IV.4 GEOLOGY AND SOILS

IV.4.1 Approach to Impact Analysis

IV.4.1.1 General Methods

This chapter addresses potential impacts on geologic and soil resources from implementing the various Desert Renewable Energy Conservation Plan (DRECP or Plan) alternatives. This analysis is based on the description of Covered Activities on federal and nonfederal lands and the overall conservation strategy within the Plan Area. Covered Activities are those actions associated with renewable energy development that would be permitted within Development Focus Areas (DFAs). Transmission development may also occur outside the DFAs but would be subject to permitting and management conditions set by the Plan. DRECP implementation would also facilitate and streamline siting decisions of renewable energy development and facility operations.

This chapter provides an analysis of impacts from geologic hazards and problematic soils, and Volume III, Chapter III.4 describes existing conditions for geologic hazards and soil resources. Appendix R2.4 includes three tables supporting this chapter. These tables present the acreage of soil texture, erosive soils, and expansive soils within the Development Focus Areas (DFAs) for each alternative.

The specific impacts of renewable energy facility development would depend on a variety of factors, including project location within DFAs, technology and scale employed, size of the development, and site-specific soil conditions. Due to the uncertainty of specific location of development within DFAs, impact analysis is based on the total acreage of land that could be affected within DFAs.

This analysis of impacts on geology and soils includes the following assumptions:

- Soil resources within Bureau of Land Management (BLM)-administered lands will be managed to meet the Rangeland Health Standards and Guidelines for California and Northwestern Nevada.
- Substantial surface disturbance to soil—including exposure of bare ground, loss of vegetation and soil biotic crusts, and rutting on unsurfaced roads—would increase soil compaction, water runoff, and downstream sediment loads. It would also lower soil productivity and increase fugitive dust emissions, thereby degrading water and air quality, altering channel structure, and affecting overall watershed health, air quality, and potentially human health.
- Several factors would influence the degree of impact attributed to any one disturbance or series of disturbances, including the disturbance's location within the

watershed, time and degree of disturbance, existing vegetation, and levels of precipitation at the time of the disturbance.

- Any access roads would follow the design standards of the BLM Roads Design Handbook H-9113-1 or higher standard required by the State of California to protect air or water quality.
- Stockpiling of surface soils would occur for future restoration after grading or excavation.
- Design features and management practices identified in the Best Management Practices and Guidance Manual for Renewable Energy Development (California Energy Commission [CEC] 2010]) would be implemented for site-specific projects.

The DRECP and EIR/EIS is a programmatic document; therefore, the analysis is primarily for typical impacts and does not evaluate site-specific impacts associated with specific projects. Project-specific impacts would be assessed during the permitting process and in supplemental California Environmental Quality Act (CEQA)/National Environmental Policy Act (NEPA) documents. Because the specific location of future renewable energy projects is undetermined at this time, this impact analysis presents information on faults and problematic soils within DFAs, Study Area Lands, and Reserve Design Lands.

IV.4.1.2 CEQA Standards of Significance

The following CEQA significance criteria for geology and soils are from Appendix G, CEQA Environmental Checklist. These factors guide the impact analysis and determinations of impact significance.

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

   i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the state geologist for the area or based on other substantial evidence of a known fault. Refer to Division of Mines and Geology Special Publication 42.

   ii) Strong seismic ground shaking.

   iii) Seismic-related ground failure, including liquefaction.

   iv) Landslides.

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

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

d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property.

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

Threshold (e) is not included in the impact analysis because any septic tanks required for occupied structures related to a renewable energy project design would have to be constructed in compliance with local building codes. Compliance with these codes would ensure that there are no impacts related to septic tanks.

IV.4.2 Typical Impacts Common to All Action Alternatives

The potential effects of renewable energy development (solar, wind, and geothermal) and associated transmission lines on geology and soils within the Plan Area are evaluated based on review of CEQA and NEPA documents prepared for individual renewable energy projects, the Solar Programmatic Environmental Impact Statement (Solar PEIS), Wind PEIS, and Geothermal PEIS. Existing conditions for geology and soils are described in Chapter III.4.

This section analyzes the direct and indirect impacts typical of solar, wind, and geothermal energy development and associated transmission lines. Approval of a DRECP alternative would facilitate the development of renewable energy projects within defined DFAs by streamlining permitting decisions and mitigation for protected species. Each future project would undergo required CEQA and/or NEPA analysis of its impacts, but relevant information in this EIR/EIS could be used to facilitate document preparation. Impacts related to renewable energy projects and associated facilities would vary depending on the technology proposed, the location of the project area, the time and degree of disturbance resulting from development, and the size and complexity of the facilities.

DRECP components may result in indirect impacts on geologic features, including paleontological resources and important scenic and structural geologic features, and seismic risk, seismic activity and other geologic hazards may have indirect impacts on the project. DRECP alternatives may also result in indirect impacts on soils, particularly sensitive soils, due to development of renewable energy. Impacts may result from the alteration or removal of vegetative cover, widening or increase in the number of roadways, surface disturbance in areas with high wind or water erosion potential, or activities that damage soil surface cover, such as desert pavement or biological soil crusts.

IV.4.2.1 Impacts of Renewable Energy and Transmission Development

A wide range of potential geologic impacts from development of renewable energy facilities and transmission infrastructure were considered in this analysis. Impacts include soil erosion and disturbance of desert pavement and potential effects of geologic hazards such as active faults, potentially active volcanoes, landslides and mudslides, and impacts from expansive or corrosive soils during the lifetime of a renewable energy facility. Each of these impacts is discussed in the following sections.

IV.4.2.1.1 Impacts of Site Characterization

Site characterization for renewable energy facilities involves land surveying, biological, cultural and paleontological surveys, and geotechnical studies. These activities create ground disturbances with a range of impacts. Land surveying and biological, cultural, and paleontological surveying are low-impact activities. Geotechnical studies have low to moderate impact, depending on specific site environments. Impacts from site characterization also include potential disturbance of desert pavement and increased soil erosion.

IV.4.2.1.2 Impacts of Construction and Decommissioning

Soil erosion. Soil erodibility is determined primarily by soil texture. Soils with high silt content erode more readily than those with high clay content. Erosion occurs when wind or water gradually breaks down rocks into smaller components, such as when water freezes within the cracks of rocks and expands the rock to the point of fracture. Portions of the Plan Area contain soils with a moderate-to-high potential for erosion from wind and water.

During construction and decommissioning of a renewable energy facility, excavation, grading, construction activity, and watering for dust control contribute to soil erosion. If blasting is required during excavations, it would also contribute to soil disturbance and could increase erosion. In addition, without appropriate best management practices (BMPs), a storm event during construction would increase erosion during project construction and decommissioning.

Desert pavement. As stated in Volume III, Section III.4.2, about 60% of the surficial geologic formation within the Plan Area is alluvium (material deposited by moving water). Over time, alluvium can form a protective surface crust of pebbles called desert pavement. The disturbance of desert pavement would result in a substantial increase in surface erosion from wind and water, as well as increased dust hazards. These surficial deposits are considered to be valuable because natural regeneration of desert pavement occurs very slowly in the Mojave Desert. Excavation and grading during construction and decommissioning of a renewable energy facility—as well as ground disturbance from workers, vehicles, or equipment—would damage desert pavement where they exist within the Plan Area.

Sand Transport. Development of renewable energy facilities in some parts of the Plan Area, including the Eastern Riverside County region, would occur in or near important sand transport corridors. The sand transport corridor in the eastern portion of Riverside County runs parallel to Interstate 10 in Riverside County between the areas of Desert Center and Blythe. Other sand transport corridors include the Mojave River corridor (including the Kelso Dunes), Bristol Trough corridor (including the Cadiz and Danby dunes), Rice Valley corridor (including the Rice Valley Dunes), and Clark's Pass corridor (including the Dale Lake Dunes and Ford-Palen Dunes; USGS 2003).

Renewable energy facilities in DFAs in these regions could impede sand transport and thereby affect valuable habitat within this corridor of active sand dunes. Conversely, sand transport could harm renewable energy infrastructure and reduce the production of renewable energy from installations there. Large areas of dune systems and sand transport corridors are located in the central and southern portion of the Plan Area. Approximately 1,781,000 acres of dune systems and sand transport corridors are in the entire Plan Area (Data Basin 2014a). The highest concentrations of dune systems and sand transport corridors in the Plan Area include the following:

- 841,000 acres in the eastern portion of Riverside County
- 245,000 acres in the Imperial Valley region of the Plan Area
- 205,000 acres in the Central Mojave region of the Plan Area

See Chapter III.4, Figure III.4-2, Dune Systems and Sand Transport Corridors Within the Plan Area, in Section III.4.2.2.1.1.

IV.4.2.1.3 Impacts of Operations and Maintenance

Seismic, volcanic, or landslide activity. As demonstrated based on the number and length of active faults presented in Section III.4.3, the Plan Area is highly seismically active. Some of the longest and most seismogenic faults in the state pass through the Plan Area, including the San Andreas Fault. See Figure III.4-4, Earthquake Faults within the Plan Area and Table III.4-2, Largest Faults within the Plan Area, for specific locations and seismicity of faults in the Plan Area. Within the Plan Area, seismic activity can be expected to be focused in the areas around and west of the San Andreas and Superstition Hills Faults. Major earthquakes, like the Landers Earthquake of 1992 (magnitude 7.3), will continue to occur, and property damage is likely to result. See Table III.4-3 (in Section III.4.4), Earthquakes within the Plan Area with a Magnitude 6.0 or Higher. Based on project location, future earthquakes have the potential to damage renewable energy facilities and transmission lines constructed pursuant to Plan approval.

Volcanic activity is of greatest concern where there have been recent eruptions. Younger volcanic flows exist in the Salton Buttes in the Imperial Borrego Valley ecoregion subarea (see Appendix R1, Table R1.4-1, Surficial Geology in the Plan Area) and also in the areas east of Barstow near the Pisgah Crater and in southern Inyo County. However, the low likelihood that renewable energy facilities would be located in the immediate area of an active volcanic site means that volcanic activity is not likely to affect renewable energy development.

Geothermal resources may be more likely to exist in areas with volcanic activity. These resources have been identified in Imperial County, as well as in the Coso and Randsburg areas of Inyo and San Bernardino counties.

Solar facilities are not generally constructed on steep slopes where landslides tend to occur. Therefore, it is unlikely that landslides would damage solar projects. Wind turbines that may be located on ridgelines or on steeper slopes can create hazards from landslides. Prior to site design and construction, site-specific geotechnical investigations would be required to ensure landslide hazards to wind turbines would be minimized during facility operations and maintenance.

Expansive soils. Expansive soils have a high clay content, which have a greater ability to shrink and swell with changes in soil moisture content. This includes soils with clay, silty clay, and clay loam textures. As these soils expand and contract, they could damage structural and operational elements of renewable energy facilities. Nearly 589,000 acres of expansive soils are within the entire Plan Area. The highest concentrations of expansive soils within the Plan Area include the following:

- 156,000 acres in the Death Valley area
- 89,000 acres in the eastern end of Riverside portion of the Plan Area
- 69,000 acres in the Owens River Valley portion of the Plan Area

For further details on soil texture by ecoregion subarea, see Appendix R1, Figures R1.4-1 through R1.4-10. Also, see Tables R1.4-3 through R1.4-12 (Appendix R1).

Corrosive Soils. As stated in Section III.4.2.2.2, mild to aggressive soil corrosivity within the Plan Area could corrode ungalvanized steel and concrete. Corrosion from soils has the potential to create a hazard that could undermine the long-term integrity of renewable energy infrastructure, resulting in damage to foundations and other structural elements of renewable energy facilities as well as associated transmission infrastructure during the lifetime of the project.

Vegetation in the desert is specifically adapted to soil characteristics. Playas and the presence of North American warm desert alkaline scrub and herb playa and wet flat are indicative of potentially corrosive soil within the Plan Area. Approximately 509,000 acres of potentially corrosive soils are within the entire Plan Area (Data Basin 2014b). The highest concentrations of potentially corrosive soils within the Plan Area include the following:

- 133,000 acres in the Death Valley portion of the Plan Area
- 117,000 acres in the Central Mojave portion of the Plan Area
- 63,000 acres in the Lucerne Valley portion of the Plan Area
- 55,000 acres in the West Mojave portion of the Plan Area
- 28,000 acres in the Owens Valley portion of the Plan Area

For further information on corrosive soils within the Plan Area, see Section III.4.2.2.2, Corrosive Soils. Also, see Figure III.4-3, Potentially Corrosive Soils within the Plan Area.

IV.4.2.2 Impacts of the Reserve Design

Lands within conservation areas or Legislatively and Legally Protected Areas would be protected from development, so the development-caused impacts on soil erosion, facility damage from problematic soils, or the effects of geologic hazards would not occur.

IV.4.2.3 Impacts of BLM Land Use Plan Decisions

IV.4.2.3.1 Impacts of Renewable Energy Development and Transmission on BLM Lands

The typical impacts from the various renewable energy and transmission technologies on BLM lands would be the same as those described in Section IV.4.2.1. However, the specific locations where energy and transmission development is allowed will be driven by Land Use Plan Amendment (LUPA) decisions, which may encourage or restrict development in some areas.

IV.4.2.3.2 Impacts of BLM Land Designations and Management Actions

Because the BLM LUPA land designations would be managed to protect ecological, historic, cultural, scenic, scientific, and recreation resources and values, they would also confer general protection for geologic and soil resources. While other land uses are allowed within these areas, other uses must be compatible with the resources and values that the land designation is intended to protect.

Details on allowable uses and management within National Conservation Lands, lands with wilderness characteristics, and trail management corridors are presented in the LUPA description in Volume II. Details on the goals, objectives, allowable uses, and management actions for each Area of Critical Environmental Concern (ACEC) and Special Recreation Management Area (SRMA) unit information are presented in the LUPA worksheets in Appendix H.

IV.4.2.4 Impacts of Natural Community Conservation Plan and General Conservation Plan

The Natural Community Conservation Plan (NCCP) would be administered by the California Department of Fish and Wildlife and would be applicable to the entire Plan Area. The General Conservation Plan (GCP) would be administered by the U.S. Fish and Wildlife Service (USFWS) and would be applicable to nonfederal lands, a subset of the entire Plan Area.

IV.4.2.4.1 Natural Community Conservation Plan

The impacts of renewable energy development permitted under the NCCP would be the same as those defined for the Plan-wide impacts, including the typical impacts described in Section IV.4.2. These impacts are described in Section IV.4.3.

IV.4.2.4.2 General Conservation Plan

The types of impacts resulting from renewable energy development permitted under the GCP would be the same as those defined for the Plan-wide impacts, including the typical impacts described in Section IV.4.2. However, the locations where these impacts would occur would vary by alternative. The GCP affects only nonfederal lands.

IV.4.3 Impact Analysis by Alternative

The following sections present impact analysis for the No Action Alternative, the Preferred Alternative, and Alternatives 1 through 4.

IV.4.3.1 No Action Alternative

IV.4.3.1.1 Impacts Within the Entire Plan Area in No Action Alternative

The No Action Alternative assumes that renewable energy, transmission development, and mitigation for such projects in the Plan Area would occur on a project-by-project basis and in a pattern consistent with past and present renewable energy and transmission projects. The No Action Alternative includes approximately 9,782,000 acres available for renewable

energy development and no specific Reserve Design Lands. Existing conservation comprises 7,592,000 acres of the Plan Area, as it does in all alternatives.

Development of renewable energy facilities within the Plan Area would still take place in the No Action Alternative. This discussion includes the effects of renewable energy development as well as transmission development and BLM LUPA decisions outside the Plan Area.

IV.4.3.1.1.1 Impacts and Mitigation for Renewable Energy and Transmission Development in No Action Alternative

Impact Assessment

Available developable areas in the No Action Alternative are in the Tehachapi Mountains, West Mojave, Imperial Valley, Eastern Riverside County, and Kingston and Funeral Mountains regions of the Plan Area. Impacts related to soils, geology, and geologic hazards would result from development of solar, wind, and geothermal facilities. Impacts would also occur on lands subject to potential transmission development.

The potential for increased soil erosion is quantified based on acreage of erosive soils that may be disturbed during construction and decommissioning and, to a lesser degree, during site characterization. The potential for impacts from geologic hazards is quantified based on miles of active fault lines within 25 miles of developable areas under the No Action Alternative. Other geology and soil impacts such as disturbance to desert pavement and structural damage from expansive or corrosive soils are assessed more qualitatively.

Impact SG-1: Plan components would expose people or structures to injury or damage from seismic, volcanic, or landslide activity.

As described in Volume III, Section III.4.3, the Plan Area is seismically and volcanically active, with major fault lines, young volcanic features, and landslide sediment deposits. Within the Plan Area, major faults include some of the largest in the state, such as the San Andreas and San Jacinto fault systems. During the lifetime of a renewable energy facility, earthquakes within the Plan Area are likely. Table IV.4-1 presents a list of active faults, which the U.S. Geological Survey (USGS) defines as having ruptured within the Holocene (the past 11,000 years) (USGS 2014a).

For each fault, Table IV.4-1 presents the length within the DFA boundary and the length outside the DFA but within 25 miles of the DFA boundary. Under the No Action Alternative, 410.1 miles of active fault lines are within developable areas and 202.0 miles are outside developable areas but within the 25-mile buffer set for the fault analysis. See Volume III, Table III.4-2, Largest Faults within the Plan Area, for the earthquake magnitude generating

potential for each of the listed faults and associated Alquist-Priolo designations. The faults presented in Table IV.4-1 represent a potential geologic hazard that could damage renewable energy facilities. While the majority of these facilities would not include occupied structures, damage to property could be considerable.

Table IV.4-1
Faults Within a 25-Mile Radius of Developable Areas in the No Action Alternative

Fault Name	Length of Fault Within Developable Area (miles)	Length of Fault Outside Developable Areas (miles)
San Andreas Fault Zone	56	45
Garlock Fault	77	50
Imperial Fault Zone	24	9
Coyote Creek Fault	21	29
Elsinore Fault Zone	23	25
Laguna Salada Fault	7	11
Eureka Peak Fault	6	8
San Jacinto Fault Zone	34	25
Homestead Valley	6	0
Emerson Fault	8	0
Llano Fault	4	0
Johnson Valley Fault	43	0
Bullion Fault	48	0
Manix Fault	21	0
Superstition Hills	22	0
Brawley Fault Zone	10	0
Total	**410**	**202**

Volume III, Section III.4.4.4, describes the locations of recent volcanic activity. Within DFAs in the No Action Alternative, there is less than 1 square mile of recent volcanic flow rocks. The likelihood of a renewable energy facility being located near an active volcanic site is low, because developers will likely avoid areas with this type of risk. Facility damage or threat to life from volcanic activity is possible but unlikely.

