12.3 RED SANDS

12.3.1 Background and Summary of Impacts

12.3.1.1 General Information

The proposed Red Sands SEZ is located in Otero County in south-central New Mexico (Figure 12.3.1.1-1). The SEZ has a total area of 22,520 acres (91 km^2). In 2008, the county population was 65,373, while adjacent Dona Ana County to the west had a population of 206,486. The nearest town is Boles Acres, less than 2 mi (3 km) east of the SEZ. Alamogordo is approximately 6 mi (10 km) northeast of SEZ, with a population of more than 35,000.

The nearest major road access to the SEZ is via U.S. 70, which borders the northern edge of the Red Sands SEZ. The UP railroad runs along the eastern side of the SEZ; the closest railroad stops are at Alamogordo and Omlee directly to the east of the SEZ. The nearest public airport is Alamogordo–White Sands Regional Airport located approximately 2 mi (3 km) to the northeast of the SEZ. The nearest larger airport, El Paso International Airport, is approximately 71 mi (114 km) south–southeast of the SEZ. The Holloman Air Force Base is 2 mi (3 km) northwest of the SEZ.

Three 115-kV transmission lines pass through the SEZ. It is assumed that one or more of these existing transmission lines could potentially provide access from the SEZ to the transmission grid (see Section 12.3.1.1.2).

As of March 2010, there were no ROW applications for solar projects within the SEZ; however, there is one ROW application for a wind project that would be located within 50 mi (80 km) of the SEZ. This application is discussed in Section 12.3.22.2.1.

The proposed Red Sands SEZ is in an undeveloped rural area. The SEZ is located in the Tularosa Basin, bordered on the west by the San Andres and Organ Mountains and on the east by the Sacramento Mountains. The Jarilla Mountains lie to the south. Land within the SEZ is undeveloped scrubland characteristic of a semiarid basin.

The proposed Red Sands SEZ and other relevant information are shown in Figure 12.3.1.1-1. The criteria used to identify the SEZ as an appropriate location for solar energy development included proximity to existing transmission lines or designated corridors, proximity to existing roads, a slope of generally less than 2%, and an area of more than 2,500 acres (10 km^2). In addition, the area was identified as being relatively free of other types of conflicts, such as USFWS-designated critical habitat for threatened and endangered species, ACECs, SRMAs, and NLCS lands (see Section 2.2.2.2 for the complete list of exclusions). Although these classes of restricted lands were excluded from the proposed Red Sands SEZ, other restrictions might be appropriate. The analyses in the following sections address the affected environment and potential impacts associated with utility-scale solar energy

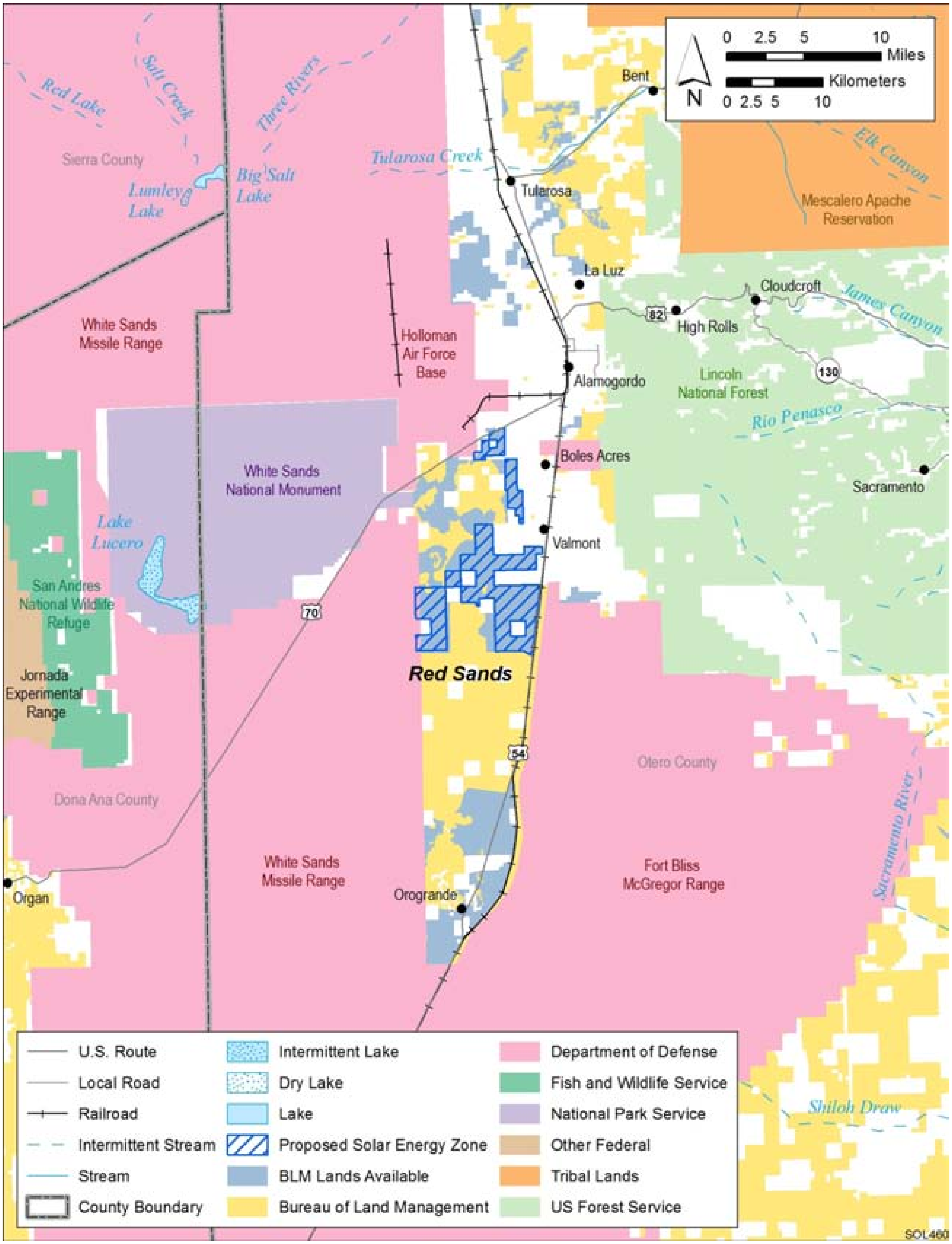

FIGURE 12.3.1.1-1 Proposed Red Sands SEZ

development in the proposed SEZ for important environmental, cultural, and socioeconomic resources.

As initially announced in the *Federal Register* on June 30, 2009, the proposed Red Sands SEZ encompassed 46,972 acres (190 km^2). Subsequent to the study area scoping period, the boundaries of the proposed Red Sands SEZ were altered substantially to avoid potentially valuable habitat for northern aplomado falcon, cultural sites, ephemeral lakes, and other resources. The revised SEZ is approximately 24,452 acres (99 km^2) smaller than the original SEZ as published in June 2009.

12.3.1.2 Development Assumptions for the Impact Analysis

Maximum solar development of the Red Sands SEZ is assumed to be 80% of the SEZ area over a period of 20 years, a maximum of 18,016 acres (73 km^2). These values are shown in Table 12.3.1.2-1, along with other development assumptions. Full development of the Red Sands SEZ would allow development of facilities with an estimated total of 2,002 MW of electrical power capacity if power tower, dish engine, or PV technologies were used, assuming 9 acres/MW (0.04 km^2/MW) of land required, and an estimated 3,603 MW of power if solar trough technologies were used, assuming 5 acres/MW (0.02 km^2/MW) of land required.

Availability of transmission facilities from SEZs to load centers will be an important consideration for future development in SEZs. The nearest existing transmission line is a115-kV line that runs through the SEZ. It is possible that an existing line could be used to provide access from the SEZ to the transmission grid, but the 115-kV capacity of that line would be inadequate for 2,002 to 3,603 MW of new capacity (note: a 500-kV line can accommodate approximately the load of one 700-MW facility). At full build-out capacity, it is clear that substantial new transmission and/or upgrades of existing transmission lines would be required to bring electricity from the proposed Red Sands SEZ to load centers; however, at this time the location and size of such new transmission facilities are unknown. Generic impacts of transmission and associated infrastructure construction and of line upgrades for various resources are discussed in Chapter 5. Project-specific analyses would need to identify the specific impacts of new transmission construction and line upgrades for any projects proposed within the SEZ.

For the purposes of analysis in the PEIS, it was assumed that an existing 115-kV transmission line that runs through the proposed SEZ could provide initial access to the transmission grid, and thus no additional acreage disturbance for transmission line access was assessed. Access to an existing transmission line was assumed, without additional information on whether this line would be available for connection of future solar facilities. If a connecting transmission line were constructed in the future to connect facilities within the SEZ to a different off-site grid location from the one assumed here, site developers would need to determine the impacts from construction and operation of that line. In addition, developers would need to determine the impacts of line upgrades if they are needed.

TABLE 12.3.1.2-1 Proposed Red Sands SEZ—Assumed Development Acreages, Solar MW Output, Access Roads, and Transmission Line ROWs

Total Acreage and Assumed Developed Acreage (80% of Total)	Assumed Maximum SEZ Output for Various Solar Technologies	Distance to Nearest State, U.S., or Interstate Highway	Distance and Capacity of Nearest Existing Transmission Line	Assumed Area of Transmission Line and Road ROWs	Distance to Nearest Designated Corridor[e]
22,520 acres and 18,016 acres[a]	2,002 MW[b] and 3,603 MW[c]	U.S. 70 0 mi[d]	0 mi and 115 kV	0 acres; 0 acres	39 mi

[a] To convert acres to km^2, multiply by 0.004047.

[b] Maximum power output if the SEZ were fully developed using power tower, dish engine, or PV technologies, assuming 9 acres/MW (0.04 km^2/MW) of land required.

[c] Maximum power output if the SEZ were fully developed using solar trough technologies, assuming 5 acres/MW (0.02 km^2/MW) of land required.

[d] To convert mi to km, multiply by 1.609.

[e] BLM-designated corridors are developed for federal land use planning purposes only and are not applicable to state-owned or privately owned land.

Existing road access to the proposed Red Sands SEZ should be adequate to support construction and operation of solar facilities, because U.S. 70 runs along the northernmost border of the SEZ. Thus, no additional road construction outside of the SEZ was assumed to be required to support solar development.

12.3.1.3 Summary of Major Impacts and SEZ-Specific Design Features

In this section, the impacts and SEZ-specific design features assessed in Sections 12.3.2 through 12.3.21 for the proposed Red Sands SEZ are summarized in tabular form. Table 12.3.1.3-1 is a comprehensive list of impacts discussed in these sections; the reader may reference the applicable sections for detailed support of the impact assessment. Section 12.3.22 discusses potential cumulative impacts from solar energy development in the proposed SEZ.

Only those design features specific to the proposed Red Sands SEZ are included in Sections 12.3.2 through 12.3.21 and in the summary table. The detailed programmatic design features for each resource area to be required under BLM's Solar Energy Program are presented in Appendix A, Section A.2.2. These programmatic design features would also be required for development in this and other SEZs.

TABLE 12.3.1.3-1 Summary of Impacts of Solar Energy Development within the Proposed Red Sands SEZ and SEZ-Specific Design Features[a]

Resource Area	Environmental Impacts—Proposed Red Sands SEZ	SEZ-Specific Design Features
Lands and Realty	Full development of the SEZ could disturb up to 18,016 acres (73 km^2). Development of the SEZ for utility-scale solar energy production would establish a large industrial area that would exclude many existing and potential uses of the land, perhaps in perpetuity. Utility-scale solar energy development would be a new and dominant land use in the area. Because of the fragmented nature of the SEZ it is likely that public access routes to lands outside the SEZ will be blocked by solar development.	None.
Specially Designated Areas and Lands with Wilderness Characteristics	Wilderness characteristics in the Culp Canyon WSA would be adversely affected. Scenic values and recreation use in the Sacramento Escarpment ACEC and the USFS Roadless Areas on the front of the Sacramento Mountains would be adversely affected. Visitors to the eastern and southeastern portions of the White Sands National Monument would have clear views of development in portions of the SEZ that would have an adverse effect on visitor experience in the monument.	Design features for visual resources should be implemented to reduce adverse impacts on White Sands National Monument, wilderness characteristics in Culp Canyon WSA, and recreation and scenic resources along the Sacramento Front.
Rangeland Resources: Livestock Grazing	Grazing permits for the Bar H W Ranch, Diamond A Ranch, Escondido Well, Lone Butte, and White Sands Ranch allotments would be reduced. A maximum of 2,495 AUMs would be lost among the five allotments.	Development of range improvements and changes in grazing management should be considered to mitigate the loss of AUMs in the five affected grazing allotments.
Rangeland Resources: Wild Horses and Burros	None.	None.

TABLE 12.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Red Sands SEZ	SEZ-Specific Design Features
Recreation	Areas developed for solar energy production would be closed to recreational use.	None.
	Recreation use in the Culp Canyon WSA, Sacramento Escarpment ACEC, White Sands National Monument, and the USFS Roadless Areas likely would be adversely affected and would not be completely mitigated.	Adoption of design features for visual resources suggested in Section 12.3.14 would reduce adverse impacts on recreation use in some specially designated areas and should be considered.
Military and Civilian Aviation	*Military airspace:* The military has expressed concern over any facilities constructed in the SEZ that could impact their current operations, including the potential for flight restrictions above any solar facilities and the height of solar facilities that could interfere with approach/departure from Holloman Air Force Base or that would intrude into low-level airspace.	The BLM should modify its land records to require consultation with DoD in any areas of the SEZ under military airspace.
	Civilian and Military aviation facilities	Because Alamogordo-White Sands Regional Airport and Holloman Air Force Base are within 3 mi (4.8 km) of the SEZ, project developers must provide necessary safety restriction information to FAA addressing required distances from flight paths, hazard lighting of facilities, impacts on radar performance, and other requirements.
Geologic Setting and Soil Resources	Impacts on soil resources would occur mainly as a result of ground-disturbing activities (e.g., grading, excavating, and drilling), especially during the construction phase. Impacts include soil compaction, soil horizon mixing, soil erosion and deposition by wind, soil erosion by water and surface runoff, sedimentation, and soil contamination. These impacts may be impacting factors for other resources (e.g., air quality, water quality, and vegetation).	Avoid disturbing gypsite crusts to the extent possible to minimize the risk of soil loss by wind erosion.
Minerals	None.	None.

TABLE 12.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Red Sands SEZ	SEZ-Specific Design Features
Water Resources	Ground-disturbing activities (affecting 27% of the total area in the peak construction year) could affect surface water quality due to surface runoff, sediment erosion, and contaminant spills.	Water resource analysis indicates that wet-cooling options would not be feasible; other technologies should incorporate water conservation measures.
	Construction activities may require up to 3,257 ac-ft (4.0 million m^3) of water during peak construction year.	Land-disturbance activities should minimize impacts on ephemeral streams located within the proposed SEZ.
	Construction activities would generate as much as 148 ac-ft (182,600 m^3) of sanitary wastewater.	Siting of solar facilities and construction activities should avoid the areas identified as within a 100-year floodplain of the unnamed ephemeral wash running north to south through the center of the proposed SEZ totaling 54 acres (0.22 km^2).
	Assuming full development of the SEZ, operations would use the following amounts of water:	
	• For parabolic trough facilities (3,603-MW capacity), 2,573 to 5,455 ac-ft/yr (3.2 million to 6.7 million m^3/yr) for dry-cooled systems; 18,066 to 54,098 ac-ft/yr (22.3 million to 66.76 million m^3/yr) for wet-cooled systems.	Groundwater management/rights should be coordinated with the NMOSE.
		Groundwater monitoring and production wells should be constructed in accordance with state standards.
	• For power tower facilities (2,002-MW capacity), 1,423 to 3,025 ac-ft/yr (1.8 million to 3.7 million m^3/yr) for dry-cooled systems; 10,031 to 30,049 ac-ft/yr (12.4 million to 37.1 million m^3/yr) for wet-cooled systems.	Stormwater management BMPs should be implemented according to the guidance provided by the New Mexico Environment Department.
	• For dish engine facilities (2,002-MW capacity), 1,023 ac-ft/yr (1.26 million m^3/yr).	Water for potable uses would have to meet or be treated to meet water quality standards as defined by the EPA.
	• For PV facilities (2,002-MW capacity), 102 ac-ft/yr (126,000 m^3/yr).	
	Assuming full development of the SEZ, operations would generate up to 50 ac-ft/yr (62,000 m^3/yr) of sanitary wastewater, and as much as 1,024 ac-ft/yr (1.2 million m^3/yr) of blowdown water.	

TABLE 12.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Red Sands SEZ	SEZ-Specific Design Features
Vegetation[b]	Approximately 80% of the SEZ (18,016 acres) would be cleared of vegetation with full development of the SEZ; dune habitats would likely be affected; re-establishment of plant communities in disturbed areas would likely be very difficult because of the arid conditions. Indirect effects outside the SEZ boundaries would have the potential to degrade affected plant communities and may reduce biodiversity by promoting the decline or elimination of species sensitive to disturbance. Noxious weeds could become established in disturbed areas and colonize adjacent undisturbed habitats, thus reducing restoration success and potentially resulting in widespread habitat degradation. Grading could result in direct impacts on the wetlands within the SEZ and could potentially alter wetland plant communities and affect wetland function. In addition, project-related reductions in groundwater elevations could alter groundwater-dependent plant communities. Grading could affect riparian and dry wash communities within the SEZ. Alteration of surface drainage patterns or hydrology could adversely affect downstream communities, such as playas west of the SEZ.	An Integrated Vegetation Management Plan addressing invasive species control and an Ecological Resources Mitigation and Monitoring Plan addressing habitat restoration should be approved and implemented to increase the potential for successful restoration of desertscrub, dune, steppe, riparian, playa, and grassland communities and other affected habitats and to minimize the potential for the spread of invasive species, such as African rue. To reduce the use of herbicides, invasive species control should focus on biological and mechanical methods where possible. All wetland, riparian, dry wash, playa, succulent, and sand dune communities within the SEZ should be avoided to the extent practicable, and any impacts minimized and mitigated. A buffer area should be maintained around wetland and riparian habitats to reduce the potential for impacts. Any yucca, agave, ocotillo, and cacti (including *Opuntia* spp., *Cylindropuntia* spp., *Echinocactus* spp., and *Sclerocactus* spp.) and other succulent plant species that cannot be avoided should be salvaged. Appropriate engineering controls should be used to minimize impacts on wetland, dry wash, and playa habitats, including downstream occurrences, resulting from surface water runoff, erosion, sedimentation, altered hydrology, accidental spills, or fugitive dust deposition to these habitats. Appropriate buffers and engineering controls would be determined through agency consultation.

TABLE 12.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Red Sands SEZ	SEZ-Specific Design Features
Vegetation[b] *(Cont.)*		Groundwater withdrawals should be limited to reduce the potential for indirect impacts on groundwater-dependent communities, such as mesquite, wetland, or riparian communities, or gypsum dune field communities, including those communities found on White Sands National Monument. Potential impacts on springs should be determined through hydrological studies.
Wildlife: Amphibians and Reptiles[b]	Direct impacts on amphibians and reptiles from SEZ development would be small (based on loss of ≤0.6% of potentially suitable habitats within the SEZ region for all other representative amphibian and reptile species). With implementation of programmatic design features, indirect impacts would be expected to be negligible for all amphibian and reptile species. Other impacts on amphibians and reptiles could result from being run over by vehicles, surface water and sediment runoff from disturbed areas, fugitive dust generated by project activities, spread of invasive species, accidental spills, collection, and harassment.	Playa, wash, and wetland habitats should be avoided.
Wildlife: Birds[b]	Direct impacts on representative bird species would be moderate for the killdeer (loss of 1.1% of its potentially suitable habitat within the SEZ region) and horned lark (loss of 2.4% of its potentially suitable habitat within the SEZ region) and small for all other representative bird species (i.e., loss of ≤0.5% of potentially suitable habitats within the SEZ region). Other impacts on birds could result from collisions with vehicles and infrastructure (e.g., buildings and fences), surface water and sediment runoff from disturbed areas, fugitive dust generated by project activities, noise, lighting, spread of invasive species, accidental spills, and harassment.	The requirements contained within the 2010 Memorandum of Understanding between the BLM and USFWS to promote the conservation of migratory birds will be followed. Take of golden eagles and other raptors should be avoided. Mitigation regarding the golden eagle should be developed in consultation with the USFWS and the NMDGF. A permit may be required under the Bald and Golden Eagle Protection Act. Wash, playa, and palustrine and wetland areas, which could provide unique habitats for some bird species, should be avoided.

TABLE 12.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Red Sands SEZ	SEZ-Specific Design Features
Wildlife: Mammals[b]	Direct impacts on representative mammal species would be small (i.e., loss of ≤0.5% of potentially suitable habitats within the SEZ region). Other impacts on mammals could result from collision with vehicles and infrastructure (e.g., fences), surface water and sediment runoff from disturbed areas, fugitive dust generated by project activities, noise, lighting, spread of invasive species, accidental spills, and harassment.	The fencing around the solar energy development should not block the free movement of mammals, particularly big game species. Wash, playa, and palustrine and riverine wetlands should be avoided.
Aquatic Biota[b]	There are no perennial streams, wetlands, or water bodies present within the SEZ, but intermittent or ephemeral surface water features are present and they could be affected by ground disturbance and sedimentation related to solar energy development. However, these features are typically dry and are not expected to contain aquatic habitat although aquatic biota may be seasonally present. Intermittent and ephemeral streams and the perennial Holloman Lake and associated wetlands are present in the area of indirect effects. Aquatic habitat and biota in Holloman Lake could be affected by soil transport via waterborne and airborne deposition. Solar energy development within the SEZ could introduce contaminants into intermittent surface water, but the lack of hydrologic connection between the SEZ and perennial surface water minimized the potential for introducing contaminants into perennial surface water.	Implement appropriate engineering controls to minimize the amount of ground disturbance, contaminants, surface water runoff and fugitive dust that reaches intermittent streams and wetlands within the SEZ. Implement appropriate engineering controls to minimize the amount of surface water runoff and fugitive dust that reaches Holloman Lake and the intermittent streams and wetlands outside of the SEZ.
Special Status Species[b]	Potentially suitable habitat for 43 special status species occurs in the affected area of the Red Sands SEZ. For most of these special status species, less than 1% of the potentially suitable habitat in the region occurs in the area of direct effects; for several special status species, between 2 and 3% of the potentially suitable habitat in the region occurs in the area of direct effects.	Pre-disturbance surveys should be conducted within the area of direct effects to determine the presence and abundance of special status species. Disturbance to occupied habitats for these species should be avoided or minimized to the extent practicable. If avoiding or minimizing impacts on occupied habitats is not possible for some species, translocation of

TABLE 12.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Red Sands SEZ	SEZ-Specific Design Features
Special Status Species[b] *(Cont.)*	One groundwater-dependent species occurs outside of the areas of direct and indirect effects. Potential impacts on this species could range from small to large, depending on the solar energy technology deployed, the scale of development within the SEZ, and the cumulative rate of groundwater withdrawals.	individuals from areas of direct effect; or compensatory mitigation of direct effects on occupied habitats could reduce impacts. A comprehensive mitigation strategy for special status species that used one or more of these options to offset the impacts of development should be developed in coordination with the appropriate federal and state agencies. Consultation with the USFWS and NMDGF should be conducted to address the potential for impacts on the following species currently listed as threatened or endangered under the ESA: Kuenzler's hedgehog cactus, Sacramento Mountains prickly-poppy, interior least tern, and northern aplomado falcon. Consultation would identify an appropriate survey protocol, avoidance and minimization measures, and, if appropriate, reasonable and prudent alternatives, reasonable and prudent measures, and terms and conditions for incidental take statements (if necessary). Avoiding or minimizing disturbance to desert grasslands, sand dune habitat and sand transport systems, and playas on the SEZ could reduce or eliminate impacts on 11 special status species. Avoidance or minimization of groundwater withdrawals from the Tularosa Basin to serve solar energy development on the SEZ could reduce or eliminate impacts on the White Sands pupfish. In particular, impacts on spring-fed habitats in the Lost River and Salt Creek could be reduced with the avoidance of groundwater withdrawals in the region.

TABLE 12.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Red Sands SEZ	SEZ-Specific Design Features
Special Status Species[b] *(Cont.)*		Harassment or disturbance of special status species and their habitats in the affected area should be mitigated. This can be accomplished by identifying any additional sensitive areas and implementing necessary protection measures based upon consultation with the USFWS and NMDGF.
Air Quality and Climate	*Construction:* Temporary exceedances of AAQS for 24-hour and annual PM_{10} and $PM_{2.5}$ concentration levels at the SEZ boundaries and in the immediate surrounding area, including the closest residence adjacent to the east–central SEZ boundary. Higher concentrations would be limited to the immediate area surrounding the SEZ boundary and would decrease quickly with distance. Modeling indicates that emissions from construction activities are not anticipated to exceed Class I PSD PM_{10} increments at the nearest federal Class I area (White Mountain WA). In addition, construction emissions (primarily NO_x emissions) from the engine exhaust from heavy equipment and vehicles has the potential to affect AQRVs (e.g., visibility and acid deposition) at the nearest federal Class I area. *Operations:* Positive impact due to avoided emission of air pollutants from combustion-related power generation: 10 to 18% of total emissions of SO_2, NO_x, Hg, and CO_2 from electric power systems in the state of New Mexico avoided (up to 5,665 tons/yr SO_2, 14,096 tons/yr NO_x, 0.21 ton/yr Hg, and 6,282,000 tons/yr CO_2).	None.
Visual Resources	The SEZ is in an area of low scenic quality, with cultural disturbances already present. Residents, workers, and visitors to the area may experience visual impacts from solar energy facilities located within the SEZ (as well as any associated access roads and transmission lines) as they travel area roads.	The development of power tower facilities within the SEZ should be prohibited.

TABLE 12.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Red Sands SEZ	SEZ-Specific Design Features
Visual Resources *(Cont.)*	Solar development could produce large visual impacts on the SEZ and surrounding lands within the SEZ viewshed due to major modification of the character of the existing landscape. The SEZ is located 4.1 mi (6.6 km) from White Sands National Monument. Because of the open views of the SEZ and its close proximity to the NM, strong visual contrasts could be observed by NM visitors. The SEZ is located 8.4 mi (13.5 km) from Culp Canyon WSA. Because of the open views of the SEZ and elevated viewpoints in the WSA, strong visual contrasts could be observed by WSA visitors. The SEZ is located 4.4 mi (7.1 km) from Sacramento Escarpment scenic ACEC. Because of the open views of the SEZ, elevated viewpoints in the ACEC, and close proximity of the SEZ to the ACEC, strong visual contrasts could be observed by ACEC visitors. Lone Butte is culturally significant to Native Americans and is visible throughout the surrounding valley. Lone Butte is within the SEZ. Because of the very close proximity of the Lone Butte to potential solar facilities within the SEZ, strong visual contrasts would be expected for viewers located at or near Lone Butte. Furthermore, the presence of solar facilities in the immediate vicinity of the Butte could impair direct views of the Butte from surrounding areas, as well as create strong visual contrasts with the Butte's natural-appearing forms, lines, colors, and textures. Approximately 62 mi (100 km) of U.S. 70 are within the SEZ viewshed. Because U.S. 70 passes through a portion of the SEZ, strong visual contrasts would be expected for some viewpoints on U.S. 70. Approximately 57 mi (92 km) of U.S. 54 are within the SEZ viewshed. Because a section of U.S. 4 is directly adjacent to the SEZ, strong-visual contrasts would be expected for some viewpoints on U.S. 54.	

TABLE 12.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Red Sands SEZ	SEZ-Specific Design Features
Visual Resources *(Cont.)*	The communities of Alamogordo, Boles Acres, La Luz, and Tularosa are located within the viewshed of the SEZ, although slight variations in topography and vegetation could provide some screening. Because of the close proximity of the SEZ to Alamogordo and Boles Acres, strong visual contrasts could be observed within Alamogordo, and Boles Acres. Weak visual contrasts could be observed within the other communities.	
Acoustic Environment	*Construction:* For construction of a solar facility located near the east–central SEZ boundary, estimated noise levels at the nearest residence (next to the east–central SEZ boundary) would be about 74 dBA, which is well above the typical daytime mean rural background level of 40 dBA. In addition, an estimated 70-dBA L_{dn} at this residence is well above the EPA guidance of 55 dBA L_{dn} for residential areas. *Operations:* For operation of a parabolic trough or power tower facility located near the east–central SEZ boundary, the predicted noise level would be about 51 dBA at the nearest residence, which is higher than the typical daytime mean rural background level of 40 dBA. If the operation were limited to daytime, 12 hours only, a noise level of about 49 dBA L_{dn} would be estimated for the nearest residence, which is below the EPA guideline of 55 dBA L_{dn} for residential areas. However, in the case of 6-hour TES, the estimated nighttime noise level at the nearest residence would be 61 dBA, which is well above the typical nighttime mean rural background level of 30 dBA. The day–night average noise level is estimated to be about 63 dBA L_{dn}, which is above the EPA guideline of 55 dBA L_{dn} for residential areas. If 80% of the SEZ were developed with dish engine facilities, the estimated noise level at the nearest residence would be about 58 dBA, which is well above the typical daytime mean rural background level of 40 dBA. On the basis of 12-hour daytime operation, the estimated 55 dBA L_{dn} at this residence would be equivalent to the EPA guideline of 55 dBA L_{dn} for residential areas.	Noise levels from cooling systems equipped with TES should be managed so that levels at the closest residences to the northern or eastern SEZ boundary are kept within applicable guidelines. This could be accomplished in several ways, for example, through placing the power block approximately 1 to 2 mi (1.6 to 3 km) or more from residences, limiting operations to a few hours after sunset, and/or installing fan silencers. Dish engine facilities within the Red Sands SEZ should be located more than 1 to 2 mi (1.6 to 3 km) from the nearby residences (i.e., the facilities should be located in the western or southern portion of the proposed SEZ). Direct noise control measures applied to individual dish engine systems could also be used to reduce noise impacts at nearby residences.

TABLE 12.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Red Sands SEZ	SEZ-Specific Design Features
Paleontological Resources	The potential for impacts on significant paleontological resources in the proposed Red Sands SEZ is low. A more detailed look at the geological deposits is needed to verify the initial classifications of these areas as PFYC Class 1 and 2.	The need for and the nature of any SEZ-specific design features would depend on the results of future paleontological investigations; however, based on the current level of information, the need for SEZ-specific mitigation is not anticipated.
Cultural Resources	Direct impacts on significant cultural resources could occur in the proposed Red Sands SEZ; however, further investigation is needed. A cultural resources survey of the entire area of potential effects of any project proposed would first need to be conducted to identify archaeological sites, historic structures and features, and traditional cultural properties, and an evaluation would need to follow to determine whether any are eligible for listing in the NRHP.	SEZ-specific design features would be determined during consultations with the New Mexico SHPO and affected Tribes and would depend on the results of future investigations. Coordination with the White Sands National Monument and local historical societies regarding impacts on nearby NRHP-listed properties is also recommended.
Native American Concerns	The proposed Red Sands SEZ falls primarily within the traditional use area of the Mescalero Apache and elements of the Pueblo of Ysleta del Sur. The SEZ supports plants and habitat of animals traditionally important to these Tribes; however, these plants and habitats are abundant in surrounding areas. The adjacent Sacramento and San Andres Mountains were home bases for some Mescalero groups. Views from these mountains may be of cultural importance. The Pueblo of Ysleta del Sur has expressed a wish to be informed if human burials or other NAGPRA objects are encountered during development of the SEZ.	The need for and nature of SEZ-specific design features would be determined during government-to-government consultation with the affected Tribes.
Socioeconomics	*Livestock grazing:* Construction and operation of solar facilities could decrease the amount of land available for livestock grazing in the SEZ, resulting in the loss of less than 1 job (total) and $0.1 million (total) in income in the ROI.	None.

TABLE 12.3.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Red Sands SEZ	SEZ-Specific Design Features
Socioeconomics *(Cont.)*	*Construction:* A total 806 to 10,667 jobs would be added; ROI income would increase by $44.3 million to $587.0 million. *Operations:* A total of 56 to 1,312 annual jobs would be added; ROI income would increase by $1.8 million to $45.1 million.	
Environmental Justice	There are minority populations, as defined by CEQ guidelines, within the 50-mi (80-km) radius around the boundary of the SEZ. Therefore, any adverse impacts of solar projects, although likely to be small, could disproportionately affect minority populations.	None.
Transportation	The primary transportation impacts are anticipated to be from commuting worker traffic. U.S. 54 and U.S. 70 provide regional traffic corridors that would experience small impacts for single projects that may have up to 1,000 workers each day, with an additional 2,000 vehicle trips per day (maximum). Such an increase ranges from less than 15% to more than 50% of the current traffic on U.S. 70 and U.S. 54. Light-to-moderate congestion impacts could occur on either highway, primarily near site access point(s). If construction of up to two large projects were to occur over the same period of time, there could be up to 4,000 additional vehicle trips per day, assuming no ride-sharing or other mitigation measures. If all site access were from U.S. 54 and U.S. 70, this would result in a about a 110% increase in traffic. Such an increase would have a moderate impact on traffic flow during peak commuter times.	Siting of power towers with respect to the air traffic associated with Alamogordo-White Sands Regional Airport and Holloman Air Force Base should be carefully considered so as not to pose a hazard to navigation or to interfere with Air Force operations.

Footnotes continue on next page.

TABLE 12.3.1.3-1 (Cont.)

Abbreviations: AAQS = ambient air quality standards; ACEC = Area of Critical Environmental Concern; AQRV = air quality-related value; AUM = animal unit month; BLM = Bureau of Land Management; BMP = best management practice; CEQ = Council on Environmental Quality; CO_2 = carbon dioxide; dBA = A-weighted decibel; DoD = Department of Defense; EPA = U.S. Environmental Protection Agency; ESA = Endangered Species Act; Hg = mercury; L_{dn} = day-night average sound level; NAGPRA = Native American Graves Protection and Repatriation Act; NHNM = National Heritage New Mexico; NM = National Monument; NMDGF = State of New Mexico Department of Game and Fish; NO_x = nitrogen oxides; NRHP = *National Register of Historic Places*; $PM_{2.5}$ = particulate matter with an aerodynamic diameter of 2.5 µm or less; PM_{10} = particulate matter with an aerodynamic diameter of 10 µm or less; PSD = prevention of significant deterioration; PV= photovoltaic; ROI = region of influence; SEZ = solar energy zone; SHPO = State Historic Preservation Office; SO_2 = sulfur dioxide; SRMA = Special Recreation Management Area; TES = thermal energy storage; USFS = U.S. Forest Service; USFWS = U.S. Fish and Wildlife Service; WA = Wilderness Area; WSA = Wilderness Study Area.

