CBC to specifically include laboratory test data, associated geotechnical engineering analyses, and a thorough
15 discussion of the potential for liquefaction; settlement due to compressible soils, subsidence associated with shrinkage of
16 clay soils, hydrocompaction, or dynamic compaction; and the presence of expansive clay soils. The report would also
17 include recommendations for ground improvement and/or foundation systems necessary to mitigate these potential
18 geologic hazards, if present.

19
20 **PAL-1** requires the project applicant to provide BLM's Authorized Officer and the Compliance Project Manager (CPM)
21 with the resume and qualifications of its Paleontological Resource Specialist (PRS) for review and approval. Any changes
22 to the PRS will be approved by the BLM's Authorized Officer and CPM.

23
24 **PAL-2** requires the project applicant to provide to the PRS, BLM's Authorized Officer, and the CPM, for approval, maps
25 and drawings showing the footprint of the power plants, construction lay down areas, and all related facilities identifying all
26 areas of the project where ground disturbance is anticipated. Any changes must be approved by the PRS, BLM's
27 Authorized Officer and CPM. A letter identifying the proposed schedule of each project power plant shall be provided to
28 the PRS, BLM's Authorized Officer and CPM. At a minimum, the project owner shall ensure that the PRS or PRM
29 consults weekly with the project superintendent or construction field manager to confirm area(s)

30
31 **PAL-3** requires, if after review of the plans provided pursuant to **PAL-2**, the PRS determines that materials with
32 moderate, high, or unknown paleontological sensitivity could be impacted, the project applicant to ensure that the PRS
33 prepares, and the project owner submits to BLM's Authorized Officer and the CPM for review and approval, a PRMMP to
34 identify general and specific measures to minimize potential impacts to paleontological resources. Approval of the
35 PRMMP by BLM's Authorized Officer and the CPM shall occur prior to any ground disturbance.

36
37 **PAL-4** requires, if after review of the plans provided pursuant to **PAL-2**, the PRS determines that materials with
38 moderate, high, or unknown paleontological sensitivity could be impacted then, prior to ground disturbance and for the
39 duration of construction activities involving ground disturbance, the project applicant and the PRS shall prepare and
40 conduct weekly BLM Authorized Officer and CPM-approved training for the following workers: project managers,
41 construction supervisors, foremen and general workers involved with or who operate ground-disturbing equipment or
42 tools.

43
44 **PAL-5** requires the project applicant to ensure that the PRS and PRM(s) monitor consistent with the PRMMP all
45 construction-related grading, excavation, trenching, and augering in areas where potential fossil-bearing materials have
46 been identified, both at the site and along any constructed linear facilities associated with the project. In the event that the
47 PRS determines full-time monitoring is not necessary in locations that were identified as potentially fossil-bearing in the
48 PRMMP, the project owner shall notify and seek the concurrence of BLM's Authorized Officer and the CPM.

49
50 **PAL-6** requires the project applicant, through the designated PRS, to ensure that all components of the PRMMP are
51 adequately performed including collection of fossil materials, preparation of fossil materials for analysis, analysis of

1 fossils, identification and inventory of fossils, the preparation of fossils for curation, and the delivery for curation of all
2 paleontological resource materials encountered and collected during project construction.

3
4 **PAL-7** requires the project applicant to ensure preparation of a Paleontological Resources Report (PRR) by the
5 designated PRS. The PRR shall be prepared following completion of the ground-disturbing activities. The PRR shall
6 include an analysis of the collected fossil materials and related information, and submit it to the CPM for review and
7 approval.

8
9 **GEO-1** requires the ISEGS project applicant to prepare a Soils Engineering Report that meets Section 1802A of the 2007
10 CBC. The report must include laboratory test data, geotechnical engineering analyses, and a thorough discussion of the
11 potential for geological hazards, as well as recommendations for ground improvement and/or foundation systems
12 necessary to mitigate the hazards, if present.

13
14 **PAL-1** requires the project applicant to provide BLM's Authorized Officer and the CEC's Compliance Project Manager
15 (CPM) with the resume and qualifications of its Paleontological Resource Specialist (PRS) for review and approval. Any
16 changes to the PRS require BLM and CEC approval.