Impact SG-2: Soil or sand erosion would be triggered or accelerated due to plan components.

Erosion. Table R2.4-2, Acreage of Erosive Soils Within DFAs for each Alternative, (Appendix R2) presents erosion potential of soil textures found in the Plan Area and acreage of soil textures with potential for erosion found in DFAs in each alternative. Within DFAs in the No

Action Alternative, there are approximately 576,000 acres of soils with a moderate-to-high potential for wind erosion and approximately 54,000 acres of soils with a moderate-to-high potential for water erosion. Development of renewable energy facilities within these areas of DFAs in the No Action Alternative would increase the likelihood of soil erosion occurring from wind and water.

Sand Transport. Under the No Action Alternative, DFAs in the Eastern Riverside County region are on or near an important sand transport corridor in the Chuckwalla Valley. The corridor runs parallel to Interstate 10 in Riverside County between the areas of Desert Center and Blythe. Other sand transport corridors include the Mojave River corridor, which includes the Kelso Dunes, the Bristol Trough corridor, which includes the Cadiz and Danby dunes, the Rice Valley corridor, which includes the Rice Valley Dunes, and the Clark's Pass corridor, which includes the Dale Lake Dunes and Palen-Ford Dunes (USGS 2003). Renewable energy facilities in these DFAs could impede sand transport and thereby affect valuable habitat within this corridor of active sand dunes. Approximately 429,000 acres of dune systems and sand transport corridors are within developable areas in the No Action Alternative.

Impact SG-3: Plan components would expose structures to damage from corrosive or expansive soils.

As stated in Section IV.4.2.1.2, Typical Impacts, corrosive soils could damage foundations and structural elements of renewable energy facilities. Expansive soils could cause soils to shrink or swell, damaging foundations and structural elements of renewable energy facilities. The No Action Alternative includes 677,000 acres of potentially expansive soils. See Table R2.4-3, Acreage of Expansive Soil Textures Within DFAs for Each Alternative (Appendix R2). Expansive soils include clay, clay loam, silty clay, and silty clay loam. Corrosive soils are widespread throughout the Plan Area. Playas and the presence of North American warm desert alkaline scrub and herb playa and wet flat are indicative of potentially corrosive soil within the Plan Area. Approximately 51,000 acres of potentially corrosive soils are within the developable areas in the No Action Alternative.

Impact SG-4: Plan components would destroy or disturb desert pavement.

Renewable energy facilities in the No Action Alternative may damage desert pavement. Excavation and grading during construction and decommissioning of a renewable energy facility—as well as ground disturbance from workers, vehicles, or equipment—would damage or disturb this important habitat. Specific locations of desert pavement that have not been mapped would require field surveys.

Laws and Regulations

Existing laws and regulations would reduce the impacts of renewable energy development projects in the absence of the DRECP. Relevant regulations are presented in the Regulatory Setting in Volume III. Note that because this EIR/EIS addresses amendments to BLM's land use plans, these plans are addressed separately and are not included in this section.

The requirements of relevant regulations would reduce impacts through the following mechanisms:

- The Clean Water Act of 1972 requires operators of construction sites one acre or larger to obtain coverage under the National Pollutant Discharge Elimination System (NPDES) General Permit for Stormwater Discharges Associated With Construction Activity (General Permit). Stormwater runoff from construction activities can have significant effects on water quality. As part of the General Permit requirements, a Stormwater Pollution Prevention Plan must be prepared to include a site description; a map that identifies sources of stormwater discharges on the site; anticipated drainage patterns after major grading; areas where structural and nonstructural measures will be employed; surface waters, including wetlands; and locations of discharge points to surface waters.
- The California Building Code Section 1613.3.5 (CBC 2013) requires all new construction to follow earthquake design guidelines by completing a geotechnical investigation for all buildings in Seismic Design Categories C, D, E, and F. The majority of the Plan Area is made up of categories C, D, and E, which are based on the following three criteria:
    1. Probable site ground motion – Probable site motion is based on Federal Emergency Management Agency (FEMA) maps, the maximum acceleration of an object in an earthquake, and the structure's response to wave acceleration. See Volume III, Figure III.4-13, Peak Horizontal Ground Acceleration within the Plan Area.
    2. Soil site classifications – Soil classifications A through F include hard rock, rock, dense soil, stiff soil, soft soil, and special soils.
    3. Building occupancy type – Building occupancy is grouped into four types: agricultural, essential, hazardous structures in the event of a collapse, and "other."
- In addition, Appendix J of the California Business Code requires that county grading permits be obtained for appropriate management of on-site drainage and erosion control.

- The Alquist-Priolo Earthquake Fault Zoning Act (1972) prohibits permitting of buildings used for human occupancy whose construction would take place across active faults.

In addition, the Solar PEIS includes numerous design features that would reduce the impacts of solar energy development on geology and soil resources (full text of all design features is presented in Appendix W). Relevant design features include the following measures:

- SR1-1 would minimize soil erosion and geologic hazards by identifying local factors that would cause slope instability, as well as on-site soil erosion and geologic hazard concerns in proximity to the proposed project.
- SR2-1 would minimize soil erosion and sediment transport during all project phases. It requires minimal ground disturbing activities, requiring culverts to control runoff to minimize erosion, siting projects to avoid disturbance of desert pavement, avoiding areas with unstable slopes and soils, and conducting construction grading in compliance with CBC 2013. It also requires soil testing in compliance with American Society for Testing and Materials standards, performing studies to determine the effects from construction on sand transport corridors, and replanting project areas with native vegetation to reduce exposed soil through wind and water erosion.
- SR3-1 would maintain soil erosion and geologic hazard design elements during Operations and Maintenance by requiring permanent barriers around washes and wetlands to ensure effective erosion control; regularly maintaining catch basins, roadway ditches, and culverts; and performing routine site inspections to monitor effectiveness of erosion and sediment control measures.
- SR4-2 would restore the original grade and drainage patterns on the site during Site Reclamation and Decommissioning.
- SR4-3 would restore the site's natural vegetation patterns by seeding and transplanting native plant communities during Reclamation and Decommissioning to prevent future erosion and sedimentation.
- WR1-1 would control project site drainage, erosion, and sedimentation by conducting hydrologic analysis and modeling to define the 100-year 24-hour rainfall events and calculating projected runoff, demonstrating the project will not increase off-site flooding potential, demonstrating compliance with the NPDES program, managing runoff from impervious surfaces, and creating or improving landscaping for capturing runoff.

Mitigation

Under the No Action Alternative, individual projects would continue to be reviewed and approved with mitigation measures adopted by CEQA and NEPA Lead Agencies. Mitigation for geology and soils generally includes the following:

- **Protect disturbed soil from wind erosion during project construction.** Prior to issuance of construction permits, the applicant shall submit to the lead agency for review and approval a sedimentation and erosion control plan that identifies how disturbed surface soils will be stabilized to prevent wind erosion during construction and immediately after construction until revegetation begins. Wind erosion control measures may include, but are not limited to, use of mulch, soil stabilizers, and temporary revegetation (all compatible with sensitive species). The plan may also include standard provisions for dust control by water truck or periodic application of soil stabilizers during construction.
- **Reduce effects of ground shaking.** Prior to issuance of construction permits, the design-level geotechnical investigations the applicant performs shall include site-specific seismic analyses to evaluate ground accelerations for design of project components. Based on these findings, project structure designs shall be modified/strengthened, as deemed appropriate by the project engineer, if the anticipated seismic forces are found to be greater than standard design load stresses on project structures. Study results and proposed design modifications shall be provided to the lead agency for review before final project design and prior to construction permit issuance.
- **Protect desert pavement.** Grading for new access roads or work areas in areas covered by desert pavement shall be avoided or minimized. If avoidance of these areas is not possible, the desert pavement surface shall be protected from damage or disturbance from construction vehicles by use of temporary mats on the surface. A plan for identification and avoidance or protection of sensitive desert pavement shall be prepared and submitted to the lead agency for review and approval prior to start of construction. The plan shall include consideration of the following:
    - Define all locations of surface disturbance including new access roads, and locations of all grading.
    - Develop specific measures to protect desert pavement surfaces from damage or disturbance from construction vehicles by use of temporary mats on the surface, if disturbance would occur only during construction.
    - Apply a nontoxic soil stabilizer prior to project operation. The applicant shall develop, for review and approval by the lead agency, a plan that outlines the fre-

quency of nontoxic soil stabilizer applications based on the specifications of the selected soil stabilizer.

- Evaluate the potential for replacement of desert pavement with similar gravel-sized layer over exposed underlying fine-grained soils

- **Conduct landslide surveys and protect against slope instability.** A landslide survey of any steep hillside areas shall be conducted in and adjacent to areas of planned construction and installation of renewable energy projects. The survey will identify areas with the potential for unstable slopes, landslides, earth flows, debris flows, and seismically induced slope failure. If the results of the landslide survey indicate the presence of slopes likely to fail and damage these structures, appropriate support and protection measures shall be designed and implemented to minimize potential damage. These design measures may include, but are not limited to, retaining walls, re-engineered slopes, removal of potentially unstable materials, and avoidance of areas below highly unstable areas. Study results and proposed design modifications shall be provided to the lead agency for review before final project design and construction permit issuance.
- **Conduct geotechnical studies to assess problem soil characteristics.** Prior to issuance of construction permits, the design-level geotechnical studies to be performed by the applicant shall identify the presence, if any, of potentially detrimental soil chemicals, such as chlorides and sulfates. Appropriate design measures for protection of reinforcement, concrete, and metal-structural foundation components against corrosion shall be used, such as corrosion-resistant materials and coatings, thicker components for projects exposed to potentially corrosive conditions, and passive and/or active cathodic protection systems. The geotechnical studies shall also identify areas with potentially expansive or collapsible soils and include appropriate design features, including excavation of potentially expansive or collapsible soils during construction and replacement with engineered backfill, ground-treatment processes, and redirection of surface water and drainage away from expansive foundation soils. Studies shall conform to industry standards of care and American Society for Testing and Materials standards for field and laboratory testing. Study results and proposed solutions shall be provided to the lead agency for review and approval prior to construction permit issuance.
- **Protect sand and sand transport corridors.** To mitigate loss of sand transport corridors, the project owner shall provide compensatory mitigation, which may include compensation lands purchased in fee title or in easement in whole or in part, at the following ratios:
  - 3:1 mitigation for direct impacts on stabilized and partially stabilized sand dunes
  - 1:1 mitigation for direct impacts on nondune Mojave fringe-toed lizard habitat

- 0.5:1 mitigation for indirect impacts on stabilized and partially stabilized sand dunes

If compensation lands are acquired, the project owner shall provide funding for the acquisition in fee title or in easement, initial habitat improvements and long-term maintenance and management of the compensation lands. In addition, the compensation lands must include, at a minimum, the number of acres of stabilized and partially stabilized sand dune habitat defined by the lead agency.

Compensation lands selected for acquisition shall provide suitable habitat for any sand-dependent species. Compensation lands must:

- Be located within the bounds of the sand transport corridor from which habitat was lost.
- Build linkages between known populations of sand-dependent species.
- Be near larger blocks of lands either already protected or planned for protection, or which could be protected long-term by a public resource agency or a nongovernmental organization dedicated to habitat preservation.
- Not have a history of intensive recreational use or other disturbance that might make habitat recovery and restoration infeasible.
- Not be characterized by high densities of invasive species, either on or immediately adjacent to the parcels under consideration, that might jeopardize habitat recovery and restoration.
- Not contain hazardous wastes that cannot be removed to the extent the site is suitable for habitat.
- Have water and mineral rights included as part of the acquisition.
- Be on land for which long-term management is feasible.

Security for Implementation of Mitigation: The project owner shall provide financial assurances to the lead agency to guarantee that an adequate level of funding is available to implement the acquisitions and enhancement of sand-dependent species habitat as described in this mitigation measure.

Preparation of Management Plan: The project owner shall submit to the lead agency a draft Management Plan that reflects site-specific enhancement measures for the sand-dependent species habitat on the acquired compensation lands. The objective of the Management Plan shall be to enhance the value of the compensation lands, and may include enhancement actions such as weed control, fencing to exclude livestock, erosion control, or protection of sand sources or sand transport corridors.

IV.4.3.1.1.2 Impacts from Reserve Design in the No Action Alternative

The No Action Alternative has no reserve design, but even without approval of one of the action alternatives, there would be continued protection of existing LLPAs such as wilderness areas in which no development would be allowed. In addition, under the No Action Alternative, renewable energy projects would continue to be evaluated and approved with project-specific mitigation requirements.

IV.4.3.1.2 Impacts on BLM Lands of Existing BLM Land Use Plans in No Action Alternative

Under the No Action Alternative, the existing BLM land management plans within the Plan Area would continue to be implemented. Existing ACECs and wildlife allocation areas would continue to limit adverse impacts on geology and soils because only those projects determined to be consistent with these areas' goals and objectives would be allowed. Existing SRMAs would continue to have potentially adverse effects related to soil erosion, depending on the extent of allowable uses and management within specific SRMAs.

Under the No Action Alternative, development would continue to occur on certain BLM lands such as Solar Energy Zones and Solar PEIS Variance Lands, or with a project-specific LUPA where required. The potential developable areas include:

- 11,000 acres of BLM lands with soils that have high wind erosion potential
- 14,000 acres of BLM lands with soils that have moderate-to-high wind erosion potential.
- 14,000 acres of BLM lands with soils that have moderate-to-high water erosion potential.

While the CDCA Plan did not establish any goals for soil resources, BLM uses standard best management practices to protect soil resources. Among the reference guides listing these BMPs is the BLM publication *Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development*, commonly referred to as the Gold Book, last updated in 2007. Under the No Action Alternative, BLM's management of geology and soil resources through these standard BMPs, as well as mitigation imposed as a result of NEPA review, would reduce the impacts of renewable energy construction.

IV.4.3.1.3 Impacts of Natural Community Conservation Plan in No Action Alternative

The NCCP would apply to all lands within the Plan Area. In the absence of Plan implementation, the NCCP would not be approved and no incidental take permits would be issued under

the NCCP. The appropriate lead agency would continue to consider projects individually. The impacts that would occur in the absence of the NCCP would be the same as those described in Section IV.4.3.1.1.1.

IV.4.3.1.4 Impacts of General Conservation Plan in No Action Alternative

As described in Appendix M, the GCP would apply to nonfederal lands in the Plan Area. In the absence of Plan implementation, the GCP would not be approved and no incidental take permits would be issued under the GCP. The appropriate lead agency would continue to consider projects individually. The impacts that would occur in the absence of the GCP would be the same as those described in Section IV.4.3.1.1.1 but would be specific to nonfederal lands.

IV.4.3.1.5 Impacts Outside the Plan Area in No Action Alternative

IV.4.3.1.5.1 Impacts of Transmission Outside the Plan Area

Outside of the Plan Area, additional transmission lines would be needed to deliver the additional renewable energy to load centers (areas of high demand). It is assumed that new Outside the Plan Area transmission lines would use existing transmission corridors between the Plan Area and existing substations in the more populated coastal areas of the state. The Outside the Plan Areas through which new transmission lines might be constructed are San Diego, Los Angeles, North Palm Springs–Riverside, and the Central Valley. These areas and associated geology and soils are described in Volume III, Section III.4.8.

IV.4.3.1.5.2 Impacts of Transmission Outside the Plan Area

Impact SG-1: Plan components would expose people or structures to injury or damage from seismic, volcanic, or landslide activity.

Active fault lines are found near and across transmission line corridors. Transmission projects would continue to expose people or structures to injury or damage from seismic activity or landslides if the towers were to fail. In addition, the possibility for service interruption exists due to tower damage from seismic activity or landslides. However, the risk of earthquakes and landslides is taken into consideration during site evaluations and in the specifications for tower and span designs.

Impact SG-2: Soil or sand erosion would be triggered or accelerated due to plan components.

Transmission tower construction requires earthwork to establish construction areas, tower footings, and site access. Soil disturbed in the process is subject to wind and water

erosion, with the greatest risk being on slopes. Except where corridors pass through the Tehachapi Mountains and San Gabriel Mountains, transmission corridors outside the Plan Area are in relatively flat terrain. The susceptibility of soil to erosion varies by soil type, slope, and vegetative cover. To control erosion, transmission line developers would be required to prepare and implement stormwater pollution prevention plans, which would include erosion control and site restoration. Because of their spacing and relatively narrow profile, transmission towers would not impede natural sand transport.

Impact SG-3: Plan components would expose structures to damage from corrosive or expansive soils.

Corrosive soils could damage tower foundations, and expansive soils could cause soils to shrink or swell, also damaging foundations. Typical foundation installation involves excavating or boring a hole, installing a reinforced steel bar cage, and encasing the cage in concrete. Where soil conditions would have the potential to damage the footings, the excavation is oversized and backfilled with suitable material that will not corrode or damage the footing.

Impact SG-4: Plan components would destroy or disturb desert pavement.

Renewable energy facilities in the Preferred Alternative may cause damage to desert pavement. Excavation and grading during construction and decommissioning of a renewable energy facility, as well as ground disturbance from workers, vehicles, or equipment, would result in damage or disturbance to this important habitat. Specific locations of desert pavement that have not been mapped would require field surveys.

IV.4.3.1.5.3 Impacts of Existing BLM Land Use Plans Outside the Plan Area

Under the No Action Alternative, the existing BLM CDCA Plan would continue to be implemented on CDCA lands. In the CDCA lands extending outside Plan boundaries, renewable energy projects would still be developed through BLM's existing policies and with NEPA compliance. Impacts on geology and soil resources would be similar to those described in Section IV.4.2.1, with similar mitigation measures being included on a case-by-case basis.