[a] The detailed programmatic design features for each resource area to be required under BLM's Solar Energy Program are presented in Appendix A, Section A.2.2. These programmatic design features would be required for development in the proposed Red Sands SEZ.

[b] The scientific names of all plants, wildlife, aquatic biota, and special status species are provided in Sections 12.3.10 through 12.3.12.

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12.3.2 Lands and Realty

12.3.2.1 Affected Environment

The proposed Red Sands SEZ is a fragmented area of 22,520 acres (91 km^2) of rural and undeveloped BLM-administered land located about 6 mi (6.4 km) southwest of Alamogordo, New Mexico. The area of the currently proposed SEZ is reduced in size from the original proposal, which included 46,972 acres (190 km^2). The SEZ is surrounded by state, private, and other BLM-administered lands that are not included within the SEZ. The area also is bordered by three different U.S. military installations on the north, east, and west. The White Sands National Monument boundary lies about 4 mi (6.4 km) west of the SEZ. U.S. Highways 70 and 54 provide access to the area on the north and east, and the interior of the SEZ is accessible via several dirt/gravel roads. The Alamogordo-White Sands Regional Airport is about 2 mi (3.2 km) east of the northern portion of the SEZ and Holloman Air Force Base is about 2 mi (3.2 km) northwest of the northern portion of the SEZ. The area along Highway 90 on the northern border of the SEZ has an industrial/commercial character, while the areas within a few miles to the northeast and east are residential. There are natural gas pipelines, water pipelines, electric transmission lines, telecommunication lines, and livestock management facilities on public lands within the SEZ.

As of February 2010, there were no ROW applications for solar energy facilities within the SEZ (see Section 12.3.22.2).

12.3.2.2 Impacts

12.3.2.2.1 Construction and Operations

Full development of the proposed Red Sands SEZ could disturb up to 18,016 acres (73 km^2) of BLM-administered lands (Table 12.3.1.2-1) and would establish a large industrial area that would exclude many existing and potential uses of the land, perhaps in perpetuity. Although there is industrial/commercial and residential development along or near the northern and eastern borders of the SEZ, the overall appearance of the SEZ is rural and undeveloped, and utility-scale solar energy development would be a new and discordant land use in the area. It is possible that the state and private lands located within and adjacent to the SEZ would be developed in the same or a complementary manner as the public lands.

The fragmented nature of the SEZ (see Figure 12.3.1.1-1) would likely complicate its future development and the management of the private, state, and public lands that surround the SEZ. The SEZ's shape would make it difficult to consolidate common facilities such as roads and utilities to support development of the area. Management of sensitive resources on the remaining public lands would also be complicated by the need to provide for access to parcels that are available for development. Industrial-type development adjacent to private lands on the eastern border of the SEZ may also create issues with the private landowners.

Roads and trails that provide public access to the area, especially from the east, would be blocked or rerouted by solar energy development. Access to the remaining public lands that are not within the SEZ likely would be impaired by solar development.

Current ROW authorizations in the SEZ would not be affected by solar energy development, since they are prior rights. The existing ROWs remove land from potential solar development within the SEZ and contribute to the fragmentation of the SEZ in some areas. Should the proposed SEZ be identified as an SEZ in the ROD for this PEIS, the BLM would still have discretion to authorize additional ROWs in the area until solar energy development was authorized, and then, future ROWs would be subject to the rights granted for solar energy development. It is not anticipated that approval of solar energy development within the SEZ would have a significant impact on the amount of public land available for future ROWs near the area.

12.3.2.2.2 Transmission Facilities and Other Off-Site Infrastructure

Three existing 115-kV transmission lines run through the SEZ; any of these lines might be available to transport the power produced in this SEZ. Establishing a connection to one of these existing lines would not involve the construction of a new transmission line outside of the SEZ. If a connecting transmission line were constructed in a different location outside of the SEZ in the future, site developers would need to determine the impacts from construction and operation of that line. In addition, developers would need to determine the impacts of line upgrades if they were needed.

Road access to the area is readily available from the U.S. highways that border the SEZ on the north and east, so there would be no additional land disturbance outside the SEZ associated with road construction to provide access to the SEZ.

Roads and power collection lines would be constructed within the SEZ as part of the development of the area.

12.3.2.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features for solar development within the proposed Red Sands SEZ would be necessary. Implementing the programmatic design features described in Appendix A, Section A.2.2, as required under BLM's Solar Energy Program would provide adequate mitigation for lands and realty activities.

12.3.3 Specially Designated Areas and Lands with Wilderness Characteristics

12.3.3.1 Affected Environment

There are seven specially designated areas within 25 mi (40 km) of the proposed Red Sands SEZ that potentially could be affected by solar energy development within the SEZ, principally from impact on scenic, recreational, and/or wilderness resources. Additionally, it is not anticipated that these areas would experience increased visitation impacts associated with SEZ development. The ACEC included below has scenic values as one of the components supporting the designation (BLM 1996). The Black Grama ACEC located southeast of the SEZ is not being analyzed, because it was designated to protect natural vegetation communities. The areas include the following (see Figure 12.3.3.1-1):

- Wilderness Study Area
  - Culp Canyon

- Area of Critical Environmental Concern
  - Sacramento Escarpment

- National Monument
  - White Sands

- National Wildlife Refuge
  - San Andres

- National Historic Landmark
  - Launch Complex 33

- Scenic Byway
  - Sunspot

- USFS Roadless Areas
  - Sacramento Mountains

While not a “specially designated area,” because of its proximity and elevation relative to the SEZ, portions of Alamogordo and surrounding areas would have clear views of solar energy development in portions of the SEZ.

There are no lands near the SEZ and outside of designated WSAs that have been identified by BLM to be managed to protect wilderness characteristics.

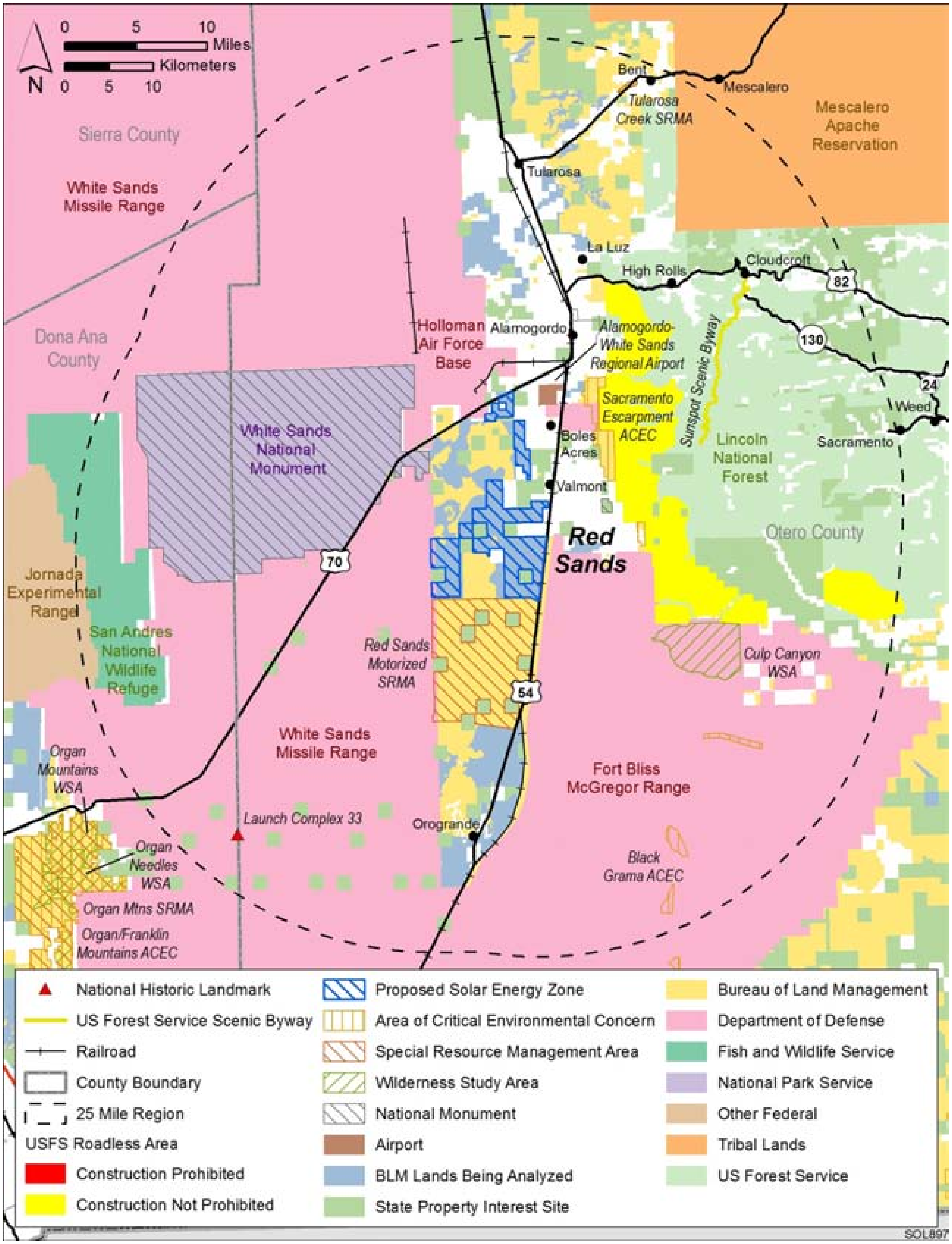

FIGURE 12.3.3.1-1 Specially Designated Areas in the Vicinity of the Proposed Red Sands SEZ

12.3.3.2 Impacts

12.3.3.2.1 Construction and Operations

The primary potential impact on the specially designated areas near the SEZ would be from visual impacts of solar energy development that could affect scenic and/or recreation resources, or wilderness characteristics of the areas. The visual impact could be associated with direct views of the solar facilities, including transmission facilities, glint and glare from reflective surfaces, steam plumes, hazard lighting of tall structures, and night lighting of the facilities. For WSAs, visual impacts from solar development would be most likely to cause the loss of outstanding opportunities for solitude and primitive and unconfined recreation. While the visibility of solar facilities from specially designated areas is relatively easy to determine, the impact of this visibility is difficult to quantify and would vary by solar technology employed, the specific area being affected, and the perception of individuals viewing solar facilities while recreating in areas within sight of the SEZ. Development of the SEZ, especially full development, would be an important visual component in the viewshed from portions of some of these specially designated areas, as summarized in Table 12.3.3.2-1. The data provided in the table, which shows the area with visibility of development within the SEZ, assumes the use of power tower solar energy technology, 198.1 m (650 ft) tall, which, because of the potential height of these facilities, could be visible from the largest amount of land of the technologies being considered in the PEIS. Viewshed analysis for this SEZ has shown that the visibility of shorter solar energy facilities would be less in some areas than power tower technology. Section 12.3.14 provides detail on all viewshed analyses discussed in this section. Potential impacts discussed below are general, and assessment of the visual impact of solar energy projects must be conducted on a site-specific and technology-specific basis to accurately identify impacts.

In general, the closer a viewer is to solar development, the greater the effect on an individual's perception of impact. From a visual analysis perspective, the most sensitive viewing distances generally are from 0 to 5 mi (0 to 8 km), but could be further depending on other factors, including the viewing height above or below a solar energy development area; the size of the solar development area; and the purpose for which people visit an area. Individuals seeking a wilderness or scenic experience within these specially designated areas could be expected to be more adversely affected than those simply traveling along the highway with another destination in mind. In the case of the Red Sands SEZ, the flat terrain and the low-lying location of the SEZ in relation to portions of some of the surrounding specially designated areas would highlight the industrial-like development in the SEZ.

The occurrence of glint and glare at solar facilities could potentially cause large though temporary increases in brightness and visibility of the facilities. The visual contrast levels projected for sensitive visual resource areas that were used to assess potential impacts on specially designated areas do not account for potential glint and glare effects; however, these effects would be incorporated into a future site-and project-specific assessment that would be conducted for specific proposed utility-scale solar energy projects.

TABLE 12.3.3.2-1 Potentially Affected Sensitive Visual Resources within a 25-mi (40-km) Viewshed of the Proposed Red Sands SEZ, Assuming a Target Height of 650 ft (198.1 m)

		Feature Area or Linear Distance		
			Visible between	
Feature Type	Feature Name (Total Acreage/Linear Distance)[a]	Visible within 5 mi	5 and 15 mi	15 and 25 mi
WSA	Culp Canyon (11,276 acres[a])	0 acres	6,385 acres (57%)[b]	0 acres
ACEC	Sacramento Escarpment (4,867 acres)	1,391 acres (29%)	3,406 acres (70%)	0 acres
National Monument	White Sands National Monument (152,363 acres)	1,835 acres (1%)	86,343 acres (57%)	58,927 acres (39%)
National Wildlife Refuge	San Andres National Wildlife Refuge (60,141 acres)	0 acres	0 acres	24,687 acres (41%)
National Historic Landmark	Launch complex 33	0 acres	0 acres	Yes
Scenic Byway	Sunspot	0 mi	0.2 mi	0 acres
USFS Roadless Areas	Sacramento Mountains	0 acres	0 acres[c]	0 acres

a To convert acres to km^2, multiply by 0.004047. To convert mi to km, multiply by 1.609.

b Values in parentheses are percentage of feature acreage or length visible.

c This is a visual estimate and is not based on viewshed analysis.

Wilderness Study Area

Culp Canyon. Culp Canyon is an 11,276-acre (45.6-km^2) WSA located 8.4 mi (13.5 km) southeast of the SEZ. The visible area of the WSA extends to 14.5 mi (23.3 km) from the southeastern boundary of the SEZ. The viewshed of the SEZ within the WSA includes about 6,385 acres (25.8 km^2) or about 57% of the total acreage of the WSA. Because of the distance to the SEZ, the angle of view of solar reflector fields would be very low, resulting in reduced visual contrast with the surrounding and background areas. Under certain lighting conditions, glint and glare from the reflectors would be visible, and the SEZ would occupy most of the horizontal field of view. Taller facilities (such as power towers or transmission lines) would be visible, especially in the nearer portions of the SEZ, and at night, could have hazard warning lights that would contribute to their impact. Depending on where facilities would be constructed within the SEZ, the type of facilities, and the location of individuals viewing the solar development from within the WSA, the visual contrast caused by the facilities could be strong and would adversely affect wilderness characteristics.

Area of Critical Environmental Concern

Sacramento Escarpment. The 4,867-acre (19.7-km^2) ACEC, located on the steep slopes east of the SEZ, was established because of its dramatic appearance as viewed from outside of the ACEC. Visitors within the ACEC would have a dominating view of the whole SEZ from many locations. At its closest point, the Sacramento Escarpment is 4.4 mi (7.1 km) from the boundary of the SEZ, and the viewshed within the ACEC extends to 7.0 mi (11.3 km) from the SEZ, encompassing 4,797 acres (19.4 km^2), or 99% of the ACEC. The proximity of the ACEC to the SEZ and the elevated views of solar development within the area would result in strong visual contrast with the surrounding area that would likely reduce the scenic values within the ACEC. While it is difficult to correlate these visual impacts with impacts on other resource uses, it is anticipated that this could result in reduced recreation use of the area. The presence of existing residential and commercial development at the base of the ACEC may tend to moderate the impact of solar development.

National Monument

White Sands. The monument is very large, containing 152,363 acres (616.6 km^2), and the closest boundary of the monument is 4.1 mi (6.6 km) west of the SEZ. Visitation to the monument averages just under 600,000 visitors per year (Welsh 1995). About 97% of the monument is within the viewshed of the SEZ and the area of the national monument with visibility of the SEZ extends to 24.0 mi (38.6 km) from the western boundary of the SEZ. The potential for impact on the monument is dependent upon the distance from which solar facilities would be viewed. Generally, the southeastern and eastern portions of the monument would have the clearest views of solar development within the SEZ. Since the monument is so flat and is located at an elevation at or slightly below the SEZ, viewing angles of solar facilities would be low, resulting in a reduction in visual contrast of solar reflector arrays. Visual contrast levels, as viewed from the monument from closer locations, would be highly dependent on the presence or absence of power towers, and to a lesser extent, other tall solar facility components in the nearer portions of the SEZ. Absent these taller facility components, contrast levels would be expected to be weak, but if multiple power towers were present, moderate-to-strong contrast levels would be perceived as far into the monument as the area around the Monument Nature Center, which is about 10.8 mi (17.4 km) from the nearest boundary of the SEZ. Visibility of solar facilities from that point west would be expected to deteriorate rapidly.

The NPS has commented that lighting of solar facilities in the SEZ has the potential to adversely affect the quality of night sky viewing from the monument. NPS has also indicated a concern over potential adverse impacts of any groundwater withdrawals within the SEZ on resources within the monument.

Visitors to the visitor center and the most heavily used eastern portion of the monument would have extensive views of solar development in the SEZ, especially if power tower facilities are present, and this would industrialize a presently undeveloped setting, likely creating an adverse effect that detracts from the overall monument visitor's experience.

National Wildlife Refuge

San Andres. The 60,141-acre (243.4-km^2) refuge is totally surrounded by the White Sands Missile Range and is open to the public on only a limited, guided-tour basis. The refuge is located 19.4 mi (31.2 km) west of the SEZ, and the portions of the refuge with visibility of the SEZ extend to about 23.9 mi (38.5 km) from the SEZ. The refuge is located along the crest of the San Andres Mountains and only the east-facing slopes would have views of development within the SEZ. About 41% of the refuge is within the viewshed of the SEZ. Although there would be long-distance views of solar facilities, it is anticipated that the very weak levels of contrast caused by solar facilities would have no impact on the refuge.

National Historic Landmark

Launch Complex 33. This NHL is located within the White Sands Missile Range. The area was established in 1945 to 1946 and was the site of the first rocket launches in the United States. The missile range is closed to general public entry, but guided tours can be arranged. The complex is located about 21.5 mi (34.6 km) from the southwestern boundary of the SEZ. The topography between the SEZ and the launch complex is very flat and only the tops of power towers possibly would be visible from this location. Because of the distance and extremely low viewing angle, there would be no impacts on the NHL from construction within the SEZ.

National Scenic Byway

Sunspot. This congressionally designated scenic byway that extends 14 mi (22.5 km) through the Lincoln National Forest. The route runs along the rim of the Sacramento Mountains and provides panoramic views of the Tularosa Basin and White Sands National Monument. Although the scenic byway passes within 11.5 mi (18.5 km) east of the SEZ, only about 0.2 mi (0.3 km) of the byway is within the viewshed of the SEZ. Based on viewshed analysis, if visible at all, only the tops of power towers within the SEZ might be visible from the byway. The distance to the SEZ and the brief time that facilities might be visible from the byway indicate that there would be no adverse impact on the use of the byway caused by solar facility development within the SEZ.

U.S. Forest Service Roadless Areas

Sacramento Mountain Front. There are about 58,507 acres (237 km^2) of USFS-administered roadless areas located along the front of the Sacramento Mountains that provide extremely scenic backdrops and are important recreation resources. The SEZ is directly west and below these areas, and about 50% of the area has visibility of the SEZ. Most of the areas with visibility of the SEZ are located between 5 and 10 mi (8 to16 km) from the western boundary of the SEZ. The proximity of the roadless area to the SEZ, and the elevated views of solar development that would be possible from within the area, would result in solar facilities creating strong visual contrast with the surrounding area that would reduce the scenic qualities for users of the roadless areas. While it is difficult to correlate these visual impacts with impacts on other resource uses, it is anticipated that this could result in reduced recreation use of the area. The presence of existing residential and commercial development at the base of the mountain front may moderate the adverse visual impact of solar development.

12.3.3.2.2 Transmission Facilities and Other Off-Site Infrastructure

Since there are three existing 115-kV transmission lines within the SEZ, no additional construction of transmission facilities was assessed. Should additional transmission lines be required outside of the SEZ, there may be additional impacts on specially designated areas. See Section 12.3.1.2 for the development assumptions underlying this analysis.

Road access to the area is readily available from the U.S. highways that border the SEZ on the north and east, so there would be no additional land disturbance outside the SEZ associated with road construction to provide access to the SEZ.

Roads and power collection lines would be constructed within the SEZ as part of the development of the area.

12.3.3.3 SEZ-Specific Design Features and Design Feature Effectiveness

Implementing the programmatic design features described in Appendix A, Section A.2.2, as required under BLM's Solar Energy Program would provide adequate mitigation for some identified impacts.

There is one proposed design feature specific to the Red Sands SEZ:

- Design features for visual resources should be implemented to reduce adverse impacts on White Sands National Monument, wilderness characteristics in Culp Canyon WSA, and recreation and scenic resources along the Sacramento Front.

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12.3.4 Rangeland Resources

Rangeland resources include livestock grazing and wild horses and burros, both of which are managed by the BLM. These resources and possible impacts on them from solar development within the proposed Red Sands SEZ are discussed in Sections 12.3.4.1 and 12.3.4.2.

12.3.4.1 Livestock Grazing

12.3.4.1.1 Affected Environment

There are five grazing allotments that are overlain by the SEZ, and all five have water pipelines, fences, and water development installed. See Table 12.3.4.1-1 for a summary of key allotment information.

TABLE 12.3.4.1-1 Grazing Allotments within the Proposed Red Sands SEZ

Allotment	Total Acres[a]	% of Acres in SEZ[b]	Active BLM AUMs[c]	No. of Permittees
Bar HW Ranch	11,873	16	876	1
Diamond A Ranch (Mogee Tank)	9,320	15	612	1
Escondido Well	29,641	13	2,364	1
Lone Butte	22,714	51	2,608	1
White Sands Ranch	19,158	19	1,782	1

[a] Includes public, state, and private land included in the allotment based on the Allotment Master Reports included in the BLM's Rangeland Administration System (BLM 2009c), dated March 16, 2010.

[b] This is the calculated percentage of public lands located in the SEZ of the total allotment acreage.

[c] This is the permitted use for the whole allotment including public, state, and private lands.

12.3.4.1.2 Impacts

Construction and Operations

Should utility-scale solar development occur in the SEZ, grazing would be excluded from the areas developed, as provided for in the BLM grazing regulations (43 CFR Part 4100). This would include reimbursement of the permittee for the portion of the value for any range improvements in the area removed from the grazing allotment. The impact of this change in the grazing permits would depend on several factors, including (1) how much of an allotment the permittee might lose to development, (2) how important the specific land lost is to the permittee's overall operation, and (3) the amount of actual forage production that would be lost by the permittee. The specific location of solar facilities within the allotments is likely to disrupt existing livestock improvements such as water pipelines, water development, and fences that support livestock management activities. The actual impact on these facilities cannot be determined until a specific solar project has been proposed. Impact on these management facilities is one of the items that would be considered when analyzing the three factors mentioned above.

The Lone Butte Allotment would experience the largest decrease in acreage, should full-scale solar development occur in the SEZ. In addition to land in the allotment within the SEZ (51%), there are approximately an additional 2,560 acres (10.4 km^2), including two state, one private, and parts of two public land sections that would be isolated by solar development and would likely not be available for continued grazing use. If this is true, the total percentage of the allotment that would be lost would be about 62%, not accounting for any disruption to existing management facilities. There remains a consolidated block of land in the southwestern corner of the allotment of approximately 6,720 acres (27.2 km^2) that includes public, state, and private lands that would likely still be physically usable for grazing; but whether it would be economically feasible for the Lone Butte permittee to operate, and whether there would be enough water facilities to support livestock use would need to be determined. It might be more feasible to attach this remaining block of land to the Escondido Well allotment that adjoins it to the south, which is also losing land in the SEZ.

Determining the actual impact on the Lone Butte allotment permittee would require a specific analysis that considered, at a minimum, the three points identified in the first paragraph of this section, but for the purpose of this PEIS, a simplified assumption is being made that the percentage reduction in authorized AUMs would be the same as the percentage reduction in land area of the allotment. Using this assumption, a total of 1,617 AUMs would be lost in the Lone Butte allotment. This would be a major impact on this permittee and it is not clear that the remainder of the land in the southwestern corner of the allotment could be used economically by the Lone Butte permittee, so there could be additional losses over those assumed here.

Potential impacts on the White Sands Ranch and Escondido Well allotments are less extensive than those described for Lone Butte. The primary reasons for this are that (1) less acreage in these allotments is being affected, and (2) discrete and peripheral blocks of land are being affected, while the main core of the allotments would be undisturbed. Using the simplified procedure described above to identify the number of AUMs that could be lost from each allotment, the following losses would occur: White Sands Ranch allotment (339 AUMs) and Escondido Well allotment (307 AUMs). The level of impact on both of these allotments is expected to be small, but the actual impact on each of the permittees would be determined by their specific economic situations. These impacts may also be mitigated to a lower level if a combination of changes to allotment livestock management systems and construction of additional range improvements could be implemented.

Potential impacts on the Bar HW Ranch and Diamond A Ranch (Mogee Tank) allotments may be more difficult to determine, because the lands included in the SEZ are located more in the middle of these allotments and complications associated with livestock movement and distribution may occur. There may also be issues associated with disruption of pipelines and water sources. Definition of these impacts would require a specific analysis that would consider the unique situation of each allotment and how it would be affected by a specific solar energy development proposal. Again, applying the simplified procedure described above to identify the number of AUMs that could be lost from each allotment, the following losses would occur: Bar HW Ranch allotment, 140 AUMs, and the Diamond A Ranch allotment, 92 AUMs. The level of impact on both of these allotments is expected to be small, but the actual impact on each of the permittees would be determined by their specific economic situation. These impacts may also be mitigated to a lower level if a combination of changes to allotment livestock management systems and construction of additional range improvements could be implemented.

Assuming the loss of a total of 2,495 AUMs as described above, there would be a minimal impact on livestock use within the Las Cruces District from the development of the proposed Red Sands SEZ. This conclusion is derived from comparing the loss of the 2,495 AUMs with the total BLM-authorized AUMs in the District for grazing year 2009, which totaled 413,702 AUMs (BLM 2009c). This represents a loss of about 0.6%. The actual level of impact on the allotments/permittees would be affected by any mitigation of the anticipated losses that could be accomplished on the remaining public lands in the allotments.

Transmission Facilities and Other Off-Site Infrastructure

Since there are three existing 115-kV transmission lines within the SEZ, and assuming that additional project-specific analysis would be done for construction of transmission lines, no assessment of the impacts of such activities outside of the SEZ was conducted (see Section 12.3.1.2).

Road access to the area is readily available from the U.S. highways that border the SEZ on the north and east, so it is assumed there would be no additional impact on livestock grazing outside the SEZ associated with road construction to provide access to the SEZ.

Roads and power collection lines would be constructed within the SEZ as part of the development of the area.

12.3.4.1.3 SEZ-Specific Design Features and Design Feature Effectiveness

Implementing the programmatic design features described in Appendix A, Section A.2.2, as required under BLM's Solar Energy Program would provide adequate mitigation for some identified impacts.

Proposed design features specific to the Red Sands SEZ include:

- Development of range improvements and changes in grazing management should be considered to mitigate the loss of AUMs in the five affected grazing allotments.

- If the remaining block of the Lone Butte allotment cannot be economically used by the existing Lone Butte permittee, consideration should be given to including that block of land in the Escondido Well allotment, which could mitigate some of the impact on that allotment and keep the public land in livestock production.

12.3.4.2 Wild Horses and Burros

12.3.4.2.1 Affected Environment

Section 4.4.2 discusses wild horses (*Equus caballus*) and burros (*E. asinus*) that occur within the six-state study area. Two wild horse and burro HMAs occur within New Mexico (BLM 2010a). The Bordo Atravesado HMA in Socorro County, the closest HMA to the proposed Red Sands SEZ, is located about 90 mi (145 km) north of the SEZ.

In addition to the HMAs managed by the BLM, the USFS has wild horse and burro territories in Arizona, California, Nevada, New Mexico, and Utah, and is the lead management agency that administers 37 of the territories (Giffen 2009; USFS 2007). USFS territories in New Mexico occur primarily in the northern portion of the state, 200 mi (322 km) or more from the proposed Red Sands SEZ region.

12.3.4.2.2 Impacts

Because the proposed Red Sands SEZ is about 90 mi (145 km) or more from any wild horse and burro HMA managed by BLM, and about 200 mi (322 km) from any wild horse and burro territory administered by the USFS, solar energy development within the SEZ would not directly or indirectly affect wild horses and burros that are managed by these agencies.

12.3.4.2.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features for solar development within the proposed Red Sands SEZ would be necessary to protect or minimize impacts on wild horses and burros.

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12.3.5 Recreation

12.3.5.1 Affected Environment

The SEZ is generally flat and there is little within the area to attract recreation users, except that it is public land that is easily accessible from Holloman Air Force Base located just across Highway 70, and from Alamogordo, located a few miles to the northeast. Although there are no recreation use figures for the area, Las Cruces BLM staff report there is very little recreation use of the area (Montoya 2010). There are sand dunes in portions of the area that provide some minor topography and interesting vegetative communities, and the area provides opportunities for hiking, biking, backcountry driving, and hunting, especially during the cooler months of the year. Principal species of interest to hunters include small game such as quail, dove, and rabbits, but there is also a unique opportunity to hunt oryx, an exotic African antelope originally introduced on the White Sands Missile Range, which is now found occasionally in the area. A large off-highway vehicle (OHV) area exists immediately south of the SEZ and most OHV activity occurs there. In the White Sands Resource Area RMP (BLM 1986c), the area in the SEZ is among the 1,526,180 acres (6,176 km^2) in the group of lands designated for OHV and vehicle use as "Open."

12.3.5.2 Impacts

12.3.5.2.1 Construction and Operations

Areas developed for solar energy production would be closed and would be unavailable for recreation use. There are numerous roads and trails that provide access throughout the area, but because of the fragmented nature of the SEZ, public access to the area using these roads and trails, especially from the east, would become more difficult; and whether the remaining undeveloped areas outside the SEZ would be utilized by recreational visitors is unknown. Public access on some roads through the area, outside of the developed solar areas, would continue to be available. Because of the large amount of land closed in the immediate area of the SEZ for military and the national monument, people displaced from this area would have to travel farther to access BLM-managed public lands or move their activities onto National Forest lands. Overall, it is not anticipated that there would be a large loss of recreation use if the area is developed, but some users would be displaced.

Based on viewshed analysis (see Section 12.3.14) and as discussed in Section 12.3.3.2.1, solar development in the SEZ would be visible from a wide area and, at full development, would become a dominating feature of the landscape from portions of many of the listed scenic and recreation areas, and from within portions of Alamogordo and adjacent communities. The viewshed analysis shows that development within the SEZ would be visible from large portions of the Culp Canyon WSA, White Sands National Monument, the Sacramento Escarpment ACEC, and USFS Roadless Areas located along the front of the Sacramento Mountains. While it is difficult to equate the visibility of industrial-looking solar energy facilities to a specific loss of recreation use, adverse impacts on recreation use in these four areas is anticipated. This includes the loss of outstanding opportunities for solitude and primitive and unconfined recreation in portions of the Culp Canyon WSA. The extent of the impact of solar energy facilities on the level of recreation use in affected areas is not known.

Solar development within the SEZ would affect public access along OHV routes designated open and available for public use. If open routes within a proposed project area were identified during project-specific analyses, they would be re-designated as closed (see Section 5.5.1 for more details on how routes coinciding with proposed solar facilities would be treated).

12.3.5.2.2 Transmission Facilities and Other Off-Site Infrastructure

Since there are three existing 115-kV transmission lines within the SEZ no additional construction of transmission or road facilities was assessed.

Road access to the area is readily available from the U.S. highways that border the SEZ on the north and east, so it is assumed that there would be no additional impact on recreation use outside the SEZ associated with road construction to provide access to the SEZ.

Roads and power collection lines would be constructed within the SEZ as part of the development of the area.

12.3.5.3 SEZ-Specific Design Features and Design Feature Effectiveness

Implementing the programmatic design features described in Appendix A, Section A.2.2, as required under BLM's Solar Energy Program would provide adequate mitigation for some identified impacts.

The following is a proposed design feature specific to the Red Sands SEZ:

- Adoption of design features for visual resources suggested in Section 12.3.14 would reduce adverse impacts on recreation use in some specially designated areas and should be considered.

12.3.6 Military and Civilian Aviation

12.3.6.1 Affected Environment

Portions of the proposed Red Sands SEZ are bordered on the west by the White Sands Missile Range, on the north by Holloman Air Force Base, and on the east by the Ft. Bliss McGregor Training Range. The northern portion of the Red Sands SEZ is located within about 2 mi (3.2 km) of an active runway at Holloman Air Force Base. The SEZ is also located in the center of a concentration of MTRs and SUAs that support activities at these military installations. BLM has identified lands in only a small portion of the southwestern portion of the SEZ as requiring consultation with DoD prior to approval of any facilities that might have an impact on military uses (BLM and USFS 2010b). Military activities include missile test firings, airplane approach/departure at Holloman Air Force Base, and use of high-speed combat aircraft and helicopter training routes.

The nearest public airport is Alamogordo-White Sands Regional Airport, which is located approximately 2 mi (3 km) to the northeast of the SEZ along U.S. 70. This airport does have regularly scheduled passenger service.

12.3.6.2 Impacts

12.3.6.2.1 Construction and Operations

The military has identified concerns over any facilities constructed in the SEZ that could impact their current operations. Specific concerns have been raised over the potential for flight restrictions above any solar facilities; the height of solar facilities, specifically, any that could interfere with Holloman Air Force Base operations or that would intrude into low-level airspace; concerns that the presence of solar facilities would require restrictions on supersonic flight down to 10,000 ft (3,048 m) MSL; any possible restrictions on hydrocarbon or residue from fuel burn by military aircraft; possible glare from reflective surfaces that might affect pilot vision; and, degradation of the performance of Holloman's final-approach radar.

The Alamogordo-White Sands Regional Airport is inside the 3-mi (4.8-km) zone within which FAA requires specific application by project proponents to allow FAA to determine necessary safety restrictions that would address required distances from flight paths, hazard lighting of facilities, impacts on radar performance, and other requirements. FAA requirements would prevent construction of any solar energy facilities that could adversely affect airport operation.

