IV.21 NOISE AND VIBRATION

This chapter provides a programmatic analysis of potential noise impacts from implementing the Land Use Plan Amendment (LUPA) for the Desert Renewable Energy Conservation Plan (DRECP) alternatives. The primary consideration in addressing these impacts is to identify the extent to which noise generated within Proposed LUPA components on BLM-administered public lands, including Development Focus Areas (DFAs), would affect existing land uses and wildlife under each alternative. Existing regulations and the affected environment are described in Volume III, Chapter III.21, Noise and Vibration.

IV.21.1 Approach to Impact Analysis

Impacts were determined based on the area of potential development and the summary of common noise impacts associated with all renewable energy developments as well as potential technology-specific impacts.

The noise and vibration analyses are based on the description of the Proposed LUPA actions associated with renewable energy development that would be permitted within DFAs as well as activities on Variance Process Lands and BLM LUPA conservation designations. Transmission development and operation would occur in previously designated corridors and other identified areas, both inside and outside the DFAs. LUPA decisions will not affect management on lands outside of the BLM's jurisdiction.

This chapter analyzes the potential noise and vibration impacts typical of solar, wind, and geothermal energy development and associated transmission facilities. Direct or primary effects occur at the same time and place as the project. An indirect effect is caused by a project, but unlike direct effects, it occurs later in time or is farther removed in distance. Short-term impacts occur for a specific and limited period during and after the proposed actions (e.g., construction noise during development). Long-term impacts occur over the life of the development or for an extended period after development and construction are complete (e.g., maintenance activities).

The DRECP would result in future renewable energy development applications within each DFA, and each project would undergo subsequent individual National Environmental Policy Act (NEPA) analysis for project-specific impacts. Impacts related to renewable energy projects and associated facilities would vary depending on the technology proposed, specific location of the project site, the time and degree of disturbance resulting from development, and the size and complexity of the facilities.

This chapter assesses potential noise and vibration impacts and conflicts that may result from the development and operation of utility-scale renewable energy facilities in the DRECP area and from the designation of proposed new conservation designations. This

chapter also discusses the potential noise and vibration impacts resulting from the No Action Alternative, Preferred Alternative, and the four action alternatives.

In particular, this analysis considers the impacts of noise and vibration based on the proximity of potential noise- or vibration-sensitive receptors to proposed development areas under each alternative. In addition, because this is a programmatic analysis, the impact analysis is based on general impacts anticipated if renewable energy development occurs; therefore, the impacts are not site or technology specific. This chapter also identifies Conservation and Management Actions (CMAs) and applicable laws and regulations that would reduce identified adverse impacts.

IV.21.2 Typical Impacts Common to All Action Alternatives

The DRECP and Proposed LUPA Final Environmental Impact Statement (EIS) alternatives offer planning and programmatic options that identify areas for development and conservation, as well as a range of management actions. The alternatives considered would result in future renewable energy development applications within identified development areas, but implementation of the LUPA would not result directly in noise impacts. Project-specific impacts of renewable energy development will be assessed during the permitting process and in supplemental site-specific NEPA documents.

Impacts related to renewable energy projects vary greatly depending on the technology proposed and the location of the project. This analysis first identifies typical noise impacts common to solar, wind, and geothermal renewable energy development that occur regardless of the alternative or technology. Activities associated with solar, wind, and geothermal projects under the DRECP include site characterization, construction and decommissioning, and operation and maintenance. Potential noise impacts may occur from these LUPA components. Volume II, Chapter II.3, Preferred Alternative, identifies the activities anticipated to occur during each of these phases.

Because LUPA conservation designations would be managed to protect ecological, historic, cultural, scenic, scientific, and recreation resources and values, they would also confer general limitations and restrictions on allowable noise levels. 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.

IV.21.2.1 Impacts of Renewable Energy and Transmission Development

Many activities associated with utility-scale renewable energy and transmission development can generate noise and ground vibration. Impacts differ in some important aspects based on the particular technologies employed, however many impacts are common to all technologies and development approaches.

IV.21.2.1.1 Impacts of Site Characterization

Site characterization activities common to all renewable energy development would include geotechnical testing to establish the suitability of a site for construction, temporary vehicle disturbance on identified corridors, and site reconnaissance. Noise impacts from pre-construction activities would typically be negligible, as these activities require minimal site disturbance, are short term, and can be conducted with small crews and equipment. Drilling related to soil coring or installing monitoring wells and piezometers may require larger areas of disturbance and larger equipment. Site characterization activities may occur immediately before or during the construction phase to reduce overall impacts.

Solar and Wind. Solar and wind projects may include the installation of temporary meteorological stations prior to construction of the main components of a facility. These meteorological towers assess the generation potential and weather conditions of a project site. The number of towers depends on the size of the project terrain, although typically there would be two to four towers.

IV.21.2.1.2 Impacts of Construction and Decommissioning

Construction noise impacts would be similar for all renewable energy technologies. Construction noise typically occurs intermittently and varies depending on the nature or phase of construction (e.g., demolition and land clearing, grading and excavation, erection). Construction noise in any one particular area would be temporary and short term and include noise from site preparation, trucks hauling material, concrete pouring, power tools, and the activities described earlier. Construction equipment, including earthmovers, material handlers, and portable generators also produce noise and could reach high levels for brief periods. Helicopters may be used to install transmission tower structures (where access is difficult by ground) and to string the conductors, fiber optics, or other wires.

Although noise ranges are generally similar for all construction phases, grading activities tend to involve the most equipment. The noisiest equipment types typically range from 74 decibels (dB) to 88 dB maximum sound level (L_{max}) at 50 feet. Table IV.21-1 shows the measured noise levels of common construction equipment.

Table IV.21-1
Noise Levels for Common Construction Equipment

Equipment	Typical Maximum Sound Pressure Level at 50 feet From Source (dBA)
ATV	79
Backhoe/trencher	85
Dump Truck	88

Table IV.21-1
Noise Levels for Common Construction Equipment

Equipment	Typical Maximum Sound Pressure Level at 50 feet From Source (dBA)
Front End Loader	85
Generators/Compressors	81
Grader	85
Personal cars	74
Roller/Compactor	74
Scraper/Dozer	85
Semi	86
Water Truck	88
Crew Delivery Bus	80
Flat-bed truck	88
Vibratory Post Driver	85
Concrete Truck	88
Forklift	83
Cranes/Lifts	83

Source: Federal Transit Administration (FTA) 2006

Typical operating cycles for noise-emitting equipment may involve a few minutes of full power, followed by several minutes at lower power settings. Average noise levels from the center of construction sites typically range from approximately 65 to 83 A-weighted dB (dBA) equivalent continuous noise level (L_{eq}) at 50 feet, depending on the activities performed. Assuming a conservative acoustically hard site condition, 83 dBA L_{eq} would attenuate to 75 dBA L_{eq} at approximately 125 feet and 60 dBA L_{eq} at approximately 705 feet. These distances are provided for informational purposes, as 75 dBA L_{eq} is typically considered an acceptable construction noise level limit for noise-sensitive human receptors and 60 dBA L_{eq} is typically used as a benchmark for determining potential impacts to threatened or endangered noise-sensitive species.

Construction activities could include pile driving and blasting, which generate impulse noise sources. A single impact pile driver typically produces maximum noise levels of 95 dBA L_{max} at a distance of 50 feet (FTA 2006). Assuming a conservative hard site condition, a single unshielded pile driver could exceed 75 dBA L_{eq} within 225 feet and 60 dBA L_{eq} within 1,255 feet.

In some cases, power plant construction practices such as blasting or pile driving, may produce ground vibration. The ground-borne energy of vibration has the potential to cause structural damage and annoyance.

Construction activities common to renewable energy facilities across all Proposed LUPA components would include development of access roads and spur roads, facility buildings, storage yards, fencing, and flood and drainage control facilities. The following summarizes noise levels associated with these components.

- **Access Roads and Spur Roads:** Generally, road construction would be required to access a project site and maintain equipment during operations. Circulation roads leading to facilities and on-site roads would be constructed using heavy equipment such as bulldozers, loaders, scrapers, graders, and rollers, which typically generate noise levels of 74 to 85 dBA at 50 feet. Permanent roads within the boundary of a facility would typically be constructed of compacted gravel. The extent to which roads would be required depends on site topography, condition, and extent of current roads. Access roads typically require a shallow gradient for larger vehicles and loads. In steep or complex terrain, the road may be wider to accommodate the turning circle of larger vehicles.
- **Buildings:** Permanent operations and maintenance buildings, including control rooms, would be constructed using standard building and construction techniques. Ancillary buildings are assumed to include parking and equipment storage facilities that typically occupy a maximum of 10 acres. Construction of operations and maintenance buildings is anticipated to generate maximum noise levels of approximately 83 dBA at 50 feet during grading and foundation construction.
- **Storage Yards:** Temporary construction areas including laydown yards, on-site construction trailers, material storage, and on-site cement batch plants (if required) would require clearing and grading. These yards are assumed to occupy 40 to 50 acres within a project boundary. Typical activities in staging and storage yards include maintenance of heavy equipment and movement of equipment and materials. Typically, noise levels from staging and laydown areas would be anticipated to be approximately 75 dBA L_{eq} at the edge of the yard.
- **Fencing:** Temporary security fencing around laydown yards, on-site construction trailers, material storage, and any on-site cement batch plants would typically be required. Permanent security fencing would surround the perimeter of solar and geothermal sites and around wind operations and maintenance buildings, switchyards, and meteorological (met) towers. Turbines are not usually fenced, although roads accessing turbines may be gated. Construction of fencing involves limited equipment; therefore, hourly noise levels would be anticipated to generate approximately 65 dBA L_{eq} at 50 feet from the fence line.
- **Flood Control Structures:** Temporary drainage control may be required at laydown yards and temporary sites, including temporary roads, and would be determined on a project–by-project basis. Construction of temporary flood control

structures typically involves loaders and cranes to relocate soil or erect barriers. These activities would typically generate noise levels approximately 72 dBA L_{eq} at 50 feet from the center of active equipment.