IV.4.3.1.6 CEQA Significance Determination: No Action Alternative

Section IV.4.1.2, CEQA Standards of Significance, identifies four relevant criteria to consider when determining if there are significant impacts from a project under CEQA. These criteria are included as part of the more general impacts identified below as SG-1 through SG-4. The following describes the impacts on geologic and soil resources and their associated significance determinations for the No Action Alternative:

SG-1: Plan components would expose people or structures to injury or damage from seismic, volcanic, or landslide activity. Landslides and potentially active volcanoes are not considered likely to damage facilities because it is unlikely that they would be sited in these clearly hazardous areas. Therefore, impacts related to landslides or volcanic activity are not anticipated.

Active faults are widespread throughout the Plan Area, and it is likely that a major earthquake occurring within about 25 miles of a generation facility would cause facility damage. However, assuming that occupied structures that may be components of the energy facilities were constructed according to the California Building Code Section 1613.3.5 (CBC 2013) and other regulations (see Section IV.4.3.1.1 for summary of relevant regulations), impacts would be adverse but less than significant. The significance threshold stated in Section IV.4.1.2 is the exposure of people or structures to potential injury, death, or damage due to rupture of an earthquake fault or strong seismic ground shaking. Typical mitigation developed following site-specific geotechnical surveys would minimize impacts by (1) requiring project structural components to be modified and strengthened if anticipated seismic forces are found to be greater than standard design load stresses and (2) adopting design measures such as retaining walls, re-engineered slopes, removal of unstable material, and avoidance of unstable areas. Implementation of these measures ensures that impacts would be less than significant.

SG-2: Soil or sand erosion would be triggered or accelerated due to plan components. Siting, construction, and decommissioning of renewable energy facilities, as well as associated transmission lines and substations, would result in grading and ground disturbance that would increase soil erosion. The significance threshold stated in Section IV.4.1.2 is the substantial loss of topsoil. Typical mitigation measures would minimize impacts by requiring development and implementation of erosion control plans, use of soil stabilizers during and after construction, and restoration of native plant communities and drainage patterns once construction is complete. Implementation of these mitigation measures would ensure that impacts from soil erosion would be less than significant.

SG-3: Plan components would expose people or structures to injury or damage from corrosive or expansive soils. Siting a renewable energy facility in an area with corrosive or expansive soils could result in structural damage or degrade steel and concrete elements of the facility. Soil corrosivity ranges from mild to aggressive within the entire Plan Area. Expansive soils are limited to clay soils, which occur in low to medium frequency throughout the Plan Area. The significance threshold stated in Section IV.4.1.2 is the substantial risk to life or property. Typical mitigation measures would minimize damage to structures from corrosive and expansive soils by requiring site-specific soil characteristics to be assessed prior to construction, implementing design features such as use of corrosion resistant materials and coatings or use of thicker structural components, and excavating

potentially expansive soil and replacing it with engineered backfill. Implementation of these typical mitigation measures would reduce impacts from corrosive or expansive soils to less than significant levels.

SG-4: Plan components would destroy or disturb desert pavement. Disturbance of desert pavement would result in increased erosion, sedimentation, and dust hazards from any ground-disturbing activities. This degradation of the soil surface also causes the loss of valuable habitat for plants and wildlife (see Chapter IV.7, Biological Resources). Desert pavement generally overlies older alluvium formations within the Plan Area. The significance threshold stated in Section IV.4.1.2 is the substantial soil erosion or loss of topsoil, or in this case, desert pavement. As defined in Section IV.4.3.1.1.1, standard mitigation measures for protection of desert pavement would minimize impacts by requiring delineation and avoidance of sensitive desert pavement within a project site, use of temporary mats where desert pavement surfaces cannot be avoided, application of nontoxic soil stabilizers prior to construction, and replacement of desert pavement with a similar gravel-sized layer. Implementing these standard mitigation measures would reduce impacts to less than significant levels.

IV.4.3.2 Preferred Alternative

Under the Preferred Alternative, Covered Activities associated with solar, wind, and geothermal development and operation would be permitted within Development Focus Areas. The Preferred Alternative includes 2,028,000 acres of DFAs and 15,515,000 acres of Reserve Design Lands. The Reserve Design Lands comprise 7,592,000 acres of existing conservation, 6,194,000 acres of BLM LUPA conservation designations, and 1,728,000 acres of Conservation Planning Areas.

In the Preferred Alternative, dispersed solar is emphasized for the West Mojave and Eastern Slopes ecoregion subarea and the Cadiz Valley and Chocolate Mountains ecoregion subarea. Dispersed wind is emphasized in the West Mojave and Eastern Slopes ecoregion subarea and the Pinto Lucerne Valley and Eastern Slopes ecoregion subarea. Dispersed geothermal development is emphasized in the Imperial Borrego Valley and the Owens River Valley ecoregion subareas.

Effects of the Preferred Alternative on geology and soils are described in the following sections. This discussion includes the effects of renewable energy development as well as transmission development and BLM LUPA decisions outside the Plan Area.

IV.4.3.2.1 Plan-wide Impacts of Implementing the DRECP: Preferred Alternative

IV.4.3.2.1.1 Plan-wide Impacts and Mitigation Measures from Renewable Energy and Transmission Development

Impact Assessment

Under the Preferred Alternative, DFAs are primarily in the Imperial Valley, West and Central Mojave regions, and the Eastern Riverside County portions of the Plan Area. Impacts related to soils, geology, and geologic hazards would occur within the Plan Area from development of solar, wind, and geothermal facilities. Impacts would also occur on lands subject to potential transmission development, both within and outside the DFAs.

The potential for soil erosion can be quantified based on acreage of erosive soils that may be disturbed during construction and decommissioning and, to a lesser degree, during site characterization. The potential for impacts from geologic hazards can be quantified based on miles of active fault lines within 25 miles of DFAs in the Preferred Alternative. Other geology and soil impacts such as disturbance to desert pavement and structural damage from expansive or corrosive soils are assessed more qualitatively.

Impact SG-1: Plan components would expose people or structures to injury or damage from seismic, volcanic, or landslide activity.

As described in Volume III, Section III.4.3, the Plan Area is seismically and volcanically active, with major fault lines, young volcanic features, and landslide sediment deposits. Within the Plan Area, major faults include some of the largest in the state, such as the San Andreas and San Jacinto fault systems. During the lifetime of a renewable energy facility, earthquakes within the Plan Area are likely. Table IV.4-2, Faults within a 25-mile Radius of DFAs, in the Preferred Alternative, presents a list of active faults, which the USGS defines as having ruptured within the Holocene (the past 11,000 years) (USGS 2014a).

For each fault, Table IV.4-2 presents the length within the DFA boundary and the length outside the DFA but within 25 miles of the DFA boundary. Under the Preferred Alternative, 70 miles of active fault lines are within DFAs and 247.1 miles outside DFAs but within the 25-mile buffer set for the fault analysis. See Volume III, Table III.4-2, Largest Faults Within the Plan Area, for the earthquake magnitude generating potential for each of the listed faults and associated Alquist-Priolo designations. The faults presented in Table IV.4-2 represent a potential geologic hazard that could damage renewable energy facilities. While the majority of these facilities would not include occupied residential structures, damage to property could be considerable.

Table IV.4-2
Faults Within a 25-Mile Radius of DFAs in the Preferred Alternative

Fault Name	Length of Fault Within DFAs (miles)	Length of Fault Outside DFAs (miles)
San Andreas Fault Zone	7	27
Garlock Fault	16	29
Owens Valley Fault Zone	3	11
Coyote Creek Fault	0	11
Elsinore Fault Zone	0	7
Laguna Salada Fault	0	6
Pinto Mountain Fault	0	10
San Jacinto Fault Zone	0	18
Lenwood Fault	4	12
Lockhart Fault	2	9
North Lockhart Fault	0	1
Emerson Fault	0	9
Helendale Fault	12	6
Johnson Valley Fault	3	10
Gravel Hills – Harper Fault	1	17
Blackwater Fault	0	30
Bullion Fault	0	10
Calico Fault Zone	6	1
North Frontal Fault Zone	4	3
Manix Fault	1	3
Mesquite Lake	0	1
Superstition Hills	4	3
Little Lake Fault Zone	5	14
Brawley Fault Zone	3	0
Total	**71**	**248**

Source: USGS (2014b)

Volume III, Section III.4.4.4, describes the locations of recent volcanic activity. Within DFAs in the Preferred Alternative, there is less than 1 square mile of recent volcanic flow rocks. The likelihood of a renewable energy facility being located near an active volcanic site is low, so facility damage or threat to life from volcanic activity is possible but unlikely.

Impact SG-2: Soil or sand erosion would be triggered or accelerated due to plan components.

Erosion. Table R2.4-2, Acreage of Erosive Soils Within DFAs for Each Alternative (Appendix R2), presents erosion potential of soil textures found in the Plan Area and acreage of soil textures with moderate-to-high potential for erosion found in DFAs in each alternative. Within DFAs in the Preferred Alternative, there are approximately 516,000 acres of soils with a moderate-to-high potential for wind erosion and approximately 23,000acres of soils with a moderate-to-high potential for water erosion. Development of renewable energy facilities within these areas of DFAs in the Preferred Alternative would increase the likelihood of soil erosion occurring from wind and water.

Sand Transport. Under the Preferred Alternative, DFAs in the East Riverside region are on or near an important sand transport corridor in the Chuckwalla Valley. The corridor runs parallel to Interstate 10 in Riverside County between the areas of Desert Center and Blythe. Other sand transport corridors include the Mojave River corridor, which includes the Kelso Dunes, the Bristol Trough corridor, which includes the Cadiz and Danby dunes, the Rice Valley corridor, which includes the Rice Valley Dunes, and the Clark's Pass corridor, which includes the Dale Lake Dunes and Palen-Ford Dunes (USGS 2003). Renewable energy facilities in these DFAs could impede sand transport and thereby affect valuable habitat within this corridor of active sand dunes. Within DFAs in the Preferred Alternative, there are approximately 127,000 acres of dune systems and sand transport corridors.

Impact SG-3: Plan components would expose structures to damage from corrosive or expansive soils.

As stated in Section IV.4.2.1.2, Typical Impacts, corrosive soils could damage foundations and structural elements of renewable energy facilities. Expansive soils could cause soils to shrink or swell, damaging foundations and structural elements of renewable energy facilities. The Preferred Alternative includes approximately 559,000 acres of potentially expansive soils. See Table R2.4-3, Acreage of Expansive Soil Textures Within DFAs for Each Alternative (Appendix R2), which defines areas of clay, clay loam, silty clay, and silty clay loam. Corrosive soils are widespread throughout the Plan Area. Presence of playas and North American warm desert alkaline scrub and herb playa and wet flat are indicative of potentially corrosive soil within the Plan Area. The Preferred Alternative includes approximately 21,000 acres of potentially corrosive soils within DFAs.

Impact SG-4: Plan components would destroy or disturb desert pavement.

Renewable energy facilities in the Preferred Alternative may cause damage to desert pavement. Excavation and grading during construction and decommissioning of a renewable

energy facility, as well as ground disturbance from workers, vehicles, or equipment, would result in damage or disturbance to this important habitat. Specific locations of desert pavement that have not been mapped would require field surveys.

Impacts in Study Area Lands

Study Area Lands refer to three categories of lands shown on alternative maps: Future Assessment Areas (FAAs), Special Analysis Areas (SAAs) and DRECP Variance Lands. See Volume II, Figure II.3-1.

Future Assessment Areas. Lands within FAAs are neither reserve lands nor DFAs; they are simply areas that will be assessed for development in the future. The future assessment will determine their suitability for renewable energy development or for ecological conservation. If renewable energy development occurs on FAA lands, a Land Use Plan Amendment would not be required. FAAs for each alternative are shown in Table IV.1-2 and in Volume II, Figure II.3-1. The FAAs represent areas where renewable energy development or inclusion in the reserve design could be implemented through an amendment to the DRECP but additional assessment would be needed.

Because most of the FAAs are presented as "undesignated areas" in the action alternatives, there would be no difference between the FAAs in the Preferred Alternative except that renewable development in an FAA would not require a BLM Land Use Plan Amendment so the environmental review process would be somewhat simpler than if the location were left undesignated.

For FAAs that may be developed for renewable energy projects, there is the potential that they would be affected by geologic hazards or that development would be affected by soil conditions. The majority of the FAA east of Twentynine Palms is within an area of sand dunes and sand transport. Impact SG-2 could occur here, but the impact would be avoided with implementation of Mitigation Measure SG-2b (Protect sand and sand transport corridors). Approximately half of this FAA is also within an area of both corrosive and expansive soils. Impact SG-3 would be less severe with implementation of Mitigation Measure SG-3a (Complete geotechnical studies for soil conditions).

Special Analysis Areas. Two areas are defined as SAAs, representing areas subject to ongoing analysis. These areas (located in the Silurian Valley and just west of Highway 395 in Kern County) have high value for renewable energy development, and also high value for ecological and cultural conservation, and recreation. SAA lands are expected to be designated in the Final EIR/EIS as either DFAs or included in the reserve design. If these areas were to be designated as DFAs, impacts related to geology and soils would be lessened with implementation of mitigation measures recommended below.

DRECP Variance Lands. DRECP Variance Lands represent the BLM Solar PEIS Variance Lands as screened for the DRECP and EIR/EIS based on BLM's assessment. Covered Activities could be permitted for NCCP purposes only through an NCCP Plan amendment. However, development of renewable energy on Variance Lands would not require a BLM Land Use Plan Amendment so the environmental review process would be somewhat simpler than if the location were left undesignated.

Impact Reduction Strategies and Mitigation

The implementation of the Plan would result in conservation of some desert lands as well as the development of renewable energy generation and transmission facilities on other lands. The impacts of the renewable energy development covered by the Plan would be lessened in several ways. First, the Plan incorporates Conservation and Management Actions (CMAs) for each alternative, including specific biological reserve design components and LUPA components. Also, the implementation of existing laws, orders, regulations, and standards would reduce the impacts of project development. If significant impacts would still result after implementation of CMAs and compliance with applicable laws and regulations, then specific mitigation measures are recommended in this section.

Conservation and Management Actions

The conservation strategy for the Preferred Alternative (presented in Volume II, Section II.3.1.1) defines specific actions that would reduce the impacts of this alternative. The conservation strategy includes definition of the reserve design and specific CMAs for the Preferred Alternative. CMAs that would reduce impacts related to geology and soils are presented below.

<u>CMAs for the Preferred Alternative for Geology and Soils</u>

- Limit disturbance of sand flow corridors so that no more than 5% of the sand flow corridors and sand dunes within a proposed project footprint or right-of-way shall be disturbed during construction.
- The extent of desert pavement within the proposed project right-of-way shall be mapped. Limit disturbance of desert pavements so that no more than 20% of the desert pavements within a proposed project right-of-way shall be disturbed during construction.
- The extent of additional sensitive soil areas (cryptobiotic soil crusts[1], hydric soils, highly corrosive soils, expansive soils, and soils at severe risk of erosion) shall be

[1] Note that cryptobiotic soil crusts are addressed in Chapter IV.7, Biological Resources.

mapped. Limit disturbance of sensitive soil areas (e.g., cryptobiotic soil crusts), so that no more than 20% of the sensitive soil areas within a proposed project footprint shall be disturbed during construction.

- Where possible, side casting shall be avoided where road construction requires cut-and-fill procedures.

Biological CMAs Relevant to Geology and Soils

- **AM-PW-9:** Implement project-specific drainage, erosion, and sedimentation control actions, which meet the approval of the DRECP Coordination Group and the applicable regulatory agencies, which will be carried out during all phases of the project. Identify site-specific surface water runoff patterns and develop measures to prevent excessive erosion, reduce amount of area covered by impervious surfaces, and conduct regular inspections of erosion control structures. Design the project to minimize site disturbance during construction, operation, and decommissioning.
- **AM-PW-10:** Use construction and installation techniques that minimize new site disturbance, soil erosion and deposition, soil compaction, disturbance to topography, and removal of vegetation. Implement standard industry construction practices to prevent pollutants from leaching into the soil and minimize water and air erosion of soils.
- **AM-PW-14:** Delineate the boundaries of areas to be disturbed using temporary construction fencing and flagging prior to construction and confine disturbances, project vehicles, and equipment to the delineated project areas to protect natural communities and Covered Species.
- **AM-LL-3:** Covered Activities that potentially occur within or bordering sand dune, or Aeolian, transport corridors will complete studies to verify the accuracy of the DRECP dunes and sand resources mapping and to determine whether the Covered Activities would occur within an Aeolian transport corridor.

While the CMAs were developed for BLM lands only, this analysis assumes that all CMAs would be applied also to nonfederal lands.

Laws and Regulations

Similar to the No Action Alternative, existing laws and regulations will reduce certain impacts of Plan implementation. Relevant regulations are presented in the Regulatory Setting in Volume III, Section III.3.1.1. The requirements of relevant laws and regulations are summarized for the No Action Alternative in Section IV.4.3.1.1.1.

Mitigation Measures

After implementation of the CMAs and existing laws and regulations, mitigation measures will be applied to further reduce some of the DRECP's adverse impacts.

Mitigation Measures for Impact SG-1: Plan Components Would Expose People or Structures to Injury or Damage from Seismic, Volcanic, or Landslide Activity.

Mitigation is required to prevent projects from being located in hazardous locations and to minimize damage from events that are difficult to predict.

SG-1a **Complete Geotechnical Investigations for Hazards.** Prior to design and construction of renewable energy facilities, site-specific geotechnical investigations shall be conducted to identify site-specific geologic conditions and potential geologic hazards. Construction shall not take place within 100 yards of active faults, on younger (Holocene) volcanic geologic formations, or on steep topography, unless permitted by the Authorized Officer.

SG-1b **Reduce Effects of Ground Shaking.** Prior to issuance of construction permits, the design-level geotechnical investigations performed by the applicant shall include site-specific seismic analyses to evaluate ground accelerations for design of project components. Based on these findings, project structure designs shall be modified/strengthened, as deemed appropriate by the project engineer, if the anticipated seismic forces are found to be greater than standard design load stresses on project structures. Study results and proposed design modifications shall be provided to the lead agency for review before final project design and prior to construction permit issuance.