12.3.6.2.2 Transmission Facilities and Other Off-Site Infrastructure

Since there are three existing 115-kV transmission lines within the SEZ, it is assumed that there would be no additional impact on military or civilian aircraft use associated with construction of additional transmission capacity to connect the SEZ to the regional grid. Similarly, since there is adequate road access to the SEZ, it is assumed there would be no new access road construction outside of the SEZ and no impact on military or civilian airspace.

12.3.6.3 SEZ-Specific Design Features and Design Feature Effectiveness

The programmatic design features described in Appendix A, Section A.2.2, would require early coordination with the DoD to identify and mitigate, if possible, potential impacts on the use of MTRs.

Proposed design features specific to the Red Sands SEZ include:

- Because Alamogordo-White Sands Regional Airport and Holloman Air Force Base are within 3 mi (4.8 km) of the SEZ, project developers must provide necessary safety restriction information to FAA addressing required distances from flight paths, hazard lighting of facilities, impacts on radar performance, and other requirements.

- The BLM should modify its land records to require consultation with DoD in any areas of the SEZ under military airspace.

12.3.7 Geologic Setting and Soil Resources

12.3.7.1 Affected Environment

12.3.7.1.1 Geologic Setting

Regional Setting

The proposed Red Sands SEZ is located in the Tularosa Basin, an alluvium-filled structural basin within the Basin and Range physiographic province in south-central New Mexico (Figure 12.3.7.1-1). The valley is bordered on the west by the San Andres and Organ Mountains and on the east by the Sacramento Mountains. The Jarilla Mountains lie to the south.

The Tularosa Basin is an axial basin of the Rio Grande rift, a north-trending tectonic feature that extends from south-central Colorado to northern Mexico, crossing (and bisecting) the length of New Mexico. Basins in the rift zone generally follow the course of the Rio Grande (river) and are bounded by normal faults that occur along the rift zone margins. The basin extends about 75 mi (120 km) from the northern end of Carrizozo (Malpais) Lava Flow to the Jarilla Mountains; it ranges in width from about 20 mi (30 km) at its northern end to 35 mi (60 km) near the Red Sands SEZ (Chapin 1988).

Basin fill consists of late Tertiary to Quaternary sediments of the Santa Fe Group, which are at least 1,800 ft (550 m) thick below the Red Sands SEZ, based on logs of a railroad well drilled near Valmont (less than a mile outside the northeast corner of the main site) (Figure 12.3.7.1-2). The basin deepens to the south toward the Hueco Basin (Texas), where unconsolidated sediments have been encountered in test wells at depths up to 4,920 ft (1,500 m) (Kottlowski 1955). The lower and middle units of the Santa Fe Group were deposited during the development of the Rio Grande rift (Miocene to Pliocene); they are predominantly made up of eolian sands and fine-grained basin floor and playa lake sediments (in the valley center) intertongued with alluvial fan deposits (along the valley margins). Tertiary volcanic and intrusive rocks (Rubio Peak, Bell Top, Mimbres Peak, and Bear Springs Formations) overlie these sediments. Above these units are the fluvial-deltaic sands of the upper Santa Fe Group. The main component of the upper Santa Fe Group is the Camp Rice Formation; it is interlayered with late Tertiary and Quaternary basalt flows (Fryberger 2010).

Exposed sediments near the proposed Red Sands SEZ consist mainly of alluvium deposited on fan piedmont surfaces (Qp) by streams discharging through a series of canyons along the western front of the Sacramento Mountains to the east. Fine-grained windblown deposits (Qe and Qeg), originating from sediments of ancient Lake Otero, are abundant throughout the valley and include the gypsum-rich deposits (Qeg) making up the dunes of the White Sands National Monument (Figure 12.3.7.1-3). Playa lake sediments (Qpl) occur around

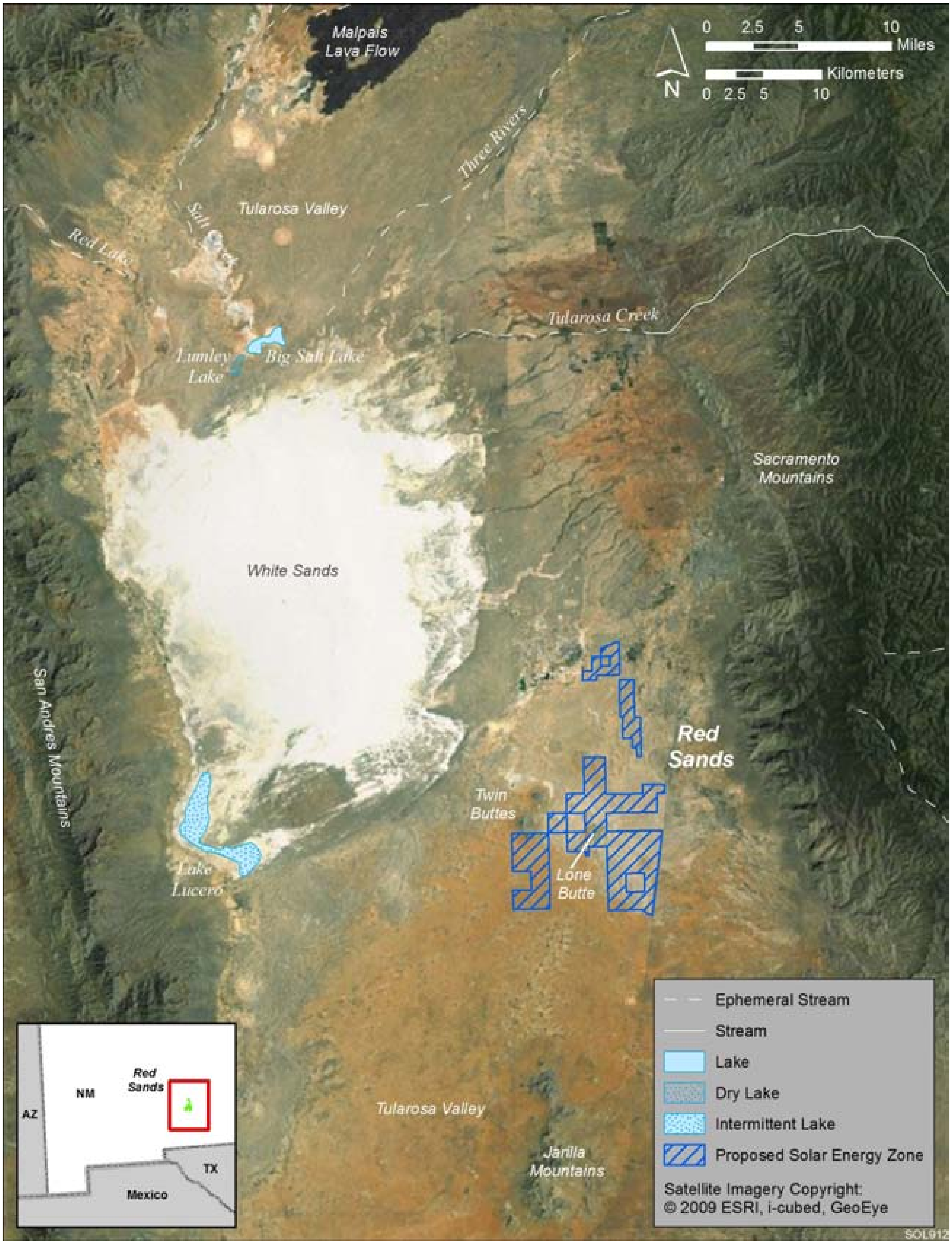

FIGURE 12.3.7.1-1 Physiographic Features of the Tularosa Basin

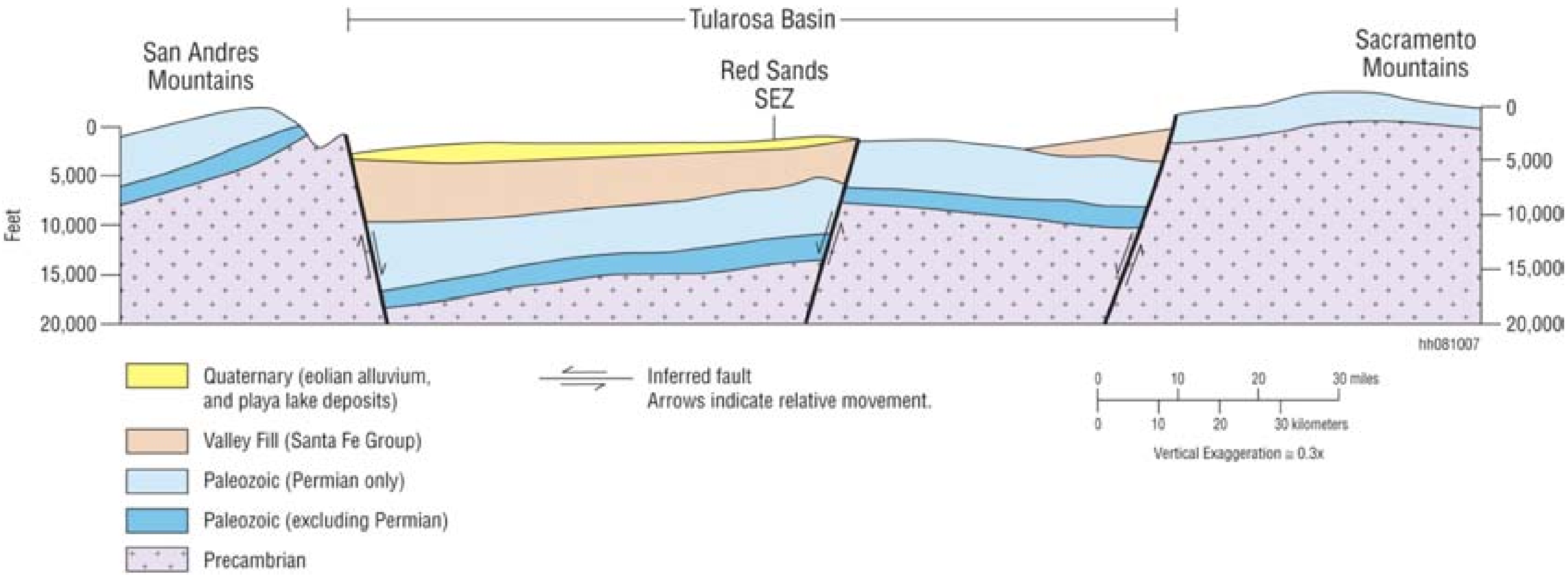

FIGURE 12.3.7.1-2 Generalized Cross Section (West to East) across Tularosa Basin near the Proposed Red Sands SEZ (see Figure 12.3.7.1-5 for Section Location [modified from Fryberger 2010])

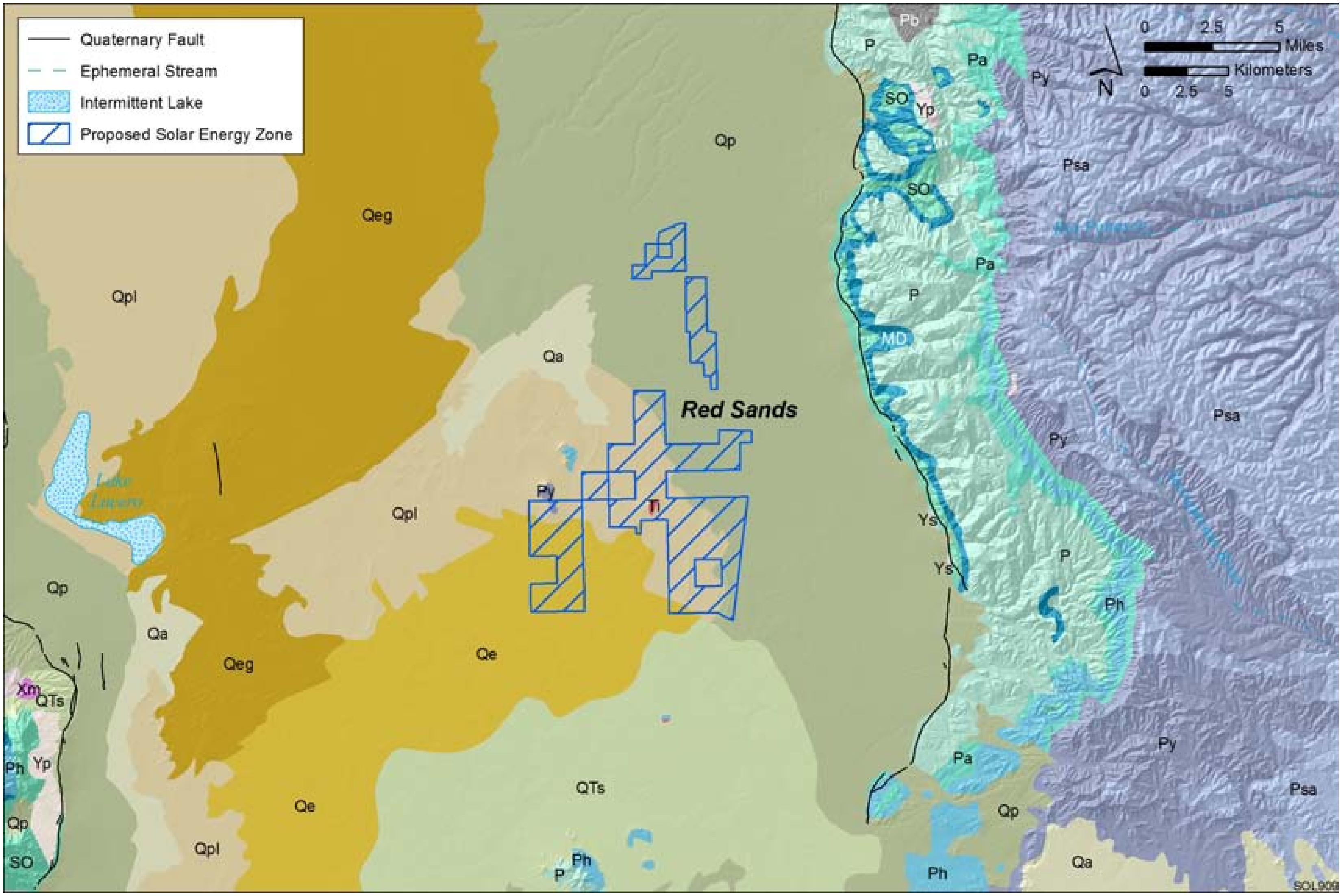

FIGURE 12.3.7.1-3 Geologic Map of the Tularosa Basin near the Proposed Red Sands SEZ (adapted from Stoeser et al. 2007; Scholle 2003)

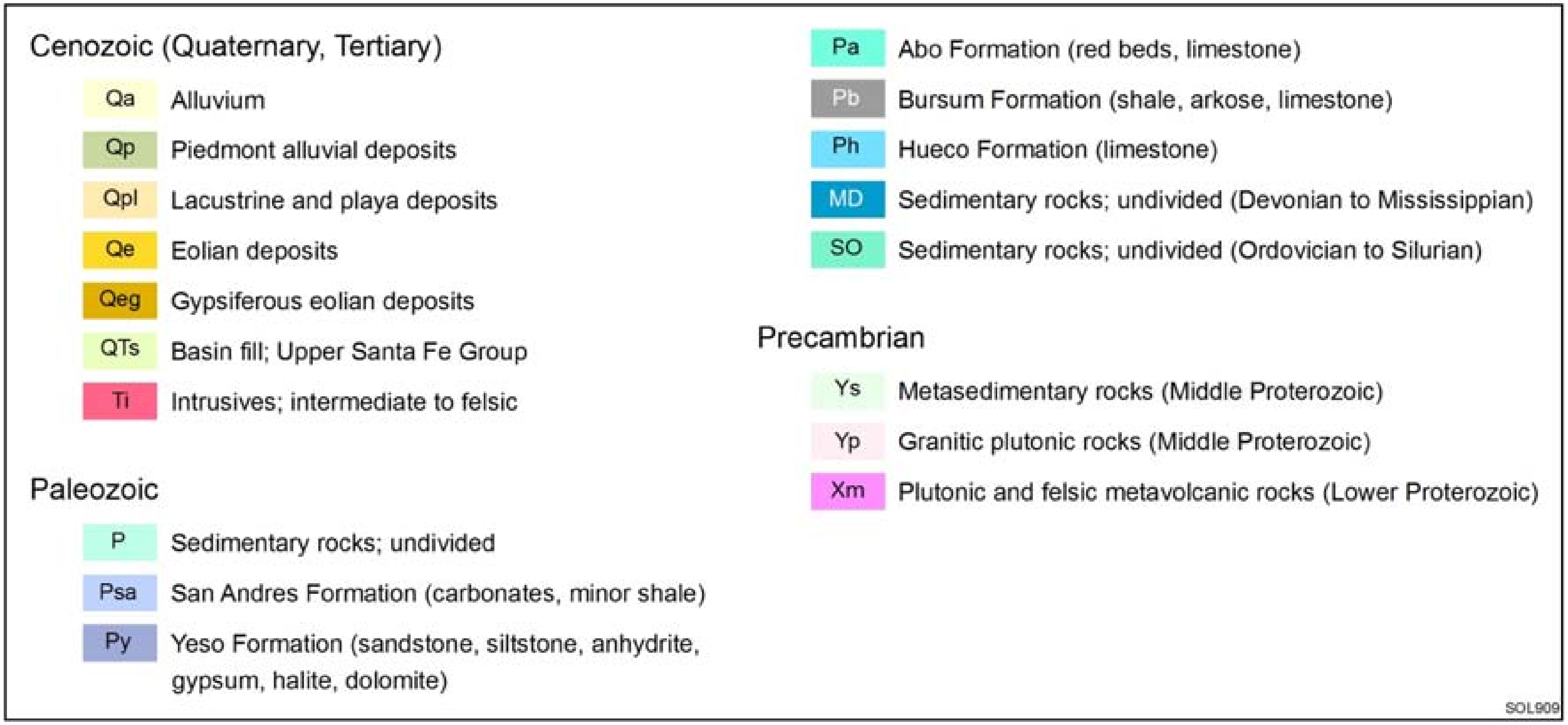

FIGURE 12.3.7.1-3 (Cont.)

Lake Lucero and within the SEZ. Paleozoic sedimentary units of sandstone, shale, and carbonates are exposed throughout the Sacramento Mountains.

Topography

The Tularosa Basin is a closed basin with a complexity of topographic features, including alluvial fans, arroyos, active and inactive dune fields, coppice dunes, sand sheets, lunette dunes, dry lakes, and rock outcrops. The proposed Red Sands SEZ is located in the southern part of the basin, a few miles east of the White Sands National Monument in Otero County (Figure 12.3.7.1-1). Its terrain is fairly flat, with a gentle slope to the southwest, toward the Rio Grande valley. Elevations across the SEZ range from about 4,403 ft (1,342 m) near Twin Buttes in the western part of the site to about 3,967 ft (1,209 m) in the southeastern part of the main site. Low crescent-shaped ridges (lunette dunes) occur in the southeastern part of the main site; these are shoreline remnants of an ancient basin floor lake (Figure 12.3.7.1-4).

Geologic Hazards

The types of geologic hazards that could potentially affect solar project sites and their mitigation are discussed in Sections 5.7.3 and 5.7.4. The following sections provide a preliminary assessment of these hazards at the proposed Red Sands SEZ. Solar project developers may need to conduct a geotechnical investigation to assess geologic hazards locally to better identify facility design criteria and site-specific design features to minimize their risk.

Seismicity. Seismicity in New Mexico is concentrated in the Rio Grande rift valley near Socorro, an area referred to as the Socorro Seismic Anomaly (SSA). The SSA covers an area of about 1.2 million acres (5,000 km^2) and accounts for about 23% of earthquakes in New Mexico with magnitudes greater than 2.0. It is thought to be the result of crustal extension occurring above an upwelling magma body about 12 mi (19 km) below the ground surface. Seismic activity outside of the SSA shows some concentration of earthquakes along a prominent topographic lineation (the Socorro fracture zone) that extends from the SSA to the north–northeast into eastern New Mexico. The strongest earthquakes in New Mexico tend to occur near Socorro along the rift valley (Sanford and Lin 1998; Sanford et al. 2002, 2006; Balch et al. 2010).

No known Quaternary faults occur within the proposed Red Sands SEZ; however, range-bounding faults lie to the east and west of the site (Figure 12.3.7.1-5). These include the south and central sections of the San Andres Mountains fault that runs along the eastern base of San Andres Mountains, about 20 mi (30 km) to the west of the SEZ, and the McGregor and Sacramento Mountains sections of the Alamogordo fault that runs along the western base of the Sacramento Mountains, just 7 mi (12 km) to the east. The San Andres Mountains fault is a north-trending high-angle normal fault with a total length of about 71 mi (114 km). Movement along the fault has uplifted and tilted the western San Andres Mountains block, exposing Precambrian and Paleozoic rocks along the fault plane (footwall). The eastern block has dropped down

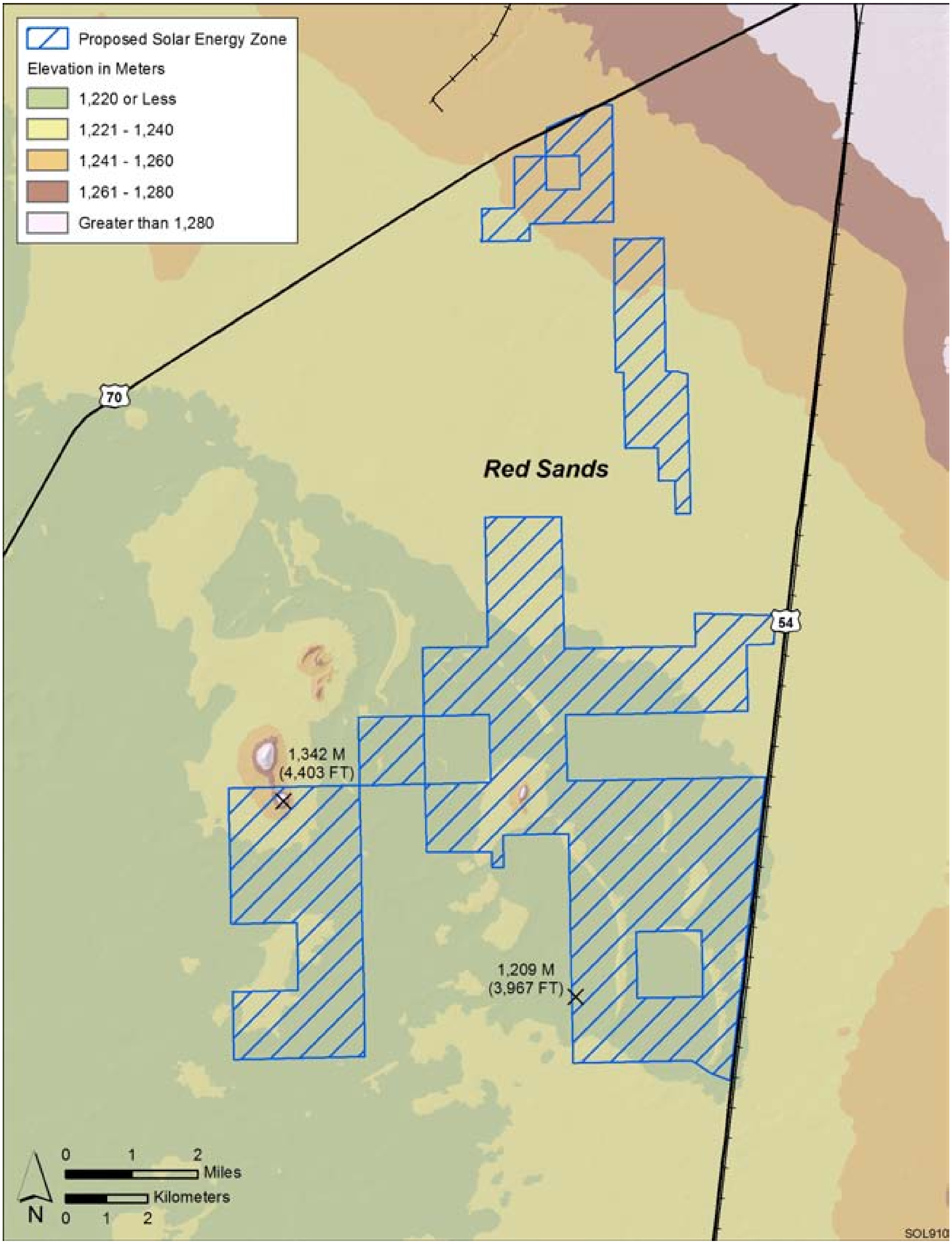

FIGURE 12.3.7.1-4 General Terrain of the Proposed Red Sands SEZ

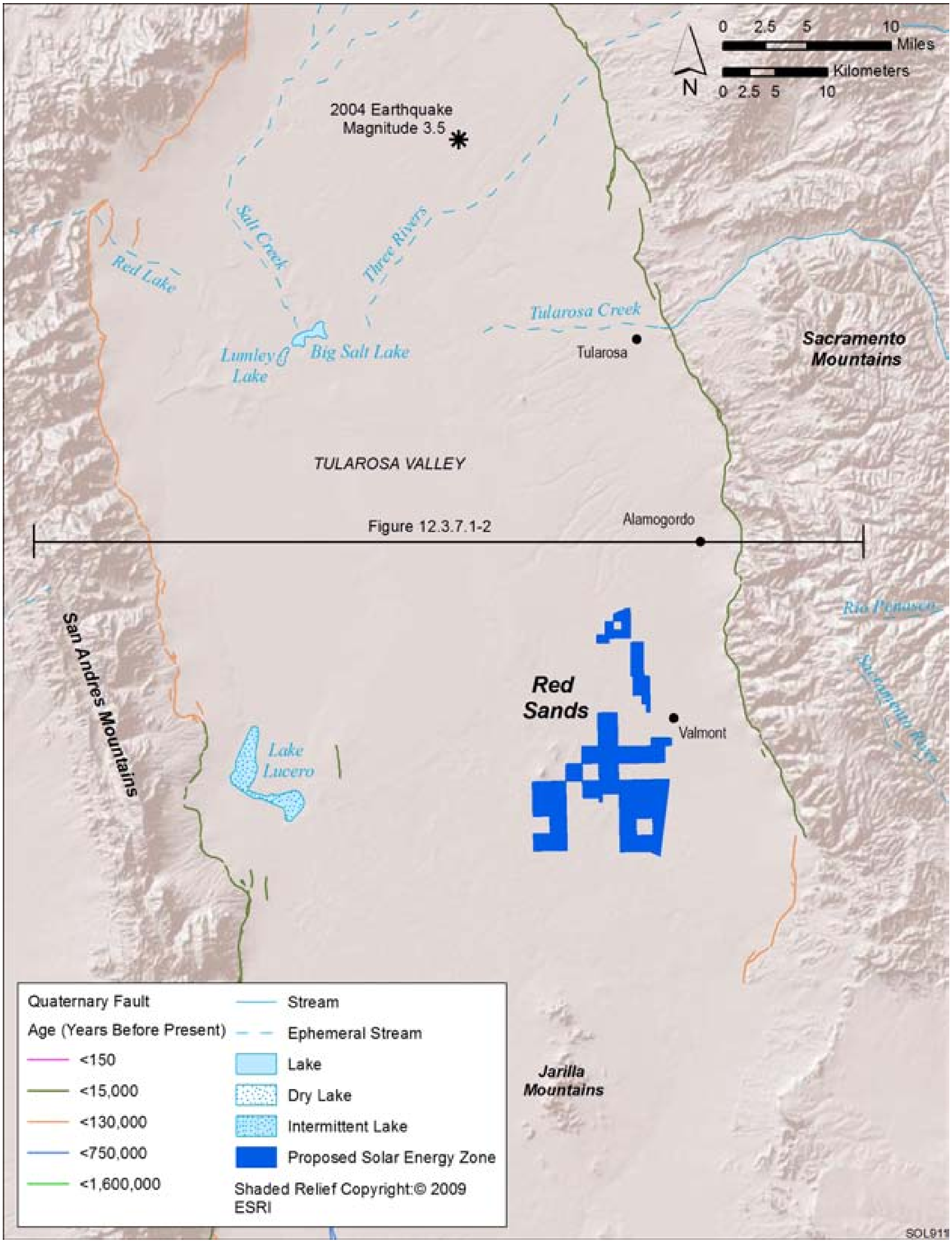

FIGURE 12.3.7.1-5 Quaternary Faults in the Tularosa Basin (USGS and NMBMMR 2009; USGS 2010a)

relative to the mountains and is covered by Tertiary and Quaternary basin-fill sediments. Offsets of late Pleistocene sediments place the most recent movement along the fault at less than 130,000 years ago, with movement as recently as 15,000 years ago along the southern section (based on scarp morphology). Slip rates along the south and central sections are thought to be low. Recurrence intervals are estimated at 20,000 to 50,000 years. Study of the San Andres Mountains fault has been limited due to its proximity to White Sands Proving Ground, which has had restricted access since the mid 1940s (Machete 1996a,b).

The Alamogordo fault is also a north-striking high-angle normal fault; it has a total length of about 68 mi (110 km). Movement along the fault has uplifted and tilted the Sacramento Mountains to the east relative to the sediment-filled basin to the west. Offsets of late Pleistocene and Holocene sediments place the most recent movement along the Sacramento section at less than 15,000 years ago; movement along the McGregor section is less constrained, but likely occurred less than 130,000 years ago. Slip rates along both sections are estimated to be less than 0.008 in./yr (0.2 mm/yr); recurrence intervals are estimated at 20,000 to 25,000 years (Machete and Kelson 1996a,b).

From June 1, 2000, to May 31, 2010, only one earthquake was recorded within a 61-mi (100-km) radius of the proposed Red Sands SEZ (USGS 2010a). The earthquake occurred on November 14, 2004. It was located about 40 mi (80 km) northwest of the SEZ just south of the Carrizozo Lava Flow and registered a magnitude[1] (LgGS) of 3.5 (Figure 12.3.7.1-5). The largest earthquake in the region occurred on January 4, 1977, about 50 mi (85 km) southwest of the Red Sands SEZ. The earthquake registered a magnitude (ML[2]) of 3.2. Six other earthquakes have occurred in the region since 1977; three of these had a magnitude greater than 3.0 (USGS 2010a).

Liquefaction. The proposed Red Sands SEZ lies within an area where the peak horizontal acceleration with a 10% probability of exceedance in 50 years is between 0.04 and 0.05 g. Shaking associated with this level of acceleration is generally perceived as moderate; however, potential damage to structures is very light (USGS 2008). Given the very low intensity of ground shaking estimated for the area and the low incidence of historical seismicity in the region, the potential for liquefaction in sediments within and around the SEZ is also likely to be low.

Volcanic Hazards. The major volcanic fields in New Mexico are associated with mantle upwelling within two zones of crustal weakness—the Jemez lineament and the Rio Grande rift.

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1 Surface wave magnitude (MLg) is an Lg magnitude determined by the USGS. It is based on the amplitude of the Lg surface wave group and is commonly used for small to moderate-size earthquakes that have mostly continental propagation paths (Leith 2010).

2 Richter scale magnitude (ML) was the original magnitude defined by Richter and Gutenberg for local earthquakes in 1935. It was based on the maximum amplitude recorded on a Wood-Anderson torsion seismograph but is currently calculated for earthquakes with magnitudes ranging from 2 to 6, using modern instruments with adjustments (USGS 2010e).

The Jemez lineament is defined by a series of Tertiary to Quaternary volcanic vents with a northeast alignment in northern New Mexico. These include the Zuni-Bandera volcanic field, Mount Taylor, the Jemez volcanic field, and the Raton-Clayton volcanic field. Eruptions from vents along the Jemez lineament have occurred within the past 10,000 years. The Jemez Mountains (near Los Alamos) are located at the intersection of the Jemez lineament and the north-trending Rio Grande rift. Rift valley vents nearest the Red Sands SEZ include Sierra Blanca on the eastern edge of the Tularosa Basin near Mescalero about 40 mi (70 km) to the northeast; and Jornado del Muerto, near Socorro about 70 mi (115 km) to the north. The Mogollon-Datil volcanic field is about 120 mi (195 km) to the northwest. Except for the Valles caldera in the Jemez Mountains, all these volcanoes are considered extinct and unlikely to erupt again. The most likely location of new volcanism in New Mexico is near Socorro, where an extensive magma body 12 mi (19 km) below the ground surface has created a zone of intense seismic activity (the Socorro Seismic Anomaly) (NMBGMR 2006; Wolf and Gardner 1995).

Slope Stability and Land Subsidence. The incidence of rock falls and slope failures can be moderate to high along mountain fronts and can present a hazard to facilities on the relatively flat terrain of valley floors such as the Tularosa Basin, if they are located at the base of steep slopes. The risk of rock falls and slope failures decreases toward the flat valley center.

While there have been no recent reports of land subsidence monitoring within the Tularosa Basin to date, a study conducted by MacMillan et al. (1976) concluded that withdrawals of large volumes of saline groundwater in the Tularosa Basin could potentially lower the water table and land surface, with the greatest subsidence occurring in the north-central part of the basin. Earth fissures have been documented in the Mimbres Basin about 90 mi (140 km) to the west of the proposed Red Sands SEZ. The fissures are likely the result of land subsidence caused by compaction of unconsolidated alluvial sediments due to groundwater withdrawal. The maximum subsidence measured was about 14 in. (36 cm) in areas where groundwater levels had declined at least 98 ft (30 m) (Contaldo and Mueller 1991).

Other Hazards. Other potential hazards at the proposed Red Sands SEZ include those associated with soil compaction (restricted infiltration and increased runoff), expanding clay soils (destabilization of structures), and hydro-compactable or collapsible soil (settlement). Disturbance of soil crusts and desert pavement on soil surfaces may increase the likelihood of soil erosion by wind.

Alluvial fan surfaces, such as those found in the Tularosa Basin, can be the sites of damaging high-velocity “flash” floods and debris flows during periods of intense and prolonged rainfall. The nature of the flooding and sedimentation processes (e.g., stream flow versus debris flow fans) will depend on the specific morphology of the fan (National Research Council 1996). Section 12.3.9.1.1 provides further discussion of flood risks within the Red Sands SEZ.