- **Permanent Drainage:** Culverts and drainage systems, constructed to federal and state standards, would be required to divert and control runoff. Construction of drainage structures typically involves backhoes, trenchers, and concrete trucks and pumps. These activities would typically generate noise levels approximately 70 dBA L_{eq} at 50 feet from the center of active equipment.

Noise impacts from decommissioning would be similar for all renewable energy technologies. Decommissioning of solar, wind, and geothermal facilities would involve removal of all aboveground facilities, gravel work pads, and roads. Subsurface facilities (grounding rods and grids, tower and building foundations, natural gas pipelines, etc.) would be removed to a minimum depth of 3 feet from the surface and otherwise abandoned in place. Laydown areas would be established to support decommissioning. Some may be located on the laydown areas used during construction. Dismantled components would be staged at laydown areas for only as long as necessary to arrange for their removal to disposal, reclamation, or recycling facilities. Reclamation and revegetation activities would occur after the removal of facilities. Reclamation of generation facilities laydown areas, substations, access roads, and other "deconstruction" areas would commence immediately upon completing system dismantlement.

In general, noise impacts from decommissioning activities would be similar to those associated with construction activities because the activity type and level would be similar. As with construction, most decommissioning activities would occur during the day, when noise is tolerated better than at night because of the masking effect of background noise. Nighttime noise levels would drop to the background levels of a rural environment because decommissioning activities cease at night. Like construction activities, decommissioning activities would last for a short period compared with wind turbine operation, and, accordingly, the potential impacts would be temporary and intermittent.

IV.21.2.1.3 Impacts of Operations and Maintenance

The operation and maintenance of solar, wind, and geothermal renewable energy projects and associated electricity transmission lines, roads, and rights-of-way would have potential short- and long-term noise impacts. Renewable energy facilities would include parking areas, mechanical ventilation for offices, and maintenance facilities. Maintenance activities may be required at night, which would contribute to noise impacts for nearby sensitive receptors.

Solar. Typical noise sources associated with solar facilities operations and maintenance include employee vehicles accessing the site, power inverters, tracking motors on

individual panels, and maintenance activities of the panels such as cleaning and repair. Solar thermal developments also include power block equipment, such as turbines, various pumps, and heat rejection systems.

Wind. Wind energy conversion systems generate two primary types of noise: aerodynamic noise from the turbine blades passing through the air and mechanical noise from the gears and other components of the generator. Wind turbines can produce low-frequency noise below 20 hertz, the typical threshold of human hearing. Although inaudible, this very low frequency noise has raised concerns related to potential effects on human health. Along with the wind turbine noise, typical noise sources associated with wind facilities operations and maintenance include transformer and switchgear noise from substations, corona noise from transmission lines, vehicular traffic noise associated with employees, and noise from the operations and maintenance buildings. Wind turbines and substations would be the noise sources of primary concern. Generally, the noise levels associated with site operations would be lower than the noise levels associated with short-term construction activities. Because wind facility operations and maintenance requires a low number of employees, increased traffic noise associated with employees would be negligible.

Geothermal. Typical noise sources associated with geothermal facilities operations and maintenance include employee vehicles accessing the site, the turbine/generators and the cooling towers, and various secondary noise sources including pumps and equipment associated with the crystallizer and separator. Operational noise levels of the existing geothermal facility in Imperial County were recorded at 70 dBA L_{eq} at approximately 100 feet (AECOM 2008). Because geothermal energy facility operations and maintenance requires a low number of employees, increased traffic noise associated with employees would be negligible.

Transmission. Minor noise would be generated from the post-construction maintenance of the linear transmission facilities installation (i.e., electrical conductors and fiber optic cable). Occasional inspection of the facilities would occur by helicopter, and inspections and repairs would occur by truck. Noise from the fiber optic and transmission lines would consist of wind-induced (Aeolian) and electrically induced (corona discharge) elements.

IV.21.2.2 Impacts of the Ecological and Cultural Conservation and Recreation Designations

In general, the BLM LUPA conservation designations would result in fewer noise impacts, as the management of these lands would limit disturbance and development. Similarly, the avoidance, minimization, compensation, conservation, and management actions required to achieve the conservation strategy would also result in fewer impacts. The Conservation

and Management Actions (CMAs) require noise control to be consistent with federal, state, and local noise standards.

IV.21.3 Impact Analysis by Alternative

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

IV.21.3.1 No Action Alternative

The No Action Alternative assumes the state's renewable energy goals would be achieved absent the DRECP and that renewable energy, transmission development, and mitigation for such projects in the DRECP area would occur on a project-by-project basis in a pattern consistent with past and ongoing renewable energy and transmission projects.

IV.21.3.1.1 Impacts of Renewable Energy and Transmission Development

Noise impacts of future renewable energy development are estimated to be consistent with current development patterns and technology mix, which emphasize the following:

- Solar development in the Cadiz Valley and Chocolate Mountains and Imperial Borrego Valley ecoregion subareas; wind development in the ecoregion subarea of West Mojave and Eastern Slopes; and geothermal in Imperial Borrego Valley ecoregion subarea.
- Solar Programmatic Environmental Statement (Solar PEIS) Variance Lands would be available for development, as would other lands.
- Conservation would be contained in existing protected lands and existing areas managed by BLM for the conservation of resource values (such as existing Areas of Critical Environmental Concern [ACECs] or wilderness areas).

Noise impacts from solar and ground-mounted distributed generation, wind, geothermal and transmission would occur within each ecoregion subarea. The No Action Alternative has no defined Development Focus Areas (DFAs), but its available development lands amount to approximately 2,804,000 acres. The No Action Alternative is assumed to result in approximately 100,000 acres of permanent ground disturbance from development of renewable generation projects.

Impact NV-1: Plan components would generate noise that would adversely affect sensitive receptors.

Under the No Action Alternative, renewable energy and transmission development could generally occur anywhere in the DRECP area where suitable solar insolation, wind speed, or geothermal resources exist. In addition, such development could not be prohibited or otherwise be inconsistent with existing land use plan decisions, and it would be subject to applicable National Environmental Policy Act (NEPA) analysis. The No Action Alternative map in Volume II, Figure II.2-1, shows potential development areas under the No Action Alternative, and Table II.2-1 summarizes the acreage of areas available for renewable energy and transmission development under the No Action Alternative. Most of the areas available are in Imperial, eastern Riverside, and San Bernardino counties.

Under the No Action Alternative the state's renewable energy goals would be achieved absent the DRECP, and renewable energy, transmission development, and mitigation for such projects in the DRECP area would occur on a project-by-project basis in a pattern consistent with past and ongoing renewable energy and transmission projects. Due to the noise levels associated with construction and operation, noise impacts at adjacent properties or habitat would be common. Noise impacts from renewable projects can typically be reduced through compliance with local laws and regulations and the implementation of project level noise mitigation including but not limited to noise barriers, equipment selection, and site design. Specific mitigation would be identified as part of the project-level environmental review when specific renewable energy projects are proposed.

Construction and Decommissioning Impacts

An estimate of potential noise impacts under the No Action Alternative can be correlated to the estimates of temporary and long-term impacts from renewable energy projects within each ecoregion subarea. The anticipated noise impacts from technology-specific developments under the No Action Alternative are provided in the following discussions.

Solar. In addition to the construction activities discussed in Section IV.21.2.1, construction activities for solar development would include the following:

Meteorological Stations: Solar projects would include the installation of temporary meteorological stations prior to construction of the main components of a solar energy facility. These meteorological towers would assess the generation potential of a project site. The number of towers depends on the size of the project terrain, although typically there would be two to four towers. It is assumed that meteorological stations would be 265-foot-tall, self-supporting monopole structures with an assumed permanent disturbance footprint of 900 square feet (0.02 acre). Construction equipment used to

erect these towers could include cranes, drills, pile drivers, bulldozers, loaders, and concrete trucks. If pile driving is not required, construction-generated noise levels would average approximately 80 dBA L_{eq} at 50 feet from the center of equipment activity. If pile driving is required, average hourly noise levels would be approximately 88 dBA L_{eq} at 50 feet from the impact point of the hammer and pile.