SG-1c **Conduct Landslide Surveys and Protect Against Slope Instability.** A landslide survey of any steep hillside areas shall be conducted in and adjacent to areas of planned construction and of installation of solar arrays. The survey will identify areas with the potential for unstable slopes, landslides, earth flows, debris flows, and seismically induced slope failures. If the results of the landslide survey indicate the presence of slopes are likely to fail and damage these structures, appropriate support and protection measures shall be designed and implemented to minimize potential damage. These design measures may include, but are not limited to, retaining walls, re-engineered slopes, removal of potentially unstable materials, and avoidance of areas below highly unstable areas. Study results and proposed design modifications shall be provided to the lead agency for review before final project design and prior to construction permit issuance.

Mitigation Measures for Impact SG-2: Soil or Sand Erosion Would Be Triggered or Accelerated Due to Plan Components.

National Pollutant Discharge Elimination System (NPDES) permits are required for compliance with the Clean Water Act, but specific erosion control measures are needed to ensure that rainfall events do not result in uncontrolled erosion, as defined in Mitigation Measure SG-2a. In addition, development affecting sand transport corridors shall be minimized with implementation of Mitigation Measure SG-2b.

SG-2a **Prepare Erosion Control Plan.** Prior to design and construction, prepare an Erosion Control Plan for implementation during all phases of the project. Define the specific methods for minimizing soil erosion from wind and water that would take place on the site, including the following specific components:

a) Include a timeline for construction to ensure construction activities take place in as short a time as possible to minimize ground disturbance.

b) Minimize disturbed areas by using existing roads for construction and designing new roads to follow natural land contours, minimize hill cuts, and avoid desert washes.

c) Delineate boundaries of disturbed areas, including size and length of roads, fences, borrow areas, and laydown and staging areas.

d) Include a vegetation management plan that describes how soil and vegetation disturbance will be minimized and how native plant communities and grade and drainage patterns of the site will be restored once construction has finished.

e) Describe erosion control measures that will be implemented during construction, such as stabilization of frequently used construction entrance areas and where erosion control structures will be built, including culvert outlets for runoff.

SG-2b **Protect Sand and Sand Transport Corridors.** To mitigate loss of sand transport corridors, the project owner shall provide compensatory mitigation, which may include compensation lands purchased in fee title or in easement in whole or in part, at the following ratios:

- 3:1 mitigation for direct impacts on stabilized and partially stabilized sand dunes
- 1:1 mitigation for direct impacts on nondune Mojave fringe-toed lizard habitat
- 0.5:1 mitigation for indirect impacts on stabilized and partially stabilized sand dunes

If compensation lands are acquired, the project owner shall provide funding for the acquisition in fee title or in easement, initial habitat improvements, and long-term maintenance and management of the compensation lands. In addition, the compensation lands must include, at a minimum, the number of acres of stabilized and partially stabilized sand dune habitat defined by the lead agency.

Compensation lands selected for acquisition shall provide suitable habitat for any sand-dependent species. Compensation lands must:

- Be located within the bounds of the sand transport corridor from which habitat was lost.
- Build linkages between known populations of sand-dependent species.
- Be near larger blocks of lands that are either already protected or planned for protection, or which could feasibly be protected long term by a public resource agency or a nongovernmental organization dedicated to habitat preservation.
- Not have a history of intensive recreational use or other disturbance that might make habitat recovery and restoration infeasible.
- Not be characterized by high densities of invasive species, either on or immediately adjacent to the parcels under consideration, that might jeopardize habitat recovery and restoration
- Not contain hazardous wastes that cannot be removed to the extent the site is suitable for habitat.
- Have water and mineral rights included as part of the acquisition.
- Be on land for which long-term management is feasible.

Security for Implementation of Mitigation: The project owner shall provide financial assurances to the lead agency to guarantee that an adequate level of funding is available to implement the acquisitions and enhancement of sand-dependent species habitat as described in this condition.

Preparation of Management Plan: The project owner shall submit to the lead agency a draft Management Plan that reflects site-specific enhancement measures for the sand-dependent species habitat on the acquired compensation lands. The objective of the Management Plan shall be to enhance the value of the compensation lands and may include enhancement actions such as weed control, fencing to exclude livestock, erosion control, or protection of sand sources or sand transport corridors.

Mitigation Measures for Impact SG-3: Plan Components Would Expose Structures to Damage From Corrosive or Expansive Oils.

CBC 2013 regulates construction on expansive or corrosive soils, but further mitigation is required to ensure damage to renewable energy facilities does not occur due to problematic soils.

SG-3a **Complete Geotechnical Studies for Soil Conditions.** Prior to issuance of construction permits, the design-level geotechnical studies to be performed by the applicant shall identify the presence, if any, of potentially detrimental soil chemicals, such as chlorides and sulfates. Appropriate design measures for protection of reinforcement, concrete, and metal-structural foundation components against corrosion shall be used, such as corrosion-resistant materials and coatings, thicker components for projects exposed to potentially corrosive conditions, and passive and/or active cathodic protection systems. The geotechnical studies shall also identify areas with potentially expansive or collapsible soils and include appropriate design features, including excavation of potentially expansive or collapsible soils during construction and replacement with engineered backfill, ground-treatment processes, and redirection of surface water and drainage away from expansive foundation soils. Studies shall conform to industry standards of care and American Society for Testing and Materials standards for field and laboratory testing. Study results and proposed solutions shall be provided to the lead agency for review and approval prior to construction permit issuance.

Mitigation Measures for Impact SG-4: Plan Components Would Destroy or Disturb Desert Pavement.

While there is a CMA specific to the Preferred Alternative that would limit disturbance of desert pavement to no more than 20% of any proposed project right-of-way further mitigation is necessary to ensure protection of this vital desert resource.

SG-4a: **Protect and Restore Desert Pavement.** A plan for identification and avoidance or protection of sensitive desert pavement shall be prepared and submitted to the lead agency for review and approval prior to start of construction. The plan shall include consideration of the following strategies:

- Map all locations of desert pavement and define all locations of proposed surface disturbance within desert pavement areas, including new access roads, and all grading.

- Avoid or minimize grading for new access roads or work areas in areas covered by desert pavement.
- Use temporary mats to protect desert pavement surfaces from damage or disturbance from construction vehicles, equipment, and workers.
- Select and use construction equipment that is appropriately sized for each portion of the work, avoiding the use of larger and heavier equipment than needed in order to prevent damage to desert pavement.
- Apply a nontoxic soil stabilizer where desert pavement has been disturbed.
- Reconstitute soil horizons underneath disturbed desert pavement areas through a series of five wetting and drying cycles. This can be accomplished with water trucks already present on site for dust suppression. Watering the disturbed area after applying rock mulch would re-establish the soil horizon structure that was present before disturbance of the desert pavement.
- Evaluate the potential for replacement of desert pavement with a similar gravel-sized layer over exposed underlying fine-grained soils, and propose a methodology for consideration to the lead agency.

IV.4.3.2.1.2 Impacts of the Reserve Design

The reserve design area under the Preferred Alternative would total 15,515,000 acres, or approximately 70% of the Plan Area (see Chapter IV.1, Table IV.1-1, Summary of Alternative Components). This would result in the protection of soil resources, due to the limitations on development within the Plan Area, and it would limit the extent of land on which projects could be developed. This could reduce potential effects of geologic hazards.

IV.4.3.2.2 Impacts of DRECP Land Use Plan Amendment on BLM Land: Preferred Alternative

This section addresses two components of effects of the BLM LUPA: the streamlined development of renewable energy and transmission on BLM land under the LUPA, and the impacts of the amended land use plans themselves.

IV.4.3.2.2.1 Impacts from Renewable Energy and Transmission Development on BLM Land

Streamlining renewable energy development on BLM lands within DFAs would not change the extent or severity of Impacts SG-1 through SG-4, as defined for the Plan-wide analysis; however, the extent of impacts would be considerably less and limited to BLM lands. Under the Preferred Alternative, 17,000 acres of renewable energy development on BLM land

would occur on soils that have high wind erosion potential, 11,000 acres on soils with moderate-to-high wind erosion potential, and 14,000 acres on soils with moderate-to-high water erosion potential. The same impact reduction strategies and mitigation measures described in Section IV.4.3.2.1 would also apply.

IV.4.3.2.2.2 Impacts of Changes to BLM Land Designations

The proposed BLM land use designations (e.g., National Conservation Lands, ACECs, wildlife allocations, lands with wilderness characteristics, and trail management corridors) would prohibit renewable energy development and be managed to protect the various ecological, historic, cultural, scenic, and scientific resources and values, thereby also providing general protection for geologic and soil resources. Disturbance caps on National Conservation Lands and ACECs would provide further protections. The National Conservation Lands would make up the majority of the proposed BLM land designations under the Preferred Alternative.

Existing or expanded SRMAs would also prohibit surface-occupying renewable energy development, but could have adverse effects related to soil erosion from recreation uses, depending on the extent of allowable uses and management within specific SRMAs.

IV.4.3.2.3 Impacts of Natural Community Conservation Plan: Preferred Alternative

The analysis of Covered Activities under the NCCP is equivalent to the Plan-wide analysis of the interagency alternatives. Reserve design features and other conservation actions under the NCCP alternatives represent more detailed categories of the reserve design under the interagency Plan-wide alternatives. These NCCP differences in reserve design features do not affect nonbiological resources analyzed in this document, and the analysis of reserve design and Conservation and Management Actions (CMAs)under the NCCP is therefore equivalent to the Plan-wide analysis of the interagency alternatives, as described in Section IV.4.2.

IV.4.3.2.4 Impacts of General Conservation Plan

The type and severity of impacts of the GCP for the Preferred Alternative would be similar to Impacts SG-1 through SG-4 as defined for the Plan-wide analysis, however the extent of impacts would be slightly less and limited to nonfederal lands. Under the Preferred Alternative, 3,000 acres of renewable energy development on GCP land would occur on soils that have high wind erosion potential, 55,000 acres of soils would have moderate-to-high wind erosion potential, and 66,000 acres of renewable energy development on GCP land would occur on soils that have moderate-to-high water erosion potential.

The primary difference between the GCP and Plan-wide impacts is that there would be fewer acres of DFAs on GCP lands in the Cadiz Valley and Chocolate Mountains and Imperial Borrego Valley ecoregion subareas.

The same impact reduction strategies and mitigation measures described in Section IV.4.3.2.1 would also apply on nonfederal lands.

IV.4.3.2.5 Impacts Outside the Plan Area

IV.4.3.2.5.1 Impacts of Transmission Outside the Plan Area

The impacts of Outside the Plan Area transmission on geology and soils would be the same under all alternatives. These impacts are as described for the No Action Alternative in Section IV.4.3.1.5.2, Impacts of Transmission Outside the Plan Area.

IV.4.3.2.5.2 Impacts of BLM LUPA Decisions Outside the Plan Area

The proposed BLM land use designations outside the Plan Area (i.e., National Conservation Lands, ACECs, wildlife allocations, and trail management corridors) would prohibit renewable energy development and be managed to protect the various ecological, historic, cultural, scenic, and scientific resources and values, thereby also providing general protection for geologic and soil resources. Existing or expanded SRMAs would also prohibit surface-occupying renewable energy development, but could have adverse effects related to soil erosion from recreation uses, depending on the extent of allowable uses and management within specific SRMAs.

IV.4.3.2.6 CEQA Significance Determination for the Preferred Alternative

Section IV.4.1.2, CEQA Standards of Significance, identifies four relevant criteria to consider when determining if there are significant impacts from a project under CEQA. These criteria are included as part of the more general impacts identified below as SG-1 through SG-4. The following describes the impacts on geologic and soil resources and their associated significance determinations for the Preferred Alternative:

SG-1: Plan components would expose people or structures to injury or damage from seismic, volcanic, or landslide activity. Landslides and potentially active volcanoes are not considered likely to damage renewable energy facilities because developers would avoid siting them in these clearly hazardous areas.

Active faults are widespread throughout the Plan Area, and it is likely that a major earthquake occurring within about 25 miles of a renewable energy generation facility would cause damage. However, assuming that occupied structures that may be components of the

energy facilities were constructed in accordance with the California Building Code Section 1613.5.5 (CBC 2013) and other regulations (see Section IV.4.3.1.1 for summary of relevant regulations), impacts would be adverse but less than significant. The significance threshold stated in Section IV.4.1.2 is the exposure of people or structures to potential injury, death, or damage due to rupture of an earthquake fault or strong seismic ground shaking. Implementation of Mitigation Measure SG-1a (Complete geotechnical investigations for hazards), SG-1b (Reduce effects of ground shaking), and Mitigation Measure SG-1c (Conduct landslide surveys and protect against slope instability) would prohibit construction from taking place near active faults or unstable slopes and require modification of project structural elements depending on the risk of ground shaking. Therefore, impacts would be less than significant.

SG-2: Soil or sand erosion would be triggered or accelerated due to plan components. Siting, construction, and decommissioning of renewable energy facilities, as well as associated transmission lines and substations, would result in grading and ground disturbance that would increase soil erosion. The significance threshold stated in Section IV.4.1.2 is the substantial loss of topsoil. Mitigation Measure SG-2a (Prepare erosion control plan) would reduce impacts from soil erosion, and Mitigation Measure SG-2b (Protect sand and sand transport corridors) would protect sand transport corridors from development that would affect their value. These two measures would require delineating areas where construction may take place, implementing erosion control measures during construction, restoring native plant communities and drainage patterns once construction is completed, and purchasing compensatory lands for any loss of dune systems or sand transport corridors. Therefore, impacts would be less than significant.

SG-3: Plan components would expose people or structures to injury or damage from corrosive or expansive soils. Siting a renewable energy facility in an area with corrosive or expansive soils could result in structural damage or degradation of steel and concrete elements of the facility. Soil corrosivity ranges from mild to aggressive within the entire Plan Area. Expansive soils are limited to clay soils, which occur in low to medium frequency throughout the Plan Area. The significance threshold stated in Section IV.4.1.2 is substantial risk to life or property. Mitigation Measure SG-3a (Complete geotechnical studies for soil conditions) would minimize these risks by implementing appropriate design measures for protection of reinforcement, concrete, and metal structural components and stabilizing soils prior to construction. Therefore, impacts would be reduced to less than significant.

SG-4: Plan components would destroy or disturb desert pavement. Disturbance of desert pavement would result in increased erosion, sedimentation, and dust hazards during site characterization, construction, and decommissioning. This degradation of the soil surface also causes the loss of valuable habitat for plants and wildlife (see Chapter IV.7).

Desert pavement generally overlies older alluvium formations within the Plan Area. The significance threshold stated in Section IV.4.1.2 is the substantial soil erosion or loss of topsoil, or in this case, desert pavement. Mitigation Measure SG-4a (Prepare a desert pavement protection plan) would reduce impacts on desert pavement by requiring a range of protective measures. Therefore, impacts would be reduced to less than significant.

IV.4.3.2.7 Comparison of the Preferred Alternative With No Action Alternative

Chapter IV.27 presents a comparison of all action alternatives and the No Action Alternative across all disciplines. This section summarizes the comparison of the Preferred Alternative with the No Action Alternative.

IV.4.3.2.7.1 Preferred Alternative Compared With No Action Alternative for Plan-wide DRECP

Table IV.4-3 compares the Preferred Alternative with the No Action Alternative for each of the measurable factors included in this analysis.

Table IV.4-3
Comparison of Preferred Alternative With No Action Alternative

Comparison Factor	Preferred Alternative	No Action Alternative
Miles of active fault lines within DFAs	71	410
Miles of active fault lines within 25 miles of DFA boundaries	248	202
Acres of soils with moderate-to-high potential for wind erosion	516,000	576,000
Acres of soils with moderate-to-high potential for water erosion	23,000	54,000
Acres of sand and sand transport corridors in DFAs	127,000	429,000

Note: The following general rounding rules were applied to calculated values: values greater than 1,000 were rounded to nearest 1,000; values less than 1,000 and greater than 100 were rounded to the nearest 100; values of 100 or less were rounded to the nearest 10, and therefore totals may not sum due to rounding. In cases where subtotals are provided, the subtotals and the totals are individually rounded. The totals are not a sum of the rounded subtotals; therefore the subtotals may not sum to the total within the table.

Geographic Distinctions. Many impacts related to geology and soils could occur throughout the Plan Area, and are not useful in distinguishing one alternative from another. In the Preferred Alternative, significant dune systems and sand transport corridors occur within DFAs in the East Riverside area, specifically along Interstate-10. Active faults are concentrated primarily in DFAs in the Imperial Valley and the Lucerne Valley.

IV.4.3.2.7.2 Preferred Alternative Compared With No Action Alternative for the BLM Land Use Plan Amendment (LUPA)

Under the No Action Alternative, development would continue under existing BLM land designations and protective requirements, including those of the Solar PEIS. Development would be more constrained under the Preferred Alternative, because the LUPA would encourage development within DFAs and would prohibit development within the expansive conservation areas. Therefore, the potential impacts from soil erosion and loss of desert pavement would be more severe under the No Action Alternative.

IV.4.3.2.7.3 Preferred Alternative Compared With No Action Alternative for NCCP

The impacts of the NCCP for the Preferred Alternative are the same as those defined in Section IV.4.3.2.1 for the Plan-wide analysis. As a result, the comparison of the Preferred Alternative with the No Action Alternative for the NCCP is the same as described for the Plan-wide DRECP.

IV.4.3.2.7.4 Preferred Alternative Compared With No Action Alternative for the GCP

The geology and soil impacts of the GCP for the Preferred Alternative would be similar to those defined in Section IV.20.3.2.1 for the Plan-wide analysis, but they would occur on nonfederal lands only. In the absence of Plan implementation, the GCP would not be approved and the appropriate lead agency would evaluate project impacts individually.

IV.4.3.3 Alternative 1

Alternative 1 includes 1,070,000 acres of total Development Focus Areas (DFAs) and 15,886,000 acres of Reserve Design Lands. The Reserve Design Lands comprise 7,592,000 acres of existing conservation, 6,165,000 acres of BLM LUPA conservation designations, and 2,128,000 acres of Conservation Planning Areas.

Under Alternative 1, dispersed solar is emphasized for the Imperial Borrego Valley, Pinto Lucerne Valley and Eastern Slopes, and West Mojave and Eastern Slopes ecoregion subareas. Dispersed wind is emphasized in the West Mojave and Eastern Slopes and the Pinto Lucerne Valley and Eastern Slopes ecoregion subareas. Dispersed geothermal development is emphasized in the Imperial Borrego Valley ecoregion subarea.