17
18 **PAL-2** requires the applicant to provide maps and drawings showing ground disturbance and the footprint of construction
19 areas to the PRS, BLM's Authorized Officer, and the CPM for approval. These officials must be provided with proposed
20 schedules and notified of any schedule changes. The project owner must ensure that the PRS or PRM consults weekly
21 (until ground disturbance is completed) with the project superintendent or construction field manager to confirm area(s) to
22 be worked the following week.

23
24 **PAL-3** requires preparation and submission of a paleontological resources monitoring and mitigation plan (PRMMP) to
25 minimize impacts if the PRS determines that materials with moderate, high, or unknown paleontological sensitivity could
26 be impacted. The PRMMP must be approved before ground disturbance commences and consulted when on-site
27 changes are proposed.

28
29 **PAL-4** specifies required weekly training for relevant workers and prohibits excavation before training, if the PRS
30 determines that materials with moderate, high, or unknown paleontological sensitivity could be impacted.

31
32 **PAL-5** requires monitoring consistent with the PRMMP for all construction-related ground disturbance where potential
33 fossil-bearing materials have been identified. Proposed changes in monitoring levels require the project owner to notify
34 and seek the concurrence of BLM's Authorized Officer and the CPM. The project owner must ensure that the PRS and
35 PRM(s) have the authority to halt or redirect construction if paleontological resources are encountered. A summary of the
36 monitoring must be provided in monthly reports.

37
38 **PAL-6** requires the project owner, through the designated PRS, to ensure that all components of the PRMMP are
39 adequately performed.

40
41 **PAL-7** requires that a Paleontological Resources Report (PRR) analyzing the collected fossil materials and related
42 information be submitted to the CPM for review and approval after completion of ground-disturbing activities.

43 **3.6.6 Combined Impact of EITP and ISEGS**

44
45
46 The CEQA and NEPA EITP and ISEGS impact analyses related to geology, soils, minerals, and paleontology were based
47 on similar significance criteria that evaluated the extent to which the proposed projects would impact these resources in
48 the project area and the potential impact on project components and public safety related to geologic hazards.

49
50 For EITP, the CPUC/BLM concluded that the risk related to geologic hazards would be less than significant with the
51 incorporation of APM GEO-1, APM GEO-2, MM GEO-1, MM GEO-3, and MM GEO-4. The CEC concluded that impacts

1 related to potential geologic hazards could be mitigated to less than significant levels through facility design based on the
2 geotechnical report required by the 2007 CBC and Conditions of Certification GEO-1, GEN-1, GEN-5, and CIVIL-1. For
3 ISEGS, the BLM similarly concluded that the required geotechnical investigation and GEO-1 should mitigate potential
4 geologic hazards through design considerations.

5
6 Soil erosion for both projects would be mitigated by best management practices outlined in the each project's SWPPP.

7
8 Locatable or leasable minerals were not identified on either project site. The CPUC/BLM concluded that EITP would have
9 less than significant impacts with the incorporation of the findings in the geotechnical report in APM GEO-1. The CEC
10 concluded that ISEGS should not have a significant NEPA or CEQA impact on the availability of sand and gravel
11 resources. The BLM concluded that ISEGS would have no adverse impact on the availability of sand and gravel
12 resources because they are abundant in the region. Additionally, the BLM's FEIS concludes that the ISEGS project would
13 not impact any current or reasonably foreseeable development of mineral resources.

14
15 The CPUC/BLM concluded that EITP construction would have less than significant impacts on paleontological resources
16 with the incorporation of APMs PALEO 1 through 8, including preconstruction surveys, worker training, and construction
17 monitoring. The CEC concluded that potential impacts to paleontological resources could be successfully mitigated by
18 Conditions of Certification PAL-1 through PAL-7. The BLM found that there was a high potential to encounter sensitive
19 paleontological resources, especially during excavation in the western portion of Ivanpah 3, but this impact could be
20 mitigated to less than significant levels by worker training and monitoring, as outlined in mitigation measures PAL-1
21 through PAL-7. The BLM noted that there is a potential for beneficial impacts to paleontology if fossils were located that
22 would have been undiscovered without project development.

23
24 With mitigation, impacts from the two projects together would be less than significant on geology, soils, mineral resources,
25 and paleontological resources. Additionally, the two projects would have less than significant impacts due to geologic
26 hazards. See Section 5.3.8.6 for a discussion of cumulative impacts.

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