Foundations: Depending on the technology, solar facilities may require relatively flat sites, which may require substantial grading. Thus, grubbing, clearing, and site grading is assumed across the entirety of an area required for solar generation facilities (solar arrays, troughs, mirror towers, etc.). Equipment used to construct foundations would include bulldozers, excavators, loaders, and concrete trucks. This type of equipment and activity would typically generate noise levels between 74 dB to 88 dB L_{max} at 50 feet or approximately 83 dBA L_{eq} at 50 feet from the center of the equipment activity. If pile drivers are used for foundations, construction generated noise levels are calculated to be approximately 88 dBA L_{eq} at 50 feet from the pile impact point.

Evaporation Ponds: Concentrated solar power projects may require the construction of cooling evaporation ponds as part of the cooling structures. Construction of the evaporation ponds would typically use bulldozers, loaders, and graders. This construction is anticipated to generate noise levels of approximately 83 dBA L_{eq} from the center of the active equipment.

Wind. In addition to the construction activities discussed in Section IV.21.2.1, construction activities for wind development would include the following:

Meteorological Stations: Temporary meteorological stations would be required for wind energy developments. As a worst case, it is assumed that meteorological stations would be 328-foot-tall, self-supporting monopole structures with an assumed long-term disturbance footprint of 900 square feet (0.02 acre). Permanent meteorological stations are anticipated to be collocated with the wind turbines. Construction equipment used to erect the temporary towers could include cranes, pile drivers, bulldozers, loaders, and concrete trucks. If pile driving is not required, construction-generated noise levels would average approximately 80 dBA L_{eq} at 50 feet from the center of equipment activity. If pile driving is required, average hourly noise levels would be approximately 88 dBA L_{eq} at 50 feet from the impact point of the hammer and pile.

Blasting: Depending on local geological conditions, explosive blasting for wind turbine foundations might be needed. Blasting would create a compressional wave in the air (air blast overpressure) and the audible portion would be noise. Blasting would generate the maximum noise levels of approximately 95 dBA L_{max} or 74 dBA L_{eq}.

Staging/Laydown Area: At each turbine site, vegetation clearance and grading would be required to prepare the ground for heavy lifting cranes and transport vehicles. Typically, an area of about 3 acres is cleared, within which the ground is compacted and stabilized to enable the use of heavy lifting cranes. Construction equipment would typically include bulldozers, loaders, graders, and ground compactors, and would generate noise levels of approximately 83 dBA L_{eq}.

Geothermal. In addition to the construction activities discussed in Section IV.21.2.1, construction activities for geothermal development would include the following:

Well Field Facilities: Well fields consist of multiple injection and production wells situated on concrete pads that hold all the equipment necessary to operate a well. Geothermal production fluid pipelines and injection fluid pipelines run throughout the well field to circulate steam and fluids between the well field and the generation site. Drilling associated with well fields would generate noise levels of approximately 85 dBA L_{eq} at 50 feet from the center of equipment. Well head and pipeline construction would involve a welder truck and cranes. These activities would generate noise levels of approximately 80 dBA L_{eq} at 50 feet.

Transmission. In addition to the construction activities discussed in Section IV.21.2.1, construction activities for transmission development would include the following.

Pole Placement: Construction activities associated with the pole and tower placement, or replacement and conductor and cable installation, would be temporary in nature and would not result in a long-term increase in noise levels. Pole placement would require the use of cranes, mounted augur drills, and depending on the size of the poles used, pile drivers. The maximum intermittent noise level expected during pole and tower replacement and conductor and cable installation—without pile driving—would be 82 dBA at approximately 50 feet. If pile driving is required, pile driving of poles would generate noise levels of approximately 88 dBA L_{eq} at 50 feet.

Operation and Maintenance Impacts

Renewable energy technologies and transmission would result in long-term impacts due to operational and maintenance activities under the No Action Alternative. In addition to the typical impacts from renewable energy developments discussed in Section IV.21.2.1, the anticipated noise impacts from technology-specific developments are provided in the following discussions.

Solar. Typical noise sources associated with solar facilities operations and maintenance include employee vehicles accessing the site, power inverters, tracking motors on individual panels, and maintenance of the panels such as cleaning and repair. Based on a review of noise assessments prepared for solar development projects in Southern

California, a typical power inverter generates 66 dBA L_{eq} at 50 feet without an enclosure. The tracking motors that tilt an array of panels typically generate 38 dBA L_{eq} at 50 feet. Maintenance, panel washing, and cleaning of the facility generate approximately 76 dBA L_{eq} at 50 feet. Because solar facilities operations and maintenance requires a low number of employees, increased traffic noise associated with employees would be negligible.

Concentrated solar power technologies (parabolic trough and power tower) generally require additional equipment, such as small-scale boilers and cooling towers, which would create additional noise sources. Other sources may include space-heating boilers and diesel-fueled emergency power generators or emergency fire-water pump engines (typically operating only a few minutes per month for preventive maintenance purposes). Noise levels from these sources would be similar to light industrial noise levels (80 to 85 dBA L_{eq} at 50 feet); however, these sources are well-documented, and the industry has developed effective methods for reducing noise levels at the source to comply with local noise standards. These sources are typically placed within structures or enclosures.

Geographic Distribution of Solar Development. No solar projects are anticipated for the Panamint Death Valley, Piute Valley and Sacramento Mountains, Mojave and Silurian Valley, or Owens River Valley ecoregion subareas; therefore, there are no expected noise impacts from solar projects in these ecoregion subareas.

Under the No Action Alternative, solar energy projects would occur within the following ecoregion subareas: Cadiz Valley and Chocolate Mountains, Imperial Borrego Valley, Kingston and Funeral Mountains, Pinto Lucerne Valley and Eastern Slopes, Providence and Bullion Mountains, and West Mojave and Eastern Slopes. Approximately 108,000 acres of long-term ground conversion associated with solar development would potentially occur within these ecoregion subareas. Any solar development would result in impacts described in Section IV.21.2., Typical Impacts Common to All Alternatives. The degree of impact would depend on the location of sensitive receptors relative to a project site, size, and acres disturbed for development.

Wind. In addition to operation noise sources common to all renewable energy sources, wind development includes large turbines that would be the noise sources of primary concern.

Turbines: Wind turbines generate two types of noise: aerodynamic and mechanical. The significance of a turbine's noise impact is a combination of both. The blades passing through the air generate aerodynamic noise, and the turbine's internal gears and components generate mechanical noise. Large-scale turbines used by utilities are insulated to prevent mechanical noise from proliferating outside the nacelle (cover housing) or tower. Smaller residential turbines are more likely to produce noticeable mechanical noise

due to inadequate insulation. The magnitude of aerodynamic noise relates to the ratio of the blade tip speed to wind speed and corresponds to the generation of power.

Recent improvements in mechanical design of large wind turbines have resulted in significantly reduced mechanical noise from both broadband and pure tones. Thus, the noise emission from modern wind turbines is dominated by broadband aerodynamic noise, and the wind turbine sound level is primarily a function of wind speed.

Depending on the turbine model and the wind speed, aerodynamic noise can generate a whooshing or pulsing effect. Most noise radiates perpendicular to the blades' rotation. However, since turbines rotate to face the wind, they may radiate noise in different directions each day. Wind turbines generate broadband noise with frequency components from 20 hertz to 3.6 kilohertz. There is also evidence that wind turbines generate a very low frequency, inaudible noise (below 20 hertz) that has raised concerns regarding health effects. The frequency components vary with pitch of the blade and wind and blade speed. The "swish-swish" sound is the high-frequency noise of blade tip turbulence; it does not contain low frequencies. Large variable-speed wind turbines often rotate at slower speeds in low winds and increase in higher winds until the limiting rotor speed is reached. This results in much quieter operation in low winds than comparable constant-speed wind turbines.

As the turbines typically operate both during the daytime and at night, the impacts of turbine noise are typically based on the change in the lowest nighttime ambient noise levels. However, wind generates noise due to interactions between wind and vegetation, which dominates and determines the existing ambient noise levels. While several factors influence the sound level generated by wind flowing over vegetation, the total magnitude of wind-generated noise depends more on the size of the windward surface of the vegetation than the foliage density (Fégeant 1999). Thus, whether a wind turbine exceeds the background sound level will depend on how much the ambient noise level varies with wind speed.

Favorable conditions for sound propagation can typically occur on a clear night when the temperature increases and a temperature inversion is created, which forces sound to refract or bend downward (i.e., the sound of the turbine will carry farther). This condition would typically occur only at lower wind speeds; that is, less than 9 feet per second, as stronger winds reduce the effect of an inversion. Modern wind turbines have a required operational minimum wind speed requirement of about 8 to 13 feet per second; thus, increased noise propagation associated with temperature inversion is anticipated to be minimal in most operations. The exception would be in sheltered valleys with relatively low ambient noise levels. However, the effects of wind speed on noise propagation would generally dominate over those of temperature gradient.