12.3.7.1.2 Soil Resources

Soils within the Red Sands SEZ are predominantly very fine sandy loams, silt loams, and loamy fine sands of the Holloman-Reeves association and the Pintura-Dona Ana and Gypsum land-Holloman complexes, which together make up about 76% of the soil coverage at the site (Figure 12.3.7.1-6). Soil map units within the Red Sands SEZ are described in Table 12.3.7.1-1. These level to nearly level soils are derived from gypsum-rich alluvial and eolian deposits. They are characterized as shallow to very deep and well-drained. Most of the soils on the site have high surface-runoff potential and high permeability. The water erosion potential is very low to low for all soils at the site, except those of the Nickel-Tencee association, which have a high potential. These soils occur along the slopes of Twin Buttes and Lone Butte and cover only about 2% of the site. The susceptibility to wind erosion is very high for all soils (except for those on rock outcrops, which were not rated), with as much as 134 tons (122 metric tons) of soil eroded by wind per acre (4,000 m^2) each year (NRCS 2010). Biological soil crusts and desert pavement have not been documented in the SEZ, but may be present. Older "fossil" dune terrains are stabilized by gypsite crusts that formed as a result of long exposures to weathering and solution redeposition by percolating rainwater (Freyberger 2010). These terrains are typical of the downwind locations of Lake Lucero (e.g., Site NE 30 and the inactive parabolic dunes in that region) to the west of U.S. 70, but may be present on land surfaces throughout the valley.

None of the soils within the Red Sands SEZ is rated as hydric.[3] Flooding is not likely for soils at the site, occurring with a frequency of less than once in 500 years. None of the soils is classified as prime or unique farmland (NRCS 2010).

12.3.7.2 Impacts

Impacts on soil resources would occur mainly as a result of ground-disturbing activities (e.g., grading, excavating, and drilling), especially during the construction phase of a solar project. These include soil compaction, soil horizon mixing, soil erosion and deposition by wind, soil erosion by water and surface runoff, sedimentation, and soil contamination. Such impacts are common to all utility-scale solar energy development in varying degrees and are described in more detail for the four phases of development in Section 5.7 1.

Because impacts on soil resources result from ground-disturbing activities in the project area, soil impacts would be roughly proportional to the size of a given solar facility, with larger areas of disturbed soil having a greater potential for impacts than smaller areas (Section 5.7.2). The magnitude of impacts would also depend on the types of components built for a given facility, because some components would involve greater disturbance and would take place over a longer time frame.

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[3] A hydric soil is a soil that formed under conditions of saturation, flooding, or ponding (NRCS 2010).

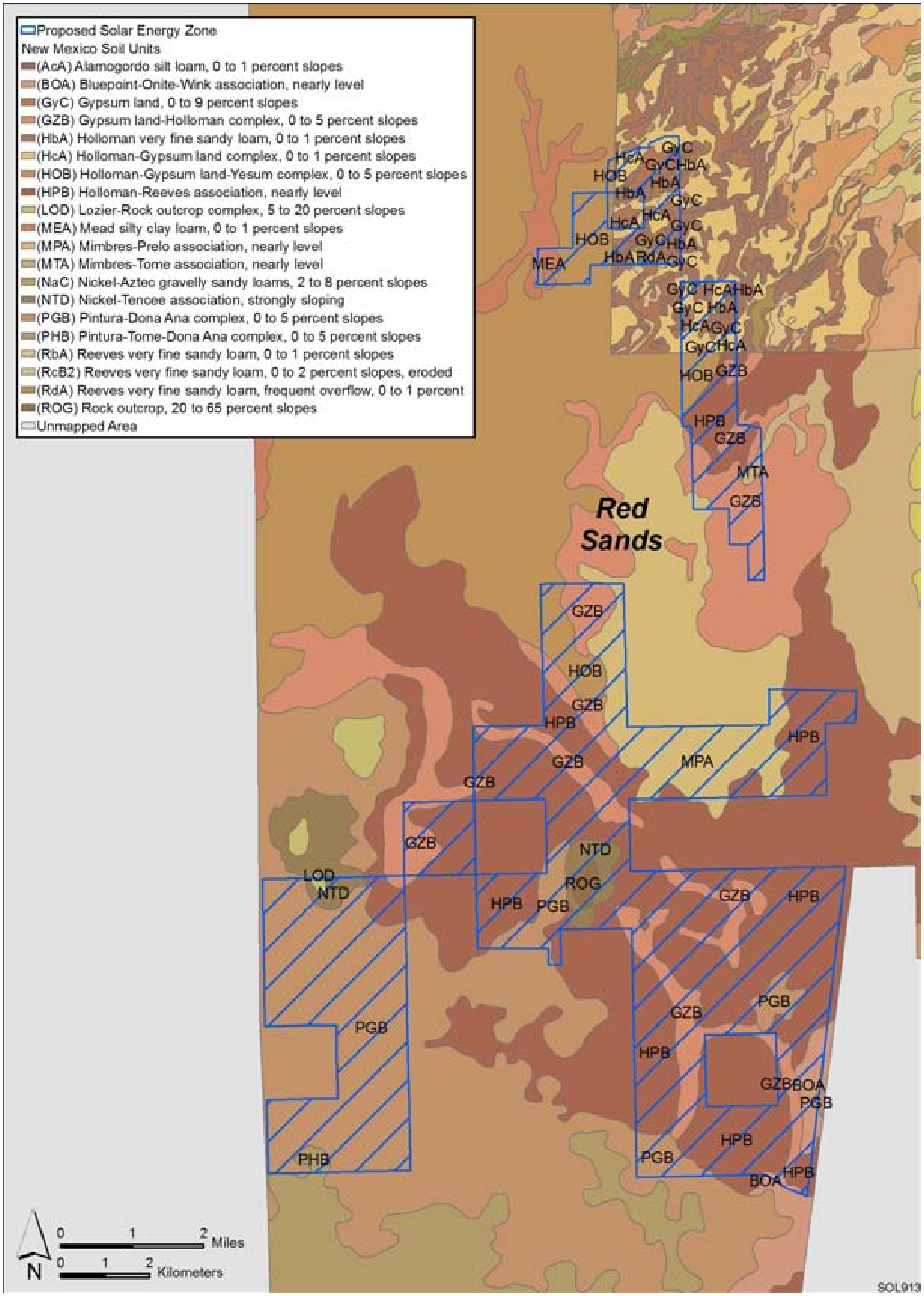

FIGURE 12.3.7.1-6 Soil Map for the Proposed Red Sands SEZ (Source: NRCS 2008)

TABLE 12.3.7.1-1 Summary of Soil Map Units within the Proposed Red Sands SEZ

Map Unit Symbol	Map Unit Name	Water Erosion Potential[a]	Wind Erosion Potential[b]	Description	Area, in Acres[c] (percentage of SEZ)
HPB	Holloman-Reeves association (nearly level)	Very low	High (WEG 4)[d]	Consists of about 60% Holloman very fine sandy loam and 30% Reeves silt loam. Nearly level soils on basin floors. Parent material includes gypsiferous and calcareous fine-loamy alluvium and/or gypsiferous eolian deposits. Shallow and very shallow to very deep and well-drained, with high surface-runoff potential (very low infiltration rate) and moderately high permeability. Shrink-swell potential is high. Available water capacity is very low to moderate. Severe rutting hazard. Used mainly as rangeland, forestland, or wildlife habitat.	8,990 (40)
PGB	Pintura-Doña Ana complex (0 to 5% slope)	Low	Very high (WEG 2)	Consists of about 45% Pintura loamy fine sand and 35% Dona Ana fine sandy loam. Level to nearly level soils on and between the dunes of basin floors. Parent material is coarse-loamy eolian deposits. Very deep and somewhat excessively well-drained, with low surface-runoff potential (high infiltration rate) and high permeability. Available water capacity is very moderate. Moderate rutting hazard. Used mainly as rangeland, forestland, or wildlife habitat.	5,014 (22)
GZB	Gypsum land-Holloman complex (0 to 5% slope)	Low	High (WEG 4)	Consists of about 45% Gypsum land and 45% Holloman very fine sandy loam. Level to nearly level soils on basin floors and fan piedmonts. Parent material includes gypsiferous alluvium and/or gypsiferous eolian deposits (on lunette dunes). Shallow to very shallow and well-drained, with high surface-runoff potential (low infiltration rate) and high permeability. Available water capacity is very low. Severe rutting hazard. Used mainly for recreational purposes, rangeland, wildlife habitat, watershed, military, or esthetic purposes.	3,189 (14)
MPA	Mimbres-Prelo association (nearly level)	Very low	High (WEG 3)	Consists of about 50% Mimbres very fine sandy loam and 20% Prelo silt loam. Nearly level soils on alluvial fans and fan piedmonts. Parent material is calcareous fine-silty alluvium derived from limestone, sandstone, and shale. Deep to very deep and well-drained, with moderate surface runoff potential and low permeability. Available water capacity is high. Severe rutting hazard. Used mainly as rangeland, forestland, or wildlife habitat.	1,760 (8)

TABLE 12.3.7.1-1 (Cont.)

Map Unit Symbol	Map Unit Name	Water Erosion Potential[a]	Wind Erosion Potential[b]	Description	Area, in Acres[c] (percentage of SEZ)
HOB	Holloman-Gypsum land-Yesum complex (0 to 5% slope)	Low	High (WEG 4)	Consists of about 35% Holloman very fine sandy loam, 30% Gypsum land, and 20% Yesum very fine sandy loam. Level to nearly level soils on basin floors. Parent material includes gypsiferous alluvium and/or gypsiferous eolian deposits. Shallow to very shallow and well-drained, with high surface runoff potential (very low infiltration rate) and moderately high permeability. Shrink-swell potential is high. Available water capacity is very low. Severe rutting hazard. Used mainly as rangeland, forestland, or wildlife habitat.	1,124 (5)
HcA	Holloman-Gypsum land complex (0 to 1% slope)	Very low	High (WEG 4)	Consists of about 45% Holloman very fine sandy loam and 40% Gypsum land. Level to nearly level soils on basin floors and fan piedmonts. Parent material includes gypsiferous alluvium and/or gypsiferous eolian deposits. Shallow to very shallow and well-drained, with high surface-runoff potential (very low infiltration rate) and moderately high permeability. Shrink-swell potential is high. Available water capacity is very low. Severe rutting hazard. Used mainly as rangeland, forestland, or wildlife habitat.	471 (2)
NTD	Nickel-Tencee association (strongly sloping)	High	Moderate (WEG 5)	Consists of about 50% Nickel gravelly fine sandy loam and 35% Tencee very gravelly sandy loam. Strongly sloping soils on alluvial fans and fan piedmonts. Parent material is mixed gravelly alluvium derived from limestone. Shallow and very deep and well-drained, with high surface runoff potential (low infiltration rate) and moderate permeability. Available water capacity is low to very low. Moderate rutting hazard. Used mainly as rangeland, forestland, or wildlife habitat.	470 (2)
GyC	Gypsum land (0 to 9% slope)	Not rated	Not rated (particle)	Gently sloping soils on basin floors. Parent material consists of gypsiferous alluvium and/or gypsiferous eolian deposits. Well-drained with high surface runoff potential (low infiltration rate) and high permeability. Slight rutting hazard. Used mainly for recreational purposes, rangeland, wildlife habitat, watershed, military, or aesthetic purposes.	435 (2)

TABLE 12.3.7.1-1 (Cont.)

Map Unit Symbol	Map Unit Name	Water Erosion Potential[a]	Wind Erosion Potential[b]	Description	Area, in Acres[c] (percentage of SEZ)
HbA	Holloman very fine sandy loam (0 to 1% slope)	Very low	High (WEG 4)	Level to nearly level soils on basin floors. Parent material consists of gypsiferous alluvium and/or gypsiferous eolian deposits. Shallow and very shallow and well-drained, with high surface-runoff potential (very low infiltration rate) and moderately high permeability. Shrink-swell potential is high. Severe rutting hazard. Used mainly as rangeland, forestland, or wildlife habitat.	347 (1.5)
BOA	Bluepoint-Onite-Wink association (nearly level)	Very low	Very high (WEG 2)	Consists of 35% Bluepoint, 25% Onite, and 20% Wink loamy fine sands. Nearly level soils on the dunes and within depressions of fan piedmonts. Parent material includes sandy eolian deposits and mixed coarse-loamy alluvium. Very deep and well- to somewhat excessively well-drained, with moderate surface-runoff potential and high permeability. Moderate rutting hazard. Used mainly as rangeland, forestland, or wildlife habitat.	301 (1.5)
ROG	Rock outcrop (20 to 65% slope)	Not rated	Not rated (particle)	Steeply sloping soils on rock outcrops on the crests and slopes of hills. Parent material is igneous rock. High surface-runoff potential (very low infiltration rate). Slight rutting hazard. Used mainly for recreational purposes, rangeland, wildlife habitat, watershed, military, or esthetic purposes.	106 (<1)
PHB	Pintura-Tome-Dona Ana complex (0 to 5% slope)	Low	Very high (WEG 2)	Consists of 30% Pintura loamy fine sand, 25% Tome very fine sandy loam, and 20% fine sandy loam. Level to nearly level soils on and between dunes on basin floors and within relict lakebeds. Parent material includes coarse-loamy eolian deposits and mixed fine-silty or fine-loamy alluvium. Very deep and well- to somewhat excessively well-drained, with moderate surface runoff potential and high permeability. Moderate rutting hazard. Used mainly as rangeland, forestland, or wildlife habitat.	83 (<1)
MEA	Mead silty clay loam (0 to 1% slope)	Very low	High (WEG 3)	Level to nearly level soils on alluvial fans. Parent material consists of mixed clayey alluvium. Very deep and poorly drained, with high surface-runoff potential (very low infiltration rate) and moderately low permeability. Shrink-swell potential is high. Available water capacity is low. Severe rutting hazard. Used mainly as rangeland, forestland, or wildlife habitat.	78 (<1)

Footnotes on next page.

TABLE 12.3.7.1-1 (Cont.)

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[a] Water erosion potential is a qualitative interpretation based on soil properties or a combination of properties that contribute to runoff and have low resistance to water erosion processes. The ratings are on a 1.0 scale and take into account soil features such as surface layer particle size, saturated hydraulic conductivity, and high runoff landscapes. A rating of “very high” (>0.9 to ≤1.0) indicates that the soil has the greatest relative vulnerability to water erosion; a rating of “very low” (<0.10) indicates that the soil has little or no relative water erosion vulnerability. A rating of “moderate” (>0.35 and ≤0.65) indicates the soil has medium relative water erosion vulnerability.

[b] Wind erosion potential is a qualitative interpretation based on surface soil properties or a combination of properties that contribute to the soil’s potential wind erosivity. The ratings are on a 1.0 scale and assume that the affected area is bare and smooth and has a long distance exposed to the wind. It is not a measure of actual soil loss from erosion. A rating of “very high” (>0.9 to ≤1.0) denotes a soil with a surface layer of sandy particles, high carbonate content, low organic matter content, or no coarse fragment protection. A rating of “low” (>0.2 to ≤0.4) is given to soils with favorable surface particle size, high organic matter content, or protective coarse fragments.

[c] To convert from acres to km^2, multiply by 0.004047.

[d] WEG = wind erodibility group. WEGs are based on soil texture, content of organic matter, effervescence of carbonates, content of rock fragments, and mineralogy, and also take into account soil moisture, surface cover, soil surface roughness, wind velocity and direction, and the length of unsheltered distance (USDA 2004). Groups range in value from 1 (most susceptible to wind erosion) to 8 (least susceptible to wind erosion). The NRCS provides a wind erodibility index, expressed as an erosion rate in tons per acre per year, for each of the wind erodibility groups: WEG 2, 134 tons (122 metric tons) per acre (4,000 m^2) per year; WEGs 3 and 4, 86 tons (78 metric tons) per acre (4,000 m^2) per year; and WEG 5, 56 tons (51 metric tons) per acre (4,000 m^2) per year.

Source: NRCS (2010); Bolluch and Neher (1980).

12.3.7.3 SEZ-Specific Design Features and Design Feature Effectiveness

Implementing the programmatic design features described in Appendix A, Section A.2.2., as required under BLM's Solar Energy Program would reduce the potential for soil impacts during all project phases.

A proposed design feature specific to the Red Sands SEZ is as follows:

- Avoid disturbing gypsite crusts to the extent possible to minimize the risk of soil loss by wind erosion.

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12.3.8 Minerals (Fluids, Solids, and Geothermal Resources)

12.3.8.1 Affected Environment

As of August 31, 2010, there were no active locatable mining claims within the proposed Red Sands SEZ. There were numerous (now closed) claims in the past in the southeastern portion of the SEZ, in T19S, R9E, and four claims in T18S and R8E. Of the latter four claims, one was located in a quarter-section that is included in the SEZ (BLM and USFS 2010b). The public land within the SEZ has been closed to locatable mineral entry since June 2009, pending the outcome of this solar energy PEIS.

While there are no active oil and gas leases in the SEZ, most of the area in and around the area has been leased in the past, but the leases have expired (BLM and USFS 2010a). The area remains open for leasing for oil and gas and other leasable minerals, and for disposal of salable minerals. There is no active geothermal leasing or development in or near the SEZ, nor has the area been leased previously (BLM and USFS 2010a).

12.3.8.2 Impacts

If the area is identified as a solar energy zone, it would continue to be closed to all incompatible forms of mineral development. It is assumed that future development of oil and gas resources, should any be discovered, would continue to be possible, since such development could occur, utilizing directional drilling from outside the SEZ.

Since the SEZ does not contain existing mining claims, it is also assumed that there would be no future loss of locatable mineral production. The production of common minerals, such as sand and gravel and mineral materials used for road construction or other purposes, might take place in areas not directly developed for solar energy production.

The SEZ has had no history of development of geothermal resources. For that reason, it is not anticipated that solar development would adversely affect the development of geothermal resources.

12.3.8.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features are required to protect mineral resources. Implementing the programmatic design features described in Appendix A, Section A.2.2, as required under BLM's Solar Energy Program would provide adequate mitigation for impacts on mineral resources.

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12.3.9 Water Resources

12.3.9.1 Affected Environment

The proposed Red Sands SEZ is located within the Tularosa Valley Basin of the Rio Grande Hydrologic Region (USGS 2010b) and the Basin and Range physiographic province characterized by north-south trending basins flanked by small mountain ranges (Robson and Banta 1995). The proposed SEZ is located in the Tularosa Valley between the San Andres Mountains to the west, the Sacramento Mountains to the east, the Chupadera Mesa to the north, and a low surface drainage divide to the south near the New Mexico-Texas border. Surface elevations in the proposed SEZ range between 3,995 and 4,115 ft (1,218 and 1,254 m), with surface elevations in the surrounding mountains reaching higher than 7,000 ft (2,134 m) (Figure 12.3.9.1-1). Annual precipitation is estimated to be 9 in. (23 cm), with average annual snowfalls of 2.5 in. (6.4 cm) in the Tularosa Valley (WRCC 2010a). In the higher elevations of the Sacramento Mountains, annual precipitation is approximately 19 in. (48 cm), with average annual snowfalls of 20 in. (51 cm) (WRCC 2010b). Evapotranspiration rates within the Tularosa Valley have been estimated at 48 in./yr (122 cm/yr) (Huff 2004) and pan evaporation rates in the vicinity of the proposed SEZ were estimated to be 92 in./yr (234 cm/yr) (Cowherd et al. 1988; WRCC 2010c).

12.3.9.1.1 Surface Waters (Including Drainages, Floodplains, and Wetlands)

No perennial surface water features are located in the proposed Red Sands SEZ. Several ephemeral washes drain off the Sacramento Mountains to the east of the proposed SEZ, with some branches crossing the site, typically in a northeast to southwest direction. Several small ponds and dry lakes are located between 5 and 10 mi (8 and 16 km) west of the proposed SEZ near White Sands National Monument; these include Holloman (Raptor) Lake (perennial lake) and Foster Lake (dry lake). Tularosa Creek is a perennial stream that drains out of the Sacramento Mountains near the town of Tularosa, about 17 mi (27 km) north of the proposed SEZ, where it becomes an intermittent stream (Figure 12.3.9.1-1). Salt Creek is a groundwater-fed, intermittent stream that drains from the northwest to southeast and discharges to Big Salt Lake, a small perennial lake covering 768 acres (3 km^2) 25 mi (40 km) northwest of the proposed SEZ. Discharges in Salt Creek have been measured to be less than 1 ft^3/s (0.03 m^3/s) when flowing (Huff 2004). Lake Lucero is an intermittent lake covering 4,032 acres (16 km^2) located 15 mi (24 km) west of the proposed SEZ. The headwaters for the Sacramento River and Rio Penasco (both intermittent streams) are located in the Sacramento Mountains about 13 mi (21 km) east of the proposed SEZ and drain eastward.

Several springs are located within a radius of about 10 mi (16 km) from the proposed SEZ, with a majority of these springs located near the base of the Sacramento Mountains at elevations between 4,925 and 6,560 ft (1,500 and 2,000 m). Discharges from these springs are typically less than 1 ft^3/s (0.03 m^3/s) (SCMRCDC 2002).

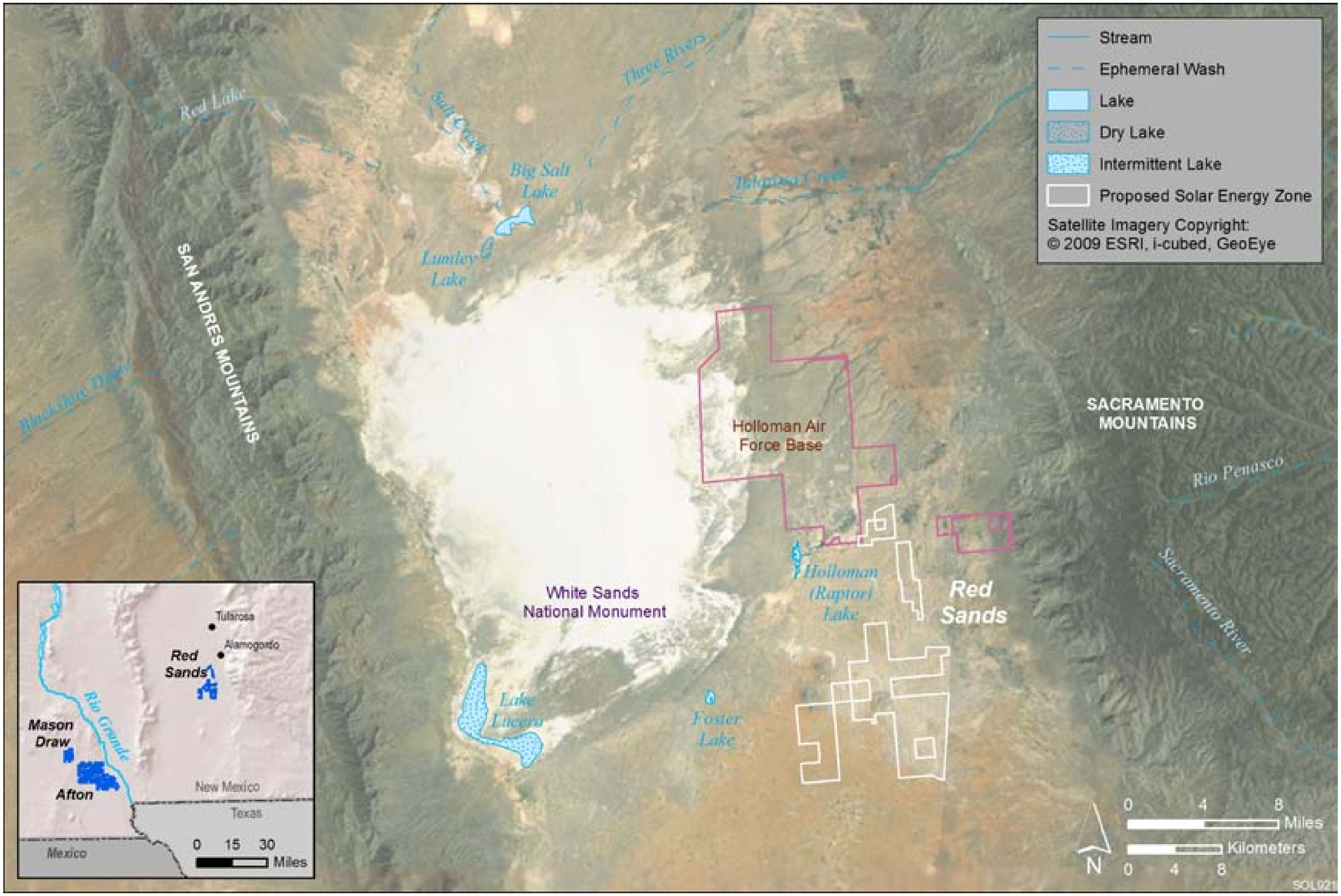

FIGURE 12.3.9.1-1 Surface Water Features near the Proposed Red Sands SEZ

Flood hazards have been mapped in the proposed Red Sands SEZ (FEMA 2009), with the majority of the site being identified as being not within the 500-year floodplain (Zone X). Areas along some of the ephemeral washes coming off the Sacramento Mountains are located within the 100-year floodplain (Zone A), of which some cross the northern segment of the proposed Red Sands SEZ, covering about 54 acres (0.2 km^2). During storm events, intermittent flooding may occur in these ephemeral wash features with temporary ponding of water along with channel erosion and deposition.

According to the NWI survey, several small palustrine and riverine wetlands are located within the proposed SEZ and within a 10-mi (16-km) radius of the site (USFWS 2009). Many of the ephemeral washes contain reaches of riverine wetlands, and several of the palustrine wetlands are located west of the SEZ near White Sands National Monument (Figure 12.3.9.1-1). Within the proposed Red Sands SEZ, there are a total of 17 acres (0.069 km2) of palustrine wetlands and 14,000 ft (4,300 m) of riverine wetlands. Further information on these wetland features is provided in Section 12.3.10.1.

12.3.9.1.2 Groundwater

The proposed Red Sands SEZ is located in the Eastern subbasin of the Tularosa Basin. The Tularosa Basin occupies about 4.16 million acres (16,840 km^2) and lies between the Sacramento Mountains to the east and the San Andres and Oscura Mountains to the west. The basin is about 155 mi (249 km) long north to south, and about 43 mi (69 km) wide east to west. The basin drains to the Hueco Bolson (Basin) to the south, and the basins are separated by a low topographic rise near the New Mexico–Texas state line (SCMRCDC 2002). The Tularosa–Hueco Basin complex is the primary source of water for the large cities of El Paso, Texas, and Ciudad Juarez, Mexico, and for military installations and smaller cities in New Mexico, Texas, and Mexico (CLABS 2001).

The Tularosa Basin is composed of basin-fill sediments derived from erosion of the surrounding mountains. Unconsolidated coarse- to fine-grained piedmont deposits rim the basin and grade basinward into finer alluvial, fluvial, and lacustrine deposits (Huff 2004). The basin has been divided into three subbasins based on hydrologic characteristics. The Red Sands SEZ lies within the Eastern Subbasin in a transition zone between the mountain front and the basin center (SCMRCDC 2002). The areas of the Western and Eastern Subbasins are divided by the Jarilla Fault, a north-south trending subsurface structural feature that creates a bedrock high and separates the two subbasins (SCMRCDC 2002). However, there is no groundwater divide between the two basins, and groundwater flows from northeast to southwest over the Jarilla Fault (SCMRCDC 2002; Huff 2004).

The basin-fill is at least 2,500 ft (760 m) thick in the Eastern Subbasin and acts as the primary aquifer, containing good-quality water in areas at or near alluvial fans adjacent to the Sacramento Mountains (SCMRCDC 2002). Beneath the alluvial fan sediments, basin-fill deposits are underlain by the Santa Fe Group deposited by the ancient Rio Grande of Late Tertiary and early Pleistocene time. The Santa Fe Group is dominated by coarse-grained sediments, such as sand, pebbles, and cobbles, with lesser amounts of clay (SCMRCDC 2002).

Transmissivities for the basin-fill aquifer range from about 60 to 20,000 ft^2/day (5.6 to 1,900 m^2/day) and average around 1,400 to 2,700 ft^2/day (130 to 250 m^2/day near) the eastern margin of the basin (SCMRCDC 2002; Huff 2004). Values of hydraulic conductivity estimated from aquifer tests in the Holloman Air Force Base well field range from 6 to 23 ft/day (1.8 to 7.0 m/day). Groundwater in the Tularosa Basin generally flows from northeast to southwest with a hydraulic gradient of approximately 0.014, with deviations in the general flow path occurring near well fields of concentrated groundwater pumping (e.g., well fields near the city of Alamogordo and the Holloman Air Force Base) (Huff 2004).

Groundwater recharge in the Tularosa Basin occurs by mountain-front recharge, infiltration of intermittent surface-water flows into coarse sediment of alluvial fans, and as underflow along stream channels. Groundwater discharge is primarily by evapotranspiration, groundwater extractions, subsurface flow to the Hueco Bolson, and discharge to streams and springs (Huff 2004). Estimates of groundwater recharge and discharge processes for the Tularosa Basin are highly variable depending upon the methods used. The regional water planning effort done by the SCMRCDC (2002) suggests that total recharge ranges from 68,800 and 86,390 ac-ft/yr (84.8 million and 107 million m^3/yr) based on estimates of average annual stream flow to the basin, while groundwater extractions are on the order of 35,235 ac-ft/yr (43.5 million m^3/yr). The subsurface flow to the Hueco Bolson was estimated to be 5,922 ac-ft/yr (7.3 million m^3/yr) (Heywood and Yeager 2003) and the discharge to springs and streams within the basin was estimated to range between 760 and 3,152 ac-ft/yr (937,400 and 3.9 million m^3/yr) (McLean 1970). The basin-scale groundwater model developed by Huff (2004) suggested that in 1995 the total groundwater recharge for the Tularosa Basin was approximately 42,343 ac-ft/yr (52.2 million m^3/yr), and that groundwater discharge by evapotranspiration was between 30,052 and 34,052 ac-ft/yr (37.1 million to 42 million m^3/yr), groundwater extractions were 24,576 ac-ft/yr (30.3 million m^3/yr), subsurface discharge to the Hueco Bolson was between 3,849 to 4,125 ac-ft/yr (4.7 million to 5.1 million m^3/yr), and discharge to springs and streams was between 1,179 and 1,362 ac-ft/yr (1.5 million and 1.7 million m^3/yr).

Examining basin-scale estimates of groundwater recharge and discharge processes is complicated by the large-scale of the Tularosa Basin, in combination with spatially variable hydrologic processes and concentrated areas of groundwater extractions, creates a situation where localized groundwater balances can vary significantly. The NMOSE uses a numerical groundwater model to assess groundwater right applications within a sub-area of the Tularosa Basin, which includes the cities of Tularosa and Alamogordo, as well as the northern half of the proposed Red Sands SEZ (see Section 12.3.9.1.3). For this sub-area, the numerical model assumed that groundwater recharge was 11,890 ac-ft/yr (14.7 million m^3/yr), and that groundwater discharge by evapotranspiration was 9,905 ac-ft/yr (12.2 million m^3/yr) and 16,491 ac-ft/yr (20.3 million m^3/yr) by groundwater extractions in 2005 (Keyes 2005). Seasonal patterns in temperature and precipitation, as well as periods of sustained drought conditions, can cause variation in groundwater recharge and discharge processes as well (SCMRCDC 2002; Fryberger 2010).

Depth to groundwater near the cities of Tularosa and Alamogordo in the Tularosa Basin is between 20 and 150 ft (6 and 46 m) below the land surface (Sheng et al. 2001). Depth to water in the vicinity of the Red Sands SEZ is about 75 ft (23 m) (SCMRCDC 2002). The depth to water in USGS well 324539105573401 (about 3 mi [4.8 km] east of the SEZ) was about 90 ft (27 m) in 2001 (USGS 2010c). Water levels have been observed to drop between 15 and 35 ft (5 and 11 m) between 1954 and 1996 east of the proposed SEZ (USGS 2010c; wells 324539105580301 and 324442105564501). This drawdown is occurring near well fields used to supply water to Holloman Air Force Base, which are located in the freshwater aquifers that receive mountain front recharge (USGS 2010c; SCMRCDC 2002; City of Alamogordo 2006). Groundwater pumping in the Tularosa Basin has led to drawdown of the water table elevation. By 1995, areas of water-level drawdown were observed in the Tularosa irrigation district, the City of Alamogordo's La Luz well field, Boles Acres, White Sands (the San Andres well field), near the Texas state line in the Western Tularosa Basin area, and in the Salt Basin irrigation district near Crow Flat (SCMRCDC 2002).

Groundwater quality in the Tularosa Basin varies from freshwater to saline water, with TDS concentrations ranging from less than 1,000 mg/L to more than 35,000 mg/L. Groundwater with TDS concentrations of less than 1,000 mg/L are typically found in the alluvial fan deposits near the base of the Sacramento Mountains to the east and near the base of the San Andres Mountains to the west. Areas with the largest TDS concentrations are found near playa deposits near Lake Lucero and Big Salt Lake, as well as throughout the gypsum sand dunes located in White Sands National Monument (Figure 12.3.9.1-1) (Fryberger 2010). In the vicinity of the Red Sands SEZ, TDS concentrations in groundwater are mainly 3,000 to 10,000 mg/L, but groundwater in an area in the southwest portion of the SEZ contains TDS concentrations of between 500 and 3,000 mg/L (Sandia National Laboratories 2002; WRRI 2010).

Groundwater is a vital component with respect to the formation and maintenance of the gypsum sand dunes located in White Sands National Monument (Bennett and Wilder 2009; Langford et al. 2009; Fryberger 2010). Groundwater surface elevations are shallow, with depths to groundwater ranging between 1 and 6 ft (0.3 and 1.8 m) below the land surface within the White Sands National Monument (Langford et al. 2009). These groundwater surface elevations are higher than expected in comparison to basin-scale groundwater patterns described by Huff (2004) for the Tularosa Basin (Bennett and Wilder 2009). Some studies have suggested these higher groundwater surface elevations are the result of a perched aquifer; however, there are no data indicating that an unsaturated layer exists between the basin-fill aquifer and the shallow groundwater levels in the vicinity of the dune fields (Bennett and Wilder 2009). The western portion of the gypsum sand dunes do not support vegetation because the saline groundwater is near the surface, while the eastern portion of the sand dunes are at a higher elevation and contain shallow lenses of freshwater trapped from precipitation infiltration that support vegetation growth (Langford et al. 2009). Ultimately, feedbacks between groundwater surface elevations, groundwater salinity, freshwater lenses, vegetation growth, and eolian processes affect the stability of the gypsum sand dunes located in White Sands National Monument (Fryberger 2010; Langford et al. 2009).