Effects of Alternative 1 on geology and soils are described in the following sections. This discussion includes the effects of renewable energy development as well as transmission development and BLM LUPA decisions outside the Plan Area.

IV.4.3.3.1 Plan-wide Impacts of Implementing the DRECP: Alternative 1

IV.4.3.3.1.1 Plan-wide Impacts and Mitigation Measures from Renewable Energy and Transmission Development

Impact Assessment

Under Alternative 1, DFAs are primarily in the Imperial Valley, West and Central Mojave regions, and, to a lesser degree, the East Riverside portions of the Plan Area. Impacts related to soils, geology, and geologic hazards would result from development of solar, wind, and geothermal facilities. Impacts would also occur on lands subject to potential transmission development, both within and outside the DFAs.

The potential for soil erosion can be quantified based on acreage of erosive soils that may be disturbed during construction and decommissioning, as well as, to a lesser degree, during site characterization. The potential for impacts from geologic hazards can be quantified based on miles of active fault lines within 25 miles of DFAs in Alternative 1. Other geologic and soil impacts such as disturbance to desert pavement and structural damage from expansive or corrosive soils are assessed more qualitatively.

Impact SG-1: Plan components would expose people or structures to injury or damage from seismic, volcanic, or landslide activity.

As described in Volume III, Section III.4.3, the Plan Area is seismically and volcanically active, with major fault lines, young volcanic features, and landslide sediment deposits. Within the Plan Area, major faults include some of the largest in the state, such as the San Andreas and San Jacinto fault systems. During the life of a renewable energy facility, earthquakes within the Plan Area are likely. Table IV.4-4presents a list of active faults, which the USGS defines as having ruptured within the Holocene (the past 11,000 years) (USGS 2014a).

For each fault, Table IV.4-4 presents the length within the DFA boundary and the length outside the DFA but within 25 miles of the DFA boundary. Under Alternative 1, 41.0 miles of active fault lines are within DFAs and 266.3 miles outside DFAs but within the 25-mile buffer set for the fault analysis. See Volume III, Table III.4-2 for the earthquake magnitude generating potential for each of the listed faults and associated Alquist-Priolo designations. The faults presented in Table IV.4-4 represent a potential geologic hazard that could damage renewable energy facilities. While the majority of these facilities would not include occupied residential structures, damage to property could be considerable.

Table IV.4-4
Faults Within a 25-Mile Radius of DFAs in Alternative 1

Fault Name	Length of Fault Within DFAs (miles)	Length of Fault Outside DFAs (miles)
San Andreas Fault Zone	5	25
Garlock Fault	5	44
Owens Valley Fault Zone	3	20
Coyote Creek Fault	0	11
Elsinore Fault Zone	0	7
Laguna Salada Fault	0	6
Pinto Mountain Fault	0	11
San Jacinto Fault Zone	0	18
Lenwood Fault	0	15
Lockhart Fault	0	10
North Lockhart Fault	0	1
Emerson Fault	0	9
Helendale Fault	8	11
Johnson Valley Fault	0	13
Gravel Hills – Harper Fault	0	17
Blackwater Fault	0	11
Bullion Fault	0	10
Calico Fault Zone	7	0
North Frontal Fault Zone	4	3
Manix Fault	1	3
Mesquite Lake	0	1
Superstition Hills	4	3
Little Lake Fault Zone	4	15
Brawley Fault Zone	1	2
Total	**42**	**266**

Source: USGS 2014b.

Volume III, Section III.4.4.4 describes the locations of recent volcanic activity. Within DFAs in Alternative 1, there is less than 1 square mile of recent (Holocene) volcanic flow rocks. Developers would avoid locating renewable energy facilities near an active volcanic site, so facility damage or threat to life from volcanic activity is considered possible but unlikely.

Impact SG-2: Soil or sand erosion would be triggered or accelerated due to plan components.

Erosion. Table R2.4-2, Acreage of Erosive Soils Within DFAs for Each Alternative, (Appendix R2) presents the erosion potential of soil textures found in the Plan Area and the acreage of soil textures with moderate-to-high potential for erosion found in DFAs in each alternative. Within DFAs in Alternative 1, there are 563,000acres of soils with a moderate-to-high potential for wind erosion and 561,000 acres of soils with a moderate-to-high potential for water erosion. Development of renewable energy facilities within these areas of DFAs in the Alternative 1 would increase the likelihood of soil erosion occurring from wind and water.

Sand Transport. In Alternative 1, DFAs in the East Riverside region are on or near an important sand transport corridor in the Chuckwalla Valley. The corridor runs parallel to Interstate 10 in Riverside County between the areas of Desert Center and Blythe. Other sand transport corridors include the Mojave River corridor, which includes the Kelso Dunes, the Bristol Trough corridor, which includes the Cadiz and Danby dunes, the Rice Valley corridor, which includes the Rice Valley Dunes, and the Clark's Pass corridor, which includes the Dale Lake Dunes and Palen-Ford Dunes (USGS 2003). Renewable energy facilities in these DFAs could impede sand transport and thereby affect valuable habitat within this corridor of active sand dunes. Within DFAs in Alternative 1, there are approximately 46,000 acres of dune systems and sand transport corridors.

Impact SG-3: Plan components would expose structures to damage from corrosive or expansive soils.

As stated in Section IV.4.2.1.2, corrosive soils could damage foundations and structural elements of renewable energy facilities. Expansive soils could cause soils to shrink or swell, damaging foundations and structural elements of renewable energy facilities. Alternative 1 includes 343,000acres of potentially expansive soils. See Table R2.4-3, Acreage of Expansive Soil Textures Within Developable Areas for Each Alternative (Appendix R2), which includes clay, clay loam, silty clay, and silty clay loam. Presence of playas and North American warm desert alkaline scrub and herb playa and wet flat are indicative of potentially corrosive soil within the Plan Area. Alternative 1 includes approximately 5,000 acres of potentially corrosive soils within DFAs.

Impact SG-4: Plan components would destroy or disturb desert pavement.

Renewable energy facilities constructed in DFAs under Alternative 1 may damage desert pavement. Excavation and grading during construction and decommissioning of a renewable energy facility as well as ground disturbance from workers, vehicles, or equipment

would damage or disturb this important habitat. Specific locations of desert pavement that have not been mapped would require field surveys.

Impacts in Study Area Lands

Future Assessment Areas. Alternative 1 does not include FAA.

Special Analysis Areas. Designating the SAAs as conservation would have no impact on soils or geologic hazards. Impacts would be the same as those explained for the Plan-wide reserve design in Section IV.4.3.3.1.2 (Impacts from the Reserve Design).

DRECP Variance Lands. DRECP Variance Lands represent the BLM Solar PEIS Variance Lands as screened for the DRECP and EIR/EIS based on BLM screening criteria. Covered Activities could be permitted for NCCP purposes only through an NCCP Plan amendment. However, development of renewable energy on Variance Lands would not require a BLM Land Use Plan Amendment so the environmental review process would be somewhat simpler than if the location were left undesignated.

Impact Reduction Strategies and Mitigation

The implementation of the Plan would result in conservation of some desert lands as well as the development of renewable energy generation and transmission facilities on other lands. The impacts of the renewable energy development covered by the Plan would be lessened in several ways. First, the Plan incorporates CMAs for each alternative, including specific biological reserve design components and LUPA components. Also, the implementation of existing laws, orders, regulations, and standards would reduce the impacts of project development. If significant impacts would still result after implementation of CMAs and compliance with applicable laws and regulations, then specific mitigation measures are recommended in this section.

Conservation and Management Actions

The conservation strategy for Alternative 1 (presented in Volume II, Section II.3.1.1) defines specific actions that would reduce the impacts of this alternative. The conservation strategy includes definition of the reserve design and specific CMAs for the Preferred Alternative. CMAs that would reduce impacts related to geology and soils are presented below.

<u>CMAs for Alternative 1 related to Geology and Soils:</u>

- Limit disturbance of sensitive soil areas so no more than 5% of the sensitive soil areas within a proposed project footprint shall be disturbed for construction.
- Exclude renewable energy development that disturbs sand dunes.

- Limit disturbance of sand flow corridors so no more than 1% of the sand flow corridors within a proposed project footprint shall be disturbed for construction.
- Limit disturbance of desert pavement so no more than 5% of the desert pavement within a proposed project footprint shall be disturbed for construction.
- Avoid development in floodplains, unless such development can be mitigated.
- Apply a 0.25-mile protective offset around playas.
- Exceptions to any of these stipulations may be granted by the authorized officer if the operator submits a plan that demonstrates:
    - The impacts from the proposed action are temporary.
    - The impacts are minimal or can be adequately mitigated.
    - Critical resources, including threatened and endangered species, are fully protected.
- No modifications or waivers will be granted.

While the CMAs were developed for BLM lands only, this analysis assumes that all CMAs would be applied also to nonfederal lands.

Biological CMAs relevant to geology and soils under the Preferred Alternative apply to Alternative 1 as well. These include measures to control on-site surface runoff and erosion (AM-PW-9), minimize on-site construction impacts (AM-PW-10), use construction fencing to confine disturbed areas (AM-PW-14), and complete studies to determine whether Covered Activities would occur within a sand transport corridor (AM-LL-3).

Laws and Regulations

As defined under the No Action Alternative, existing laws and regulations will reduce certain impacts of Plan implementation as summarized in Section IV.4.3.1.1.1. Relevant regulations are described in more detail in Volume III, Section III.3.1.1, Regulatory Setting.

Mitigation Measures

After implementation of the CMAs and existing laws and regulations, implementation of mitigation measures is required to further reduce identified adverse impacts described for Impacts SG-1 through SG-4. The seven mitigation measures defined for the Preferred Alternative would also apply to Alternative 1.

IV.4.3.3.1.2 Impacts from Reserve Design

The reserve design area under Alternative 1 would total 15,886,000 acres, or approximately 70% of the Plan Area (see Chapter IV.1, Table IV.1-1, Summary of Alternative Components). This would result in the protection of soil resources, due to the limitations on development within the Plan Area, and it would limit the extent of land on which projects could be developed. This could reduce potential effects of geologic hazards.

IV.4.3.3.2 Impacts of DRECP Land Use Plan Amendment on BLM Land: Alternative 1

This section addresses two components of effects of the BLM LUPA: the streamlined development of renewable energy and transmission on BLM land under the LUPA, and the impacts of the amended land use plans themselves.

IV.4.3.3.2.1 Impacts from Renewable Energy and Transmission Development on BLM Land

Streamlining renewable energy development on BLM lands within DFAs would not meaningfully change the extent or severity of Impacts SG-1 through SG-4, as defined for the Plan-wide analysis. Under Alternative 1, 7,000 acres of renewable energy development on BLM land would occur on soils that have high wind erosion potential, 7,000 acres on soils with moderate-to-high wind erosion potential, and 11,000 acres on soils with moderate-to-high water erosion potential. The same impact reduction strategies and mitigation measures described in Section IV.4.3.3.1 would also apply.

IV.4.3.3.2.2 Impacts of Changes to BLM Land Designations

The proposed BLM land use designations (e.g., National Conservation Lands, ACECs, wildlife allocations, and trail management corridors) would prohibit renewable energy development and be managed to protect the various ecological, historic, cultural, scenic, and scientific resources and values, thereby also providing general protection for geologic and soil resources. Disturbance caps on National Conservation Lands and ACECs would provide further protections. ACECs would make up the majority of the proposed BLM land designations under Alternative 1.

Existing or expanded SRMAs would also prohibit surface-occupying renewable energy development, but could have adverse effects related to soil erosion from recreation uses, depending on the extent of allowable uses and management within specific SRMAs.

IV.4.3.3.3 Impacts of Natural Community Conservation Plan: Alternative 1

The analysis of Covered Activities under the NCCP is equivalent to the Plan-wide analysis of the interagency alternatives. Reserve design features and other conservation actions under the NCCP alternatives represent more detailed categories of the reserve design under the interagency Plan-wide alternatives. These NCCP differences in reserve design features do not affect nonbiological resources analyzed in this document, and the analysis of reserve design and CMAs under the NCCP is therefore equivalent to the Plan-wide analysis of the interagency alternatives as described in Section IV.4.2.

IV.4.3.3.4 Impacts of General Conservation Plan

The impacts of the GCP for Alternative 1 would be similar to those defined in Section IV.4.3.2.1 for the Plan-wide analysis, but they would occur on nonfederal lands only. Under Alternative 1, 6,000 acres of renewable energy development would be on GCP land on soils with high wind erosion potential, 60,000 acres on soils with moderate-to-high wind erosion potential, and 79,000 acres on soils that have moderate-to-high water erosion potential.

The primary difference between the GCP and Plan-wide impacts is that there would be slightly fewer acres of DFAs on GCP lands in the Owens River Valley and Imperial Borrego Valley ecoregion subareas.

The same impact reduction strategies and mitigation measures described in Section IV.4.3.3.1 would also apply on nonfederal lands.

IV.4.3.3.5 Impacts Outside the Plan Area

IV.4.3.3.5.1 Impacts of Transmission Outside the Plan Area

The impacts of Outside the Plan Area transmission on geology and soils would be the same under all alternatives. These impacts are as described for the No Action Alternative in Section IV.4.3.1.5.2, Impacts of Transmission Outside the Plan Area.

IV.4.3.3.5.2 Impacts of BLM LUPA Decisions Outside the Plan Area

The proposed BLM land use designations outside the Plan Area (i.e., National Conservation Lands, ACECs, and wildlife allocations) would prohibit renewable energy development and be managed to protect the various ecological, historic, cultural, scenic, and scientific resources and values, thereby also providing general protection for geologic and soil resources. Existing or expanded SRMAs would also prohibit surface-occupying renewable energy development, but could have adverse effects related to soil erosion from recreation uses, depending on the extent of allowable uses and management within specific SRMAs.

IV.4.3.3.6 CEQA Significance Determination for Alternative 1

Impacts on and from soil resources and geologic hazards would occur primarily in DFAs in Alternative 1. However, as detailed in Section IV.4.3.2.6 under the Preferred Alternative, the four geology and soil impacts would be less than significant with implementation of the seven recommended mitigation measures.

IV.4.3.3.7 Comparison of Alternative 1 With Preferred Alternative

Chapter IV.27 presents a comparison of all action alternatives and the No Action Alternative across all disciplines. This section summarizes the comparison of Alternative 1 with the Preferred Alternative.

IV.4.3.3.7.1 Alternative 1 Compared With Preferred Alternative for Plan-wide DRECP

Table IV.4-5 compares Alternative 1 with the Preferred Alternative for each of the measurable factors included in this analysis.

Table IV.4-5
Comparison of Alternative 1 With the Preferred Alternative

Comparison Factor	Alternative 1	Preferred Alternative
Miles of active fault lines within DFAs	42	71
Miles of active fault lines within 25 miles of DFA boundaries	266	248
Acres of soils with moderate-to-high potential for wind erosion	563,000	576,000
Acres of soils with moderate-to-high potential for water erosion	561,000	23,000
Acres of sand and sand transport corridors in DFAs	46,000	127,000

Note: The following general rounding rules were applied to calculated values: values greater than 1,000 were rounded to nearest 1,000; values less than 1,000 and greater than 100 were rounded to the nearest 100; values of 100 or less were rounded to the nearest 10, and therefore totals may not sum due to rounding. In cases where subtotals are provided, the subtotals and the totals are individually rounded. The totals are not a sum of the rounded subtotals; therefore the subtotals may not sum to the total within the table.

Geographic Distinctions. Many impacts related to geology and soils could occur throughout the Plan Area, and are not useful in distinguishing one alternative from another. Under Alternative 1, there are fewer acres in DFAs in the eastern Riverside County area. Therefore, fewer areas of dune systems and sand transport corridors are within DFAs in this region. In this alternative, active faults are concentrated primarily in the DFAs east of Barstow, the Lucerne Valley, and the Imperial Valley.

IV.4.3.3.7.2 Alternative 1 Compared With Preferred Alternative for the BLM Land Use Plan Amendment

The impacts of renewable energy on BLM lands under LUPA for Alternative 1 would be less than under the Preferred Alternative. BLM-proposed land designations under Alternative 1 would offer similar protection to soil resources as those under the Preferred Alternative; however, CMAs under Alternative 1 would have stricter limits on disturbance to sand flow corridors, desert pavements, and sensitive soils.

IV.4.3.3.7.3 Alternative 1 Compared With Preferred Alternative for NCCP

The impacts of the NCCP for Alternative 1 are the same as those defined in Section IV.4.3.2.1 for the Plan-wide analysis. As a result, the comparison of Alternative 1 with the No Action Alternative for the NCCP is the same as described for the Plan-wide DRECP.

IV.4.3.3.7.4 Alternative 1 Compared With Preferred Alternative for the GCP

Under Alternative 1, the distribution of the impacts on GCP lands would be more confined than under the Preferred Alternative, but the overall amount of impacts would be slightly greater than under the Preferred Alternative.

IV.4.3.4 Alternative 2

Under Alternative 2, Covered Activities associated with solar, wind, and geothermal development and operation would be permitted within Development Focus Areas. Alternative 2 includes 2,475,000 acres of total DFAs and 15,324,000 acres of Reserve Design Lands. The Reserve Design Lands comprise 7,592,000 acres of existing conservation, 6,165,000 acres of BLM LUPA conservation designations, and 1,421,000 acres of Conservation Planning Areas. In Alternative 2, dispersed geothermal development is emphasized in the Imperial Borrego Valley and the Owens River Valley ecoregion subareas.

Effects of Alternative 2 on geology and soils are described in the following sections. This discussion includes the effects of renewable energy development as well as transmission development and BLM LUPA decisions outside the Plan Area.

IV.4.3.4.1 Plan-wide Impacts of Implementing the DRECP: Alternative 2

IV.4.3.4.1.1 Plan-wide Impacts and Mitigation Measures from Renewable Energy and Transmission Development

Impact Assessment

Under Alternative 2, DFAs are primarily in the Imperial Valley, West and Central Mojave regions, and the East Riverside area, and the Owens Valley portions of the Plan Area. Impacts related to soils, geology, and geologic hazards would occur within the Plan Area resulting from development of solar, wind, and geothermal facilities. Impacts would also occur on lands subject to potential transmission development, both within and outside the DFAs.