Whether the turbine noise is intrusive depends not only on its distribution of amplitude and frequency, but also on the background noise, which varies with the level of human and animal activities and meteorological conditions (primarily wind speed). While there is no uniform standard for regulating noise from wind turbines and there is no common noise level for wind turbines, setbacks of 1,800 feet or greater from local residences and habitat containing threatened or endangered noise-sensitive species may avoid the need for detailed studies. Increased setbacks from residences may be required to address concerns related to effects of low frequency and very-low frequency noise. Setbacks associated with low frequency noise would be evaluated on a project-level, site-specific basis. This distance would be refined based on make, model, and acoustic package of specific wind turbines and the applicable regulation and detailed noise propagation modeling.

Wind energy projects are anticipated in the Imperial Borrego Valley, the Pinto Lucerne Valley and Eastern Slopes, and the West Mojave and Eastern Slopes ecoregion subareas. Under the No Action Alternative, noise impacts from wind projects would occur in these three ecoregion subareas.

Geothermal. Typical noise sources associated with geothermal facilities operations and maintenance include the turbines and generators and the cooling towers and various secondary noise sources including pumps and equipment associated with the crystallizer and separator. Operational noise levels of the existing geothermal facility in Imperial County were recorded at 70 dBA L_{eq} at approximately 100 feet (AECOM 2008).

In addition to operation noise associated with the main facilities, noise is also generated during ongoing drilling operations, which would be similar to noise generated under construction and exploration, although longer durations of the noise related to the well drilling would be expected. In addition, construction of injection wells and sump pits would increase local noise in the short-term impacts.

Under the No Action Alternative, geothermal projects are anticipated in the Imperial Borrego Valley ecoregion subarea.

Transmission. Noise would be generated from the maintenance of the linear facilities (i.e., fiber optic cable). Operations noise from transmission facilities would consist of noise associated with substations: transformer noise and switchgear noise. Each has a characteristic noise spectrum and pattern of occurrence.

Transformers: Substations usually generate steady noise from the operation of transformers and the cooling fans and oil pumps needed to cool the transformer during periods of high electrical demand. With all auxiliary cooling fans operating, the worst-case noise level from the transformers at full load is predicted to be no more than 66 dBA at 3 feet away from the

equipment. Typically, transformers are located near the center of the substation footprint. Due to the typical distance to the nearest noise-sensitive receivers, transformer-generated noise would not be audible over ambient noise levels.

Switchgear: Switchgear noise is generated by the operation of circuit breakers used to break high-voltage connections. An arc formed between the separating contacts has to be "blown out" using a blast of high-pressure gas. The resultant noise is impulsive in character (i.e., loud and of very short duration).

Circuit breaker noise occurs only very occasionally and not during normal operations. Circuit breaker noise would only occur to protect the grid in an unusual event, such as a lightning strike. A circuit breaker can generate maximum instantaneous noise levels (over approximately 6 milliseconds) on the order of 90 dBA L_{max} at 65 feet, which is approximately equivalent to 50 dBA L_{eq} at 50 feet.

Impact NV-2: Plan components would generate ground-borne vibrations that adversely affect sensitive receptors.

Renewable energy technologies and transmission would generate vibrations during construction from the movement of heavy equipment, earth movement, drilling, pile driving, rock breaking, and explosives blasting.

Construction activities produce varying degrees of ground vibration, depending on the equipment and methods employed. While ground vibrations from typical construction activities rarely reach levels high enough to cause damage to structures, special consideration must be made when sensitive or historic land uses are near the construction site. Ground-borne vibration generated by construction projects is usually highest during pile driving, soil compacting, jackhammering, and demolition-related activities; with the exception of these sources, vibrations are well below the levels of concern at distances ranging beyond 65 feet. Vibrations generated by sources such as pile drivers, soil tampers, jackhammers, and explosives are typically below a level of concern at distances ranging beyond 200 feet. Vibrations from transmission line construction are generally below a level of concern at distances ranging beyond 65 feet.

Some renewable energy technologies would generate vibrations during operation. Experience at renewable energy facilities demonstrates a low probability for ground-borne induced vibration impacts to surrounding land uses associated with solar PV developments or transmission projects. However, wind, geothermal, and solar thermal include the use of high-speed rotating mechanical equipment, including turbines and generators, during operation and have the potential to be sources of ground-borne vibrations. An imbalance in a turbine would generate ground vibration in the vicinity of the equipment. Mechanical

equipment typically used is well-balanced and designed to avoid substantial vibration levels throughout the life of the project. In addition, vibration-monitoring systems are usually installed in the equipment to ensure that the equipment remains balanced. The ongoing monitoring along with the typical distances between the power blocks and the nearest sensitive receptors (typically on the order of a half-mile or more for renewable energy), as well as the characteristics of the buildings surrounding turbine generators, would control vibration such that vibrations above the threshold of detectability would not be generated beyond the project boundary. However, project-specific impacts of renewable energy development and vibration sources will be assessed during the permitting process and in supplemental site-specific CEQA/NEPA documents.

Impact NV-3: Plan components would generate noise or ground-borne vibration levels in conflict with local standards.

Renewable energy technologies and transmission would result in noise and vibration impacts from construction and operation, which would potentially conflict with local standards. Local standards usually allow limited noise from daytime construction activities, and the potential for operational and maintenance noise to create land use conflicts would only occur for particular sites unable to provide sufficient setbacks between the renewable energy project and sensitive areas. As such, sources of noise or vibration that operate at night or in the immediate vicinity of sensitive areas would be the most likely to conflict with local standards. Conflicts with local noise ordinances or vibration standards under the No Action Alternative would be an impact on these communities. Project-specific impacts of noise and vibration and potential land use conflicts will be assessed during the permitting process and in supplemental site-specific CEQA/NEPA documents.

Impact Reduction Strategies

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. Although federal and state laws identify the hazards of noise, limits on noise and vibration are largely enforced by the local jurisdictions as follows:

- Local regulations limit the duration of construction activities and the time construction activities are allowed in daytime hours. Typically, construction activities are only allowed between the hours of 7:00 a.m. and 7:00 p.m.
- Local regulations limit the noise levels from construction activities. Construction noise levels are typically limited to 75 dBA L_{eq} or less at noise-sensitive receptors.

- Local regulations include noise level limitation between properties. These limitations are usually based on the land use zone and the time of day with greatest protections provided for residential uses at night. Typical noise level limits are 45 to 60 dBA L_{eq} for noise-sensitive uses (such as residential, institutional, medical, etc.), 60 to 70 dBA L_{eq} for office and other commercial land uses, and greater than 70 dBA L_{eq} for industrial and non-noise-sensitive land uses.
- The Solar PEIS includes numerous design features (Appendix W) that would reduce the potential impacts on the acoustic environment from solar energy development on BLM lands, including measures for early-phase consultation to identify existing ambient levels and potentially sensitive receptors (Appendix W design feature N1-1) and to control or minimize noise impacts to surrounding properties and habitat during siting, design, and construction (Appendix W design feature N2-1).
- The Solar PEIS also includes design features (Appendix W, N3-1 and N4-1) to control and minimize noise impacts on surrounding properties and habitat from operation, maintenance, reclamation, and decommissioning of solar energy development on BLM lands.

Typical Mitigation Measures

Noise mitigation that has been adopted for approved renewable energy and transmission development projects is likely to be the same as mitigation that would be applied in the future under the No Action Alternative. Typical mitigation measures include setbacks and buffers, noise barriers, equipment selection, and site design to reduce noise impacts.

Typical Mitigation Measures Common to Renewable Energy and Transmission:

1. Conduct noise measurements to assess the existing background ambient sound levels both within and outside the project site and compare these with the anticipated noise levels proposed at the facility. The ambient measurement protocols of all affected land management agencies shall be considered and utilized. Nearby residences and likely sensitive human and wildlife receptor locations shall be identified.
2. Limit noisy activities (including blasting and pile driving) to the least noise-sensitive times of day (weekdays only between 7:00 a.m. and 7:00 p.m.).
3. All equipment should have sound-control devices no less effective than those provided on the original equipment. Muffle and maintain all construction equipment used.
4. If blasting or other noisy activities are required during the construction period, notify nearby residents in advance.

5. Locate all stationary construction equipment (i.e., compressors and generators) as far as practicable from nearby residences and other sensitive receptors.
6. Locate permanent sound-generating facilities (e.g., compressors, pumps) away from residences and other sensitive receptors. In areas of known conflicts, consider installing acoustic screening.
7. Where feasible, incorporate low-noise systems, such as ventilation systems, pumps, generators, compressors, and fans.
8. Whenever feasible, schedule different noisy activities (e.g., blasting and earthmoving) to occur at the same time since additional sources of noise generally do not add a significant amount of noise. That is, less-frequent noisy activities are not as annoying as frequent less-noisy activities.
9. To the extent practicable, route heavy truck traffic supporting construction activities away from residences and other sensitive receptors.

Typical Mitigation Measures for Solar Energy:

1. Schedule maintenance activities, such as panel washing, to minimize disruption to adjacent residents and habitat.
2. Locate transformer and inverter packages centrally within the project.
3. Orient inverter ventilation fans toward the center of the project site and away from project boundaries.
4. Require a minimum 300-foot setback from project boundaries for all noise generating equipment and internal roadways.
5. Install transformers with reduced flux density, which generate noise levels as much as 10 to 20 dB lower than National Electrical Manufacturers Association (NEMA) standard values, or use barrier walls, partial enclosures, or full enclosures to shield or contain transformer noise.