12.3.9.1.3 Water Use and Water Rights Management

In 2005, water withdrawals from surface waters and groundwater in Otero County were 40,711 ac-ft/yr (50.2 million m^3/yr), 27% of which came from surface waters and 73% from groundwater. The largest water use category was agricultural irrigation, at 36,743 ac-ft/yr (45.3 million m^3/yr). Public supply water use accounted for 3,408 ac-ft/yr (4.2 million m^3/yr), which was provided by groundwater only. Aquaculture, livestock, and industrial supply made up the remaining water use sectors, with each accounting for less than 225 ac-ft/yr (278,000 m^3/yr) (Kenny et al. 2009).

Water rights in New Mexico are managed using the doctrine of prior appropriation. All waters (both groundwater and surface water) are public and subject to appropriation by a legal entity with plans of beneficial use for the water (BLM 2001). A water right in New Mexico is a legal entity's right to appropriate water for a specific beneficial use and is defined by seven major elements: owner, point of diversion, place of use, purpose of use, priority date, amount of water, and periods of use. Water rights in New Mexico are administered through the Water Resources Allocation Program (WRAP) under the New Mexico Office of the State Engineer (NMOSE 2010b). The WRAP and NMOSE are responsible for both surface water and groundwater appropriations (both novel and transfer of existing water rights). The extent of the NMOSE's authority to regulate groundwater applies only to groundwater basins that are "declared" underground water basins; however, as of 2005, all groundwater basins within the state have been declared. When assessing water right applications, the WRAP considers the following: the existence of unappropriated waters within the basin, the possibility of impairing existing water rights, whether granting the application would be contrary to the conservation of water within the state, and if the application would be detrimental to public welfare (BLM 2001).

In most regions of the state, groundwater and surface water appropriation application procedures are handled in a similar fashion. The criteria for which the applications are evaluated and administered can vary by region or case (NMOSE 2005a, 2006). For select basins, in addition to the routine evaluations described above, groundwater and surface water rights applications may be subject to water management plans to ensure that the proposed junior water rights will not be detrimental to more senior water rights or impair water conservation efforts in their specific regions (NMOSE 2004). Under the WRAP is the Active Water Resource Management (AWRM) initiative, which is responsible for administering the water management plans in specific basins/regions (NMOSE 2010a). The AWRM is also responsible for prioritizing basins that are in need of conservation and water management plans. For basins deemed "priority," policies are set in place that mandate junior water rights be temporarily curtailed in favor of more senior water rights in times of drought or shortage. These priority basins are generally more restrictive in terms of awarding novel water rights and transferring existing water rights (NMOSE 2004). Specific tools to be used in the AWRM initiative are associated with (1) detailed accounting of water use, (2) implementing new or existing regulations, (3) creating water districts for management purposes, and (4) assigning water masters to those districts (NMOSE 2004). The water masters are tasked with prioritizing water rights; this effort is necessary to accurately determine which rights will be curtailed and which will not in a time of water shortage. The process of curtailing junior water rights in favor of more senior ones is called "priority administration" (NMOSE 2010c).

Freshwater supplies (defined as having a TDS concentration of less than 1,000 mg/L) are one of the primary factors governing the management of water resources in the Tularosa Basin. The majority of the groundwater in the basin-fill aquifer is saline, with freshwater found primarily in alluvial fan deposits along the base of the mountains surrounding the valley that receive mountain front recharge (Orr and Meyers 1986). Surface water and groundwater extractions in the Tularosa Basin are concentrated along the Sacramento Mountains to the east by reservoirs collecting streams and spring discharge in the canyons and groundwater pumping fields at the base of the mountains in the alluvial fan deposits (SCMRCDC 2002). Persistent drought conditions have reduced surface water supplies (SCMRCDC 2002), and groundwater extractions have historically exceeded recharge, resulting in the Tularosa Basin's being classified as a "mined" basin (NMOSE 1997).

While water supplies are scarce in the Tularosa Basin, it is not a part of the AWRM priority basin initiative, so water rights are managed by the NMOSE using criteria for declared basins under WRAP. Surface waters are considered fully appropriated in the Tularosa Basin (SCMRCDC 2002) and groundwater rights are managed by the NMOSE using a developed criteria for the Alamogordo-Tularosa Administrative Area (ATAA), which includes the area bounded by townships 13S-18S and ranges 8E-10E, and on a case-by-case basis for regions outside the ATAA (NMOSE 1997). The northern half of the proposed Red Sands SEZ is located within the ATAA. The administrative criteria used for the ATAA is to allow for the use of groundwater to a specified amount of dewatering during a 40-year planning period (NMOSE 1997), which is assessed by the NMOSE using a numerical groundwater model (Keyes 2005). Groundwater withdrawals within the basin are limited to a drawdown of groundwater surface elevations of less than 100 ft (30 m) over the 40-year planning period (NMOSE 1997). This results in a maximum allowable drawdown rate of 2.5 ft/yr (0.8 m/yr) of groundwater surface elevations. For the majority of the ATAA, this results in a dewatering of approximately 25% of the thickness of the freshwater zone over the 40-year planning period (SCMRCDC 2002; City of Alamogordo 2006). In certain areas of the ATAA, freshwater is found in layers that are less than 400 ft (122 m) thick, so groundwater withdrawals in these areas are limited to less than one-half of the recoverable freshwater (NMOSE 1997).

The scarcity of freshwater supplies in the Tularosa Basin has generated more interest in desalinating groundwater with high TDS concentrations to meet future water demands (SCMRCDC 2002; City of Alamogordo 2006), along with the development of a research facility focused on technical issues and environmental consequences of desalination facilities (Sandia National Laboratories 2002). The City of Alamogordo is currently implementing the Alamogordo Water Supply Project, which consists of pumping up to 4,000 ac-ft/yr (4.9 million m^3/yr) of saline groundwater from a well field located approximately 25 mi (40 km) north of the proposed SEZ (BLM 2010e).

12.3.9.2 Impacts

Potential impacts on water resources related to utility-scale solar energy development include direct and indirect impacts on surface waters and groundwater. Direct impacts occur at the place of origin and at the time of the proposed activity, while indirect impacts occur away from the place of origin or later in time. Impacts on water resources considered in this analysis are the result of land disturbance activities (construction, final developed site plan, as well as off-site activities such as road and transmission line construction) and water use requirements for solar energy technologies that take place during the four project phases: site characterization, construction, operations, and decommissioning/reclamation. Both land disturbance and consumptive water use activities can affect groundwater and surface water flows, cause drawdown of groundwater surface elevations, modify natural drainage pathways, obstruct natural recharge zones, and alter surface water-wetland-groundwater connectivity. Water quality can also be degraded through the generation of wastewater, chemical spills, increased erosion and sedimentation, and increased salinity (e.g., by the excessive withdrawal from aquifers).

12.3.9.2.1 Land Disturbance Impacts on Water Resources

Impacts related to land disturbance activities are common to all utility-scale solar energy facilities, which are described in more detail for the four phases of development in Section 5.9.1; these impacts will be minimized through the implementation of programmatic design features described in Appendix A, Section A.2.2. Land disturbance impacts in the vicinity of the Red Sands SEZ should be minimized near ephemeral washes and wetlands to prevent channel incision, erosion, and sedimentation impacts.

12.3.9.2.2 Water Use Requirements for Solar Energy Technologies

Analysis Assumptions

A detailed description of the water use assumptions for the four utility-scale solar energy technologies (parabolic trough, power tower, dish engine, and PV systems) is presented in Appendix M. Assumptions regarding water use calculations specific to the proposed Red Sands SEZ include the following:

- On the basis of a total area of 22,520 acres (91 km^2), it is assumed that two solar projects would be constructed during the peak construction year;

- Water needed to make concrete would come from an off-site source;

- The maximum land disturbance for an individual solar facility during the peak construction year is 3,000 acres (12 km^2);

- Assumptions on individual facility size and land requirements (Appendix M), along with the assumed number of projects and maximum allowable land disturbance, results in the potential to disturb up to 27% of the SEZ total area during the peak construction year; and

- Water use requirements for hybrid cooling systems are assumed to be on the same order of magnitude as those using dry cooling (see Section 5.9.2.1).

Site Characterization

During site characterization, water would be used mainly for controlling fugitive dust and providing for the workforce potable water supply. Impacts on water resources during this phase of development are expected to be negligible since activities would be limited in area, extent, and duration; water needs could be met by trucking water in from an off-site source.

Construction

During construction, water would be used mainly for fugitive dust suppression and the workforce potable supply. Because there are no significant surface water bodies on the proposed Red Sands SEZ, the water requirements for construction activities could be met either by trucking water to the sites or by using on-site groundwater resources. Water requirements for dust suppression and potable water supply during the peak construction year, shown in Table 12.3.9.2-1, could be as high as 3,257 ac-ft (4.0 million m^3). Groundwater wells would have to yield an estimated 2,020 gpm (7,640 L/min) to meet the estimated construction water requirements, which is of the same order of magnitude as large agricultural and municipal production wells (Harter 2003). The availability of groundwater and the impacts of groundwater withdrawal would need to be assessed during the site characterization phase of a solar development project.

Groundwater quality in the vicinity of the SEZ is known to have high concentrations of TDS and would need to be tested to verify the quality would comply with drinking water standards, if groundwater was to be used for potable supply during construction. Also during construction, up to 148 ac-ft (182,000 m^3) of sanitary wastewater would be generated annually and would need to be either treated on-site or sent to an off-site facility.

Operations

During operations, water would be required for mirror/panel washing, the workforce potable water supply, and cooling (parabolic trough and power tower only) (Table 12.3.9.2-2). Water needs for cooling are a function of the type of cooling used (dry, hybrid, wet). Further refinements to water requirements for cooling would result from the percentage of time that the option was employed (30 to 60% range assumed) and the power of the system. The differences between the water requirements reported in Table 12.3.9.2-2 for the parabolic trough and power tower technologies are attributable to the assumptions of acreage per megawatt. As a result, the water usage for the more energy-dense parabolic trough technology is estimated to be almost twice as large as that for the power tower technology.

TABLE 12.3.9.2-1 Estimated Water Requirements during the Peak Construction Year for the Proposed Red Sands SEZ

Activity	Parabolic Trough	Power Tower	Dish Engine	Photovoltaic
Water use requirements[a]				
Fugitive dust control (ac-ft)[b,c]	2,111	3,167	3,167	3,167
Potable supply for workforce (ac-ft)	148	90	37	19
Total water use requirements (ac-ft)	2,259	3,257	3,204	3,186
Wastewater generated				
Sanitary wastewater (ac-ft)	148	90	37	19

[a] Assumptions of water use for fugitive dust control, potable supply for workforce, and wastewater generation are presented in Table M.9-1 (Appendix M).

[b] Fugitive dust control estimation assumes a local pan evaporation rate of 92 in./yr (234 cm/yr) (Cowherd et al. 1988; WRCC 2010c).

[c] To convert ac-ft to m^3, multiply by 1,234.

TABLE 12.3.9.2-2 Estimated Water Requirements during Operations at the Proposed Red Sands SEZ

Activity	Parabolic Trough	Power Tower	Dish Engine	Photovoltaic
Full build-out capacity (MW)[a,b]	3,603	2,002	2,002	2,002
Water use requirements				
Mirror/panel washing (ac-ft/yr)[c,d]	1,802	1,001	1,001	100
Potable supply for workforce (ac-ft/yr)	50	22	22	2
Dry cooling (ac-ft/yr)[e]	721–3,603	400–2,002	NA[f]	NA
Wet cooling (ac-ft/yr)[e]	16,214–52,246	9,008–29,026	NA	NA
Total water use requirements				
Non-cooled technologies (ac-ft/yr)	NA	NA	1,023	102
Dry-cooled technologies (ac-ft/yr)	2,5735,455	1,423–3,025	NA	NA
Wet-cooled technologies (ac-ft/yr)	18,066–54,098	10,031–30,049	NA	NA

TABLE 12.3.9.2-2 (Cont.)

Activity	Parabolic Trough	Power Tower	Dish Engine	Photovoltaic
Wastewater generated				
Blowdown (ac-ft/yr)[g]	1,024	569	NA	NA
Sanitary wastewater (ac-ft/yr)	50	22	22	2

[a] Land area for parabolic trough was estimated at 5 acres/MW (0.02 km^2/MW); land area for the power tower, dish engine, and PV technologies was estimated at 9 acres/MW (0.04 km^2/MW).

[b] Water needs are linearly related to power. Water usage for any other size project can be estimated by using multipliers provided in Table M.9-2 (Appendix M).

[c] Value assumes a usage rate of 0.5 ac-ft/yr/MW for mirror washing for parabolic trough, power tower, and dish engine technologies and a rate of 0.05 ac-ft/yr/MW for panel washing for PV systems.

[d] To convert ac-ft to m^3, multiply by 1,234.

[e] Dry-cooling value assumes 0.2 to 1.0 ac-ft/yr per MW and wet-cooling value assumes 4.5 to 14.5 ac-ft/yr per MW (range in these values represents 30 and 60% operating times) (DOE 2009).

[f] NA = not applicable.

[g] Value scaled from 250-MW Beacon Solar project with an annual discharge of 44 gpm (167 L/min) (AECOM 2009). Blowdown estimates are relevant to wet cooling only.

Water use requirements among the solar energy technologies being evaluated are a factor of the full build-out capacity for the SEZ, as well as assumptions on water use and technology operations discussed in Appendix M. Table 12.3.9.2-2 lists the quantities of water needed for mirror/panel washing, potable water supply, and cooling activities for each solar energy technology. At full build-out capacity, the estimated total water use requirements for non-cooling technologies (i.e., technologies that do not use water for cooling) during operations are 102 and 1,023 ac-ft/yr (126,000 and 1.2 million m^3/yr) for the PV and dish engine technologies, respectively. For technologies that use water for cooling (i.e., parabolic trough and power tower), total water needs range from 1,423 ac-ft/yr (1.8 million m^3/yr) (power tower for an operating time of 30% using dry cooling) to 54,098 ac-ft/yr (67 million m^3/yr) (parabolic trough for an operating time of 60% using wet cooling). Operations would generate up to 50 ac-ft/yr (62,000 m^3/yr) of sanitary wastewater; in addition, for wet-cooled technologies, 569 to 1,024 ac-ft/yr (702,000 to 1.2 million m^3/yr) of cooling system blowdown water would need to be either treated on-site or sent to an off-site facility. Any on-site treatment of wastewater would have to ensure that treatment ponds are effectively lined in order to prevent any groundwater contamination.

Groundwater in the basin fill aquifer is the primary water source available in the vicinity of the proposed Red Sands SEZ. The relatively shallow depth and isolated areas of the freshwater supply within the basin fill aquifer and the estimated value of local groundwater recharge limits the amount of usable groundwater for solar energy development. Given the estimates of needed water resources for the full build-out scenario (Table 12.3.9.2-2), technologies using wet cooling are not feasible because their water needs far exceed estimates of local groundwater recharge. Technologies using dry cooling have water needs of similar magnitude to the estimated local groundwater recharge rate, so impacts associated with potential groundwater drawdown effects would need to be assessed during the site characterization phase.

PV and dish engine technologies have water use requirements that are reasonable considering what information is known about groundwater in the vicinity of the proposed SEZ. Further characterization of the effects of groundwater withdrawal rates on potential groundwater elevations and flow directions would be needed during the site characterization phase of a solar project and during the development of water supply wells. Groundwater quality in the vicinity of the SEZ would need to be tested to verify the quality would comply with drinking water standards for any potable water supply sources.

Decommissioning/Reclamation

During decommissioning/reclamation, all surface structures associated with the solar project would be dismantled, and the site would be reclaimed to its preconstruction state. Activities and water needs during this phase would be similar to those during the construction phase (dust suppression and potable supply for workers) and may also include water to establish vegetation in some areas. However, the total volume of water needed is expected to be less. Because quantities of water needed during the decommissioning/reclamation phase would be less than those for construction, impacts on surface and groundwater resources also would be less.

12.3.9.2.3 Off-Site Impacts: Roads and Transmission Lines

Impacts associated with the construction of roads and transmission lines primarily deal with water use demands for construction, water quality concerns relating to potential chemical spills, and land disturbance effects on the natural hydrology. The extent of the impacts on water resources is proportional to the amount and location of land disturbance needed to connect the proposed SEZ to major roads and existing transmission lines. The proposed Red Sands SEZ is located adjacent to existing roads and transmission lines, so impacts on water resources are expected to be minimal.

12.3.9.2.4 Summary of Impacts on Water Resources

The impacts on water resources from developing solar energy at the proposed Red Sands SEZ are associated with land disturbance effects on the natural hydrology, water quality concerns, and water use requirements for the various solar energy technologies. Land disturbance activities can cause localized erosion and sedimentation issues, as well as alter groundwater recharge and discharge processes. The Red Sands SEZ contains ephemeral wash features, wetland areas, and areas within the 100-year floodplain. These areas are susceptible to increased erosion and sedimentation as a result of solar energy development.

Impacts related to water use requirements for operations vary depending on the type of solar technology built and, for technologies using cooling systems, the type of cooling (wet, dry, or hybrid) used. Groundwater is the primary water resource available to solar energy facilities in the proposed Red Sands SEZ. Given the large-scale and variability in local recharge and discharge processes within the Tularosa Basin, it is difficult to assess potential impacts on groundwater resources. Assuming the local groundwater recharge is 11,890 ac-ft/yr (14.7 million m^3/yr) as used for the management area that includes portions of the proposed SEZ, groundwater sources would not be able to support wet cooling for a full build-out of the Red Sands SEZ. Even dry-cooling technologies could use up to 46% of the estimated local groundwater recharge.

The Tularosa Basin is currently a mined basin, meaning that groundwater withdrawals are higher than basin recharge, and the water table is declining in the basin. The NMOSE may allow further withdrawals from the basin if groundwater modeling shows that the withdrawals do not violate the administrative criteria discussed above in Section 12.3.9.1.3. A potential impact of groundwater withdrawals from proposed solar energy development is the decline in groundwater surface elevations in the vicinity of White Sands National Monument. It has been suggested that any long-term rise or fall of 3 ft (1 m) in groundwater surface elevations would initiate major changes in the dynamics that govern the gypsum sand dunes (Fryberger 2010). Therefore, critical evaluation and numerical modeling efforts will be needed with respect to groundwater use at the proposed Red Sands SEZ.

Groundwater quality in the vicinity of the SEZ is high in TDS concentrations. Groundwater obtained for a solar development would need to be tested to verify the quality would comply with drinking water standards for any potable water supply sources.

12.3.9.3 SEZ-Specific Design Features and Design Feature Effectiveness

The program for solar energy development on BLM-administered lands will require implementation of the programmatic design features given in Appendix A, Section A.2.2, thus mitigating some impacts on water resources. Design features would focus on coordinating with federal, state, and local agencies that regulate the use of water resources to meet the requirements of permits and approvals needed to obtain water for development, and conducting hydrological studies to characterize the aquifer from which groundwater would be obtained (including drawdown effects, if a new point of diversion is created). The greatest consideration for mitigating water impacts would be in the selection of solar technologies. The mitigation of impacts would be best achieved by selecting technologies with low water demands.

Design features specific to the proposed Red Sands SEZ include the following:

- Water resource analysis indicates that wet-cooling options would not be feasible; other technologies should incorporate water conservation measures;

- Land-disturbance activities should minimize impacts on ephemeral streams located within the proposed SEZ;

- Siting of solar facilities and construction activities should avoid the areas identified as within a 100-year floodplain of the unnamed ephemeral wash running north to south through the center of the proposed SEZ totaling 54 acres (0.22 km^2);

- Groundwater management/rights should be coordinated with the NMOSE;

- Groundwater monitoring and production wells should be constructed in accordance with state standards (NMOSE 2005b);

- Stormwater management BMPs should be implemented according to the guidance provided by the New Mexico Environment Department (NMED 2010); and

- Water for potable uses would have to meet or be treated to meet water quality standards as defined by the EPA (2009d).

12.3.10 Vegetation

This section addresses vegetation that could occur or is known to occur within the potentially affected area of the proposed Red Sands SEZ. The affected area considered in this assessment includes the areas of direct and indirect effects. The area of direct effects is defined as the area that would be physically modified during project development (i.e., where ground-disturbing activities would occur) and includes only the SEZ. The area of indirect effects was defined as the area within 5 mi (8 km) of the SEZ boundary where ground-disturbing activities would not occur but that could be indirectly affected by activities in the area of direct effect.

Indirect effects considered in the assessment include effects from surface runoff, dust, and accidental spills from the SEZ, but do not include ground-disturbing activities. The potential degree of indirect effects would decrease with increasing distance from the SEZ. This area of indirect effect was identified on the basis of professional judgment and was considered sufficiently large to bound the area that would potentially be subject to indirect effects. The affected area is the area bounded by the areas of direct and indirect effects. These areas are defined and the impact assessment approach is described in Appendix M.

12.3.10.1 Affected Environment

The proposed Red Sands SEZ is located within the Chihuahuan Basins and Playas Level IV ecoregion (EPA 2010c), which supports communities of desert shrubs and grasses on alluvial fans, flat to rolling internally drained basins, and river valleys and includes areas of saline and alkaline soils, salt flats, sand dunes, and areas of wind-blown sand (Griffith et al. 2006). The dominant species of the desert shrubland is creosotebush (*Larrea tridentata*), with tarbush (*Flourensia cernua*), yuccas (*Yucca* spp.), sand sage (*Artemisia filifolia*), viscid acacia (*Acacia neovernicosa*), tasajillo (*Cylindropuntia leptocaulis*), lechuguilla (*Agave lechuguilla*), and mesquite (*Prosopis* sp.) also frequently occurring. Gypsum areas support gyp grama (*Bouteloua breviseta*), gyp mentzelia (*Mentzelia humulis*), and Torrey ephedra (*Ephedra torreyana*). Fourwing saltbush (*Atriplex canescens*), seepweed (*Suaeda* sp.), pickleweed (*Allenrolfea occidentalis*), and alkali sacaton (*Sporobolus airoides*) occur on saline flats and along alkaline playa margins. Cacti, including horse crippler (*Echinocactus texensis*), are common in this ecoregion. This ecoregion is located within the Chihuahuan Deserts Level III ecoregion, which is described in Appendix I. Annual precipitation in the Chihuahuan Desert occurs mostly in summer (Brown 1994), and is low in the area of the SEZ, averaging about 9.0 in. (23 cm) at White Sands National Monument (see Section 12.3.13).

Areas surrounding the SEZ include this ecoregion as well as the Gypsiferous Dunes and Chihuahuan Desert Slopes Level IV ecoregions. The Gypsiferous Dunes ecoregion consists of white gypsum sand dunes that are mostly barren, with scattered vegetation on interdune flats (Griffith et al. 2006). The Chihuahuan Desert Slopes ecoregion includes lower mountain slopes that mostly support desert shrubs; however, grasslands occur near alluvial fans and on gentle slopes (Griffith et al. 2006).

Land cover types described and mapped under SWReGAP (USGS 2005a) were used to evaluate plant communities in and near the SEZ. Each cover type encompasses a range of similar plant communities. Land cover types occurring within the potentially affected area of the proposed Red Sands SEZ are shown in Figure 12.3.10.1-1. Table 12.3.10.1-1 lists the surface area of each cover type within the potentially affected area.

Apacherian-Chihuahuan Piedmont Semi-Desert Grassland and Steppe, Chihuahuan Stabilized Coppice Dune and Sand Flat Scrub, and Chihuahuan Mixed Salt Desert Scrub are the predominant cover types within the proposed Red Sands SEZ. Additional cover types within the SEZ are given in Table 12.3.10.1-1. During a July 2009 visit to the site, burrograss (*Scleropogon brevifolius*), Alkali sacaton, and mesa dropseed (*Sporobolus flexuosus*) were the dominant species observed in the grassland and shrub steppe communities present throughout most of the SEZ, with soaptree yucca (*Yucca elata*) frequently occurring. Creosotebush, honey mesquite, and fourwing saltbush also occur within the grasslands, increasing in the shrub steppe and becoming dominant in desertscrub communities. Cacti observed on the SEZ included mound hedgehog cactus (*Echinocereus triglochidiatus*), which is restricted to gypsum soils. Sensitive habitats on the SEZ include wetlands, riparian areas, desert dry washes, playas, and sand dunes. The area has a history of livestock grazing, and the plant communities on the SEZ have likely been affected by grazing.

The area of indirect effects, including the area within 5 mi (8 km) around the SEZ, includes 20 cover types, which are listed in Table 12.3.10.1-1. The predominant cover types in the area of indirect effects are Chihuahuan Stabilized Coppice Dune and Sand Flat Scrub, Chihuahuan Mixed Salt Desert Scrub, and Apacherian-Chihuahuan Piedmont Semi-Desert Grassland and Steppe.

Five palustrine wetlands mapped by the NWI occur in the Red Sands SEZ and total approximately 17 acres (0.07 km^2), and two riverine wetlands total 0.3 mi (0.4 km) (USFWS undated). NWI maps are produced from high-altitude imagery and are subject to uncertainties inherent in image interpretation (USFWS 2009). Three wetlands within the SEZ are classified as palustrine flats wetlands, which are unvegetated or support sparse plant communities. They are approximately 1, 2, and 3 acres (0.004, 0.008, and 0.01 km^2) in size, totaling approximately 6 acres (0.02 km^2). Two riverine wetlands, located in intermittent drainages, are temporarily flooded and total about 0.3 mi (0.4 km) in length. One palustrine wetland with scrub-shrub plant communities in the northern portion of the SEZ is approximately 10.5 acres (0.04 km^2) in size. One palustrine open water wetland, about 0.5 acres (0.002 km^2) in size, occurs in the central portion of the SEZ. Ephemeral dry washes occur within the SEZ and typically contain water for short periods during or following precipitation events. These washes generally do not support wetland habitats; however, some desert dry washes in the SEZ support riparian communities.

Numerous riverine wetlands occur outside the SEZ, within the area of indirect effects, to the north, east, and west. Scattered palustrine open water wetlands occur in several locations just outside the SEZ boundary, and palustrine flat wetlands occur to the north and south within the area of indirect effects. A large number of wetlands are located west of the SEZ, within the area

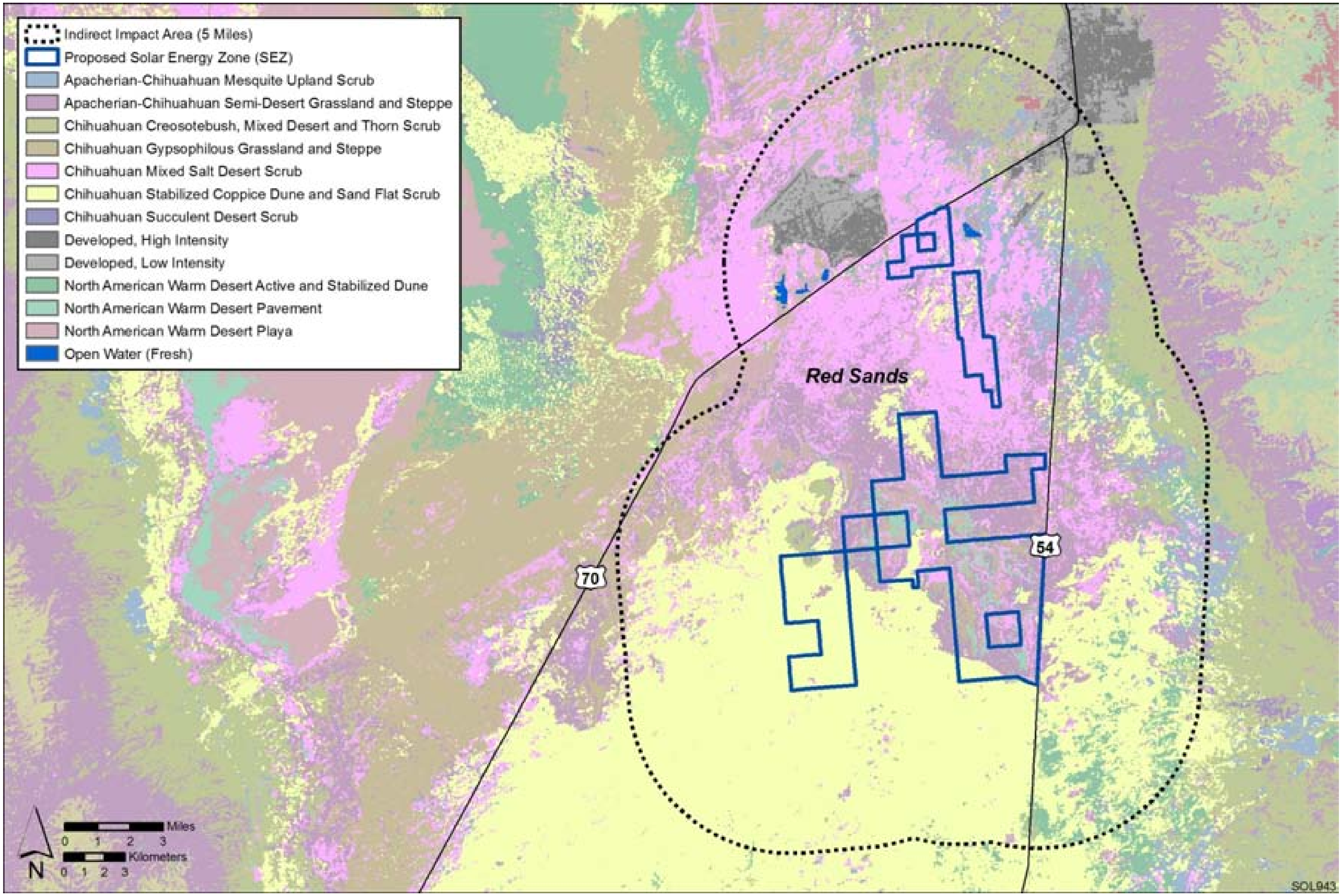

FIGURE 12.3.10.1-1 Land Cover Types within the Proposed Red Sands SEZ (Source: USGS 2004)

TABLE 12.3.10.1-1 Land Cover Types within the Potentially Affected Area of the Proposed Red Sands SEZ and Potential Impacts

	Area of Cover Type Affected (acres)[b]		
Land Cover Type[a]	Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Overall Impact Magnitude[e]
Apacherian-Chihuahuan Piedmont Semi-Desert Grassland and Steppe: Occurs on gently sloping bajadas, as well as on mesas and steeper piedmont and foothill slopes. Consists of grassland, steppe, and savanna characterized by a high diversity of perennial grasses as well as succulents (such as *Agave*, sotol [*Dasylirion* spp.], and *Yucca*) and tall shrub/short tree species.	6,706 acres[f] (0.5%, 2.2%)	27,483 acres (2.1%)	Small
Chihuahuan Stabilized Coppice Dune and Sand Flat Scrub: Consists of vegetated dunes and sandsheets with open shrublands (generally 10 to 30% plant cover) that include grasses.	5,973 acres (0.9%, 8.6%)	78,780 acres (11.8%)	Small
Chihuahuan Mixed Salt Desert Scrub: Occurs in saline basins, often on alluvial flats and around playas. Consists of one or more species of *Atriplex* along with other halophytic plant species. Grasses are present in varying densities.	4,712 acres (2.7%, 30.0%)	39,402 acres (22.3%)	Moderate
North American Warm Desert Playa: Consists of barren and sparsely vegetated areas (generally <10% plant cover) that are intermittently flooded; salt crusts are common. Sparse shrubs occur around the margins, and patches of grass may form in depressions. In large playas, vegetation forms rings in response to salinity. Herbaceous species may be periodically abundant.	1,626 acres (1.6%, 35.1%)	3,806 acres (3.7%)	Moderate
North American Warm Desert Pavement: Consists of unvegetated to very sparsely vegetated (<2% plant cover) areas, usually in flat basins, with ground surfaces of fine to medium gravel coated with "desert varnish." Desertscrub species are usually present. Herbaceous species may be abundant in response to seasonal precipitation.	1,574 acres (16.8%, 86.0%)	914 acres (9.7%)	Large
Chihuahuan Gypsophilous Grassland and Steppe: Occurs on gypsum outcrops and on basins and slopes with sandy gypsiferous and/or alkaline soils. Consists of generally sparse grassland, steppe, or dwarf shrubland.	1,366 acres (1.0%, 37.1%)	7,556 acres (5.4%)	Small

TABLE 12.3.10.1-1 (Cont.)

Land Cover Type[a]	Area of Cover Type Affected (acres)[b] Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Overall Impact Magnitude[e]
Apacherian-Chihuahuan Mesquite Upland Scrub: Occurs on foothills where deeper soil layers store winter precipitation. Dominant species are western honey mesquite (*Prosopis glandulosa*) or velvet mesquite (*P. velutina*) along with succulents and other deep-rooted shrubs. Cover of grasses is low.	241 acres (0.1%, 0.4%)	9,780 acres (3.9%)	Small
Chihuahuan Creosotebush, Mixed Desert and Thorn Scrub: Occurs in basins and plains as well as the foothill transition zone. Consists of creosotebush (*Larrea tridentata*) alone or with thornscrub or other desertscrub species, including succulents such as *Agave* and cacti. Although grasses may be common, shrubs generally have greater cover.	177 acres (<0.1%, 0.1%)	19,981 acres (2.3%)	Small
North American Warm Desert Active and Stabilized Dune: Consists of unvegetated to sparsely vegetated (generally <10% plant cover) active dunes and sand sheets. Vegetation includes shrubs, forbs, and grasses. Includes unvegetated "blowouts" and stabilized areas.	100 acres (0.1%, 1.2%)	5,235 acres (3.4%)	Small
Chihuahuan Succulent Desert Scrub: Occurs on hot, dry colluvial slopes, upper bajadas, sideslopes, ridges, canyons, hills, and mesas. Includes an abundance of succulent species such as cacti, *Agave*, *Yucca*, and others. Shrubs are generally present and perennial grasses are sparse.	6 acres (0.4%, 3.2%)	11 acres (0.7%)	Small
Developed, Open Space-Low Intensity: Includes housing, parks, golf courses, and other areas planted in developed settings. Impervious surfaces comprise up to 49% of the total land cover.	0 acres	4,347 acres (22.3%)	Small
Developed, Medium-High Intensity: Includes housing and commercial/industrial development. Impervious surfaces compose 50–100% of the total land cover.	0 acres	3,284 acres (14.4%)	Small
Open Water: Plant or soil cover is generally less than 25%.	0 acres	289 acres (42.8%)	Small

TABLE 12.3.10.1-1 (Cont.)