The potential for soil erosion can be quantified based on acreage of erosive soils that may be disturbed during construction and decommissioning and, to a lesser degree, during site characterization. The potential for impacts from geologic hazards can be quantified based on miles of active fault lines within 25 miles of DFAs in Alternative 2. Other geologic and soil impacts such as disturbance to desert pavement and structural damage from expansive or corrosive soils are assessed more qualitatively

Impact SG-1: Plan components would expose people or structures to injury or damage from seismic, volcanic, or landslide activity.

As described in Volume III, Section III.4.3, the Plan Area is seismically and volcanically active, with major fault lines, young volcanic features, and landslide sediment deposits. Within the Plan Area, major faults include some of the largest in the state, such as the San Andreas and San Jacinto fault systems. During the lifetime of a renewable energy facility, earthquakes within the Plan Area are likely. Table IV.4-6presents a list of active faults, which the USGS defines as having ruptured within the Holocene (the past 11,000 years) (USGS 2014a).

For each fault, Table IV.4-6 presents the length within the DFA boundary and the length outside the DFA but within 25 miles of the DFA boundary. In Alternative 2, 59.7 miles of active fault lines are within DFAs and 281.6 miles outside DFAs but within the 25-mile buffer set for the fault analysis. See Volume III, Table III.4-2, for the earthquake magnitude generating potential for each of the listed faults and associated Alquist-Priolo designations. The faults presented in Table IV.4-6 represent a potential geologic hazard that could damage renewable energy facilities. While the majority of these facilities would not include occupied residential structures, damage to property could be considerable.

Table IV.4-6
Faults Within a 25-Mile Radius of DFAs in Alternative 2

Fault Name	Length of Fault Within DFAs (miles)	Length of Fault Outside DFAs (miles)
San Andreas Fault Zone	7	27
Garlock Fault	11	39
Owens Valley Fault Zone	3	11
Coyote Creek Fault	0	12
Elsinore Fault Zone	0	7
Laguna Salada Fault	0	6
Pinto Mountain Fault	1	12
San Jacinto Fault Zone	0	18
Panamint Valley	0	14
Lenwood Fault	4	11
Lockhart Fault	2	8
North Lockhart Fault	0	1
Death Valley Fault	0	4
Emerson Fault	0	9
Helendale Fault	8	11
Johnson Valley Fault	0	13
Gravel Hills – Harper Fault	1	16
Blackwater Fault	0	11
Bullion Fault	0	11
Calico Fault Zone	6	7
North Frontal Fault Zone	4	9
Manix Fault	1	3
Mesquite Lake	0	5
Superstition Hills	4	3
Little Lake Fault Zone	6	13
Brawley Fault Zone	3	0
Total	**61**	**281**

Source: USGS 2014b.

Volume III, Section III.4.4.4 describes the locations of recent volcanic activity. Within DFAs in Alternative 2, there is less than 1 square mile of recent volcanic flow rocks. The likelihood of a renewable energy facility being located in the immediate area of an active volcanic site is low, so facility damage or threat to life from volcanic activity is possible but unlikely.

Impact SG-2: Soil or sand erosion would be triggered or accelerated due to plan components.

Erosion. Table R2.4-2, Acreage of Erosive Soils Within DFAs for Each Alternative, (Appendix R2), presents erosion potential of soil textures found in the Plan Area and acreage of soil textures with moderate-to-high potential for erosion found in DFAs in each alternative. Within DFAs in Alternative 2, there are approximately 1,463,000 acres of soils with a moderate-to-high potential for wind erosion and approximately 1,166,000 acres of soils with a moderate-to-high potential for water erosion. Development of renewable energy facilities within these areas of DFAs in the Alternative 2 would increase the likelihood of soil erosion occurring from wind and water.

Sand Transport. Under Alternative 2, DFAs in the East Riverside region are on or near an important sand transport corridor in the Chuckwalla Valley. The corridor runs parallel to Interstate 10 in Riverside County between the areas of Desert Center and Blythe. Other sand transport corridors include the Mojave River corridor (including the Kelso Dunes), the Bristol Trough corridor (including the Cadiz and Danby dunes), the Rice Valley corridor (including the Rice Valley Dunes), and the Clark's Pass corridor (including the Dale Lake Dunes and Palen-Ford Dunes; USGS 2003). Renewable energy facilities in these DFAs could impede sand transport and thereby affect valuable habitat within this corridor of active sand dunes. Within DFAs in Alternative 2, there are approximately 150,000 acres of dune systems and sand transport corridors.

Impact SG-3: Plan components would expose structures to damage from corrosive or expansive soils.

As stated in Section IV.4.2.1.2, Typical Impacts, corrosive soils could damage foundations and structural elements of renewable energy facilities. Expansive soils could shrink or swell, damaging foundations and structural elements of renewable energy facilities. Alternative 2 includes approximately 562,000 acres of potentially expansive soils. See Table R2.4-3, Acreage of Expansive Soil Textures Within DFAs for Each Alternative (Appendix R2), which includes clay, clay loam, silty clay, and silty clay loam. Presence of playas and North American warm desert alkaline scrub and herb playa and wet flat are indicative of potentially corrosive soil within the Plan Area. Alternative 2 includes approximately 28,000 acres of potentially corrosive soils within DFAs.

Impact SG-4: Plan components would destroy or disturb desert pavement.

Renewable energy facilities constructed in DFAs in Alternative 2 may cause damage to desert pavement. Excavation and grading during construction and decommissioning of a renewable energy facility as well as ground disturbance from workers, vehicles, or equip-

ment would result in damage or disturbance to this important habitat. Specific locations of desert pavement that have not been mapped would require field surveys.

Impacts in Study Area Lands

Future Assessment Areas. Lands within FAAs are neither reserve lands nor DFAs; they are simply areas that are deferred for future assessment. The future assessment will determine their suitability for renewable energy development or for ecological conservation. If renewable energy development occurs on FAA lands, a Land Use Plan Amendment would not be required. FAAs for each alternative are shown in Table IV.1-2 and in Volume II, Figure II.5-1. The FAAs represent areas where renewable energy development or inclusion in the reserve design could be implemented through an amendment to the DRECP but additional assessment would be needed.

Because most of the FAAs are presented as "undesignated areas" in the action alternatives, there would be no difference between the FAAs in Alternative 2 and those in the Preferred Alternative, except that renewable development in an FAA would not require a BLM Land Use Plan Amendment. Therefore, the environmental review process would be somewhat simpler than if the location were left undesignated.

Special Analysis Areas. Two areas are defined as SAAs, representing areas subject to ongoing analysis. These areas (located in the Silurian Valley and just west of Highway 395 in Kern County) have high value for renewable energy development, and also high value for ecological and cultural conservation, and recreation. SAA lands are expected to be designated in the Final EIR/EIS as either DFAs or included in the reserve design/Conservation Designation. If these areas were to be designated as DFAs, impacts related to geology and soils would be reduced with implementation of mitigation measures recommended below.

Impact Reduction Strategies and Mitigation

The implementation of the Plan would result in conservation of some desert lands as well as the development of renewable energy generation and transmission facilities on other lands. The impacts of the renewable energy development covered by the Plan would be lessened in several ways. First, the Plan incorporates CMAs for each alternative, including specific biological reserve design components and LUPA components. Also, the implementation of existing laws, orders, regulations, and standards would reduce the impacts of project development. If significant impacts would still result after implementation of CMAs and compliance with applicable laws and regulations, then specific mitigation measures are recommended in this section.

Conservation and Management Actions

The conservation strategy for Alternative 2 (presented in Volume II, Section II.3.1.1) defines specific actions that would reduce the impacts of this alternative. The conservation strategy includes definition of the reserve design and specific CMAs for the Preferred Alternative. CMAs that would reduce impacts related to geology and soils are presented below.

CMAs for Alternative 2 for geology and soils are:

- Limit disturbance of sensitive soil areas so no more than 20% of the sensitive soil areas within a proposed project footprint shall be disturbed for construction.
- Limit disturbance of sand dune areas so no more than 5% of sand dune areas within a proposed project footprint shall be disturbed for construction.
- Limit disturbance of sand flow corridors so no more than 5% of the sand flow corridors within a proposed project footprint shall be disturbed for construction.
- Limit disturbance of desert pavement so no more than 5% of the desert pavement within a proposed project footprint shall be disturbed for construction.
- Avoid development in floodplains, unless such development can be mitigated.
- Exceptions: Exceptions to any of these stipulations may be granted by the authorized officer if the operator submits a plan that demonstrates:
    - The impacts from the proposed action are temporary;
    - The impacts are minimal or can be adequately mitigated; and
    - Critical resources, including threatened and endangered species, are fully protected.
- Modifications: No modifications will be granted.
- Waivers: No waivers will be granted.

While the CMAs were developed for BLM lands only, this analysis assumes that all CMAs would be applied also to nonfederal lands.

Biological CMAs relevant to geology and soils under the Preferred Alternative apply to Alternative 2 as well. These include measures to control on-site surface runoff and erosion (AM-PW-9), minimize on-site construction impacts (AM-PW-10), use construction fencing to confine disturbed areas (AM-PW-14), and complete studies to determine whether Covered Activities would occur within a sand transport corridor (AM-LL-3).

Laws and Regulations

Similar to the No Action Alternative, existing laws and regulations will reduce certain impacts of Plan implementation; they are summarized in Section IV.4.3.1.1.1. The requirements of relevant regulations are described in more detail in Volume III, Section III.3.1.1, Regulatory Setting.

Mitigation Measures

After implementation of the CMAs and existing laws and regulations, implementation of mitigation measures is required to further reduce identified adverse impacts described for Impacts SG-1 through SG-4. The seven mitigation measures defined for the Preferred Alternative would also apply to Alternative 2.

IV.4.3.4.1.2 Impacts from Reserve Design

The reserve design area under Alternative 2 would total 15,324,000 acres, or approximately 68% of the Plan Area (see Chapter IV.1, Table IV.1-1, Summary of Alternative Components). This would result in the protection of soil resources, due to the limitations on development within the Plan Area, and it would limit the extent of land on which projects could be developed. This could reduce potential effects of geologic hazards.

IV.4.3.4.2 Impacts of DRECP Land Use Plan Amendment on BLM Land: Alternative 2

This section addresses two components of effects of the BLM LUPA: the streamlined development of renewable energy and transmission on BLM land under the LUPA, and the impacts of the amended land use plans themselves.

IV.4.3.4.2.1 Impacts from Renewable Energy and Transmission Development on BLM Land

Streamlining renewable energy development on BLM lands within DFAs would not change the severity of Impacts SG-1 through SG-4, as defined for the Plan-wide analysis, however the extent of impacts would be considerably less and limited to BLM lands. Under Alternative 2, 19,000 acres of renewable energy development on BLM land would occur on soils that have high wind erosion potential, 20,000 acres on soils with moderate-to-high wind erosion potential, and 17,000 acres on soils with moderate-to-high water erosion potential. The same impact reduction strategies and mitigation measures described in Section IV.4.3.4.1 would also apply.

IV.4.3.4.2.2 Impacts of Changes to BLM Land Designations

The proposed BLM land use designations (e.g., National Conservation Lands, ACECs, wildlife allocations, lands with wilderness characteristics, and trail management corridors) would prohibit renewable energy development and be managed to protect the various ecological, historic, cultural, scenic, and scientific resources and values, thereby also providing general protection for geologic and soil resources. More restrictive disturbance caps on National Conservation Lands (0.25%) and ACECs would provide further protections. The National Conservation Lands proposed under this alternative are expansive and would make up the majority of the proposed BLM land designations.

Existing or expanded SRMAs would also prohibit surface-occupying renewable energy development (except where surface geothermal development would be allowed within the Ocotillo Wells East SRMA), but could also have adverse effects related to soil erosion from recreation uses, depending on the extent of allowable uses and management within specific SRMAs.

IV.4.3.4.3 Impacts of Natural Community Conservation Plan: Preferred Alternative

The analysis of Covered Activities under the NCCP is equivalent to the Plan-wide analysis of the interagency alternatives. Reserve design features and other conservation actions under the NCCP alternatives represent more detailed categories of the reserve design under the interagency Plan-wide alternatives. These NCCP differences in reserve design features do not affect nonbiological resources analyzed in this document, and the analysis of reserve design and CMAs under the NCCP is therefore equivalent to the Plan-wide analysis of the interagency alternatives, as described in Section IV.4.2.

IV.4.3.4.4 Impacts of General Conservation Plan

The impacts of the GCP for Alternative 2 would be similar to those defined in Section IV.4.3.2.1 for the Plan-wide analysis, but they would occur on nonfederal lands only. Under Alternative 2, there would be 4,000 acres of renewable energy development on GCP land on soils with high wind erosion potential, 53,000 acres on soils with a moderate-to-high wind erosion potential, and 55,000 acres on soils with moderate-to-high water erosion potential.

The primary difference between the GCP and Plan-wide impacts is that there would be fewer acres of DFAs on GCP lands in the Cadiz Valley and Chocolate Mountains and Imperial Borrego Valley ecoregion subareas.

The same impact reduction strategies and mitigation measures described in Section IV.4.3.2.1 would also apply on nonfederal lands.

IV.4.3.4.5 Impacts Outside the Plan Area

IV.4.3.4.5.1 Impacts of Transmission Outside the Plan Area

The impacts of Outside the Plan Area transmission on geology and soils would be the same under all alternatives. These impacts are as described for the No Action Alternative in Section IV.4.3.1.5.2, Impacts of Transmission Outside the Plan Area.

IV.4.3.4.5.2 Impacts of BLM LUPA Decisions Outside the Plan Area

The proposed BLM land use designations outside the Plan Area (i.e., National Conservation Lands, ACECs, wildlife allocations, and trail management corridors) would prohibit renewable energy development and be managed to protect the various ecological, historic, cultural, scenic, and scientific resources and values, thereby also providing general protection for geologic and soil resources. Existing or expanded SRMAs would also prohibit surface-occupying renewable energy development, but could have adverse effects related to soil erosion from recreation uses, depending on the extent of allowable uses and management within specific SRMAs.

IV.4.3.4.6 CEQA Significance Determination for Alternative 2

Impacts on and from soil resources and geologic hazards would occur primarily in DFAs in Alternative 2. However, as detailed in Section IV.4.3.2.6 under the Preferred Alternative, the impacts of all four geology and soil impacts would be less than significant with implementation of the seven recommended mitigation measures.

IV.4.3.4.7 Comparison of Alternative 2 With Preferred Alternative

Chapter IV.27 presents a comparison of all action alternatives and the No Action Alternative across all disciplines. This section summarizes the comparison of Alternative 2 with the Preferred Alternative.

IV.4.3.4.7.1 Alternative 2 Compared With Preferred Alternative for Plan-wide DRECP

Table IV.4-7 compares Alternative 2 with the Preferred Alternative for each of the measurable factors included in this analysis.

Table IV.4-7
Comparison of Alternative 2 With the Preferred Alternative

Comparison Factor	Alternative 2	Preferred Alternative
Miles of active fault lines within DFAs	61	71
Miles of active fault lines within 25 miles of DFA boundaries	281	248
Acres of soils with moderate-to-high potential for wind erosion	1,463,000	516,000
Acres of soils with moderate-to-high potential for water erosion	1,166,000	23,000
Acres of sand and sand transport corridors in DFAs	150,000	127,000

Note: The following general rounding rules were applied to calculated values: values greater than 1,000 were rounded to nearest 1,000; values less than 1,000 and greater than 100 were rounded to the nearest 100; values of 100 or less were rounded to the nearest 10, and therefore totals may not sum due to rounding. In cases where subtotals are provided, the subtotals and the totals are individually rounded. The totals are not a sum of the rounded subtotals; therefore the subtotals may not sum to the total within the table.

Geographic Distinctions. Many impacts related to geology and soils could occur throughout the Plan Area, and are not useful in distinguishing one alternative from another. In Alternative 2, the DFA in the eastern Riverside County area is similar in size to the DFA in the Preferred Alternative. Significant dune systems and an important sand transport corridor are located within this DFA, specifically along Interstate-10. In this alternative, active faults are concentrated in DFAs in the Imperial Valley, DFAs east of Barstow, in the Lucerne Valley, and in the Lower Owens Valley.

IV.4.3.4.7.2 Alternative 2 Compared With Preferred Alternative for the BLM Land Use Plan Amendment

The impacts of renewable energy on BLM lands under LUPA for Alternative 2 would be greater than under the Preferred Alternative. BLM-proposed land designations under Alternative 2 would offer more protection to soil resources than under the Preferred Alternative, primarily through a greater amount of National Conservation Lands and the more restrictive disturbance cap on those lands. Additionally, CMAs under Alternative 2 would have stricter limits on disturbance to desert pavements.

IV.4.3.4.7.3 Alternative 2 Compared With Preferred Alternative for NCCP

The impacts of the NCCP for Alternative 2 are the same as those defined in Section IV.4.3.2.1 for the Plan-wide analysis. As a result, the comparison of Alternative 2 with the Preferred Alternative for the NCCP is the same as described for Plan-wide DRECP.

IV.4.3.4.7.4 Alternative 2 Compared With Preferred Alternative for the GCP

Under Alternative 2, the amount of overall impacts would be slightly less than under the Preferred Alternative; the distribution of impacts on GCP lands under Alternative 2 would be very similar to the Preferred Alternative.

IV.4.3.5 Alternative 3

In Alternative 3, Covered Activities associated with solar, wind, and geothermal development and operation would be permitted within Development Focus Areas. Alternative 3 includes 1,408,000 acres of total DFAs and 15,819,000 acres of Reserve Design Lands.

The Reserve Design Lands comprise 7,592,000 acres of existing conservation, 6,347,000 acres of BLM LUPA conservation designations, and 1,880,000 acres of Conservation Planning Areas. In Alternative 3, dispersed solar is emphasized for the West Mojave and Eastern Slopes and the Imperial Borrego Valley ecoregion subareas. Dispersed wind is emphasized in the Pinto Lucerne Valley and Eastern Slopes and the West Mojave and Eastern Slopes ecoregion subareas. Dispersed geothermal development is emphasized in the Imperial Borrego Valley and the Owens River Valley ecoregion subareas.

Effects of Alternative 3 on geology and soils are described in the following sections. This discussion includes the effects of renewable energy development as well as transmission development and BLM LUPA decisions outside the Plan Area.