Typical Mitigation Measures for Wind Energy:

1. Require a minimum 1,800-foot setback between all wind turbines and occupied structures, and require site-specific acoustical studies before locating new wind turbines within 3,000 feet of an occupied structure.
2. Wind turbine blade tip speed will be limited, 10 meters per second or less, to reduce noise in high wind events.

Typical Mitigation Measures for Geothermal Energy:

1. The project will prepare a noise control program. The noise control program shall be used to reduce employee exposure to high noise levels from geothermal operations and to comply with applicable OSHA and Cal/OSHA standards.
2. The project will equip steam blow piping with a temporary silencer that quiets the noise of steam blows to no greater than 74 dBA measured at a distance of 100 feet.
3. Prior to the first steam blow, the project will notify residences within 500 feet of the facility property line of the scheduled testing. The notification may be in the form of a letter to the residence, a telephone call, a flier or other effective means. The notification will include a description of the purpose and nature of the steam blow, the proposed schedule, the expected sound levels, and the explanation that it is a one-time operation and not a part of normal plant operations.
4. Following the project first achieving a sustained output of 80% or greater of rated capacity, the project owner will conduct a noise survey to identify potential noise impacts from the facility. The survey results will be used to determine the magnitude of noise exposure at surrounding properties.
5. Drilling activities will not be allowed after 7:00 p.m. or before 7:00 a.m. on any weekday and will not be allowed on weekends or holidays.

IV.21.3.1.2 Impacts of Ecological and Cultural Conservation and Recreation Designations

The No Action Alternative would have no new conservation designations, but without approval of one of the action alternatives, there would be continued protection of existing Legislatively and Legally Protected Areas (LLPAs) on BLM lands, like wilderness areas, in which no development would be allowed. Under the No Action Alternative, renewable energy projects would continue to be evaluated and approved with project-specific mitigation requirements.

IV.21.3.1.3 Impacts of Transmission Outside the DRECP Area

To convey renewable energy from the DRECP area to load centers, additional transmission lines would be required outside the DRECP area. Under all alternatives, these lines would be in existing transmission corridors in four geographic areas: San Diego County, Los Angeles County, North Palm Springs–Riverside, and the Central Valley.

Impact NV-1: Plan components would generate noise that would adversely affect sensitive receptors.

Activities associated with transmission pole and tower placement or replacement and conductor installation would be temporary and would not result in a long-term increase in noise levels. Pole and tower placement would require graders to prepare tower sites and, if needed, access roads, mounted augur drills and concrete trucks to create tower foundations, trucks to deliver materials, and cranes to install tower sections. The maximum intermittent noise level expected during pole and tower replacement and conductor and cable installation would be 82 dBA at approximately 50 feet.

Once in operation, occasional vehicle noise would be generated from the maintenance and inspection of lines. Substations usually generate steady noise from the operation of transformers, switchgears, and circuit breakers. Fans and oil pumps needed to cool transformers during periods of high electrical demand would generate noise levels typically around 65 dBA. With all auxiliary cooling fans operating, the worst-case noise level from the transformers at full load is predicted to be no more than 66 dBA at 3 feet away from the equipment. Typically, transformers are located near the center of the substation footprint. Due to the typical distance to the nearest noise-sensitive receivers, transformer-generated noise would not be audible over ambient noise levels. Switchgear noise is generated by the operation of circuit breakers used to break high-voltage connections. An arc formed between the separating contacts has to be "blown out" using a blast of high-pressure gas. The resultant noise is impulsive in character (i.e., loud and of very short duration). Circuit breaker noise occurs only very occasionally and not during normal operations. Circuit breaker noise would only occur to protect the grid in an unusual event, such as a lightning strike.

None of these operational noise sources would be loud enough or of sufficient duration to create adverse noise effects.

Impact NV-2: Plan components would generate ground-borne vibrations that adversely affect sensitive receptors.

Transmission construction activities can produce varying degrees of ground vibration, depending on the equipment and methods employed. Ground vibrations from typical construction activities very rarely reach levels high enough to cause damage to structures. Ground-borne vibration generated by construction projects is usually highest for activities such as pile driving, soil compacting, jackhammering, and demolition-related activities, none of which are typical in transmission line construction. Vibration levels typically are well below the levels of concern at distances ranging beyond 65 feet.

Impact NV-3: Plan components would generate noise or ground-borne vibration levels in conflict with local standards.

Transmission line construction would result in noise impacts that potentially would conflict with local standards. When specific transmission lines are proposed, an analysis of noise and vibration levels for potential land use conflicts would be completed in supplemental site-specific CEQA/NEPA documents.

IV.21.3.2 Preferred Alternative

IV.21.3.2.1 Impacts of Renewable Energy and Transmission Development

The Preferred Alternative balances biological and nonbiological resource conflicts with renewable energy goals on BLM lands within the LUPA Decision Area. Thus, under the Preferred Alternative, the DFAs have moderate conflict between biological and nonbiological resources and provide moderate development flexibility. The DFAs are concentrated in few locations with some smaller DFAs throughout the DRECP area. Based on these parameters, the DFAs under the Preferred Alternative total 388,000 acres.

The Preferred Alternative results in long-term ground disturbance of approximately 81,000 acres with approximately 38,000 acres from solar projects, approximately 3,000 acres from wind projects, approximately 7,000 acres from geothermal projects, and approximately 33,000 additional acres from associated transmission within the DRECP area.

In addition to the DFAs and associated transmission described above, the Preferred Alternative would (1) designate new National Landscape Conservation System (NLCS) lands, (2) designate new ACECs, (3) designate new and expanded Special Recreation Management Areas (SRMAs), (4) define buffer corridors along National Scenic and Historic Trails, and (5) manage lands to protect wilderness characteristics.

Impact NV-1: Plan components would generate noise that would adversely affect sensitive receptors.

Construction and operation of renewable energy technologies and transmission would result in increases in both short- and long-term noise levels in the vicinity of the developments, represented by ground disturbance. The permanent ground disturbance is estimated to be 81,000 acres throughout the DRECP area. Receptors around these lands would be exposed to short-term noise impacts from construction activities and long-term noise impacts of operation. The Preferred Alternative would be subject to the same noise standards as described for the No Action Alternative in Section IV.21.3.1.1. Therefore, as with the No Action Alternative, renewable energy and transmission development under the Preferred Alternative likely would result in adverse noise impacts.

Impact NV-2: Plan components would generate ground-borne vibrations that adversely affect sensitive receptors.

Construction and operation of renewable energy technologies and transmission would cause vibration impacts under the Preferred Alternative for sensitive receptors not provided a sufficient setback or buffer distance from activities. Examples of these impacts are discussed in Impact NV-2 under the No Action Alternative in Section IV.21.3.1.1. Typical vibration levels generated during development of renewable energy projects and transmission have a low probability of being above the threshold of detectability beyond the project boundary. Therefore, renewable energy and transmission development under the Preferred Alternative likely would not result in substantial adverse effects related to vibration.

Impact NV-3: Plan components would generate noise or ground-borne vibration levels in conflict with local standards.

DRECP components from the renewable energy technologies and transmission would result in noise and vibration levels that could potentially conflict with local standards under the Preferred Alternative. Sources of noise or vibration that operate at night or in the immediate vicinity of sensitive areas would be the most likely to conflict with local standards. This is because standards usually allow limited noise from daytime construction activities, and the potential for operational and maintenance noise to create land use conflicts would only occur for particular sites unable to provide sufficient setbacks between the renewable energy project and sensitive areas. Therefore, renewable energy and transmission development under the Preferred Alternative would result in potentially adverse effects related to noise and vibration.

Impacts on Variance Process Lands

Variance Process Lands are neither conservation lands nor DFAs. They are a subset of the variance lands identified in the Solar PEIS ROD and additional lands that, based on current information, have moderate to low ecological value and ambiguous value for renewable energy. If renewable energy development occurs on Variance Process Lands, a LUPA would not be required, so the environmental review process would be somewhat simpler than if the location were left undesignated.

Variance Process Lands for each alternative are shown in Chapter IV.1, Table IV.1-2 and in Volume II, Chapter II.3, Figure II.3-1 for the Preferred Alternative. Development of the Variance Process Lands would have similar noise effects as described above under Impacts NV-1 through NV-3.

Impact Reduction Strategies

The implementation of the Proposed LUPA 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 would be lessened in several ways. First, the LUPA incorporates Conservation and Management Actions (CMAs) for each alternative, including LUPA-wide CMAs and CMAs for specific land designations, such as NLCS lands, ACECs, and wildlife allocations. In addition, the implementation of existing laws, orders, regulations, and standards would reduce the impacts of project development.

Conservation and Management Actions

The conservation strategy for the Preferred Alternative (presented in Volume II, Section II.3.4) defines specific actions that would reduce the impacts of this alternative. The conservation strategy includes specific CMAs for the Preferred Alternative that contain measures or criteria that will guide day-to-day activities occurring on public land. The following biological resource CMA would reduce noise impacts:

LUPA-BIO-12 (formerly AM-LUPA-13)**:** For activities that may impact Focus Species or BLM Special-Status Species**,** implement the following LUPA CMA for noise:

- To the maximum extent practicable, locate stationary noise sources that exceed background ambient noise levels away from known or likely locations of Focus Species and BLM Special-Status wildlife species and their suitable habitat.
- Implement engineering controls on stationary equipment, buildings, and work areas including sound-insulation and noise enclosures to reduce the average noise level, if the activity will contribute to noise levels above existing background ambient levels.
- Use noise controls on standard construction equipment including mufflers to reduce noise.