Land Cover Type[a]	Area of Cover Type Affected (acres)[b] Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Overall Impact Magnitude[e]
Agriculture: Areas where pasture/hay or cultivated crops account for more than 20% of total vegetation cover.	0 acres	130 acres (1.9%)	Small
Chihuahuan Sandy Plains Semi-Desert Grassland: Occurs on sandy plains and sandstone mesas. Consists of grassland and steppe, and includes scattered desert shrubs and stem succulents such as *Yucca* spp.	0 acres	113 acres (0.5%)	Small
North American Warm Desert Wash: Consists of intermittently flooded linear or braided strips within desertscrub or grassland landscapes on bajadas, mesas, plains, and basin floors. Although often dry, washes are associated with rapid sheet and gully flow. The vegetation varies from sparse and patchy to moderately dense and typically occurs along the banks, but may occur within the channel. Shrubs and small trees are typically intermittent to open. Common upland shrubs often occur along the edges.	0 acres	101 acres (1.9%)	Small
North American Warm Desert Riparian Woodland and Shrubland: Occurs along medium to large perennial streams in canyons and desert valleys. Consists of a mix of riparian woodlands and shrublands. Vegetation is dependent upon annual or periodic flooding, along with substrate scouring, and/or a seasonally shallow water table.	0 acres	50 acres (0.7%)	Small
North American Warm Desert Bedrock Cliff and Outcrop: Occurs on subalpine to foothill steep cliff faces, narrow canyons, rock outcrops, and unstable scree and talus slopes. Consists of barren and sparsely vegetated areas (generally <10% plant cover) with desert species, especially succulents. Lichens are predominant in some areas.	0 acres	23 acres (0.2%)	Small
Inter-Mountain Basins Semi-Desert Shrub Steppe: Generally consists of perennial grasses with an open shrub and dwarf shrub layer.	0 acres	13 acres (0.2%)	Small

TABLE 12.3.10.1-1 (Cont.)

Land Cover Type[a]	Area of Cover Type Affected (acres)[b] Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Overall Impact Magnitude[e]
North American Arid West Emergent Marsh: Occurs in natural depressions, such as ponds, or bordering lakes, or slow-moving streams or rivers. Alkalinity is highly variable. The plant community is characterized by herbaceous emergent, submergent, and floating leaved species.	0 acres	7 acres (2.8%)	Small

a Land cover descriptions are from USGS (2005a). Full descriptions of land cover types, including plant species, can be found in Appendix I.

b Area in acres, determined from USGS (2004).

c Includes the area of the cover type within the SEZ, the percentage that area represents of all occurrences of that cover type within the SEZ region (i.e., a 50-mi [80-km] radius from the center of the SEZ), and the percentage that area represents of all occurrences of that cover type on BLM lands within the SEZ region. The SEZ region intersects portions of New Mexico and Texas. However, the SEZ and affected area occur only in New Mexico.

d Area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary where ground-disturbing activities would not occur. Indirect effects include effects from surface runoff, dust, and other factors from project development. The potential degree of indirect effects would decrease with increasing distance away from the SEZ. Includes the area of the cover type within the area of indirect effects and the percentage that area represents of all occurrences of that cover type within the SEZ region.

e Overall impact magnitude categories were based on professional judgment and include (1) *small*: a relatively small proportion ($\leq$1%) of the cover type within the SEZ region would be lost; (2) *moderate*: an intermediate proportion (>1 but $\leq$10%) of a cover type would be lost; (3) *large*: >10% of a cover type would be lost.

f To convert acres to km^2, multiply by 0.004047.

of indirect effects, and include lacustrine open water and flats, palustrine scrub-shrub and open water, and riverine wetlands. Several springs are located within approximately 10 mi (16 km) of the SEZ. Most of these are located near the base of the Sacramento Mountains, east of the SEZ (see Section 12.3.9.1.1).

The State of New Mexico maintains an official list of weed species that are designated noxious species (NMDA 2009). Table 12.3.10.1-2 provides a summary of the noxious weed species regulated in New Mexico that are known to occur in Otero County (USDA 2010; NMSU 2007), which includes the proposed Red Sands SEZ. African rue (*Peganum harmala*), included in Table 12.3.10.1-2, was observed on the SEZ in July 2009.

The New Mexico Department of Agriculture classifies noxious weeds into one of four categories (NMDA 2009):

- "Class A species are currently not present in New Mexico, or have limited distribution. Preventing new infestations of these species and eradicating existing infestations is the highest priority."

- "Class B species are limited to portions of the state. In areas with severe infestations, management should be designed to contain the infestation and stop any further spread."

- "Class C species are widespread in the state. Management decisions for these species should be determined at the local level, based on feasibility of control and level of infestation."

- "Watch List species are species of concern in the state. These species have the potential to become problematic. More data is needed to determine if these species should be listed. When these species are encountered, please document their location and contact appropriate authorities."

12.3.10.2 Impacts

The construction of solar energy facilities within the proposed Red Sands SEZ would result in direct impacts on plant communities due to the removal of vegetation within the facility footprint during land-clearing and land-grading operations. Approximately 80% of the SEZ (18,016 acres [72.9 km^2]) would be expected to be cleared with full development of the SEZ. The plant communities affected would depend on facility locations, and could include any of the communities occurring on the SEZ. Therefore, for the purposes of this analysis, all the area of each cover type within the SEZ is considered to be directly affected by removal with full development of the SEZ.

TABLE 12.3.10.1-2 Designated Noxious Weeds of New Mexico Occurring in Otero County

Common Name	Scientific Name	Category
African rue	*Peganum harmala*	Class B
Bull thistle	*Cirsium vulgare*	Class C
Hoary cress	*Cardaria* spp.	Class A
Jointed goatgrass	*Aegilops cylindrica*	Class C
Leafy spurge	*Euphorbia esula*	Class A
Malta starthistle	*Centaurea melitensis*	Class B
Musk thistle	*Carduus nutans*	Class B
Poison hemlock	*Conium maculatum*	Class B
Purple starthistle	*Centaurea calcitrapa*	Class A
Russian knapweed	*Acroptilon repens*	Class B
Russian olive	*Elaeagnus angustifolia*	Class C
Saltcedar	*Tamarix* spp.	Class C
Siberian elm	*Ulmus pumila*	Class C
Teasel	*Dipsacus fullonum*	Class B

Sources: NMDA (2009); NMSU (2007); USDA (2010).

Indirect effects (caused, for example, by surface runoff or dust from the SEZ) have the potential to degrade affected plant communities and may reduce biodiversity by promoting the decline or elimination of species sensitive to disturbance. Indirect effects can also cause an increase in disturbance-tolerant species or invasive species. High impact levels could result in the elimination of a community or the replacement of one community type by another.

Possible impacts from solar energy facilities on vegetation that are encountered within the SEZ are described in more detail in Section 5.10.1. Any such impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2 and any additional mitigation applied. Section 12.3.10.2.3, below identifies design features of particular relevance to the proposed Red Sands SEZ.

12.3.10.2.1 Impacts on Native Species

The impacts of construction, operation, and decommissioning were considered small if the impact affected a relatively small proportion (≤1%) of the cover type in the SEZ region (within 50 mi [80 km] of the center of the SEZ); a moderate impact (>1 but ≤10%) could affect an intermediate proportion of a cover type; a large impact could affect greater than 10% of a cover type.

Solar facility construction and operation in the proposed Red Sands SEZ would primarily affect communities of the Apacherian-Chihuahuan Piedmont Semi-Desert Grassland and Steppe, Chihuahuan Stabilized Coppice Dune and Sand Flat Scrub, and Chihuahuan Mixed Salt Desert Scrub cover types. Additional cover types that would be affected within the SEZ include North

American Warm Desert Playa, North American Warm Desert Pavement, Chihuahuan Gypsophilous Grassland and Steppe, Apacherian-Chihuahuan Mesquite Upland Scrub, Chihuahuan Creosotebush, Mixed Desert and Thorn Scrub, North American Warm Desert Active and Stabilized Dune, and Chihuahuan Succulent Desert Scrub. Table 12.3.10.1-1 summarizes the potential impacts on land cover types resulting from solar energy facilities in the proposed Red Sands SEZ. Many of these cover types are relatively common in the SEZ region; however, several are relatively uncommon, representing 1% or less of the land area within the SEZ region: Chihuahuan Succulent Desert Scrub (0.03%), and North American Warm Desert Pavement (0.2%). Wetlands, riparian areas, desert dry washes, playas, and sand dunes are important sensitive habitats on the SEZ.

The construction, operation, and decommissioning of solar projects within the proposed Red Sands SEZ would result in large impacts on the North American Warm Desert Pavement cover type and moderate impacts on the Chihuahuan Mixed Salt Desert Scrub and North American Warm Desert Playa cover types. Solar energy development would result in small impacts on all other cover types in the affected area.

Disturbance of vegetation in dune communities within the SEZ, as by heavy equipment operation, could result in the loss of substrate stabilization. Re-establishment of dune species could be difficult due to the arid conditions and unstable substrates. Because of the arid conditions, re-establishment of desertscrub communities in temporarily disturbed areas would likely be very difficult and might require extended periods of time. In addition, noxious weeds could become established in disturbed areas and colonize adjacent undisturbed habitats, thus reducing restoration success and potentially resulting in widespread habitat degradation. Cryptogamic soil crusts occur in many of the shrubland communities in the region, and likely occur on the SEZ. Damage to these crusts, as by the operation of heavy equipment or other vehicles, can alter important soil characteristics, such as nutrient cycling and availability, and affect plant community characteristics (Lovich and Bainbridge 1999).

The deposition of fugitive dust from large areas of disturbed soil onto habitats outside a solar project area could result in reduced productivity or changes in plant community composition. Fugitive dust deposition could affect plant communities of each of the cover types occurring within the area of indirect effects identified in Table 12.3.10.1-1.

Approximately 17 acres (0.07 km^2) of palustrine wetlands and about 0.3 mi (0.4 km) of riverine wetlands occur within the Red Sands SEZ. Grading could result in direct impacts on these wetlands if fill material is placed within wetland areas. Grading near the wetlands in the SEZ could disrupt surface water or groundwater flow characteristics, resulting in changes in the frequency, duration, depth, or extent of inundation or soil saturation, and could potentially alter wetland plant communities and affect wetland function. Increases in surface runoff from a solar energy project site could also affect wetland hydrologic characteristics. The introduction of contaminants into wetlands in or near the SEZ could result from spills of fuels or other materials used on a project site. Soil disturbance could result in sedimentation in wetland areas, which could degrade or eliminate wetland plant communities. Sedimentation effects or hydrologic changes could also extend to wetlands outside of the SEZ, such as the playa areas to the west.

Grading could also affect dry washes within the SEZ. Some desert dry washes in the SEZ support riparian communities. Alteration of surface drainage patterns or hydrology could adversely affect downstream dry wash communities. Vegetation within these communities could be lost by erosion or desiccation. Communities associated with intermittently flooded areas downgradient from solar projects in the SEZ could be affected by ground-disturbing activities. Site clearing and grading could result in hydrologic changes, and could potentially alter plant communities and affect community function. Increases in surface runoff from a solar energy project site could also affect hydrologic characteristics of these communities. The introduction of contaminants into these habitats could result from spills of fuels or other materials used on a project site. Soil disturbance could result in sedimentation in these areas, which could degrade or eliminate sensitive plant communities. See Section 12.3.9 for further discussion of impacts on washes.

Although the use of groundwater within the Red Sands SEZ for technologies with high water requirements, such as wet-cooling systems, may be unlikely, groundwater withdrawals for such systems could reduce groundwater elevations. Communities that depend on accessible groundwater include mesquite communities on and near the SEZ and interdunal communities associated with gypsum dune fields, which depend on a high water table, such as cottonwood groves and other communities on White Sands National Monument west of the SEZ. These communities could become degraded or lost as a result of lowered groundwater levels (See Section 12.3.9 for further discussion of groundwater). The potential for impacts on springs in the vicinity of the SEZ, such as those near the Sacramento Mountains, would need to be evaluated by project-specific hydrological studies.

12.3.10.2.2 Impacts from Noxious Weeds and Invasive Plant Species

On February 8, 1999, the president signed E.O. 13112, "Invasive Species," which directs federal agencies to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts of invasive species (*Federal Register*, Volume 64, page 61836, Feb. 8, 1999). Potential impacts of noxious weeds and invasive plant species resulting from solar energy facilities are described in Section 5.10.1. Invasive species, including African rue, occur on the SEZ. Additional species designated as noxious weeds in New Mexico, and known to occur in Otero County, are given in Table 12.3.10.1-2. Despite required design features to prevent the spread of noxious weeds, project disturbance could potentially increase the prevalence of noxious weeds and invasive species in the affected area of the proposed Red Sands SEZ, such that weeds could be transported into areas that were previously relatively weed-free, resulting in reduced restoration success and possible widespread habitat degradation.

Past or present land uses may affect the susceptibility of plant communities to the establishment of noxious weeds and invasive species. Existing roads, grazing, and recreational OHV use within the SEZ area of potential impact also likely contribute to the susceptibility of plant communities to the establishment and the spread of noxious weeds and invasive species. Disturbed areas, including 3,284 acres (13.3 km^2) of Developed, Medium-High Intensity and

4,347 acres (17.6 km^2) of Developed, Open Space-Low Intensity occur within the area of indirect effects and may contribute to the establishment of noxious weeds and invasive species.

12.3.10.3 SEZ-Specific Design Features and Design Feature Effectiveness

In addition to programmatic design features, SEZ-specific design features would reduce the potential for impacts on plant communities. While the specifics of some of these practices are best established when considering specific project details, some SEZ-specific design features can be identified at this time, as follows:

- An Integrated Vegetation Management Plan addressing invasive species control and an Ecological Resources Mitigation and Monitoring Plan addressing habitat restoration should be approved and implemented to increase the potential for successful restoration of desertscrub, dune, steppe, riparian, playa, and grassland communities and other affected habitats and to minimize the potential for the spread of invasive species, such as African rue. Invasive species control should focus on biological and mechanical methods where possible to reduce the use of herbicides.

- All wetland, riparian, dry wash, playa, succulent, and sand dune communities within the SEZ should be avoided to the extent practicable, and any impacts minimized and mitigated. A buffer area should be maintained around wetland and riparian habitats to reduce the potential for impacts. Any yucca, agave, ocotillo, and cacti (including *Opuntia* spp., *Cylindropuntia* spp., *Echinocactus* spp., and *Sclerocactus* spp.) and other succulent plant species that cannot be avoided should be salvaged.

- Appropriate engineering controls should be used to minimize impacts on wetland, riparian, dry wash, and playa habitats, including downstream occurrences, resulting from surface water runoff, erosion, sedimentation, altered hydrology, accidental spills, or fugitive dust deposition to these habitats. Appropriate buffers and engineering controls would be determined through agency consultation.

- Groundwater withdrawals should be limited to reduce the potential for indirect impacts on groundwater-dependent communities, such as mesquite, wetland, or riparian communities, or gypsum dune field communities, including those communities found on White Sands National Monument. Potential impacts on springs should be determined through hydrological studies.

If these SEZ-specific design features are implemented in addition to other programmatic design features, it is anticipated that a high potential for impacts from invasive species and potential impacts on wetland, riparian, dry wash, playa, succulent, and dune communities would be reduced to a minimal potential for impact.

12.3.11 Wildlife and Aquatic Biota

This section addresses wildlife (amphibians, reptiles, birds, and mammals) and aquatic biota that could occur within the potentially affected area of the proposed Red Sands SEZ. Wildlife known to occur within 50 mi (80 km) of the SEZ (i.e., the SEZ region) were determined from the SWReGAP (USGS 2007) and the BISON-M (NMDGF 2010). Land cover types suitable for each species were determined from SWReGAP (USGS 2004, 2005a, 2007) and the South Central Gap Analysis Program (USGS 2010d). The amount of aquatic habitat within the SEZ region was determined by estimating the length of linear perennial stream and canal features and the area of standing water body features (i.e., ponds, lakes, and reservoirs) within 50 mi (80 km) of the SEZ using available GIS surface water datasets.

The affected area considered in this assessment included the areas of direct and indirect effects. The area of direct effects was defined as the area that would be physically modified during project development (i.e., where ground-disturbing activities would occur) within the SEZ. The maximum developed area within the SEZ would be 18,016 acres (72.9 km^2). No areas of direct effects would occur for either a new transmission line or a new access road, because existing transmission line and road corridors are adjacent to or through the SEZ.

The area of indirect effects was defined as the area within 5 mi (8 km) of the SEZ boundary where ground-disturbing activities would not occur, but that could be indirectly affected by activities in the area of direct effects (e.g., surface runoff, dust, noise, lighting, and accidental spills in the SEZ). Potentially suitable habitats for a species within the SEZ greater than the maximum of 18,016 acres (72.9 km^2) of direct effects were also included as part of the area of indirect effects. The potential degree of indirect effects would decrease with increasing distance from the SEZ. The area of indirect effects was identified on the basis of professional judgment and was considered sufficiently large to bound the area that would potentially be subject to indirect effects. These areas of direct and indirect effects are defined and the impact assessment approach is described in Appendix M.

The primary land cover habitat type within the affected area is Chihuahuan coppice dune and sand flat scrub (see Section 12.3.10). Potentially unique habitats within the SEZ include desert dunes, playas, washes, and riverine and palustrine wetlands. Approximately 1,600 acres (6.5 km^2) of desert playa habitat occurs on the SEZ. Desert playa, riparian, and marsh habitats occur in the area of indirect effects. There are no permanent aquatic habitats known to occur on the SEZ; however, permanent open water habitats occur in the area of indirect effects, particularly at the Raptor Lake Recreational Area and Lagoon G Wildlife Refuge Area associated with Holloman Air Force Base.

12.3.11.1 Amphibians and Reptiles

12.3.11.1.1 Affected Environment

This section addresses amphibian and reptile species that are known to occur, or for which potentially suitable habitat occurs, on or within the potentially affected area of the proposed Red Sands SEZ. Amphibian and reptile species potentially present in the SEZ area were determined from species lists available from the BISON-M (NMDGF 2010). Range maps and habitat information were obtained from SWReGAP (USGS 2007), with supplemental habitat information obtained from the CDFG (2008) and NatureServe (2010). Land cover types suitable for each species were determined from SWReGAP (USGS 2004, 2005a, 2007) and the South Central GAP Analysis Program (USGS 2010d). See Appendix M for additional information on the approach used.

More than 10 amphibian species occur in Otero County. Based on species distributions within the area of the SEZ and habitat preferences of the amphibian species, Couch's spadefoot (*Scaphiopus couchii*), Great Plains toad (*Bufo cognatus*), plains spadefoot (*Spea bombifrons*), and red-spotted toad (*Bufo punctatus*) would be expected to occur within the SEZ (NMDGF 2010; USGS 2007; Stebbins 2003).

More than 50 reptile species occur within Otero County (NMDGF 2010; USGS 2007; Stebbins 2003). Lizard species expected to occur within the proposed Red Sands SEZ include the collared lizard (*Crotaphytus collaris*), eastern fence lizard (*Sceloporus undulatus*), Great Plains skink (*Eumeces obsoletus*), long-nosed leopard lizard (*Gambelia wislizenii*), round-tailed horned lizard (*Phrynosoma modestum*), side-blotched lizard (*Uta stansburiana*), and western whiptail (*Cnemidophorus tigris*). Snake species expected to occur within the SEZ are the coachwhip (*Masticophis flagellum*), common kingsnake (*Lampropeltis getula*), glossy snake (*Arizona elegans*), gophersnake (*Pituophis catenifer*), groundsnake (*Sonora semiannulata*), long-nosed snake (*Rhinocheilus lecontei*), and nightsnake (*Hypsiglena torquata*). The most common poisonous snakes that could occur on the SEZ are the western diamond-backed rattlesnake (*Crotalus atrox*) and western rattlesnake (*Crotalus viridis*).

Table 12.3.11.1-1 provides habitat information for representative amphibian and reptile species that could occur within the proposed Red Sands SEZ. Special status amphibian and reptile species are addressed in Section 12.3.12.

12.3.11.1.2 Impacts

The types of impacts that amphibians and reptiles could incur from construction, operation, and decommissioning of utility-scale solar energy facilities are discussed in Section 5.10.2.1. Any such impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2, and through any additional mitigation applied. Section 12.3.11.1.3, below, identifies SEZ-specific design features of particular relevance to the proposed Red Sands SEZ.

TABLE 12.3.11.1-1 Habitats, Potential Impacts, and Potential Mitigation for Representative Amphibian and Reptile Species That Could Occur on or in the Affected Area of the Proposed Red Sands SEZ

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Maximum Area of Potential Habitat Affected[b]: Outside SEZ (Indirect Effects)[d]	Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
Amphibians				
Couch's spadefoot (*Scaphiopus couchii*)	Desert washes, desert riparian, palm oasis, desert succulent shrub, and desertscrub habitats. Requires pools or potholes with water that lasts longer than 10 to 12 days for breeding sites. About 2,467,000 acres[g] of potentially suitable habitat occurs within the SEZ region.	7,124 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat) during construction and operations	57,364 acres of potentially suitable habitat (2.3% of available suitable habitat)	Small overall impact. Avoidance of wetlands, playa, and wash habitats could reduce impacts.
Great Plains toad (*Bufo cognatus*)	Prefers desert, grassland, and agricultural habitats. Breeds in shallow temporary pools, quiet areas of streams, marshes, irrigation ditches, and flooded fields. In cold winter months, it burrows underground and becomes inactive. About 1,453,500 acres of potentially suitable habitat occurs within the SEZ region.	8,072 acres of potentially suitable habitat lost (0.6% of available potentially suitable habitat) during construction and operations	35,341 acres of potentially suitable habitat (2.4% of available suitable habitat)	Small overall impact. Avoidance of wetland, playa, and wash habitats could reduce impacts.
Plains spadefoot (*Spea bombifrons*)	Common in areas of soft sandy/gravelly soils along stream floodplains Also occurs in semidesert shrublands. Breeds in deep open-water playa habitats. Usually remains in underground burrows until it rains. About 1,124,000 acres of potentially suitable habitat occurs within the SEZ region.	3,169 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat) during construction and operations	31,343 acres of potentially suitable habitat (2.9% of available suitable habitat)	Small overall impact. Avoidance of wetland, playa and wash habitats could reduce impacts.
Red-spotted toad (*Bufo punctatus*)	Dry, rocky areas at lower elevations near desert springs and persistent pools along rocky arroyos; desert streams and oases; open grassland; scrubland oaks; and dry woodlands. About 3,955,100 acres of potentially suitable habitat occurs within the SEZ region.	18,016 acres of potentially suitable habitat lost (0.5% of available potentially suitable habitat) during construction and operations	184,271 acres of potentially suitable habitat (4.7% of available suitable habitat)	Small overall impact. Avoidance of wetland, playa and wash habitats, otherwise no species-specific mitigation of direct effects is feasible, because suitable habitat is widespread in the area of direct effects.

TABLE 12.3.11.1-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Maximum Area of Potential Habitat Affected[b]: Outside SEZ (Indirect Effects)[d]	Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
Lizards				
Collared lizard (*Crotaphytus collaris*)	Level or hilly rocky terrain in a variety of vegetative communities. Typical habitats include lava fields, rocky canyons, slopes, and gullies. About 3,611,000 acres of potentially suitable habitat occurs within the SEZ region.	14,782 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat) during construction and operations	105,150 acres of potentially suitable habitat (2.9% of available suitable habitat)	Small overall impact.
Eastern fence lizard (*Sceloporus undulatus*)	Sunny, rocky habitats of cliffs, talus, old lava flows and cones, canyons, and outcrops. Various vegetation adjacent to or among rocks, including montane forests, woodlands, semidesert shrubland, and various forbs and grasses. About 4,058,900 acres of potentially suitable habitat occurs within the SEZ region.	18,106 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat) during construction and operations	151,378 acres of potentially suitable habitat (3.7% of available suitable habitat)	Small overall impact. No species-specific mitigation of direct effects is feasible, because suitable habitat is widespread in the area of direct effects.
Great Plains skink (*Eumeces obsoletus*)	Creosotebush desert, desert-grasslands, riparian corridors, pinyon-juniper woodlands, and pine-oak woodlands. About 3,729,900 acres of potentially suitable habitat occurs within the SEZ region.	13,568 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat) during construction and operations	105,734 acres of potentially suitable habitat (2.8% of available suitable habitat)	Small overall impact. Avoidance of riverine wetlands could reduce impacts.
Long-nosed leopard lizard (*Gambelia wislizenii*)	Desert and semidesert areas with scattered shrubs. Prefers sandy or gravelly flats and plains. Also prefers areas with abundant rodent burrows that they occupy when inactive. About 1,967,000 acres of potentially suitable habitat occurs in the SEZ region.	11,109 acres of potentially suitable habitat lost (0.6% of available potentially suitable habitat) during construction and operations	147,954 acres of potentially suitable habitat (7.5% of available potentially suitable habitat)	Small overall impact.
Round-tailed horned lizard (*Phrynosoma modestum*)	Desert-grassland and desert shrubland habitats with scrubby vegetation and sandy or gravelly soil. About 3,429,600 acres of potentially suitable habitat occurs within the SEZ region.	11,842 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat) during construction and operations	96,680 acres of potentially suitable habitat (2.8% of available suitable habitat)	Small overall impact.

TABLE 12.3.11.1-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b] Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
Lizards (Cont.)				
Side-blotched lizard (*Uta stansburiana*)	Arid and semiarid locations with scattered bushes or scrubby trees. Often occurs in sandy washes with scattered rocks and bushes. About 3,434,800 acres of potentially suitable habitat occurs within the SEZ region.	11,842 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat) during construction and operations	96,781 acres of potentially suitable habitat (2.8% of available suitable habitat)	Small overall impact. Avoidance of wash habitats could reduce impacts.
Western whiptail (*Cnemidophorus tigris*)	Arid and semiarid habitats with sparse plant cover. About 2,551,000 acres of potentially suitable habitat occurs within the SEZ region.	7,763 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat) during construction and operations	116,385 acres of potentially suitable habitat (4.6% of available potentially suitable habitat)	Small overall impact.
Snakes				
Coachwhip (*Masticophis flagellum*)	Creosotebush desert, shortgrass prairie, shrub-covered flats and hills. Sandy to rocky substrates. Avoids dense vegetation. About 3,731,600 acres of potentially suitable habitat occurs within the SEZ region.	13,308 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat) during construction and operations	109,484 acres of potentially suitable habitat (2.9% of available potentially suitable habitat)	Small overall impact.
Common kingsnake (*Lampropeltis getula*)	Coniferous forests, woodlands, swampland, coastal marshes, river bottoms, farmlands, prairies, chaparral, and deserts. Uses rock outcrops and rodent burrows for cover. About 4,711,100 acres of potentially suitable habitat occurs within the SEZ region.	18,016 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat) during construction and operations	197,833 acres of potentially suitable habitat (4.2% of available suitable habitat)	Small overall impact. No species-specific mitigation of direct effects is feasible, because suitable habitat is widespread in the area of direct effects.

TABLE 12.3.11.1-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Maximum Area of Potential Habitat Affected[b]: Outside SEZ (Indirect Effects)[d]	Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
Snakes (Cont.)				
Glossy snake (*Arizona elegans*)	Light shrubby to barren deserts, sagebrush flats, grasslands, and chaparral-covered slopes and woodlands. Prefers sandy grasslands, shrublands, and woodlands. About 3,488,700 acres of potentially suitable habitat occurs within the SEZ region.	17,915 acres of potentially suitable habitat lost (0.5% of available potentially suitable habitat) during construction and operations	180,786 acres of potentially suitable habitat (5.2% of available potentially suitable habitat)	Small overall impact. No species-specific mitigation of direct effects is feasible, because suitable habitat is widespread in the area of direct effects.
Gophersnake (*Pituophis catenifer*)	Plains grasslands, sandhills, riparian areas, marshes, edges of ponds and lakes, rocky canyons, semidesert and mountain shrublands, montane woodlands, rural and suburban areas, and agricultural areas. Likely inhabits pocket gopher burrows in winter. About 4,431,900 acres of potentially suitable habitat occurs in the SEZ region.	18,016 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat) during construction and operations	202,950 acres of potentially suitable habitat (4.6% of available potentially suitable habitat)	Small overall impact. Avoidance of wetland habitats, otherwise no species-specific mitigation of direct effects is feasible, because suitable habitat is widespread in the area of direct effects.
Groundsnake (*Sonora semiannulata*)	Arid and semiarid regions with rocky to sandy soils. River bottoms, desert flats, sand hummocks, and rocky hillsides. About 4,011,400 acres of potentially suitable habitat occurs within the SEZ region.	14,469 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat) during construction and operations	143,767 acres of potentially suitable habitat (3.6% of available potentially suitable habitat)	Small overall impact.
Long-nosed snake (*Rhinocheilus lecontei*)	Typically inhabits deserts, dry prairies, and river valleys. Occurs by day and lays eggs underground or under rocks. Burrows rapidly in loose soil. Common in desert regions. About 2,829,800 acres of potentially suitable habitat occurs within the SEZ region.	11,942 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat) during construction and operations	102,043 acres of potentially suitable habitat (3.6% of available suitable habitat)	Small overall impact.

TABLE 12.3.11.1-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Maximum Area of Potential Habitat Affected[b]: Outside SEZ (Indirect Effects)[d]	Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
Snakes (Cont.)				
Nightsnake *(Hypsiglena torquata)*	Arid and semiarid desert flats, plains, and woodlands; areas with rocky and sandy soils are preferred. During cold periods of the year, seeks refuge underground, in crevices, or under rocks. About 3,802,500 acres of potentially suitable habitat occurs within the SEZ region.	13,308 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat) during construction and operations	109,597 acres of potentially suitable habitat (2.8% of available potentially suitable habitat)	Small overall impact.
Western diamond-backed rattlesnake (*Crotalus atrox*)	Dry and semidry lowland areas. Usually found in brush-covered plains, dry washes, rock outcrops, and desert foothills. About 4,411,000 acres of potentially suitable habitat occurs within the SEZ region.	18,016 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat) during construction and operations	202,190 acres of potentially suitable habitat (4.6% of available suitable habitat)	Small overall impact. Avoidance of wash habitats, otherwise no species-specific mitigation of direct effects is feasible, because suitable habitat is widespread in the area of direct effect.
Western rattlesnake (*Crotalus viridis*)	Most terrestrial habitats. Typically inhabits plains grasslands, sandhills, semidesert and mountain shrublands, riparian areas, and montane woodlands. About 4,925,600 acres of potentially suitable habitat occurs within the SEZ region.	18,016 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat) during construction and operations	197,843 acres of potentially suitable habitat (4.0% of available suitable habitat)	Small overall impact. Avoidance of riverine wetlands, otherwise no species-specific mitigation of direct effects is feasible, because suitable habitat is widespread in the area of direct effects.

Footnotes continued on next page.

TABLE 12.3.11.1-1 (Cont.)

[a] Potentially suitable habitat was determined by using SWReGAP habitat suitability and land cover models. Area of potentially suitable habitat for each species is presented for the SEZ region, which is defined as the area within 50 mi (80 km) of the SEZ center.

[b] Maximum area of potentially suitable habitat that could be affected relative to availability within the SEZ region. Habitat availability for each species within the region was determined by using SWReGAP habitat suitability and land cover models. This approach probably overestimates the amount of suitable habitat in the project area. A maximum of 18,016 acres of direct effects within the SEZ was assumed.

[c] Direct effects within the SEZ consist of the ground-disturbing activities associated with construction and the maintenance of an altered environment associated with operations.

[d] Area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary. Potentially suitable habitat within the SEZ greater than the maximum of 18,016 acres of direct effects was also added to the area of indirect effects. Indirect effects include effects from surface runoff, dust, noise, lighting, and so on from the SEZ, but do not include ground-disturbing activities. The potential degree of indirect effects would decrease with increasing distance from the SEZ.

[e] Overall impact magnitude categories were based on professional judgment and are as follows: (1) *small*: ≤1% of the population or its habitat would be lost and the activity would not result in a measurable change in carrying capacity or population size in the affected area; (2) *moderate*: >1 but ≤10% of the population or its habitat would be lost and the activity would result in a measurable but moderate (not destabilizing) change in carrying capacity or population size in the affected area; (3) *large*: >10% of a population or its habitat would be lost and the activity would result in a large, measurable, and destabilizing change in carrying capacity or population size in the affected area. Note that much greater weight was given to the magnitude of direct effects, because those effects would be difficult to mitigate. Programmatic design features would reduce most indirect effects to negligible levels.

[f] Species-specific mitigations are suggested here, but final mitigations should be developed in consultation with state and federal agencies and should be based on pre-disturbance surveys.

[g] To convert acres to km^2, multiply by 0.004047.

Sources: CDFG (2008); NatureServe (2010); NMDGF (2010); USGS (2004, 2005a, 2007).

The assessment of impacts on amphibian and reptile species is based on available information on the presence of species in the affected area as presented in Section 12.3.11.1.1, following the analysis approach described in Appendix M. Additional NEPA assessments and coordination with state natural resource agencies may be needed to address project-specific impacts more thoroughly. These assessments and consultations could result in additional required actions to avoid or mitigate impacts on amphibians and reptiles (see Section 12.3.11.1.3).

In general, impacts on amphibians and reptiles would result from habitat disturbance (i.e., habitat reduction, fragmentation, and alteration) and from disturbance, injury, or mortality to individual amphibians and reptiles. On the basis of the magnitude of impacts on amphibians and reptiles summarized in Table 12.3.11.1-1, direct impacts on amphibians and reptiles would be small for all representative species, because 0.3 to 0.6% of the potentially suitable habitats identified for these species in the SEZ would be lost. Larger areas of potentially suitable habitats for the amphibian and reptile species occur within the area of potential indirect effects (e.g., up to 7.5% of available habitat for the long-nosed leopard lizard). Other impacts on amphibians and reptiles could result from surface water and sediment runoff from disturbed areas, fugitive dust generated by project activities, accidental spills, collection, and harassment. These indirect impacts are expected to be negligible with implementation of programmatic design features.