IV.4.3.5.1 Plan-wide Impacts of Implementing the DRECP: Alternative 3

IV.4.3.5.1.1 Plan-wide Impacts and Mitigation Measures from Renewable Energy and Transmission Development

Impact Assessment

Under the Preferred Alternative, DFAs are primarily in the Imperial Valley, West and Central Mojave regions, and the East Riverside portions of the Plan Area. Impacts related to soils, geology, and geologic hazards would occur within the Plan Area from development of solar, wind, and geothermal facilities. Impacts would also occur on lands subject to potential transmission development, both within and outside the DFAs. The potential for soil erosion can be quantified based on acreage of erosive soils that may be disturbed during construction and decommissioning and, to a lesser degree, during site characterization. The potential for impacts from geologic hazards can be quantified based on miles of active fault lines within 25 miles of DFAs in Alternative 3. Other soils and geologic impacts such as disturbance to desert pavement and structural damage from expansive or corrosive soils are assessed more qualitatively.

Impact SG-1: Plan components would expose people or structures to injury or damage from seismic, volcanic, or landslide activity.

As described in Volume III, Section III.4.3, the Plan Area is seismically and volcanically active, with major fault lines, young volcanic features, and landslide sediment deposits. Within the Plan Area, major faults include some of the largest in the state, such as the San Andreas and San Jacinto fault systems. During the lifetime of a renewable energy facility, earthquakes within the Plan Area are likely. Table IV.4-8 presents a list of active faults, which the USGS defines as having ruptured within the Holocene (the past 11,000 years) (USGS 2014a).

For each fault, Table IV.4-8 presents the length within the DFA boundary and the length outside the DFA but within 25 miles of the DFA boundary. In Alternative 3, there are 57.4 miles of active fault lines within DFAs and 266.9 miles outside DFAs but within the 25-mile buffer set for the fault analysis. See Table III.4-2, Largest Faults within the Plan Area, for the earthquake magnitude generating potential for each of the listed faults and associated Alquist-Priolo designations. The faults presented in Table IV.4-8 represent a potential geologic hazard that could damage renewable energy facilities. While the majority of these facilities would not include occupied residential structures, damage to property could be considerable.

Table IV.4-8
Faults Within a 25-Mile Radius of DFAs in Alternative 3

Fault Name	Length of Fault Within DFAs (miles)	Length of Fault Outside DFAs (miles)
San Andreas Fault Zone	7	27
Garlock Fault	12	33
Owens Valley Fault Zone	3	11
Coyote Creek Fault	0	11
Elsinore Fault Zone	0	7
Laguna Salada Fault	0	6
Pinto Mountain Fault	0	11
San Jacinto Fault Zone	0	18
Panamint Valley	0	14
Lenwood Fault	4	12
Lockhart Fault	3	7
North Lockhart Fault	0	1
Emerson Fault	0	9
Helendale Fault	8	11
Johnson Valley Fault	0	13
Gravel Hills – Harper Fault	1	16

Table IV.4-8
Faults Within a 25-Mile Radius of DFAs in Alternative 3

Fault Name	Length of Fault Within DFAs (miles)	Length of Fault Outside DFAs (miles)
Blackwater Fault	0	11
Bullion Fault	0	10
Calico Fault Zone	6	7
North Frontal Fault Zone	4	9
Manix Fault	1	3
Mesquite Lake	0	1
Superstition Hills	4	3
Little Lake Fault Zone	4	15
Brawley Fault Zone	1	2
Total	**58**	**268**

Source: USGS 2014b.

Volume III, Section III.4.4.4, describes the locations of recent volcanic activity. Within DFAs in Alternative 3, there is less than 1 square mile of recent volcanic flow rocks. The likelihood of a renewable energy developer locating a project near an active volcanic site is low, so facility damage or threat to life from volcanic activity is possible but unlikely.

Impact SG-2: Soil or sand erosion would be triggered or accelerated due to plan components.

Erosion. Table R2.4-2, Acreage of Erosive Soils Within DFAs for Each Alternative (Appendix R2) present erosion potential of soil textures found in the Plan Area and acreage of soil textures with moderate-to-high potential for erosion found in DFAs in each alternative. Within DFAs in Alternative 3, there are approximately 846,000acres of soils with a moderate-to-high potential for wind erosion and approximately 661,000acres of soils with a moderate-to-high potential for water erosion. Development of renewable energy facilities within these areas of DFAs in the Alternative 3 would increase the likelihood of soil erosion occurring from wind and water.

Sand Transport. Under Alternative 3, DFAs in the East Riverside region are on or near an important sand transport corridor in the Chuckwalla Valley. The corridor runs parallel to Interstate 10 in Riverside County between the areas of Desert Center and Blythe. Other sand transport corridors include the Mojave River corridor, which includes the Kelso Dunes, the Bristol Trough corridor, which includes the Cadiz and Danby dunes, the Rice Valley corridor, which includes the Rice Valley Dunes, and the Clark's Pass corridor, which includes the Dale Lake Dunes and Palen-Ford Dunes (USGS 2003). Renewable energy facili-

ties in these DFAs could impede sand transport and thereby affect valuable habitat within this corridor of active sand dunes. Within DFAs in Alternative 3, there are approximately 67,000 acres of dune systems and sand transport corridors.

Impact SG-3: Plan components would expose structures to damage from corrosive or expansive soils.

As stated in Section IV.4.2.1.2, Typical Impacts, corrosive soils could damage foundations and structural elements of renewable energy facilities. Expansive soils could cause soils to shrink or swell, damaging foundations and structural elements of renewable energy facilities. Alternative 3 includes 359,000acres of potentially expansive soils. See Table R2.4-3, Acreage of Expansive Soil Textures Within DFAs for Each Alternative (Appendix R2), which includes clay, clay loam, silty clay, and silty clay loam. Presence of playas and North American warm desert alkaline scrub and herb playa and wet flat are indicative of potentially corrosive soil within the Plan Area. Alternative 3 includes approximately 22,000 acres of potentially corrosive soils within DFAs.

Impact SG-4: Plan components would destroy or disturb desert pavement.

Renewable energy facilities in Alternative 3 may damage desert pavement. Excavation and grading during construction and decommissioning of a renewable energy facility as well as ground disturbance from workers, vehicles, or equipment would damage or disturb this important habitat. Specific locations of desert pavement that have not been mapped would require field surveys.

Impacts in Study Area Lands

Future Assessment Areas. Lands within FAAs are neither reserve lands nor DFAs; they are simply areas that are deferred for future assessment. The future assessment will determine their suitability for renewable energy development or for ecological conservation. If renewable energy development occurs on FAA lands, a Land Use Plan Amendment would not be required. FAAs for each alternative are shown in Table IV.1-2. The FAAs represent areas where renewable energy development or inclusion in the reserve design could be implemented through an amendment to the DRECP, but additional assessment would be needed.

Because most of the FAAs are presented as “undesignated areas” in the action alternatives, there would be no difference between the FAAs in the Preferred Alternative except that renewable development in an FAA would not require a BLM Land Use Plan Amendment so the environmental review process would be somewhat simpler than if the location were left undesignated. Development of the FAAs would not impact or be impacted by geologic hazards and soil resources.

Special Analysis Areas. Designating the SAAs as conservation would have no impact on this resource. Impacts would be the same as those explained for the Plan-wide reserve design in Section IV.4.3.5.1.2 (Impacts from the Reserve Design).

Impact Reduction Strategies and Mitigation

The implementation of the Plan would result in conservation of some desert lands as well as the development of renewable energy generation and transmission facilities on other lands. The impacts of the renewable energy development covered by the Plan would be lessened in several ways. First, the Plan incorporates CMAs for each alternative, including specific biological reserve design components and LUPA components. Also, the implementation of existing laws, orders, regulations, and standards would reduce the impacts of project development. If significant impacts would still result after implementation of CMAs and compliance with applicable laws and regulations, then specific mitigation measures are recommended in this section.

Conservation and Management Actions

The conservation strategy for Alternative 3 (presented in Volume II, Section II.3.1.1) defines specific actions that would reduce the impacts of this alternative. The conservation strategy includes definition of the reserve design and specific CMAs for Alternative 3. CMAs that would reduce impacts related to geology and soils are presented below.

CMAs for Alternative 3 for geology and soils are:

- Limit disturbance of sensitive soil areas so no more than 1% of the sensitive soil areas within a proposed project footprint shall be disturbed for construction.
- Exclude renewable energy development in sand dune areas.
- Limit disturbance of sand flow corridors so no more than 1% of the sand flow corridors within a proposed project footprint shall be disturbed for construction.
- Limit disturbance of desert pavement so no more than 5% of the desert pavement within a proposed project footprint shall be disturbed for construction.
- Avoid development in floodplains, unless such development can be mitigated.
- Apply a 0.25 mile protective offset around playas.

While the CMAs were developed for BLM lands only, this analysis assumes that all CMAs would be applied also to nonfederal lands.

Biological CMAs relevant to geology and soils under the Preferred Alternative apply to Alternative 3 as well. These include measures to control on-site surface runoff and erosion

(AM-PW-9), minimize on-site construction impacts (AM-PW-10), use construction fencing to confine disturbed areas (AM-PW-14), and complete studies to determine whether Covered Activities would occur within a sand transport corridor (AM-LL-3).

Laws and Regulations

As defined under the No Action Alternative, existing laws and regulations will reduce certain impacts of Plan implementation; they are summarized in Section IV.4.3.1.1.1. Relevant regulations are described in more detail in Section III.1.1, Regulatory Setting.

Mitigation Measures

After implementation of the CMAs and existing laws and regulations, implementation of mitigation measures is required to further reduce identified adverse impacts described for Impacts SG-1 through SG-4. The seven mitigation measures defined for the Preferred Alternative would also apply to Alternative 3.

IV.4.3.5.1.2 Impacts from Reserve Design

The reserve design area under Alternative 3 would total 15,819,000 acres, or approximately 70% of the Plan Area (see Chapter IV.1, Table IV.1-1, Summary of Alternative Components). This would result in the protection of soil resources, due to the limitations on development within the Plan Area, and would limit the extent of land on which projects could be developed. This could reduce potential effects of geologic hazards.

IV.4.3.5.2 Impacts of DRECP Land Use Plan Amendment on BLM Land: Alternative 3

This section addresses two components of effects of the BLM LUPA: the streamlined development of renewable energy and transmission on BLM land under the LUPA, and the impacts of the amended land use plans themselves.

IV.4.3.5.2.1 Impacts from Renewable Energy and Transmission Development on BLM Land

Streamlining renewable energy development on BLM lands within DFAs would not change the severity of Impacts SG-1 through SG-4, as defined for the Plan-wide analysis, and the extent of impacts would be similar but limited to BLM lands. Under Alternative 3, 16,000 acres of renewable energy development on BLM land would occur on soils that have high wind erosion potential, 11,000 acres on soils with moderate-to-high wind erosion potential, and 15,000 acres on soils with moderate-to-high water erosion potential. The same impact reduction strategies and mitigation measures described in Section IV.4.3.5.1 would also apply.

IV.4.3.5.2.2 Impacts of Changes to BLM Land Designations

The proposed BLM land use designations (e.g., National Conservation Lands, ACECs, wildlife allocations, lands with wilderness characteristics, and trail management corridors) would prohibit renewable energy development and be managed to protect the various ecological, historic, cultural, scenic, and scientific resources and values, thereby also providing general protection for geologic and soil resources. More restrictive disturbance caps on National Conservation Lands (0.25%) and ACECs would provide further protections. The National Conservation Lands would make up the majority of the proposed BLM land designations under Alternative 3.

Existing or expanded SRMAs would also prohibit surface-occupying renewable energy development, but could have adverse effects related to soil erosion from recreation uses, depending on the extent of allowable uses and management within specific SRMAs.

IV.4.3.5.3 Impacts of Natural Community Conservation Plan: Alternative 3

The analysis of Covered Activities under the NCCP is equivalent to the Plan-wide analysis of the interagency alternatives. Reserve design features and other conservation actions under the NCCP alternatives represent more detailed categories of the reserve design under the interagency Plan-wide alternatives. These NCCP differences in reserve design features do not affect nonbiological resources analyzed in this document, and the analysis of reserve design and CMAs under the NCCP is therefore equivalent to the Plan-wide analysis of the interagency alternatives, as described in Section IV.4.2.

IV.4.3.5.4 Impacts of General Conservation Plan: Alternative 3

The impacts of the GCP for Alternative 3 would be similar to those defined in Section IV.4.3.2.1 for the Plan-wide analysis, but they would occur on nonfederal lands only. Under Alternative 3, there would be 5,000 acres of renewable energy development on GCP land on soils with high wind erosion potential, 62,000 acres on soils with moderate-to-high wind erosion potential, and 66,000 acres on soils with moderate-to-high water erosion potential.

There are some differences in the distribution of DFAs on GCP lands compared to Plan-wide impacts, with fewer acres of DFAs in the Imperial Borrego Valley, Owens River Valley, Panamint Death Valley, and Cadiz Valley and Chocolate Mountains ecoregion subareas.

The same impact reduction strategies and mitigation measures described in Section IV.4.3.5.1 would also apply on nonfederal lands.

IV.4.3.5.5 Impacts Outside the Plan Area

IV.4.3.5.5.1 Impacts of Transmission Outside the Plan Area

The impacts of Outside the Plan Area transmission on geology and soils would be the same under all alternatives. These impacts are as described for the No Action Alternative in Section IV.4.3.1.5.2, Impacts of Transmission Outside the Plan Area.

IV.4.3.5.5.2 Impacts of BLM LUPA Decisions Outside the Plan Area

The proposed BLM land use designations outside the Plan Area (i.e., National Conservation Lands, ACECs, wildlife allocations, and trail management corridors) would prohibit renewable energy development and be managed to protect the various ecological, historic, cultural, scenic, and scientific resources and values, thereby also providing general protection for geologic and soil resources. Existing or expanded SRMAs would also prohibit surface-occupying renewable energy development, but could have adverse effects related to soil erosion from recreation uses, depending on the extent of allowable uses and management within specific SRMAs.

IV.4.3.5.6 CEQA Significance Determination for Alternative 3

Impacts on and from soil resources and geologic hazards would occur primarily in DFAs in Alternative 3. However, as detailed in Section IV.4.3.2.6 under the Preferred Alternative, the impacts of all four geology and soil impacts would be less than significant with implementation of the seven recommended mitigation measures.

IV.4.3.5.7 Comparison of Alternative 3 With Preferred Alternative

Chapter IV.27 presents a comparison of all action alternatives and the No Action Alternative across all disciplines. This section summarizes the comparison of Alternative 3 with the Preferred Alternative.

IV.4.3.5.7.1 Alternative 3 Compared With Preferred Alternative for Plan-wide DRECP

Table IV.4-9 compares Alternative 3 with the Preferred Alternative for each of the measurable factors included in this analysis.

Table IV.4-9
Comparison of Alternative 3 With the Preferred Alternative

Comparison Factor	Alternative 3	Preferred Alternative
Miles of active fault lines within DFAs	58	71
Miles of active fault lines within 25 miles of DFA boundaries	268	248
Acres of soils with moderate-to-high potential for wind erosion	846,000	516,000
Acres of soils with moderate-to-high potential for water erosion	661,000	23,000
Acres of sand and sand transport corridors in DFAs	67,000	127,000

Note: The following general rounding rules were applied to calculated values: values greater than 1,000 were rounded to nearest 1,000; values less than 1,000 and greater than 100 were rounded to the nearest 100; values of 100 or less were rounded to the nearest 10, and therefore totals may not sum due to rounding. In cases where subtotals are provided, the subtotals and the totals are individually rounded. The totals are not a sum of the rounded subtotals; therefore the subtotals may not sum to the total within the table.

Geographic Distinctions. Many impacts related to geology and soils could occur throughout the Plan Area, and are not useful in distinguishing one alternative from another. In Alternative 3, fewer DFA acres are in the eastern Riverside County region than in the Preferred Alternative, so potential effects to dunes and sand transport corridors in that area would be reduced. Active faults in Alternative 3 are concentrated primarily in DFAs in the Imperial Valley and in DFAs east and west of Barstow.

IV.4.3.5.7.2 Alternative 3 Compared With Preferred Alternative for the BLM Land Use Plan Amendment

The impacts of renewable energy on BLM lands under LUPA for Alternative 3 would be similar to the Preferred Alternative. BLM-proposed land designations under Alternative 3 would offer more protection to soil resources than under the Preferred Alternative, primarily through the more restrictive disturbance cap on National Conservation. Additionally, CMAs under Alternative 3 would have stricter limits on disturbance to sand flow corridors, desert pavements, and sensitive soils.

IV.4.3.5.7.3 Alternative 3 Compared With Preferred Alternative for NCCP

The impacts of the NCCP for Alternative 3 are the same as those defined in Section IV.4.3.2.1 for the Plan-wide analysis. As a result, the comparison of Alternative 3 with the Preferred Alternative for the NCCP is the same as described for Plan-wide DRECP.

IV.4.3.5.7.4 Alternative 3 Compared With Preferred Alternative for the GCP

Under Alternative 3, the impacts on soils subject to wind erosion would be moderately greater while impacts on soils subject to water erosion would be slightly less when com-

pared to the Preferred Alternative. With the exception of fewer DFAs in the Imperial Borrego Valley ecoregion subarea under Alternative 3, the distribution of the impacts on GCP lands would be similar to the Preferred Alternative.

IV.4.3.6 Alternative 4

Under Alternative 4, Covered Activities associated with solar, wind, and geothermal development and operation would be permitted within Development Focus Areas. Alternative 4 includes 1,608,000 acres of total DFAs and 15,165,000 acres of Reserve Design Lands. The Reserve Design Lands comprise 7,592,000 acres of existing conservation, 5,670,000 acres of BLM LUPA conservation designations, and 1,903,000 acres of Conservation Planning Areas. In Alternative 4, dispersed solar is emphasized for the Cadiz Valley and Chocolate Mountains ecoregion subarea. Dispersed wind is emphasized in the West Mojave and Eastern Slopes ecoregion subarea. Dispersed geothermal development is emphasized in the Imperial Borrego Valley and in the Owens River Valley ecoregion subareas.

Effects of Alternative 4 on geology and soils are described in the following sections. This discussion includes the effects of renewable energy development as well as transmission development and BLM LUPA decisions outside the DRECP area.