Laws and Regulations

Similar to the No Action Alternative, existing laws and regulations will reduce certain impacts of LUPA implementation. Relevant regulations are presented in the Regulatory Setting in Volume III. The requirements of relevant laws and regulations are summarized for the No Action Alternative in Section IV.21.3.1.1.

IV.21.3.2.2 Impacts of Ecological and Cultural Conservation and Recreation Designations

The conservation designations would set aside conservation lands and prohibit renewable energy development in these areas. Because no development would occur on these lands, no noise impacts from these lands would affect sensitive receptors.

IV.21.3.2.3 Impacts of Transmission Outside the DRECP Area

The noise and vibration impacts caused by development of transmission outside the DRECP area would be the same under all alternatives. These impacts are as described for the No Action Alternative in Section IV.21.3.1.3, Impacts of Transmission Outside the DRECP Area.

IV.21.3.2.4 Comparison of the Preferred Alternative With No Action Alternative

Compared with the No Action Alternative, the Preferred Alternative would concentrate renewable energy-related activities and the associated noise and vibration impacts to DFAs. Generation development would concentrated on disturbed lands in the West Mojave, Imperial Valley, eastern Riverside County, and around Barstow, with smaller areas in the Owens Valley and on the Nevada border. The DFAs would align with existing and planned transmission networks and would provide moderate development flexibility. Given that noise and vibration impacts would be localized to areas in the vicinity of construction and operation activities, the impacts within the ecoregion subareas are described below for the Preferred Alternative. Under the Preferred Alternative, no DFAs would be designated in the Piute Valley and Sacramento Mountains ecoregion subarea.

Solar

There would be approximately 38,000 acres of solar energy projects across the ecoregion subareas for the Preferred Alternative. The Cadiz Valley and Chocolate Mountains would have the largest area impacted, followed by the Imperial Borrego Valley and the West Mojave and Eastern Slopes ecoregion subareas. Solar projects are anticipated for all ecoregion subareas with the exception of the Piute Valley and Sacramento Mountains ecoregion subarea.

Therefore, the Preferred Alternative would cause noise impacts to all ecoregion subareas, with the exception of the Piute Valley and Sacramento Mountains ecoregion subarea. Noise impacts to the ecoregion subareas would occur during both construction and operation within and near the project boundaries.

Typical noise sources associated with solar facilities operations and maintenance include employee vehicle access to the site, power inverters, tracking motors on individual panels, and maintenance activities on the panels such as cleaning and repair (see Section IV.21.2, Typical Impacts Common to All Alternatives). Without specific development details, noise impacts may occur at any location within the boundaries and along travel routes. In comparison to the Preferred Alternative, the No Action Alternative would not concentrate development activities in any particular areas.

Wind

There would be approximately 3,000 acres of wind energy projects across the ecoregion subareas for the Preferred Alternative. The Cadiz Valley and Chocolate Mountains ecoregion subarea would have the largest impacted area, followed by the Pinto Lucerne Valley and Eastern Slopes ecoregion subarea and the West Mojave and Eastern Slopes ecoregion subarea. A small number of wind projects are also expected within DFAs in the Imperial Borrego Valley ecoregion subarea. Noise impacts to the West Mojave and Eastern Slopes, Cadiz Valley and Chocolate Mountains, Imperial Borrego Valley, and Pinto Lucerne Valley and Eastern Slopes ecoregion subareas would occur during construction and operation of any wind projects within the DFAs.

Typical noise sources associated with wind energy facilities operations and maintenance include employee vehicles accessing the site, turbine noise, and maintenance activities of the turbines, including repair (see Section IV.21.2, Typical Impacts Common to All Alternatives). As with the No Action Alternative, under the Preferred Alternative, wind energy facilities would need to be designed to demonstrate compliance with the applicable local noise standards. In comparison to the Preferred Alternative, the No Action Alternative would not focus activities to any particular areas.

Geothermal

There would be approximately 7,000 acres of DFAs for geothermal energy development across two ecoregion subareas for the Preferred Alternative. Under the Preferred Alternative, the Imperial Borrego Valley and the Owens River Valley ecoregion subareas would have noise impacts from construction and operational activities associated with development of geothermal projects within DFAs. There would be no noise impacts as a result of geothermal DFAs in the other ecoregion subareas.

Typical geothermal operational activities would include new sources of noise, and maintenance of geothermal fields may require ongoing drilling of new wells over the life of the project (see Section IV.21.2, Typical Impacts Common to All Alternatives). However, as with the No Action Alternative, under the Preferred Alternative, geothermal projects would

need to be designed to demonstrate compliance with the applicable local noise standards. In comparison to the Preferred Alternative, the No Action Alternative would not focus activities to any particular areas.

IV.21.3.3 Alternative 1

IV.21.3.3.1 Impacts of Renewable Energy and Transmission Development

Alternative 1 would confine renewable energy development to low-conflict disturbed lands, thereby providing the lowest conflicts between biological and nonbiological resources. Development flexibility would be limited as a result. The total acreage of DFAs in Alternative 1 is 81,000 compared to the Preferred Alternative's 388,000 acres.

Alternative 1 results in long-term impacts of 52,000 acres with approximately 14,000 acres from solar power generation, approximately 200 acres from wind, approximately 4,500 acres from geothermal, and approximately 34,000 additional acres from transmission within the DRECP area.

In addition to the disturbance acres described above, the LUPA associated with Alternative 1 would (1) designate new NLCS lands, (2) designate new ACECs, (3) designate new and expanded SRMAs, and (4) define buffer corridors along National Scenic and Historic Trails. These changes would generally limit the extent of future development, and impacts would be avoided or minimized where possible.

Impact NV-1: Plan components would generate noise that would adversely affect sensitive receptors.

Under Alternative 1, construction and operation of renewable energy technologies and transmission would result in short-term and long-term noise impacts. The area affected by the direct long-term noise impact would be 52,000 acres throughout the DRECP area.

Alternative 1 would affect the same sensitive receptor communities as described in Section IV.21.3.1.1. The areas with renewable energy development under Alternative 1 would generate short- and long-term noise impacts similar to those described for the Preferred Alternative in Section IV.21.3.2.1.

Impact NV-2: Plan components would generate ground-borne vibrations that adversely affect sensitive receptors.

All LUPA components included in renewable energy technologies and transmission would result in construction-related vibration impacts, and some technologies would result in operation vibration impacts under Alternative 1. Typical vibration levels would have a low

probability of being above the threshold of detectability and would not result in adverse effects, the same as described under the Impact NV-2 discussion for the Preferred Alternative in Section IV.21.3.2.1.

Impact NV-3: Plan components would generate noise or ground-borne vibration levels in conflict with local standards.

Plan components included in renewable energy technologies and transmission would result in noise and vibration levels that could potentially conflict with local noise and vibration standards under Alternative 1. Therefore, development would result in similar potential adverse effects as described under the Impact NV-3 discussion for the Preferred Alternative in Section IV.21.3.2.1.

Impacts on Variance Process Lands

Variance Process Lands are neither conservation lands nor DFAs. They are a subset of the variance lands identified in the Solar PEIS ROD and additional lands that, based on current information, have moderate to low ecological value and ambiguous value for renewable energy. If renewable energy development occurs on Variance Process Lands, a LUPA would not be required, so the environmental review process would be somewhat simpler than if the location were left undesignated.

Variance Process Lands for each alternative are as shown in Chapter IV.1, Table IV.1-2 and in Volume II, Chapter II.4, Figure II.4-1 for Alternative 1. Development of the Variance Process Lands would have similar air quality effects as described above under Impacts NV-1 through NV-3.

Impact Reduction Strategies

The implementation of the Proposed LUPA 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 DRECP would be lessened in two ways. First, the LUPA incorporates Conservation and Management Actions (CMAs) for each alternative, including LUPA-wide CMAs and CMAs for specific land designations, such as NLCS lands, ACECs, and wildlife allocations. Also, the implementation of existing laws, orders, regulations, and standards would reduce the impacts of project development.

Conservation and Management Actions

The conservation strategy for Alternative 1 (presented in Volume II, Section II.4.4) defines specific actions that would reduce the impacts of this alternative. The conservation strategy

includes specific CMAs that contain measures or criteria that will be applied to guide day-to-day activities occurring on public land. The same CMA for noise that would be implemented under the Preferred Alternative would also be implemented under Alternative 1.

Laws and Regulations

Similar to the No Action Alternative, existing laws and regulations will reduce certain impacts of DRECP implementation. Relevant regulations are presented in the Regulatory Setting in Volume III. The requirements of relevant laws and regulations are summarized for the No Action Alternative in Section IV.21.3.1.1.