Decommissioning after operations cease could result in short-term negative impacts on individuals and habitats within and adjacent to the SEZ. The negative impacts of decommissioning would be reduced or eliminated as reclamation proceeds. Potentially long-term benefits could accrue as habitats are restored in previously disturbed areas. Section 5.10.2.1.4 provides an overview of the impacts of decommissioning and reclamation on wildlife. Of particular importance for amphibian and reptile species would be the restoration of original ground surface contours, soils, and native plant communities associated with semiarid shrublands.

12.3.11.1.3 SEZ-Specific Design Features and Design Feature Effectiveness

The implementation of required programmatic design features described in Appendix A, Section A.2.2, would reduce the potential for effects on amphibians and reptiles, especially for those species that utilize habitat types that can be avoided (e.g., wetlands, washes, and playas). Indirect impacts could be reduced to negligible levels by implementing programmatic design features, especially those engineering controls that would reduce runoff, sedimentation, spills, and fugitive dust. While SEZ-specific design features are best established when considering specific project details, one design feature that can be identified at this time is:

- Playa, wash, and wetland habitats should be avoided.

If this SEZ-specific design feature is implemented in addition to other programmatic design features, impacts on amphibian and reptile species could be reduced. However, because potentially suitable habitats for a number of the amphibian and reptile species occur throughout much of the SEZ, additional species-specific mitigation of direct effects for those species would be difficult or infeasible.

12.3.11.2 Birds

12.3.11.2.1 Affected Environment

This section addresses bird species that are known to occur, or for which potentially suitable habitat occurs, on or within the potentially affected area of the proposed Red Sands SEZ. Bird species potentially present in the SEZ area were determined from species lists available from the BISON-M (NMDGF 2010). Range maps and habitat information were obtained from SWReGAP (USGS 2007), with supplemental habitat information obtained from CDFG (2008) and NatureServe (2010). Land cover types suitable for each species were determined from SWReGAP (USGS 2004, 2005a, 2007) and the South Central Gap Analysis Program (USGS 2010d). See Appendix M for additional information on the approach used.

More than 270 species of birds are reported from Otero County (NMDGF 2010); however, suitable habitats for a number of these species are limited or nonexistent within the proposed Red Sands SEZ (USGS 2007). Similar to the overview of birds provided for the six-state study area (Section 4.10.2.2), the following discussion for the SEZ emphasizes the following bird groups: (1) waterfowl, wading birds, and shorebirds; (2) neotropical migrants, (3) birds of prey; and (4) upland game birds.

Waterfowl, Wading Birds, and Shorebirds

As discussed in Section 4.10.2.2.2, waterfowl (ducks, geese, and swans), wading birds (herons and cranes), and shorebirds (avocets, gulls, plovers, rails, sandpipers, stilts, and terns) are among the most abundant groups of birds in the six-state study area. However, within the proposed Red Sands SEZ, waterfowl, wading birds, and shorebird species would be mostly absent to uncommon. Wetland, playa, and wash habitats within the SEZ may attract shorebird species, but the Rio Bonito, Rio Grande, Rio Ruidoso, West Side Canal, various intermittent streams, Holloman (Raptor) Lake and associated lagoon complex, and intermittent and dry lakes located within 50 mi (80 km) of the SEZ would provide more viable habitat for this group of birds. The killdeer (*Charadrius vociferus*) is the shorebird species most likely to occur within the SEZ.

Neotropical Migrants

As discussed in Section 4.10.2.2.3, neotropical migrants represent the most diverse category of birds within the six-state study area. Species expected to occur within the proposed Red Sands SEZ include the ash-throated flycatcher (*Myiarchus cinerascens*), black-tailed gnatcatcher (*Polioptila melanura*), black-throated sparrow (*Amphispiza bilineata*), Brewer's blackbird (*Euphagus cyanocephalus*), cactus wren (*Campylorhynchus brunneicapillus*), common poorwill (*Phalaenoptilus nuttallii*), common raven (*Corvus corax*), Costa's hummingbird (*Calypte costae*), Crissal thrasher (*Toxostoma crissale*), greater roadrunner (*Geococcyx californianus*), horned lark (*Eremophila alpestris*), ladder-backed woodpecker (*Picoides scalaris*), lesser nighthawk (*Chordeiles acutipennis*), loggerhead shrike (*Lanius ludovicianus*), Lucy's warbler (*Vermivora luciae*), phainopepla (*Phainopepla nitens*), sage sparrow (*Amphispiza belli*), Scott's oriole (*Icterus parisorum*), verdin (*Auriparus flaviceps*), and western meadowlark (*Sturnella neglecta*) (NMDGF 2010; USGS 2007).

Birds of Prey

Section 4.10.2.2.4 provides an overview of the birds of prey (raptors, owls, and vultures) within the six-state study area. Raptor species that could occur within the proposed Red Sands SEZ include the American kestrel (*Falco sparverius*), golden eagle (*Aquila chrysaetos*), great horned owl (*Bubo virginianus*), long-eared owl (*Asio otus*), prairie falcon (*Falco mexicanus*), red-tailed hawk (*Buteo jamaicensis*), and turkey vulture (*Cathartes aura*) (NMDGF 2010; USGS 2007). Several other special status birds of prey are discussed in Section 12.3.12. These include the American peregrine falcon (*Falco peregrinus anatum*), bald eagle (*Haliaeetus leucocephalus*), ferruginous hawk (*Buteo regalis*), northern aplomado falcon (*Falco femoralis septentrionalis*), osprey (*Pandion haliaetus*), and western burrowing owl (*Athene cunicularia*).

Upland Game Birds

Section 4.10.2.2.5 provides an overview of the upland game birds (primarily pheasants, grouse, quail, and doves) that occur within the six-state solar study area. Upland game species that could occur within the proposed Red Sands SEZ include the Gambel's quail (*Callipepla gambelii*), mourning dove (*Zenaida macroura*), scaled quail (*Callipepla squamata*), white-winged dove (*Zenaida asiatica*), and wild turkey (*Meleagris gallopavo*) (NMDGF 2010; USGS 2007).

Table 12.3.11.2-1 provides habitat information for representative bird species that could occur within the proposed Red Sands SEZ. Special status bird species are discussed in Section 12.3.12.

12.3.11.2.2 Impacts

The types of impacts that birds could incur from construction, operation, and decommissioning of utility-scale solar energy facilities are discussed in Section 5.10.2.1. Any such impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2, and through any additional mitigation applied. Section 12.3.11.2.3, below, identifies design features of particular relevance to the proposed Red Sands SEZ.

TABLE 12.3.11.2-1 Habitats, Potential Impacts, and Potential Mitigation for Representative Bird Species That Could Occur on or in the Affected Area of the Proposed Red Sands SEZ

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Maximum Area of Potential Habitat Affected[b]: Outside SEZ (Indirect Effects)[d]	Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
Shorebirds				
Killdeer (*Charadrius vociferus*)	Open areas such as fields, meadows, lawns, mudflats, and shores. Nests on ground in open dry or gravelly locations. About 153,929 acres[g] of potentially suitable habitat occurs within the SEZ region.	1,626 acres of potentially suitable habitat lost (1.1% of available potentially suitable habitat) during construction and operations	11,863 acres of potentially suitable habitat (7.7% of potentially suitable habitat)	Moderate overall impact. Avoidance of wetland, wash, and playa areas could reduce impacts. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Neotropical Migrants				
Ash-throated flycatcher (*Myiarchus cinerascens*)	Common in scrub and woodland habitats including desert riparian and desert washes. Requires hole/cavity for nesting. Uses shrubs or small trees for foraging perches. About 4,148,900 acres of potentially suitable habitat occurs within the SEZ region.	17,815 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat) during construction and operations	175,588 acres of potentially suitable habitat (4.2% of potentially suitable habitat)	Small overall impact. Avoidance of wash and riverine wetland areas could reduce impacts. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Black-tailed gnatcatcher (*Polioptila melanura*)	Nests in bushes mainly in wooded desert washes with dense mesquite, palo verde, ironwood, and acacia. Also occurs in desertscrub habitat. About 2,568,100 acres of potentially suitable habitat occurs within the SEZ region.	7,224 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat) during construction and operations	62,580 acres of potentially suitable habitat (2.4% of available suitable habitat)	Small overall impact. Avoidance of wash areas could reduce impacts. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 12.3.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Maximum Area of Potential Habitat Affected[b]: Outside SEZ (Indirect Effects)[d]	Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
Neotropical Migrants (Cont.)				
Black-throated sparrow (*Amphispiza bilineata*)	Chaparral and desertscrub habitats with sparse to open stands of shrubs. Often in areas with scattered Joshua trees. Nests in thorny shrubs or cactus. About 3,152,900 acres of potentially suitable habitat occurs within the SEZ region.	8,798 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat) during construction and operations	63,506 acres of potentially suitable habitat (2.0% of available suitable habitat)	Small overall impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Brewer's blackbird (*Euphagus cyanocephalus*)	Meadows, grasslands, riparian areas, agricultural and urban areas, and occasionally in sagebrush in association with prairie dog colonies and other shrublands. Requires dense shrubs for nesting. Roosts in marshes or dense vegetation. In winter, most often near open water and farmyards with livestock. About 1,586,000 acres of potentially suitable habitat occurs within the SEZ region.	8,072 acres of potentially suitable habitat lost (0.5% of available potentially suitable habitat) during construction and operations	42,970 acres of potentially suitable habitat (2.7% of available suitable habitat)	Small overall impact. Avoidance of riverine wetlands could reduce impacts. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Cactus wren (*Campylorhynchus* b*runneicapillus*)	Desert (especially areas with cholla cactus or yucca), mesquite, arid scrub, coastal sage scrub, and trees in towns in arid regions. Nests in *Opuntia* spp.; twiggy, thorny trees and shrubs; and sometimes in buildings. Nests may be used as winter roosts. About 2,241,800 acres of potentially suitable habitat occurs within the SEZ region.	6,889 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat) during construction and operations	47,649 acres of potentially suitable habitat (2.1% of available suitable habitat)	Small overall impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Common poorwill (*Phalaenoptilus nuttallii*)	Scrubby and brushy areas, prairie, desert, rocky canyons, open woodlands, and broken forests. Mostly in arid and semiarid habitats. Nests in open areas on a bare site. About 1,810,600 acres of potentially suitable habitat occurs within the SEZ region.	177 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) during construction and operations	20,155 acres of potentially suitable habitat (1.1% of potentially suitable habitat)	Small overall impact. Some measure of mitigation also provided by the requirements of the Migratory Bird Treaty Act.

TABLE 12.3.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b] — Within SEZ (Direct Effects)[c]	Maximum Area of Potential Habitat Affected[b] — Outside SEZ (Indirect Effects)[d]	Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
Neotropical Migrants (Cont.)				
Common raven (*Corvus corax*)	Occurs in most habitats. Trees and cliffs provide cover. Roosts primarily in trees. Nests on cliffs, bluffs, tall trees, or human-made structures. Forages in sparse, open terrain. About 4,691,700 acres of potentially suitable habitat occurs in the SEZ region.	18,016 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat) during construction and operations	192,102 acres of potentially suitable habitat (4.1% of available potentially suitable habitat)	Small overall impact. No species-specific mitigation of direct effects is feasible, because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Costa's hummingbird (*Calypte costae*)	Desert and semidesert areas, arid brushy foothills, and chaparral. Main habitats are desert washes, edges of desert riparian and valley foothill riparian areas, coastal shrub, desertscrub, desert succulent shrub, lower elevation chaparral, and palm oasis. Also in mountains, meadows, and gardens during migration and winter. Most common in canyons and washes when nesting. Nests are located in trees, shrubs, vines, or cacti. About 3,311,000 acres of potentially suitable habitat occurs within the SEZ region.	11,842 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat) during construction and operations	96,808 acres of potentially suitable habitat (2.9% of available suitable habitat)	Small overall impact. Avoidance of wash and riparian wetland areas could reduce impacts. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Crissal thrasher (*Toxostoma crissale*)	Desertscrub, mesquite, tall riparian brush and chaparral; usually beneath dense cover. Nests in low tree or shrubs. About 1,726,300 acres of potentially suitable habitat occurs within the SEZ region.	177 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) during construction and operations	20,132 acres of potentially suitable habitat (1.2% of available suitable habitat)	Small overall impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 12.3.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Maximum Area of Potential Habitat Affected[b]: Outside SEZ (Indirect Effects)[d]	Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
Neotropical Migrants (Cont.)				
Greater roadrunner (*Geococcyx californianus*)	Desertscrub, chaparral, edges of cultivated lands, and arid open areas with scattered brush. Fairly common in many desert habitats. Requires thickets, large bushes, or small trees for shade, refuge, and roosting. Usually nests low in trees, shrubs, or clumps of cactus. Rarely nests on ground. About 4,602,300 acres of potentially suitable habitat occurs in the SEZ region.	18,016 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat) during construction and operations	199,500 acres of potentially suitable habitat (4.3% of available potentially suitable habitat)	Small overall impact. No species-specific mitigation of direct effects is feasible, because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Horned lark (*Eremophila alpestris*)	Common to abundant resident in a variety of open habitats. Breeds in grasslands, sagebrush, semidesert shrublands, and alpine tundra. During migration and winter, inhabits the same habitats other than tundra, and occurs in agricultural areas. Usually occurs where plant density is low and there are exposed soils. About 195,100 acres of potentially suitable habitat occurs in the SEZ region.	4,712 acres of potentially suitable habitat lost (2.4% of available potentially suitable habitat) during construction and operations	39,545 acres of potentially suitable habitat (20.3% of available potentially suitable habitat)	Moderate overall impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Ladder-backed woodpecker (Picoides scalaris)	Variety of habitats including deserts, arid scrub, riparian woodlands, mesquite, scrub oak, pinyon-juniper woodlands. Digs nest hole in rotted stub or dead or dying branches of various trees. Also nests in saguaro, agave, yucca, fence posts, and utility poles. Nests on ledges; branches of trees, shrubs, and cactus; and holes in trees or walls. About 3,516,100 acres of potentially suitable habitat occurs within the SEZ region.	11,842 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat) during construction and operations	96,808 acres of potentially suitable habitat (2.8% of potentially suitable habitat)	Small overall impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 12.3.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Maximum Area of Potential Habitat Affected[b]: Outside SEZ (Indirect Effects)[d]	Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
Neotropical Migrants (Cont.)				
Lesser nighthawk (*Chordeiles acutipennis*)	Open country, desert regions, scrub, savanna, and cultivated areas. Usually near water including open marshes, salt ponds, large rivers, rice paddies, and beaches. Roosts on low perches or the ground. Nests in the open on bare sites. About 3,517,100 acres of potentially suitable habitat occurs within the SEZ region.	18,016 acres of potentially suitable habitat lost (0.5% of available potentially suitable habitat) during construction and operations	183,183 acres of potentially suitable habitat (5.2% of potentially suitable habitat)	Small overall impact. No species-specific mitigation of direct effects is feasible, because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Loggerhead shrike (*Lanius ludovicianus*)	Open country with scattered trees and shrubs, savanna, desertscrub, desert riparian, Joshua tree, and occasionally, open woodland habitats. Perches on poles, wires, or fence posts (suitable hunting perches are important aspect of habitat). Nests in shrubs and small trees. About 4,445,300 acres of potentially suitable habitat occurs in the SEZ region.	18,016 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat) during construction and operations	188,912 acres of potentially suitable habitat (4.2% of available potentially suitable habitat)	Small overall impact. No species-specific mitigation of direct effects is feasible, because suitable habitat is widespread in the area of direct effects. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 12.3.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Maximum Area of Potential Habitat Affected[b]: Outside SEZ (Indirect Effects)[d]	Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
Neotropical Migrants (Cont.)				
Lucy's warbler (*Vermivora luciae*)	Breeds most often in dense lowland riparian mesquite woodlands. Inhabits dry washes, riparian forests, and thorn forests during winter and migration. About 3,193,600 acres of potentially suitable habitat occurs within the SEZ region.	7,124 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat) during construction and operations	57,395 acres of potentially suitable habitat (1.8% of available suitable habitat)	Small overall impact. Avoidance of wash and riparian wetland areas could reduce impacts. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Phainopepla (*Phainopepla nitens*)	Desertscrub, mesquite, juniper and oak woodlands, tall brush, washes, riparian woodlands, and orchards. Nests in dense foliage of large shrubs or trees, sometimes in a clump of mistletoe. About 4,196,000 acres of potentially suitable habitat occurs within the SEZ region.	13,203 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat) during construction and operations	141,551 acres of potentially suitable habitat (3.4% of available suitable habitat)	Small overall impact. Avoidance of wash and riparian wetland areas could reduce impacts. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Sage sparrow (*Amphispiza belli*)	Prefers shrubland, grassland, and desert habitats. The nest, constructed of twigs and grasses, is located either low in a shrub or on the ground. About 2,355,700 acres of potentially suitable habitat occurs within the SEZ region.	9,796 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat) during construction and operations	86,800 acres of potentially suitable habitat (3.7% of available potentially suitable habitat)	Small overall impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 12.3.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Maximum Area of Potential Habitat Affected[b]: Outside SEZ (Indirect Effects)[d]	Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
Neotropical Migrants (Cont.)				
Scott's oriole (*Icterus parisorum*)	Yucca, pinyon-juniper, arid oak scrub and palm oases. Foothills, desert slopes of mountains, and more elevated semiarid plains. Nests in trees or yuccas. About 2,851,700 acres of potentially suitable habitat occurs within the SEZ region.	12,916 acres of potentially suitable habitat lost (0.5% of available potentially suitable habitat) during construction and operations	116,167 acres of potentially suitable habitat (4.1% of available suitable habitat)	Small overall impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Verdin (*Auriparus flaviceps*)	Desert riparian, desert wash, desertscrub, and alkali desertscrub areas with large shrubs and small trees. Nests in shrubs, small trees, or cactus. About 3,145,400 acres of potentially suitable habitat occurs within the SEZ region.	7,130 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat) during construction and operations	57,536 acres of potentially suitable habitat (1.8% of available suitable habitat)	Small overall impact. Avoidance of wash and riparian wetland areas could reduce impacts. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Western meadowlark (*Sturnella neglecta*)	Agricultural areas, especially in winter. Also inhabits native grasslands, croplands, weedy fields, and less commonly in semidesert and sagebrush shrublands. About 1,544,100 acres of potentially suitable habitat occurs within the SEZ region.	8,072 acres of potentially suitable habitat lost (0.5% of available potentially suitable habitat) during construction and operations	35,352 acres of potentially suitable habitat (2.3% of available suitable habitat)	Small overall impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 12.3.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Maximum Area of Potential Habitat Affected[b]: Outside SEZ (Indirect Effects)[d]	Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
Birds of Prey				
American kestrel (*Falco sparverius*)	Occurs in most open habitats, in various shrub and early successional forest habitats, forest openings, and various ecotones. Perches on trees, snags, rocks, utility poles and wires, and fence posts. Uses cavities in trees, snags, rock areas, banks, and buildings for nesting and cover. About 4,012,600 acres of potentially suitable habitat occurs in the SEZ region.	13,208 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat) during construction and operations	112,173 acres of potentially suitable habitat (2.8% of available potentially suitable habitat)	Small overall impact.
Golden eagle (*Aquila chrysaetos*)	Grasslands, shrublands, pinyon-juniper woodlands, and ponderosa pine forests. Occasionally in most other habitats, especially during migration and winter. Nests on cliffs and sometimes trees in rugged areas, with breeding birds ranging widely over surrounding areas. About 4,085,200 acres of potentially suitable habitat occurs in the SEZ region.	14,834 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat) during construction and operations	108,449 acres of potentially suitable habitat (2.7% of available potentially suitable habitat)	Small overall impact. Some measure of mitigation provided by the requirements of the Bald and Golden Eagle Protection Act.
Great horned owl (*Bubo virginianus*)	Needs large abandoned bird nest or large cavity for nesting. Usually lives on forest edges and hunts in open areas. In desert areas, requires wooded cliff areas for nesting. About 5,017,500 acres of potentially suitable habitat occurs within the SEZ region.	18,016 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat) during construction and operations	205,770 acres of potentially suitable habitat (4.1% of potentially suitable habitat)	Small overall impact. No species-specific mitigation of direct effects is feasible, because suitable habitat is widespread in the area of direct effects.
Long-eared owl (*Asio otus*)	Nests and roosts in dense vegetation and hunts in open areas (e.g., creosotebush-bursage flats, desertscrub, grasslands, and agricultural fields). About 2,456,000 acres of potentially suitable habitat occurs within the SEZ region.	6,706 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat) during construction and operations	27,676 acres of potentially suitable habitat (1.1% of potentially suitable habitat)	Small overall impact.

TABLE 12.3.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Maximum Area of Potential Habitat Affected[b]: Outside SEZ (Indirect Effects)[d]	Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
Birds of Prey (Cont.)				
Prairie falcon (*Falco mexicanus*)	Associated primarily with perennial grasslands, savannahs, rangeland, some agricultural fields, and desertscrub areas. Nests in pothole or well-sheltered ledge on rocky cliff or steep earth embankment. May also nest in man-made excavations on otherwise unsuitable cliffs and old nests of ravens, hawks, and eagles. Forages in large patch areas with low vegetation. May forage over irrigated croplands in winter. About 5,017,500 acres of potentially suitable habitat occurs within the SEZ region.	18,016 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat) during construction and operations	205,770 acres of potentially suitable habitat (4.1% of available suitable habitat)	Small overall impact. No species-specific mitigation of direct effects is feasible, because suitable habitat is widespread in the area of direct effects.
Red-tailed hawk (*Buteo jamaicensis*)	Wide variety of habitats from deserts, mountains, and populated valleys. Open areas with scattered, elevated perch sites such as scrub desert, plains and montane grassland, agricultural fields, pastures urban parklands, broken coniferous forests, and deciduous woodland. Nests on cliff ledges or in tall trees. About 2,864,500 acres of potentially suitable habitat occurs in the SEZ region.	11,842 acres of potentially suitable habitat lost 0.4% of available potentially suitable habitat) during construction and operations	101,260 acres of potentially suitable habitat (3.5% of available potentially suitable habitat)	Small overall impact.
Turkey vulture (*Cathartes aura*)	Occurs in open stages of most habitats that provide adequate cliffs or large trees for nesting, roosting, and resting. Migrates and forages over most open habitats. Roosts communally in trees, exposed boulders, and occasionally transmission line support towers. About 1,423,700 acres of potentially suitable habitat occurs in the SEZ region.	5,136 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat) during construction and operations	69,377 acres of potentially suitable habitat (4.9% of available potentially suitable habitat)	Small overall impact.

TABLE 12.3.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Maximum Area of Potential Habitat Affected[b]: Outside SEZ (Indirect Effects)[d]	Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
Upland Game Birds				
Gambel's quail (*Callipepla gambelii*)	Deserts, especially in areas with brushy or thorny growth, and adjacent cultivated areas. Usually occurs near water. Nests on the ground under cover of small trees, shrubs, and grass tufts. About 3,692,400 acres of potentially suitable habitat occurs within the SEZ region.	13,208 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat) during construction and operations	104,513 acres of potentially suitable habitat (2.8% of potentially suitable habitat)	Small overall impact.
Mourning dove (*Zenaida macroura*)	Habitat generalist, occurring in grasslands, shrublands, croplands, lowland and foothill riparian forests, ponderosa pine forests, deserts, and urban and suburban areas. Rarely in aspen and other forests, coniferous woodlands, and alpine tundra. Nests on ground or in trees. Winters mostly in lowland riparian forests adjacent to cropland. About 4,585,500 acres of potentially suitable habitat occurs in the SEZ region.	18,016 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat) during construction and operations	188,706 acres of potentially suitable habitat (4.1% of available potentially suitable habitat)	Small overall impact. No species-specific mitigation of direct effects is feasible, because suitable habitat is widespread in the area of direct effects.
Scaled quail (*Callipepla squamata*)	Desertscrub dominated by mesquite, yucca, and cactus and grasslands. Bare habitat is an important habitat component. About 3,672,400 acres of potentially suitable habitat occurs within the SEZ region.	13,208 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat) during construction and operations	104,276 acres of potentially suitable habitat (2.8% of available suitable habitat)	Small overall impact.
White-winged dove (*Zenaida asiatica*)	Desert riparian, wash, succulent shrub, scrub, and Joshua tree habitats; orchards and vineyards, croplands, and pastures. About 2,746,500 acres of potentially suitable habitat occurs within the SEZ region.	11,942 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat) during construction and operations	101,993 acres of potentially suitable habitat (3.7% of available suitable habitat)	Small overall impact. Avoidance of wash and riverine wetland areas could reduce impacts.

TABLE 12.3.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Maximum Area of Potential Habitat Affected[b]: Outside SEZ (Indirect Effects)[d]	Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
Upland Game Birds (Cont.)				
Wild turkey (*Meleagris gallopavo*)	Lowland riparian forests, foothill shrubs, pinyon-juniper woodlands, foothill riparian forests, and agricultural areas. About 1,482,800 acres of potentially suitable habitat occurs within the SEZ region.	241 acres of potentially suitable habitat lost (0.02% of available potentially suitable habitat) during construction and operations	9,944 acres of potentially suitable habitat (0.7% of available potentially suitable habitat)	Small overall impact.

[a] Potentially suitable habitat was determined by using SWReGAP habitat suitability and land cover models. Area of potentially suitable habitat for each species is presented for the SEZ region, which is defined as the area within 50 mi (80 km) of the SEZ center.

[b] Maximum area of potentially suitable habitat that could be affected relative to availability within the SEZ region. Habitat availability for each species within the region was determined by using SWReGAP habitat suitability and land cover models. This approach probably overestimates the amount of suitable habitat in the project area. A maximum of 18,016 acres of direct effects within the SEZ was assumed.

[c] Direct effects within the SEZ consist of the ground-disturbing activities associated with construction and the maintenance of an altered environment associated with operations.

[d] Area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary. Potentially suitable habitat within the SEZ greater than the maximum of 18,016 acres of direct effects was also added to the area of indirect effects. Indirect effects include effects from surface runoff, dust, noise, lighting, and so on from the SEZ, but do not include ground-disturbing activities. The potential degree of indirect effects would decrease with increasing distance from the SEZ.

[e] Overall impact magnitude categories were based on professional judgment and are as follows: (1) *small*: ≤1% of the population or its habitat would be lost and the activity would not result in a measurable change in carrying capacity or population size in the affected area; (2) *moderate*: >1 but ≤10% of the population or its habitat would be lost and the activity would result in a measurable but moderate (not destabilizing) change in carrying capacity or population size in the affected area; (3) *large*: >10% of a population or its habitat would be lost and the activity would result in a large, measurable, and destabilizing change in carrying capacity or population size in the affected area. Note that much greater weight was given to the magnitude of direct effects because those effects would be difficult to mitigate. Programmatic design features would reduce most indirect effects to negligible levels.

[f] Species-specific mitigations are suggested here, but final mitigations should be developed in consultation with state and federal agencies and should be based on pre-disturbance surveys.

[g] To convert acres to km^2, multiply by 0.004047.

Sources: CDFG (2008); NatureServe (2010); NMDGF (2010); USGS (2004, 2005a, 2007).

The assessment of impacts on bird species is based on available information on the presence of species in the affected area as presented in Section 12.3.11.2.1, following the analysis approach described in Appendix M. Additional NEPA assessments and coordination with federal or state natural resource agencies may be needed to address project-specific impacts more thoroughly. These assessments and consultations could result in additional required actions to avoid or mitigate impacts on birds (see Section 12.3.11.2.3).

In general, impacts on birds would result from habitat disturbance (i.e., habitat reduction, fragmentation, and alteration) and from disturbance, injury, or mortality to individual birds. Table 12.3.11.2-1 summarizes the magnitude of potential impacts on representative bird species resulting from solar energy development in the proposed Red Sands SEZ. Direct impacts on representative bird species would be moderate for the killdeer (1.1% of the potentially suitable habitats identified for the species in the SEZ would be lost) and horned lark (2.4% of the potentially suitable habitats identified for the species in the SEZ would be lost). Direct impacts on all other representative bird species would be small, because 0.01 to 0.5% of potentially suitable habitats identified for those species in the SEZ region would be lost. Larger areas of potentially suitable habitats for the bird species occur within the area of potential indirect effects (e.g., up to 20.3% of available habitat for the horned lark) (Table 12.3.11.2-1). Other impacts on birds could result from collision with vehicles and infrastructure (e.g., buildings and fences), surface water and sediment runoff from disturbed areas, fugitive dust generated by project activities, noise, lighting, spread of invasive species, accidental spills, and harassment. Indirect impacts on areas outside the SEZ (e.g., impacts caused by dust generation, erosion, and sedimentation) are expected to be negligible with implementation of programmatic design features.

Decommissioning after operations cease could result in short-term negative impacts on individuals and habitats within and adjacent to the SEZ. The negative impacts of decommissioning would be reduced or eliminated as reclamation proceeds. Potentially long-term benefits could accrue as habitats are restored in previously disturbed areas. Section 5.10.2.1.4 provides an overview of the impacts of decommissioning and reclamation on wildlife. Of particular importance for bird species would be the restoration of original ground surface contours, soils, and native plant communities associated with semiarid shrublands.

12.3.11.2.3 SEZ-Specific Design Features and Design Feature Effectiveness

The successful implementation of programmatic design features presented in Appendix A, Section A.2.2, would reduce the potential for effects on birds, especially for those species that depend on habitat types that can be avoided (e.g., wetlands, washes and playas). Indirect impacts could be reduced to negligible levels by implementing programmatic design features, especially those engineering controls that would reduce runoff, sedimentation, spills, and fugitive dust. While SEZ-specific design features important for reducing impacts on birds are best established when project details are considered, some design features can be identified at this time:

- For solar energy development within the SEZ, the requirements contained within the 2010 Memorandum of Understanding between the BLM and USFWS to promote the conservation of migratory birds will be followed.

- Take of golden eagles and other raptors should be avoided. Mitigation regarding the golden eagle should be developed in consultation with the USFWS and the NMDGF. A permit may be required under the Bald and Golden Eagle Protection Act.

- Wash, playa, and palustrine and wetland areas, which could provide unique habitats for some bird species, should be avoided.

If these SEZ-specific design features are implemented in addition to programmatic design features, impacts on bird species could be reduced. However, because potentially suitable habitats for a number of the bird species occur throughout much of the SEZ, additional species-specific mitigation of direct effects for those species would be difficult or infeasible.

12.3.11.3 Mammals

12.3.11.3.1 Affected Environment

This section addresses mammal species that are known to occur, or for which potentially suitable habitat occurs, on or within the potentially affected area of the proposed Red Sands SEZ. Mammal species potentially present in the SEZ area were determined from species lists available from the BISON-M (NMDGF 2010). Range maps and habitat information were obtained from SWReGAP (USGS 2007), with supplemental habitat information obtained from CDFG (2008) and NatureServe (2010). Land cover types suitable for each species were determined from SWReGAP (USGS 2004, 2005a, 2007) and the South Central Gap Analysis Program (USGS 2010d). See Appendix M for additional information on the approach used.

About 90 species of mammals are reported from Otero County (NMDGF 2010); however, suitable habitats for a number of these species are limited or nonexistent within the proposed Red Sands SEZ (USGS 2007). Similar to the overview of mammals provided for the six-state study area (Section 4.10.2.3), the following discussion for the SEZ emphasizes big game and other mammal species that (1) have key habitats within or near the SEZ, (2) are important to humans (e.g., big game, small game, and furbearer species), and/or (3) are representative of other species that share similar habitats.

Big Game

The big game species that could occur within the vicinity of the proposed Red Sands SEZ include cougar (*Puma concolor*), desert bighorn sheep (*Ovis canadensis mexicana*), mule deer (*Odocoileus hemionus*), and pronghorn (*Antilocapra americana*) (NMDGF 2010; USGS 2007).

Because of its special species status, the desert bighorn sheep is addressed in Section 12.3.12. Potentially suitable habitat for the cougar occurs throughout the SEZ. Figure 12.3.11.3-1 shows the areas around the SEZ where mule deer are rare or absent and where they occur at a density of less than10 deer/mi^2 (less than 4 deer/km^2). Figure 12.3.11.3-2 shows the mapped range of pronghorn relative to the location of the SEZ.

Other Mammals

A number of small game and furbearer species occur within the area of the proposed Red Sands SEZ. Species that could occur within the area of the SEZ include the American badger (*Taxidea taxus*), black-tailed jackrabbit (*Lepus californicus*), bobcat (*Lynx rufus*), coyote (*Canis latrans*), desert cottontail (*Sylvilagus audubonii*), gray fox (*Urocyon cinereoargenteus*), javelina (*Pecari tajacu*), kit fox (*Vulpes macrotis*), ringtail (*Bassariscus astutus*), and striped skunk (*Mephitis mephitis*) (NMDGF 2010; USGS 2007).

The nongame (small) mammals include rodents, bats, mice, and shrews. Representative species for which potentially suitable habitat occurs within the proposed Red Sands SEZ include Botta's pocket gopher (*Thomomys bottae*), cactus mouse (*Peromyscus eremicus*), canyon mouse (*Peromyscus crinitus*), deer mouse (*P. maniculatus*), desert pocket mouse (*Chaetodipus penicillatus*), desert shrew (*Notiosorex crawfordi*), Merriam's kangaroo rat (*Dipodomys merriami*), northern grasshopper mouse (*Onychomys leucogaster*), Ord's kangaroo rat (*Dipodomys ordii*), round-tailed ground squirrel (*Spermophilus tereticaudus*), southern plains woodrat (*Neotoma micropus*), spotted ground squirrel (*Spermophilus spilosoma*), western harvest mouse (*Reithrodontomys megalotis*), and white-tailed antelope squirrel (*Ammospermophilus leucurus*) (NMDGF 2010; USGS 2007). Bat species that may occur within the area of the SEZ include the big brown bat (*Eptesicus fuscus*), Brazilian free-tailed bat (*Tadarida brasiliensis*), California myotis (*Myotis californicus*), silver-haired bat (*Lasionycteris noctivagans*), spotted bat (*Euderma maculatum*), and western pipistrelle (*Parastrellus hesperus*) (NMDGF 2010; USGS 2007). However, roost sites for the bat species (e.g., caves, hollow trees, or buildings) would be limited to absent within the SEZ. Special status bat species that could occur within the SEZ area are addressed in Section 12.3.12.

Table 12.3.11.3-1 provides habitat information for representative mammal species that could occur within the proposed Red Sands SEZ. Special status mammal species are discussed in Section 12.3.12.