IV.4.3.6.1 Plan-wide Impacts of Implementing the DRECP: Alternative 4

IV.4.3.6.1.1 Plan-wide Impacts and Mitigation Measures from Renewable Energy and Transmission Development

Impact Assessment

Under Alternative 4, DFAs are primarily in the Imperial Valley, West and Central Mojave regions, and the East Riverside portions of the Plan Area. Impacts related to soils, geology, and geologic hazards would occur within the Plan Area from development of solar, wind, and geothermal facilities. Impacts would also occur on lands subject to potential transmission development, both within and outside the DFAs. The potential for soil erosion can be quantified based on acreage of erosive soils that may be disturbed during construction and decommissioning and, to a lesser degree, during site characterization. The potential for impacts from geologic hazards can be quantified based on miles of active fault lines within 25 miles of DFAs in Alternative 4. Other geologic and soil impacts such as disturbance to desert pavement and structural damage from expansive or corrosive soils are assessed more qualitatively.

Impact SG-1: Plan components would expose people or structures to injury or damage from seismic, volcanic, or landslide activity.

As described in Volume III, Section III.4.3, the Plan Area is seismically and volcanically active, with major fault lines, young volcanic features, and landslide sediment deposits. Within the Plan Area, major faults include some of the largest in the state, such as the San Andreas and San Jacinto fault systems. During the lifetime of a renewable energy facility, earthquakes within the Plan Area are likely. Table IV.4-10presents a list of active faults, which the USGS defines as having ruptured within the Holocene (the past 11,000 years) (USGS 2014a).

For each fault, Table IV.4-10 presents the length within the DFA boundary and the length outside the DFA but within 25 miles of the DFA boundary. In Alternative 4, 62.7 miles of active fault lines are within DFAs and 262.5 miles outside DFAs but within the 25-mile buffer set for the fault analysis. See Volume III, Table III.4-2, Largest Faults Within the Plan Area, for the earthquake magnitude generating potential for each of the listed faults and associated Alquist-Priolo designations. The faults presented in Table IV.4-10 represent a potential geologic hazard that could damage renewable energy facilities. While the majority of these facilities would not include occupied residential structures, damage to property could be considerable.

Table IV.4-10
Faults Within a 25-Mile Radius of DFAs in Alternative 4

Fault Name	Length of Fault Within DFAs (miles)	Length of Fault Outside DFAs (miles)
San Andreas Fault Zone	7	27
Garlock Fault	16	30
Owens Valley Fault Zone	3	11
Coyote Creek Fault	0	11
Elsinore Fault Zone	0	7
Laguna Salada Fault	0	6
Pinto Mountain Fault	0	11
San Jacinto Fault Zone	0	18
Panamint Valley	0	14
Lenwood Fault	2	14
Lockhart Fault	3	7
North Lockhart Fault	0	1
Emerson Fault	0	9
Helendale Fault	11	7
Johnson Valley Fault	0	13
Gravel Hills – Harper Fault	1	16

Table IV.4-10
Faults Within a 25-Mile Radius of DFAs in Alternative 4

Fault Name	Length of Fault Within DFAs (miles)	Length of Fault Outside DFAs (miles)
Blackwater Fault	0	11
Bullion Fault	0	10
Calico Fault Zone	6	7
North Frontal Fault Zone	4	9
Manix Fault	1	3
Mesquite Lake	0	1
Superstition Hills	4	3
Little Lake Fault Zone	4	15
Brawley Fault Zone	1	2
Total	**63**	**263**

Source: USGS 2014b.

Volume III, Section III.4.4.4, describes the locations of recent volcanic activity. Within DFAs in Alternative 4, there is less than 1 square mile of recent volcanic flow rocks. The likelihood of a renewable energy facility being located near an active volcanic site is low, so facility damage or threat to life from volcanic activity is possible but unlikely.

Impact SG-2: Soil or sand erosion would be triggered or accelerated due to plan components.

Erosion. Table R2.4-2, Acreage of Erosive Soils Within DFAs for Each Alternative, (Appendix R2) presents erosion potential of soil textures found in the Plan Area and acreage of soil textures with moderate-to-high potential for erosion found in DFAs in each alternative. Within DFAs in Alternative 4, there are approximately 956,000 acres of soils with a moderate-to-high potential for wind erosion and approximately 749,000 acres of soils with a moderate-to-high potential for water erosion. Development of renewable energy facilities within these areas of DFAs in the Alternative 4 would increase the likelihood of soil erosion occurring from wind and water.

Sand Transport. Under Alternative 4, DFAs in the East Riverside region are on or near an important sand transport corridor in the Chuckwalla Valley. The corridor runs parallel to Interstate 10 in Riverside County between the areas of Desert Center and Blythe. Other sand transport corridors include the Mojave River corridor (including the Kelso Dunes), the Bristol Trough corridor (including the Cadiz and Danby dunes), the Rice Valley corridor (including the Rice Valley Dunes), and the Clark's Pass corridor (including the Dale Lake Dunes and Palen-Ford Dunes; USGS 2003). Renewable energy facilities in these DFAs could

impede sand transport and thereby affect valuable habitat within this corridor of active sand dunes. Within DFAs in Alternative 4, there are 98,000 acres of dune systems and sand transport corridors.

Impact SG-3: Plan components would expose structures to damage from corrosive or expansive soils.

As stated in Section IV.4.2.1.2, Typical Impacts, corrosive soils could damage foundations and structural elements of renewable energy facilities. Expansive soils could cause soils to shrink or swell, damaging foundations and structural elements of renewable energy facilities. Alternative 4 includes approximately 355,000acres of potentially expansive soils. See Table R2.4-3, Acreage of Expansive Soil Textures Within DFAs for Each Alternative (Appendix R2). Expansive soil textures include clay, clay loam, silty clay, and silty clay loam. Presence of playas and North American warm desert alkaline scrub and herb playa and wet flat are indicative of potentially corrosive soil within the Plan Area. Alternative 4 includes 16,000 acres of potentially corrosive soils within DFAs.

Impact SG-4: Plan components would destroy or disturb desert pavement.

Renewable energy facilities constructed in DFAs in Alternative 4 may damage desert pavement. Excavation and grading during construction and decommissioning of a renewable energy facility as well as ground disturbance from workers, vehicles, or equipment would damage or disturb this important habitat. Specific locations of desert pavement that have not been mapped would require field surveys.

Impacts in Study Area Lands

Future Assessment Areas. Alternative 4 does not include FAA.

Special Analysis Areas. Designating the SAAs as conservation would have no impact on this resource. Impacts would be the same as those explained for the Plan-wide reserve design in Section IV.4.3.6.1.2 (Impacts from the Reserve Design).

DRECP Variance Lands. DRECP Variance Lands represent the BLM Solar PEIS Variance Lands as screened for the DRECP and EIR/EIS based on BLM screening criteria. Covered Activities could be permitted for NCCP purposes only through an NCCP Plan amendment. However, development of renewable energy on Variance Lands would not require a BLM Land Use Plan Amendment so the environmental review process would be somewhat simpler than if the location were left undesignated.

Development of the DRECP Variance Lands would have similar effects related to soil and geologic hazards, as would the Plan-wide development described in Section IV.4.3.6.1.

Impacts related to faulting, particularly around the Owens Valley Fault Zone, would be reduced with implementation of Mitigation Measures SG-1a (Complete geotechnical investigations for hazards) and SG-1b (Reduce effects of groundshaking). Sand and potential sand transport corridors around Owens Valley Dry Lake, the Hidden Hills area, and the Area East of Twentynine Palms would be protected with implementation of Mitigation Measure SG-2b (Protect sand and sand transport corridors).

The western half of the Area East of Twentynine Palms, the Hidden Hills area, and the area around Owens Valley Dry Lake are located within areas of expansive soils and some areas of corrosive soils. Potential facility damage related to this impact would be controlled with implementation of Mitigation Measure SG-3a (Complete geotechnical studies for soil conditions).

Impact Reduction Strategies and Mitigation

The implementation of the Plan would result in conservation of some desert lands as well as the development of renewable energy generation and transmission facilities on other lands. The impacts of the renewable energy development covered by the Plan would be lessened in several ways. First, the Plan incorporates Conservation and Management Actions (CMAs) for each alternative, including specific biological reserve design components and LUPA components. Also, the implementation of existing laws, orders, regulations, and standards would reduce the impacts of project development. If significant impacts would still result after implementation of CMAs and compliance with applicable laws and regulations, then specific mitigation measures are recommended in this section.

Conservation and Management Actions

The conservation strategy for Alternative 4 (presented in Volume II, Section II.3.1.1) defines specific actions that would reduce the impacts of this alternative. The conservation strategy includes definition of the reserve design and specific CMAs for Alternative 4. CMAs that would reduce impacts related to geology and soils are presented below.

CMAs for Alternative 4 for geology and soils are:

- Limit disturbance of sensitive soil areas, so no more than 20% of the sensitive soil areas within a proposed project footprint shall be disturbed for construction.
- Limit disturbance of sand dunes so no more than 5% of the sand dunes within a proposed project footprint shall be disturbed for construction.
- Limit disturbance of sand flow corridors so no more than 5% of the sand flow corridors within a proposed project footprint shall be disturbed for construction.

- Limit disturbance of desert pavement so no more than 5% of the desert pavement within a proposed project footprint shall be disturbed for construction.
- Avoid development in floodplains, unless such development can be mitigated.
- Exceptions: Exceptions to any of these stipulations may be granted by the authorized officer if the operator submits a plan that demonstrates:
    - The impacts from the proposed action are temporary;
    - The impacts are minimal or can be adequately mitigated; and
    - Critical resources, including threatened and endangered species, are fully protected.
- Modifications: No modifications will be granted.
- Waivers: No waivers will be granted.

While the CMAs were developed for BLM lands only, this analysis assumes that all CMAs would be applied also to nonfederal lands.

Biological CMAs relevant to geology and soils under the Preferred Alternative apply to Alternative 4 as well. These include measures to control on-site surface runoff and erosion (AM-PW-9), minimize on-site construction impacts (AM-PW-10), use construction fencing to confine disturbed areas (AM-PW-14), and complete studies to determine whether Covered Activities would occur within a sand transport corridor (AM-LL-3).

Laws and Regulations

As defined under the No Action Alternative, existing laws and regulations will reduce certain impacts of Plan implementation; they are summarized in Section IV.4.3.1.1.1. Relevant regulations are described in more detail in Volume III, Section III.3.1.1, Regulatory Setting.

Mitigation Measures

After implementation of the CMAs and existing laws and regulations, implementation of mitigation measures is required to further reduce identified adverse impacts described for Impacts SG-1 through SG-4. The seven mitigation measures defined for the Preferred Alternative would also apply to Alternative 4.

IV.4.3.6.1.2 Impacts from Reserve Design

The reserve design area under Alternative 4 would total 15,165,000 acres, or approximately 67% of the Plan Area (see Chapter IV.1, Table IV.1-1, Summary of Alternative Com-

ponents). This would result in the protection of soil resources, due to the limitations on development within the Plan Area, and would limit the extent of land on which projects could be developed. This could reduce potential effects of geologic hazards.

IV.4.3.6.2 Impacts of DRECP Land Use Plan Amendment on BLM Land: Alternative 4

This section addresses two components of effects of the BLM LUPA: the streamlined development of renewable energy and transmission on BLM land under the LUPA, and the impacts of the amended land use plans themselves.

IV.4.3.6.2.1 Impacts from Renewable Energy and Transmission Development on BLM Land

Streamlining renewable energy development on BLM lands within DFAs would not change the extent or severity of Impacts SG-1 through SG-4, as defined for the Plan-wide analysis.

Under Alternative 4, 16,000 acres of renewable energy development on BLM land would occur on soils that have high wind erosion potential, 6,000 acres on soils with moderate-to-high wind erosion potential, and 8,000 acres on soils with moderate-to-high water erosion potential. The same impact reduction strategies and mitigation measures described in Section IV.4.3.6.1 would also apply.

IV.4.3.6.2.2 Impacts of Changes to BLM Land Designations

The proposed BLM land use designations (e.g., National Conservation Lands, ACECs, wildlife allocations, and trail management corridors) would prohibit renewable energy development and be managed to protect the various ecological, historic, cultural, scenic, and scientific resources and values, thereby also providing general protection for geologic and soil resources. Disturbance caps on National Conservation Lands and ACECs would provide further protections. A combination of National Conservation Lands and ACECs would make up the majority of the proposed BLM land designations under Alternative 4.

Existing or expanded SRMAs would also prohibit surface-occupying renewable energy development, but could have adverse effects related to soil erosion from recreation uses, depending on the extent of allowable uses and management within specific SRMAs.

IV.4.3.6.3 Impacts of Natural Community Conservation Plan: Alternative 4

The analysis of Covered Activities under the NCCP is equivalent to the Plan-wide analysis of the interagency alternatives. Reserve design features and other conservation actions under the NCCP alternatives represent more detailed categories of the reserve design under the interagency Plan-wide alternatives. These NCCP differences in reserve design features do

not affect nonbiological resources analyzed in this document, and the analysis of reserve design and CMAs under the NCCP is therefore equivalent to the Plan-wide analysis of the interagency alternatives, as described in Section IV.4.2.

IV.4.3.6.4 Impacts of General Conservation Plan: Alternative 4

The impacts of the GCP for Alternative 4 would be similar to those defined in Section IV.4.3.2.1 for the Plan-wide analysis, but they would occur on nonfederal lands only. Solar energy development represents the greatest potential for soil impacts in DFAs on GCP lands for Alternative 4 (88,000 acres). Under Alternative 4, there would be 5,000 acres of renewable energy development on GCP land on soils with high wind erosion potential, 61,000 acres on soils with moderate-to-high wind erosion potential, and 66,000 acres on soils with moderate-to-high water erosion potential.

The primary difference between the GCP and Plan-wide impacts is that there would be fewer acres of DFAs on GCP lands in the Cadiz Valley and Chocolate Mountains, Owens River Valley, and Imperial Borrego Valley ecoregion subareas.

The same impact reduction strategies and mitigation measures described in Section IV.4.3.6.1 would also apply on nonfederal lands.

IV.4.3.6.5 Impacts Outside the Plan Area

IV.4.3.6.5.1 Impacts of Transmission Outside the Plan Area

The impacts of Outside the Plan Area transmission on geology and soils would be the same under all alternatives. These impacts are as described for the No Action Alternative in Section IV.4.3.1.5.2, Impacts of Transmission Outside the Plan Area.

IV.4.3.6.5.2 Impacts of BLM LUPA Decisions Outside the Plan Area

The proposed BLM land use designations outside the Plan Area (i.e., National Conservation Lands, ACECs, and wildlife allocations) would prohibit renewable energy development and be managed to protect the various ecological, historic, cultural, scenic, and scientific resources and values, thereby also providing general protection for geologic and soil resources. Existing or expanded SRMAs would also prohibit surface-occupying renewable energy development, but could have adverse effects related to soil erosion from recreation uses, depending on the extent of allowable uses and management within specific SRMAs.

IV.4.3.6.6 CEQA Significance Determination for Alternative 4

Impacts on and from soil resources and geologic hazards would be specific to developable areas in Alternative 4. However, as detailed in Section IV.4.3.2.6 under the Preferred Alternative, the impacts of all four geology and soil impacts would be less than significant with implementation of the seven recommended mitigation measures.

IV.4.3.6.7 Comparison of Alternative 4 With Preferred Alternative

Chapter IV.27 presents a comparison of all action alternatives and the No Action Alternative across all disciplines. This section summarizes the comparison of Alternative 4 with the Preferred Alternative.

IV.4.3.6.7.1 Alternative 4 Compared With Preferred Alternative for Plan-wide DRECP

Table IV.4-11 compares Alternative 4 with the Preferred Alternative for each of the measurable factors included in this analysis.

Table IV.4-11
Comparison of Alternative 4 With the Preferred Alternative

Comparison Factor	Alternative 4	Preferred Alternative
Miles of active fault lines within DFAs	61	71
Miles of active fault lines within 25 miles of DFA boundaries	263	248
Acres of soils with moderate-to-high potential for wind erosion	956,000	516,000
Acres of soils with moderate-to-high potential for water erosion	749,000	23,000
Acres of sand and sand transport corridors in DFAs	98,000	127,000

Note: The following general rounding rules were applied to calculated values: values greater than 1,000 were rounded to nearest 1,000; values less than 1,000 and greater than 100 were rounded to the nearest 100; values of 100 or less were rounded to the nearest 10, and therefore totals may not sum due to rounding. In cases where subtotals are provided, the subtotals and the totals are individually rounded. The totals are not a sum of the rounded subtotals; therefore the subtotals may not sum to the total within the table.

Geographic Distinctions. Many impacts related to geology and soils could occur throughout the Plan Area, and are not useful in distinguishing one alternative from another. In Alternative 4, the DFA in the eastern Riverside County region is similar to that of the Preferred Alternative. These significant dune and sand transport corridors that would be affected by development are located along Interstate-10. In this alternative, active faults are concentrated in DFAs in the Imperial Valley, the Lucerne Valley, and in DFAs east and west of Barstow.

IV.4.3.6.7.2 Alternative 4 Compared With Preferred Alternative for the BLM Land Use Plan Amendment

The impacts of renewable energy on BLM lands under LUPA for Alternative 4 would be less than under the Preferred Alternative. BLM-proposed land designations under Alternative 4 would offer similar protection to soil resources compared to the Preferred Alternative, but CMAs under Alternative 4 would have stricter limits on disturbance to desert pavements.

IV.4.3.6.7.3 Alternative 4 Compared With Preferred Alternative for NCCP

The impacts of the NCCP for Alternative 4 are the same as those defined in Section IV.4.3.2.1 for the Plan-wide analysis. As a result, the comparison of Alternative 4 with the Preferred Alternative for the NCCP is the same as described for Plan-wide DRECP.

IV.4.3.6.7.4 Alternative 4 Compared With Preferred Alternative for the GCP

Under Alternative 4, the impacts on soils subject to wind erosion would be slightly less while impacts on soils subject to water erosion would be similar when compared to the Preferred Alternative. With the exception of fewer DFAs in the Imperial Borrego Valley eco-region subarea under Alternative 4, the distribution of the impacts on GCP lands would be similar to the Preferred Alternative.