IV.21.3.3.2 Impacts of Ecological and Cultural Conservation and Recreation Designations

The conservation designations would set aside conservation lands and prohibit renewable energy development in these areas. Because no development would occur on these lands, no noise impacts from these lands would affect sensitive receptors.

IV.21.3.3.3 Impacts of Transmission Outside the DRECP Area

The noise and vibration impacts caused by development of transmission outside the DRECP area would be the same under all alternatives. These impacts are as described for the No Action Alternative in Section IV.21.3.1.3, Impacts of Transmission Outside the DRECP Area.

IV.21.3.3.4 Comparison of Alternative 1 With Preferred Alternative

Alternative 1 results in long-term impacts of 52,000 acres with approximately 14,000 acres from solar power generation, approximately 200 acres from wind, approximately 4,500 acres from geothermal, and approximately 34,000 additional acres from transmission within the DRECP area.

In comparison to the Preferred Alternative, Alternative 1 would result in approximately 24,000 fewer acres of solar power generation, approximately 3,000 fewer acres of wind generation, and approximately 2,300 fewer acres of geothermal generation. Alternative 1 would result in approximately 29,000 fewer acres of permanent disturbance compared to the Preferred Alternative.

Compared to the Preferred Alternative, Alternative 1 would result in substantially less permanent disturbance in the Cadiz Valley and Chocolate Mountains ecoregion subarea and the West Mojave and Eastern Slopes ecoregion subarea. Noise impacts to sensitive

receptors in these ecoregion subareas would be reduced under this alternative compared to the Preferred Alternative. The Preferred Alternative and Alternative 1 both have CMAs.

Alternative 1 results in more development and greater impacts in the Owens River Valley ecoregion subarea and nearly identical total development and permanent disturbance in the Pinto Lucerne Valley and Eastern Slopes ecoregion subarea compared to the Preferred Alternative.

The types of noise and vibration levels caused by renewable energy development under Alternative 1 would result in similar impacts as described under the Preferred Alternative.

IV.21.3.4 Alternative 2

IV.21.3.4.1 Impacts of Renewable Energy and Transmission Development

Under Alternative 2, renewable energy-related activities covered by the Proposed LUPA would be concentrated in DFAs. The footprint would encompass approximately 88,000 acres for all the technologies and transmission. Alternative 2 emphasizes renewable energy development that is geographically balanced. Nevertheless, like the Preferred Alternative, there is the potential for noise impacts from renewable energy development within the DFAs, from both construction and operation of the renewable energy developments and transmission.

In addition to the DFAs and permanent disturbance acres described above, the LUPA associated with Alternative 2 includes designation of new NLCS lands and ACECs, designation of new and expanded SRMAs, and definition of buffer corridors along National Scenic and Historic Trails. These changes would generally limit the extent of future development, and impacts would be minimized or avoided where possible.

Impact NV-1: Plan components would generate noise that would adversely affect sensitive receptors.

Under Alternative 2, construction and operation of the renewable energy and transmission facilities would result in short-term and long-term noise impacts. The area affected by the direct long-term noise impact would be 88,000 acres throughout the DRECP area.

Alternative 2 covers the same area as the No Action Alternative, which would affect the same sensitive receptor communities as described in Section IV.21.3.1.1. The areas with renewable energy development under Alternative 2 would generate short- and long-term noise impacts that would be similar to those described for the Preferred Alternative in Section IV.21.3.2.1.

Impact NV-2: Plan components would generate ground-borne vibrations that adversely affect sensitive receptors.

All DRECP components included in renewable energy technologies and transmission would result in construction-related vibration impacts, and some technologies would result in operation vibration impacts under Alternative 2. Typical vibration levels would have a low probability of being above the threshold of detectability and would not result in adverse effects, the same as described under the Impact NV-2 discussion for the Preferred Alternative in Section IV.21.3.2.1.

Impact NV-3: Plan components would generate noise or ground-borne vibration levels in conflict with local standards.

Plan components included in renewable energy technologies and transmission would result in noise and vibration levels that could potentially conflict with local noise and vibration standards under Alternative 2. Therefore, development would result in similar adverse effects as described under the Impact NV-3 discussion for the Preferred Alternative in Section IV.21.3.2.1.

Impacts on Variance Process Lands

Variance Process Lands are neither conservation lands nor DFAs. They are a subset of the variance lands identified in the Solar PEIS ROD and additional lands that, based on current information, have moderate to low ecological value and ambiguous value for renewable energy. If renewable energy development occurs on Variance Process Lands, a LUPA would not be required, so the environmental review process would be somewhat simpler than if the location were left undesignated.

Variance Process Lands for each alternative are as shown in Chapter IV.1, Table IV.1-2 and in Volume II, Chapter II.4, Figure II.4-1 for Alternative 2. Development of the Variance Process Lands would have similar air quality effects as described above under Impacts NV-1 through NV-3.

Impact Reduction Strategies

The implementation of the Proposed LUPA 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 LUPA would be lessened in several ways. First, the Proposed LUPA incorporates Conservation and Management Actions (CMAs) for each alternative, including LUPA-wide CMAs and CMAs for specific land designations, such as NLCS lands, ACECs, and wildlife

allocations. In addition, the implementation of existing laws, orders, regulations, and standards would reduce the impacts of project development.

Conservation and Management Actions

The conservation strategy for Alternative 2 (presented in Volume II, Section II.5.4) defines specific actions that would reduce the impacts of this alternative. The conservation strategy includes specific CMAs that contain measures or criteria that will guide day-to-day activities occurring on public land. The same CMA for noise that would be implemented under the Preferred Alternative would also be implemented under Alternative 2.

Laws and Regulations

Similar to the No Action Alternative, existing laws and regulations will reduce certain impacts of DRECP implementation. Relevant regulations are presented in the Regulatory Setting in Volume III. The requirements of relevant laws and regulations are summarized for the No Action Alternative in Section IV.21.3.1.1.

IV.21.3.4.2 Impacts of Ecological and Cultural Conservation and Recreation Designations

The conservation designations would set aside conservation lands and prohibit renewable energy development in these areas. Because no development would occur on these lands, no noise impacts from these lands would affect sensitive receptors.

IV.21.3.4.3 Impacts of Transmission Outside the DRECP Area

The noise and vibration impacts caused by development of transmission outside the DRECP area would be the same under all alternatives because outside the DRECP area, the same transmission would be needed. These impacts are as described for the No Action Alternative in Section IV.21.3.1.3, Impacts of Transmission Outside the DRECP Area.

IV.21.3.4.4 Comparison of Alternative 2 With Preferred Alternative

Alternative 2 results in noise impacts to 88,000 acres with approximately 39,000 acres impacted from solar power generation, approximately 8,100 acres from wind projects, approximately 6,700 acres from geothermal projects, and approximately 34,000 additional acres from associated transmission within the DRECP area.

In comparison to the Preferred Alternative, Alternative 2 would result in approximately 650 more acres of solar power generation, 4,800 more acres of wind generation, and

approximately 100 fewer acres of geothermal generation. Alternative 2 would result in 5,400 more acres of impacts compared to the Preferred Alternative.

The types of noise and vibration levels caused by renewable energy development under Alternative 2 would result in similar impacts as those from the Preferred Alternative.

IV.21.3.5 Alternative 3

IV.21.3.5.1 Impacts of Renewable Energy and Transmission Development

Alternative 3 has the common goal of the other alternatives in confining renewable energy development to low-conflict disturbed lands, thereby providing the lowest conflicts between biological and nonbiological resources. The DFAs under Alternative 3 are dispersed with less development planned for the Cadiz Valley and Chocolate Mountain, Imperial Borrego Valley, and West Mojave and Eastern Slopes ecoregion subareas. Minimum development flexibility would also result. The total acreage of DFAs in Alternative 3 is 211,000 (compared to the Preferred Alternative's 388,000 acres).

Alternative 3 results in long-term impacts of 69,000 acres with approximately 29,400 acres from solar power generation, approximately 900 acres from wind, approximately 6,800 acres from geothermal, and approximately 32,000 additional acres from transmission within the DRECP area.

In addition to the DFAs and the permanent disturbance described above, the LUPA associated with Alternative 3 includes designation of new NLCS lands and ACECs, designation of new and expanded SRMAs, and definition of buffer corridors along National Scenic and Historic Trails. These changes would generally limit the extent of future development, and impacts would be minimized or avoided where possible.

Impact NV-1: Plan components would generate noise that would adversely affect sensitive receptors.

Construction of renewable energy technologies and transmission would result in short-term impacts from construction activities and long-term noise impacts from operation of DRECP components. The area affected by the direct long-term noise impact would be 69,000 acres throughout the DRECP area.

Alternative 3 covers the same area as the No Action Alternative, which would affect the same sensitive receptor communities as described in Section IV.21.3.1.1. The areas with renewable energy development under Alternative 3 would generate short- and long-term noise impacts that would be similar to those described for the Preferred Alternative in Section IV.21.3.2.1.

Impact NV-2: Plan components would generate ground-borne vibrations that adversely affect sensitive receptors.

All DRECP components included in renewable energy technologies and transmission would result in construction-related vibration impacts. Some technologies would result in operation vibration impacts under Alternative 3. Typical vibration levels would have a low probability of being above the threshold of detectability and would not result in adverse effects, the same as described under the Impact NV-2 discussion for the Preferred Alternative in Section IV.21.3.2.1.

Impact NV-3: Plan components would generate noise or ground-borne vibration levels in conflict with local standards.

DRECP components included in renewable energy technologies and transmission would result in noise and vibration levels that could potentially conflict with local noise and vibration standards under Alternative 3. Therefore, development would result in similar adverse effects as described under the Impact NV-3 discussion for the Preferred Alternative in Section IV.21.3.2.1.

Impacts on Variance Process Lands

Variance Process Lands are neither conservation lands nor DFAs. They are a subset of the variance lands identified in the Solar PEIS ROD and additional lands that, based on current information, have moderate to low ecological value and ambiguous value for renewable energy. If renewable energy development occurs on Variance Process Lands, a LUPA would not be required, so the environmental review process would be somewhat simpler than if the location were left undesignated.

Variance Process Lands for each alternative are as shown in Chapter IV.1, Table IV.1-2 and in Volume II, Chapter II.4, Figure II.4-1 for Alternative 3. Development of the Variance Process Lands would have similar air quality effects as described above under Impacts NV-1 through NV-3.

Impact Reduction Strategies

The implementation of the LUPA 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 LUPA would be lessened in several ways. First, the LUPA incorporates Conservation and Management Actions (CMAs) for each alternative, including LUPA-wide CMAs and CMAs for specific land designations, such as NLCS lands, ACECs, and wildlife allocations. Also, the

implementation of existing laws, orders, regulations, and standards would reduce the impacts of project development.

Conservation and Management Actions

The conservation strategy for Alternative 3 (presented in Volume II, Section II.6.4) defines specific actions that would reduce the impacts of this alternative. The conservation strategy includes specific CMAs that contain measures or criteria that will be applied to guide day-to-day activities occurring on public land. The same CMA for noise that would be implemented under the Preferred Alternative would also be implemented under Alternative 3.

Laws and Regulations

Similar to the No Action Alternative, existing laws and regulations will reduce certain impacts of DRECP implementation. Relevant regulations are presented in the Regulatory Setting in Volume III. The requirements of relevant laws and regulations are summarized for the No Action Alternative in Section IV.21.3.1.1.

IV.21.3.5.2 Impacts of Ecological and Cultural Conservation and Recreation Designations

The conservation designations would set aside conservation lands and prohibit renewable energy development in these areas. Because no development would occur on these lands, no noise impacts from these lands would affect sensitive receptors.

IV.21.3.5.3 Impacts of Transmission Outside the DRECP Area

The noise and vibration impacts caused by development of transmission outside the DRECP area would be the same under all alternatives. These impacts are as described for the No Action Alternative in Section IV.21.3.1.3, Impacts of Transmission Outside the DRECP Area.

IV.21.3.5.4 Comparison of Alternative 3 With Preferred Alternative

Alternative 3 results in noise impacts across 69,000 acres with approximately 29,400 acres from solar power generation, approximately 900 acres from wind, approximately 6,800 acres from geothermal, and approximately 32,000 additional acres from transmission within the DRECP area. In comparison to the Preferred Alternative, Alternative 3 would result in 9,000 fewer acres of solar power generation, 2,300 fewer acres of wind generation, and the same acres of geothermal generation. Alternative 3 would result in 11,300 fewer acres of impacts compared to the Preferred Alternative.

The types of noise and vibration levels caused by renewable energy development under Alternative 3 would result in similar impacts as those from the Preferred Alternative.

IV.21.3.6 Alternative 4

IV.21.3.6.1 Impacts of Renewable Energy and Transmission Development

Under Alternative 4, renewable energy-related activities covered by the Proposed LUPA would be confined to 258,000 acres of DFAs, in which an estimated 71,000 acres would be permanently disturbed. This represents a similar amount of long-term disturbance as under the Preferred Alternative, but a fewer number of acres where this disturbance could occur.

In addition to the DFAs and the permanent disturbance described above, the LUPA associated with Alternative 4 includes designation of new NLCS lands and ACECs, designation of new and expanded SRMAs, and definition of buffer corridors along National Scenic and Historic Trails. These changes would generally limit the extent of future development, and impacts would be avoided where possible, minimized, and/or mitigated to the extent practicable.

Impact NV-1: Plan components would generate noise that would adversely affect sensitive receptors.

Construction of renewable energy and transmission facilities would result in short-term noise impacts from construction activities and long-term noise impacts from operation of DRECP components under Alternative 4. The area affected by the direct long-term noise impact would be 71,000 acres throughout the DRECP area.

Alternative 4 covers the same area as the No Action Alternative, which would affect the same sensitive receptor communities as described in Section IV.21.3.1.1. The areas with renewable energy development under Alternative 4 would generate short- and long-term noise impacts that would be similar to those described for the Preferred Alternative in Section IV.21.3.2.1.

Impact NV-2: Plan components would generate ground-borne vibrations that adversely affect sensitive receptors.

All DRECP components included in renewable energy technologies and transmission would result in construction-related vibration impacts. Some technologies would result in operation vibration impacts under Alternative 4. Typical vibration levels would have a low probability of being above the threshold of detectability and would not result in adverse effects, the same as described under the Impact NV-2 discussion for the Preferred Alternative in Section IV.21.3.2.1.

Impact NV-3: Plan components would generate noise or ground-borne vibration levels in conflict with local standards.

DRECP components included in renewable energy technologies and transmission would result in noise and vibration levels that could potentially conflict with local noise and vibration standards under Alternative 4. Therefore, development would result in similar adverse effects as described under the Impact NV-3 discussion for the Preferred Alternative in Section IV.21.3.2.1.

Impacts on Variance Process Lands

Variance Process Lands are neither conservation lands nor DFAs. They are a subset of the variance lands identified in the Solar PEIS ROD and additional lands that, based on current information, have moderate to low ecological value and ambiguous value for renewable energy. If renewable energy development occurs on Variance Process Lands, a LUPA would not be required, so the environmental review process would be somewhat simpler than if the location were left undesignated.

Variance Process Lands for each alternative are as shown in Chapter IV.1, Table IV.1-2 and in Volume II, Chapter II.4, Figure II.4-1 for Alternative 4. Development of the Variance Process Lands would have similar air quality effects as described above under Impacts NV-1 through NV-3.

Impact Reduction Strategies

The implementation of the LUPA 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 LUPA would be lessened in several ways. First, the LUPA incorporates Conservation and Management Actions (CMAs) for each alternative, including LUPA-wide CMAs and CMAs for specific land designations, such as NLCS lands, ACECs, and wildlife allocations. Also, the implementation of existing laws, orders, regulations, and standards would reduce the impacts of project development.

Conservation and Management Actions

The conservation strategy for Alternative 4 (presented in Volume II, Section II.7.4) defines specific actions that would reduce the impacts of this alternative. The conservation strategy includes specific CMAs that contain measures or criteria that will be applied to guide day-to-day activities occurring on public land. The same CMA for noise that would be implemented under the Preferred Alternative would also be implemented under Alternative 4.

Laws and Regulations

Similar to the No Action Alternative, existing laws and regulations will reduce certain impacts of DRECP implementation. Relevant regulations are presented in the Regulatory Setting in Volume III. The requirements of relevant laws and regulations are summarized for the No Action Alternative in Section IV.21.3.1.1.

IV.21.3.6.2 Impacts of Ecological and Cultural Conservation and Recreation Designations

The conservation designations would set aside conservation lands and prohibit renewable energy development in these areas. Because no development would occur on these lands, no noise impacts from these lands would affect sensitive receptors.

IV.21.3.6.3 Impacts of Transmission Outside the DRECP Area

The noise and vibration impacts caused by development of transmission outside the DRECP area would be the same under all alternatives. These impacts are as described for the No Action Alternative in Section IV.21.3.1.3, Impacts of Transmission Outside the DRECP Area.

IV.21.3.6.4 Comparison of Alternative 4 With Preferred Alternative

Alternative 4 results in noise impacts to 71,000 acres with approximately 33,400 acres impacted by solar power generation, approximately 2,600 acres impacted by wind projects, approximately 5,400 acres impacted by geothermal projects, and an additional approximately 30,000 acres impacted by noise associated with transmission within the DRECP area.

In comparison to the Preferred Alternative, Alternative 4 would include lower levels of development of solar power generation by approximately 5,000 acres, approximately 600 fewer acres dedicated to wind generation, and approximately 1,400 fewer acres dedicated to geothermal generation.

In total, Alternative 4 would result in a decrease of approximately 10,000 acres impacted by noise compared to the Preferred Alternative.

Alternative 4 would result in more noise impacts in the Cadiz Valley and Chocolate Mountains and Owens River Valley ecoregion subareas than the Preferred Alternative because greater development is proposed in these areas. However, in all other ecoregion subareas, the amount of renewable energy development would be reduced under Alternative 4 compared to the Preferred Alternative, and the resulting noise levels would be decreased proportionally.

The types of noise and vibration levels caused by renewable energy development under Alternative 4 would result in similar impacts as described under the Preferred Alternative.

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