12.3.11.3.2 Impacts

The types of impacts that mammals could incur from construction, operation, and decommissioning of utility-scale solar energy facilities are discussed in Section 5.10.2.1. Any such impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2, and through any additional mitigation applied. Section 12.3.11.3.3, below, identifies design features of particular relevance to mammals for the proposed Red Sands SEZ.

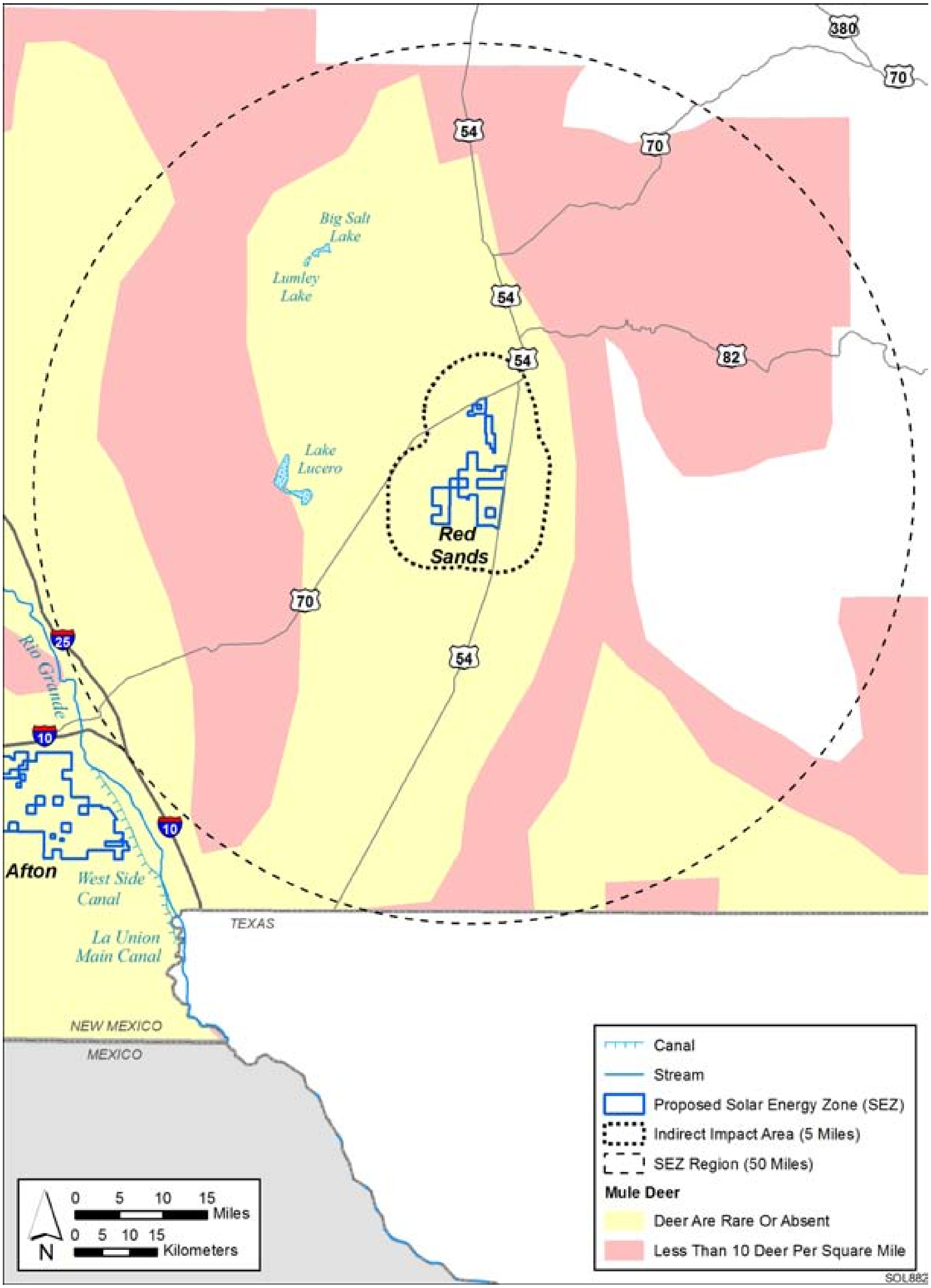

FIGURE 12.3.11.3-1 Density of Mule Deer within the Proposed Red Sands SEZ Region (Source: BLM 2009a)

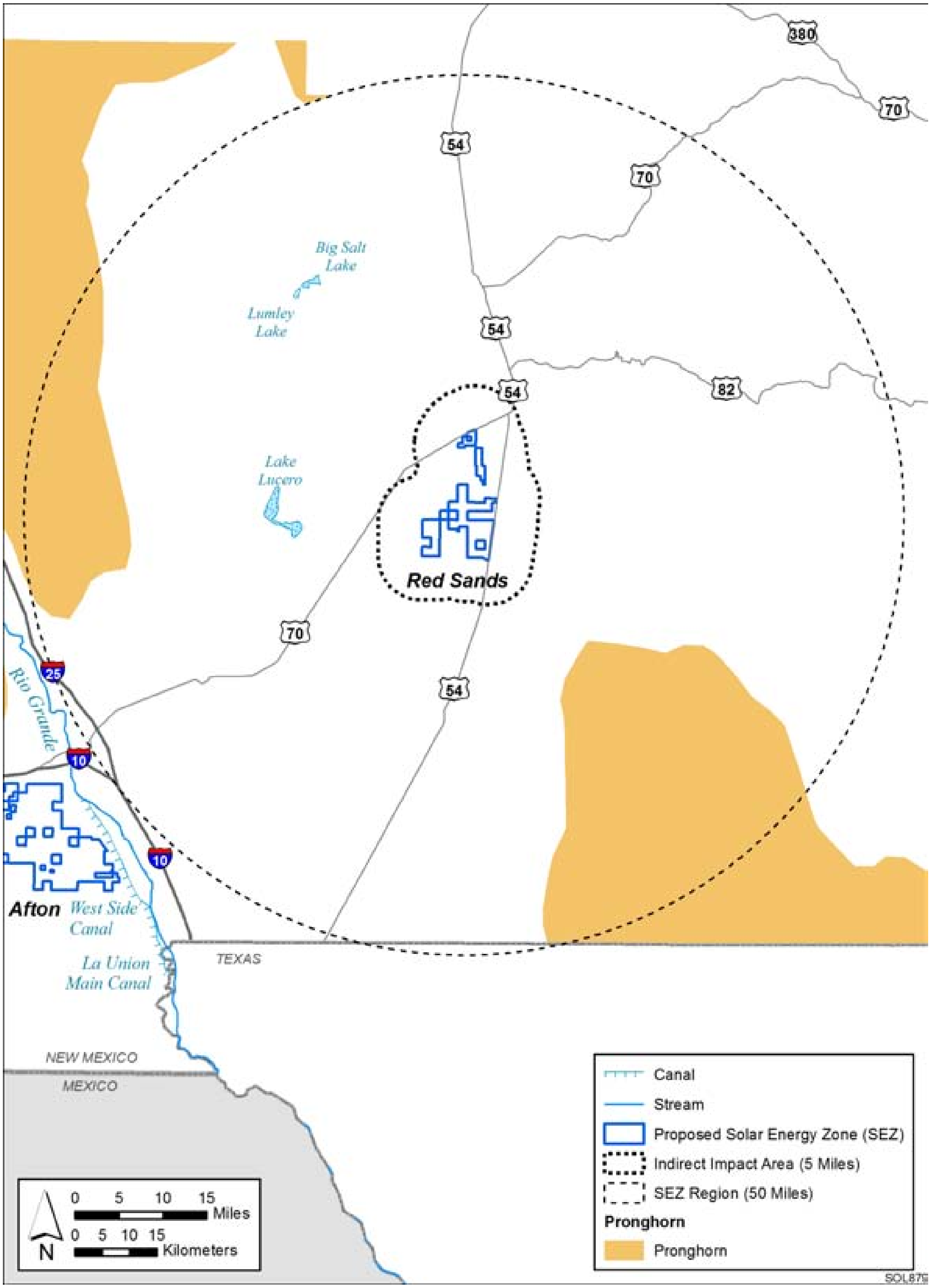

FIGURE 12.3.11.3-2 Location of the Proposed Red Sands SEZ Relative to the Mapped Range of Pronghorn (Source: BLM 2009b)

TABLE 12.3.11.3-1 Habitats, Potential Impacts, and Potential Mitigation for Representative Mammal Species That Could Occur on or in the Affected Area of the Proposed Red Sands SEZ

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]		Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
		Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	
Big Game				
Cougar (*Puma concolor*)	Most common in rough, broken foothills and canyon country, often in association with montane forests, shrublands, and pinyon-juniper woodlands. About 4,654,300 acres[g] of potentially suitable habitat occurs in the SEZ region.	18,016 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat) during construction and operations	184,357 acres of potentially suitable habitat (4.0% of available potentially suitable habitat)	Small overall impact. No species-specific mitigation of direct effects is feasible, because suitable habitat is widespread in the area of direct effects.
Mule deer (*Odocoileus hemionus*)	Most habitats including coniferous forests, desert shrub, chaparral, and grasslands with shrubs. Greatest densities in shrublands on rough, broken terrain that provides abundant browse and cover. About 4,936,900 acres of potentially suitable habitat occurs in the SEZ region.	18,016 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat) during construction and operations	199,686 acres of potentially suitable habitat (4.0% of available potentially suitable habitat)	Small overall impact. No species-specific mitigation of direct effects is feasible, because suitable habitat is widespread in the area of direct effects.
Pronghorn (*Antilocapra americana*)	Grasslands and semidesert shrublands on rolling topography that affords good visibility. Most abundant in shortgrass or midgrass prairies and least common in xeric habitats. About 1,559,100 acres of potentially suitable habitat occurs in the SEZ region.	8,078 acres of potentially suitable habitat lost (0.5% of available potentially suitable habitat) during construction and operations	35,193 acres of potentially suitable habitat (2.3% of available potentially suitable habitat)	Small overall impact.

TABLE 12.3.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Maximum Area of Potential Habitat Affected[b]: Outside SEZ (Indirect Effects)[d]	Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
Small Game and Furbearers				
American badger (*Taxidea taxus*)	Open grasslands and deserts, meadows in subalpine and montane forests, alpine tundra. Digs burrows in friable soils. Most common in areas with abundant populations of ground squirrels, prairie dogs, and pocket gophers. About 3,899,100 acres of potentially suitable habitat occurs in the SEZ region.	13,208 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat) during construction and operations	104,283 acres of potentially suitable habitat (2.7% of available potentially suitable habitat)	Small overall impact.
Black-tailed jackrabbit (*Lepus californicus*)	Open plains, fields, and deserts with scattered thickets or patches of shrubs. Also, open, early stages of forests and chaparral habitats. Rests during the day in shallow depressions, and uses shrubs for cover. About 3,789,800 acres of potentially suitable habitat occurs in the SEZ region.	8,596 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat) during construction and operations	74,710 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	Small overall impact.
Bobcat (*Lynx rufus*)	Most habitats except subalpine coniferous forest and montane meadow grasslands. Most common in rocky country from deserts through ponderosa forests. About 2,779,600 acres of potentially suitable habitat occurs in the SEZ region.	6,953 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat) during construction and operations	41,905 acres of potentially suitable habitat (1.5% of available potentially suitable habitat)	Small overall impact.
Coyote (*Canis latrans*)	All habitats at all elevations. Least common in dense coniferous forest. Where human control efforts occur, they are restricted to broken, rough country with abundant shrub cover and a good supply of rabbits or rodents. About 5,010,100 acres of potentially suitable habitat occurs in the SEZ region.	18,016 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat) during construction and operations	205,431 acres of potentially suitable habitat (4.1% of available potentially suitable habitat)	Small overall impact. No species-specific mitigation of direct effects is feasible, because suitable habitat is widespread in the area of direct effects.

TABLE 12.3.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Maximum Area of Potential Habitat Affected[b]: Outside SEZ (Indirect Effects)[d]	Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
Small Game and Furbearers				
Desert cottontail (*Sylvilagus audubonii*)	Abundant to common in grasslands, open forests, and desert shrub habitats. Can occur in areas with minimal vegetation as long as adequate cover (e.g., rock piles, fallen logs, fence rows) is present. Thickets and patches of shrubs, vines, and brush also used as cover. About 4,417,600 acres of potentially suitable habitat occurs in the SEZ region.	18,016 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat) during construction and operations	188,749 acres of potentially suitable habitat (4.3% of available potentially suitable habitat)	Small overall impact. No species-specific mitigation of direct effects is feasible, because suitable habitat is widespread in the area of direct effects.
Gray fox (*Urocyon cinereoargenteus*)	Deserts, open forests and brush. Prefer wooded areas, broken country, brushlands, and rocky areas. Tolerant of low levels of residential development. About 4,869,900 acres of potentially suitable habitat occurs in the SEZ region.	18,016 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat) during construction and operations	195,312 acres of potentially suitable habitat (4.0% of available potentially suitable habitat)	Small overall impact. No species-specific mitigation of direct effects is feasible, because suitable habitat is widespread in the area of direct effects.
Javelina (spotted peccary) (*Pecari tajacu*)	Often in thickets along creeks and washes. Beds in caves, mines, boulder fields, and dense stands of brush. May visit a water hole on a daily basis. About 3,260,400 acres of potentially suitable habitat occurs within the SEZ region.	7,124 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat) during construction and operations	57,521 acres of potentially suitable habitat (1.8% of available suitable habitat)	Small overall impact. Avoidance of wash and riverine wetland areas could reduce impacts.
Kit fox (*Vulpes macrotis*)	Desert and semidesert areas with relatively open vegetative cover and soft soils. Seek shelter in underground burrows. About 3,794,100 acres of potentially suitable habitat occurs in the SEZ region.	18,016 acres of potentially suitable habitat lost (0.5% of available potentially suitable habitat) during construction and operations	195,152 acres of potentially suitable habitat (5.1% of available potentially suitable habitat)	Small overall impact. No species-specific mitigation of direct effects is feasible, because suitable habitat is widespread in the area of direct effects.

TABLE 12.3.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Maximum Area of Potential Habitat Affected[b]: Outside SEZ (Indirect Effects)[d]	Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
Small Game and Furbearers (Cont.)				
Ringtail (*Bassariscus astutus*)	Usually in rocky areas with cliffs or crevices for daytime shelter, desertscrub, chaparral, pine-oak and conifer woodlands. About 4,041,800 acres of potentially suitable habitat occurs within the SEZ region.	13,208 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat) during construction and operations	112,060 acres of potentially suitable habitat (2.8% of available suitable habitat)	Small overall impact.
Striped skunk (*Mephitis mephitis*)	Occurs in most habitats other than alpine tundra. Common at lower elevations, especially in and near cultivated fields and pastures. Generally inhabits open country in woodlands, brush areas, and grasslands, usually near water. Dens under rocks, logs, or buildings. About 4,925,100 acres of potentially suitable habitat occurs within the SEZ region.	18,016 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat) during construction and operations	195,362 acres of potentially suitable habitat (4.0% of available suitable habitat)	Small overall impact. No species-specific mitigation of direct effects is feasible, because suitable habitat is widespread in the area of direct effects.
Nongame (small) Mammals				
Big brown bat (*Eptesicus fuscus*)	Most habitats from lowland deserts to timberline meadows. Roosts in hollow trees, rock crevices, mines, tunnels, and buildings. About 3,947,300 acres of potentially suitable habitat occurs in the SEZ region.	13,208 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat) during construction and operations	112,299 acres of potentially suitable habitat (2.8% of available potentially suitable habitat)	Small overall impact.
Botta's pocket gopher (*Thomomys bottae*)	Variety of habitats including shortgrass plains, oak savanna, agricultural lands, and deserts. Burrows are more common in disturbed areas such as roadways and stream floodplains. About 3,860,500 acres of potentially suitable habitat occurs in the SEZ region.	13,208 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat) during construction and operations	104,327 acres of potentially suitable habitat (2.7% of available potentially suitable habitat)	Small overall impact.

TABLE 12.3.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Maximum Area of Potential Habitat Affected[b]: Outside SEZ (Indirect Effects)[d]	Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
Nongame (small) Mammals (Cont.)				
Brazilian free-tailed bat (*Tadarida brasiliensis*)	Cliffs, deserts, grasslands, old fields, savannas, shrublands, woodlands, and suburban/urban areas. Roosts in buildings, caves, and hollow trees. May roost in rock crevices, bridges, signs, or cliff swallow nests during migration. Large maternity colonies inhabit caves, buildings, culverts, and bridges. About 4,154,100 acres of potentially suitable habitat occurs in the SEZ region.	13,308 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat) during construction and operations	117,396 acres of potentially suitable habitat (2.8% of available potentially suitable habitat)	Small overall impact.
Cactus mouse (*Peromyscus eremicus*)	Variety of areas including desertscrub, semidesert chaparral, desert wash, semidesert grassland, and cliff and canyon habitats. About 3,360,200 acres of potentially suitable habitat occurs in the SEZ region.	8,496 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat) during construction and operations	65,095 acres of potentially suitable habitat (1.9% of available potentially suitable habitat)	Small overall impact.
California myotis (*Myotis californicus*)	Desertscrub, semidesert shrublands, lowland riparian, swamps, riparian suburban areas, plains grasslands, scrub-grasslands, woodlands, and forests. Roosts in caves, mine tunnels, hollow trees, and loose rocks. About 3,891,200 acres of potentially suitable habitat occurs in the SEZ region.	13,208 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat) during construction and operations	104,407 acres of potentially suitable habitat (2.7% of available potentially suitable habitat)	Small overall impact.
Canyon mouse (*Peromyscus crinitus*)	Associated with rocky substrates in a variety of habitats, including desertscrub, sagebrush shrublands, woodlands, cliffs and canyons, and volcanic rock and cinder lands. Source of free water not required. About 1,564,700 acres of potentially suitable habitat occurs within the SEZ region.	6,706 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat) during construction and operations	27,533 acres of potentially suitable habitat (1.8% of available suitable habitat)	Small overall impact.

TABLE 12.3.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Maximum Area of Potential Habitat Affected[b]: Outside SEZ (Indirect Effects)[d]	Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
Nongame (small) Mammals (Cont.)				
Deer mouse (*Peromyscus maniculatus*)	Tundra; alpine and subalpine grasslands; plains grasslands; open, sparsely vegetated deserts; warm, temperate swamps and riparian forests; and Sonoran desertscrub habitats. About 4,659,100 acres of potentially suitable habitat occurs in the SEZ region.	18,016 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat) during construction and operations	184,494 acres of potentially suitable habitat (4.0% of available potentially suitable habitat)	Small overall impact. No species-specific mitigation of direct effects is feasible, because suitable habitat is widespread in the area of direct effects.
Desert pocket mouse (*Chaetodipus penicillatus*)	Sparsely vegetated sandy deserts. Prefers rock-free bottomland soils along rivers and streams. Sleeps and rears young in underground burrows. About 2,607,000 acres of potentially suitable habitat occurs within the SEZ region.	8,490 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat) during construction and operations	65,084 acres of potentially suitable habitat (4.0% of available potentially suitable habitat)	Small overall impact.
Desert shrew (*Notiosorex crawfordi*)	Generally found in arid areas with adequate cover for nesting and resting. Deserts, semiarid grasslands with scattered cactus and yucca, chaparral slopes, alluvial fans, sagebrush, gullies, juniper woodlands, riparian areas, and dumps. About 3,883,900 acres of potentially suitable habitat occurs within the SEZ region.	13,308 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat) during construction and operations	109,885 acres of potentially suitable habitat (2.8% of available suitable habitat)	Small overall impact. Avoidance of riverine wetland areas could reduce impacts.
Merriam's kangaroo rat (*Dipodomys merriami*)	Plains grasslands, scrub-grasslands, desertscrub, shortgrass plains, oak and juniper savannahs, mesquite dunes, and creosote flats. About 3,952,000 acres of potentially suitable habitat occurs in the SEZ region.	18,016 acres of potentially suitable habitat lost (0.5% of available potentially suitable habitat) during construction and operations	192,208 acres of potentially suitable habitat (4.9% of available potentially suitable habitat)	Moderate overall impact. No species-specific mitigation of direct effects is feasible, because suitable habitat is widespread in the area of direct effects.

TABLE 12.3.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Maximum Area of Potential Habitat Affected[b]: Outside SEZ (Indirect Effects)[d]	Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
Nongame (small) Mammals (Cont.)				
Northern grasshopper mouse (*Onychomys leucogaster*)	Occurs in grasslands, sagebrush deserts, overgrazed pastures, weedy roadside ditches, sand dunes, and other habitats with sandy soil and sparse vegetation. About 4,327,000 acres of potentially suitable habitat occurs within the SEZ region.	14,569 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat) during construction and operations	149,002 acres of potentially suitable habitat (3.4% of available potentially suitable habitat)	Small overall impact.
Ord's kangaroo rat (*Dipodomys ordii*)	Various habitats ranging from semidesert shrublands and pinyon-juniper woodlands to shortgrass or mixed prairie and silvery wormwood. Also occurs in dry, grazed, riparian areas if vegetation is sparse. Most common on sandy soils that allow for easy digging and construction of burrow systems. About 4,155,700 acres of potentially suitable habitat occurs within the SEZ region.	18,016 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat) during construction and operations	189,720 acres of potentially suitable habitat (4.6% of available suitable habitat)	Small overall impact. No species-specific mitigation of direct effects is feasible, because suitable habitat is widespread in the area of direct effects.
Round-tailed ground squirrel (*Spermophilus tereticaudus*)	Optimum habitat includes desert succulent shrub, desert wash, desertscrub, alkali desertscrub, and levees in cropland habitat. Also occurs in urban habitats. Burrows usually at base of shrubs. About 1,134,800 acres of potentially suitable habitat occurs within the SEZ region.	418 acres of potentially suitable habitat lost (0.04% of available potentially suitable habitat) during construction and operations	29,811 acres of potentially suitable habitat (2.6% of available suitable habitat)	Small overall impact. Avoidance of wash habitat could reduce impacts.
Silver-haired bat (*Lasionycteris noctivagans*)	Urban areas, chaparral, alpine and subalpine grasslands, forests, scrub-grassland, oak savannah and desertscrub habitats. Roosts under bark, in hollow trees, caves, and mines. Forages over clearings and open water. About 3,589,400 acres of potentially suitable habitat occurs within the SEZ region.	11,601 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat) during construction and operations	94,890 acres of potentially suitable habitat (2.6% of available suitable habitat)	Small overall impact.

TABLE 12.3.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]		Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
		Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	
Nongame (small) Mammals (Cont.)				
Southern plains woodrat (*Neotoma micropus*)	Semiarid and desert grassland environments. Burrows along the sides of arroyos and favors outwash plains and overgrazed lands. Occurs on rocky, gravelly, and sandy soils. About 4,642,200 acres of potentially suitable habitat occurs within the SEZ region.	18,016 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat) during construction and operations	189,770 acres of potentially suitable habitat (4.1% of available suitable habitat)	Moderate overall impact. Avoidance of wash and playa habitats, otherwise no species-specific mitigation of direct effects is feasible, because suitable habitat is widespread in the area of direct effects.
Spotted bat (*Euderma maculatum*)	Various habitats from desert to montane coniferous forests, mostly in open or scrub areas. Roosts in caves and cracks and crevices in cliffs and canyons. About 1,532,700 acres of potentially suitable habitat occurs within the SEZ region.	177 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) during construction and operations	20,162 acres of potentially suitable habitat (1.3% of available suitable habitat)	Small overall impact.
Spotted ground squirrel (*Spermophilus spilosoma*)	Arid grasslands and deserts. About 4,290,000 acres of potentially suitable habitat occurs within the SEZ region.	14,569 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat) during construction and operations	148,952 acres of potentially suitable habitat (3.5% of available suitable habitat)	Small overall impact.
Western harvest mouse (*Reithrodontomys megalotis*)	Various habitats including scrub-grasslands, temperate swamps and riparian forests, salt marshes, shortgrass plains, oak savannah, dry fields, agricultural areas, deserts, and desertscrub. Grasses are the preferred cover. About 3,654,000 acres of potentially suitable habitat occurs in the SEZ region.	12,967 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat) during construction and operations	102,214 acres of potentially suitable habitat (2.8% of available potentially suitable habitat)	Small overall impact.

TABLE 12.3.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Maximum Area of Potential Habitat Affected[b]: Outside SEZ (Indirect Effects)[d]	Overall Impact Magnitude[e] and Species-Specific Mitigation[f]
Nongame (small) Mammals (Cont.)				
Western pipistrelle (*Parastrellus hesperus*)	Deserts and lowlands, desert mountain ranges, desertscrub flats, and rocky canyons. Roosts mostly in rock crevices, sometimes mines and caves, and rarely in buildings. Suitable roosts occur in rocky canyons and cliffs. Most abundant bat in desert regions. About 3,641,500 acres of potentially suitable habitat occurs in the SEZ region.	12,967 acres of potentially suitable habitat lost (0.4% of available potentially suitable habitat) during construction and operations	102,100 acres of potentially suitable habitat (2.8% of available potentially suitable habitat)	Small overall impact.
White-tailed antelope squirrel *Ammospermophilus leucurus*)	Low deserts, semidesert and montane shrublands, plateaus, and foothills in areas with sparse vegetation and hard gravelly surfaces. Spends nights and other periods of inactivity in underground burrows. About 2,384,500 acres of potentially suitable habitat occurs within the SEZ region.	6,889 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat) during construction and operations	47,725 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	Small overall impact.

[a] Potentially suitable habitat was determined by using SWReGAP habitat suitability and land cover models. Area of potentially suitable habitat for each species is presented for the SEZ region, which is defined as the area within 50 mi (80 km) of the SEZ center.

[b] Maximum area of potentially suitable habitat that could be affected relative to availability within the SEZ region. Habitat availability for each species within the region was determined by using SWReGAP habitat suitability and land cover models. This approach probably overestimates the amount of suitable habitat in the project area. A maximum of 18,016 acres of direct effects within the SEZ was assumed.

[c] Direct effects within the SEZ consist of the ground-disturbing activities associated with construction and the maintenance of an altered environment associated with operations.

[d] Area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary. Potentially suitable habitat within the SEZ greater than the maximum of 18,016 acres of direct effects was also added to the area of indirect effects. Indirect effects include effects from surface runoff, dust, noise, lighting, and so on from the SEZ, but do not include ground-disturbing activities. The potential degree of indirect effects would decrease with increasing distance away from the SEZ.

Footnotes continued on next page.

TABLE 12.3.11.3-1 (Cont.)

[e] Overall impact magnitude categories were based on professional judgment and are as follows: (1) *small*: ≤1% of the population or its habitat would be lost and the activity would not result in a measurable change in carrying capacity or population size in the affected area; (2) *moderate*: >1 but ≤10% of the population or its habitat would be lost and the activity would result in a measurable but moderate (not destabilizing) change in carrying capacity or population size in the affected area; (3) *large*: >10% of a population or its habitat would be lost and the activity would result in a large, measurable, and destabilizing change in carrying capacity or population size in the affected area. Note that much greater weight was given to the magnitude of direct effects, because those effects would be difficult to mitigate. Programmatic design features would reduce most indirect effects to negligible levels.

[f] Species-specific mitigations are suggested here, but final mitigations should be developed in consultation with state and federal agencies and should be based on pre-disturbance surveys.

[g] To convert acres to km^2, multiply by 0.004047.

Sources: CDFG (2008); NatureServe (2010); NMDGF (2010); USGS (2004, 2005a, 2007).

The assessment of impacts on mammal species is based on available information on the presence of species in the affected area as presented in Section 12.3.11.3.1, following the analysis approach described in Appendix M. Additional NEPA assessments and coordination with state natural resource agencies may be needed to address project-specific impacts more thoroughly. These assessments and consultations could result in additional required actions to avoid or mitigate impacts on mammals (see Section 12.3.11.3.3).

Table 12.3.11.3-1 summarizes the magnitude of potential impacts on representative mammal species resulting from solar energy development (with the inclusion of design features) in the proposed Red Sands SEZ.

Cougar

Up to 18,016 acres (72.9 km^2) of potentially suitable cougar habitat could be lost by SEZ development within the proposed Red Sands SEZ. This represents about 0.4% of potentially suitable cougar habitat within the SEZ region. About 184,360 acres (746 km^2) of potentially suitable cougar habitat occurs within the area of indirect effects. Overall, impacts on cougar from solar energy development in the SEZ would be small.

Mule Deer

Based on land cover analyses, up to 18,016 acres (72.9 km^2) of potentially suitable mule deer habitat could be lost by SEZ development within the proposed Red Sands SEZ. This represents about 0.4% of potentially suitable mule deer habitat within the SEZ region. More than 199,700 acres (808 km^2) of potentially suitable mule deer habitat occurs within the area of indirect effects. Based on mapped ranges, up to 22,520 acres (91.1 km^2) of mule deer range where deer are rare or absent could be directly impacted by solar energy development in the SEZ. This is 1.0% of such range within the SEZ region. About 224,185 acres (907 km^2) of this low-density deer range occurs within the area of indirect effects. No acreage of higher-density mule deer range (i.e., less than 10 deer/mi^2 [less than 4 deer/km^2]) occur within the area of direct or indirect effects (Figure 12.3.11.3-1). Overall, impacts on mule deer from solar energy development in the SEZ would be small.

Pronghorn

Based on land cover analyses, up to 8,078 acres (32.7 km^2) of potentially suitable pronghorn habitat could be lost by SEZ development within the proposed Red Sands SEZ. This represents about 0.5% of potentially suitable mule deer habitat within the SEZ region. About 35,200 acres (142.4 km^2) of potentially suitable pronghorn habitat occurs within the area of indirect effects. However, based on mapped range, pronghorn do not occur within the SEZ or areas of indirect impacts (Figure 12.3.11.3-2). Overall, impacts on pronghorn from solar energy development in the SEZ would be small.

Other Mammals

Direct impacts on all other representative mammal species would be small, because 0.01 to 0.5% of potentially suitable habitats identified for those species in the proposed Red Sands SEZ region would be lost. Larger areas of potentially suitable habitat for the representative mammal species occur within the area of potential indirect effects (e.g., up to 5.1% of available habitat for the kit fox) (Table 12.3.11.3-1).

Summary

Overall, direct impacts on mammal species from habitat loss would be small (Table 12.3.11.3-1). Other impacts on mammals could result from collision with vehicles and infrastructure (e.g., fences), surface water and sediment runoff from disturbed areas, fugitive dust generated by project activities, noise, lighting, spread of invasive species, accidental spills, and harassment. Indirect impacts on areas outside the SEZ (e.g., impacts caused by dust generation, erosion, and sedimentation) would be negligible with implementation of programmatic design features.

Decommissioning after operations cease could result in short-term negative impacts on individuals and habitats within and adjacent to the SEZ. The negative impacts of decommissioning would be reduced or eliminated as reclamation proceeds. Potentially long-term benefits could accrue as habitats are restored in previously disturbed areas. Section 5.10.2.1.4 provides an overview of the impacts of decommissioning and reclamation on wildlife. Of particular importance for mammal species would be the restoration of original ground surface contours, soils, and native plant communities associated with semiarid shrublands.

12.3.11.3.3 SEZ-Specific Design Features and Design Feature Effectiveness

The implementation of required programmatic design features described in Appendix A, Section A.2.2, would reduce the potential for effects on mammals. Indirect impacts could be reduced to negligible levels by implementing design features, especially those engineering controls that would reduce runoff, sedimentation, spills, and fugitive dust. While SEZ-specific design features important for reducing impacts on mammals are best established when considering specific project details, design features that can be identified at this time are as follow:

- The fencing around the solar energy development should not block the free movement of mammals, particularly big game species.

- Wash, playa, and palustrine and riverine wetlands should be avoided.

If these SEZ-specific design features are implemented in addition to other programmatic design features, impacts on mammals could be reduced. However, potentially suitable habitats for a number of the mammal species occur throughout much of the SEZ; therefore, species-specific mitigation of direct effects for those species would be difficult or infeasible.

12.3.11.4 Aquatic Biota

12.3.11.4.1 Affected Environment

This section addresses aquatic habitats and biota known to occur in the proposed Red Sands SEZ itself or within an area that could be affected, either directly or indirectly, by activities associated with solar energy development within the proposed SEZ. There are no perennial water bodies or streams within the proposed Red Sands SEZ. NWI maps (USFWS undated) indicate there are 17 acres (0.07 km^2) of palustrine wetlands and 0.3 mi (0.4 km) of intermittent stream wetlands as well as small ephemeral washes and unnamed dry lakes within the SEZ (see Section 12.3.10). The streams and washes within the SEZ do not drain into any permanent surface water. The ephemeral and intermittent surface waters within the SEZ are normally dry and typically do not support aquatic or riparian habitats. Although not considered aquatic habitat, nonpermanent surface waters may contain invertebrates that are either aquatic opportunists (i.e., species that occupy both temporary and permanent waters) or specialists adapted to living in temporary aquatic environments (Graham 2001). On the basis of information from ephemeral pools in the American Southwest, ostracods (seed shrimp) and small planktonic crustaceans (e.g., copepods or cladocerans) are expected to be present, and larger branchiopod crustaceans such as fairy shrimp could occur (Graham 2001). Various types of insects that have aquatic larval stages, such as dragonflies and a variety of midges and other fly larvae, may also occur, depending on the duration of standing water, the distance to permanent water features, and the abundance of other invertebrates for prey (Graham 2001).

There are no perennial streams located within the area of indirect effects associated with the proposed Red Sands SEZ. However, one dry lake (Foster Lake) is present, west of the SEZ. In addition, Holloman Lake is a permanent water body within the area of indirect effects, approximately 3 mi (5 km) west of the SEZ along U.S. 70. There are also wetlands, canals, and lagoons associated with Holloman Lake. Holloman Lake is a man-made lake supplied by groundwater and surface water runoff (Holloman Air Force Base 2009). Holloman Lake and the associated surface waters provide habitat for aquatic biota, but the only fish species currently present are introduced mosquito fish (*Gambusia affinis*), although there are plans to stock hybrid striped bass (*Morone* sp.) (Holloman Air Force Base 2009). In addition, intermittent streams, wetlands, and ephemeral washes are present within the area of indirect effects. However, most of these features are typically dry and not likely to contain aquatic habitat, although opportunistic aquatic biota may be present. Streams within the area of indirect effects do not drain into any perennial surface waters.

Outside of the potential indirect effects area, but within 50 mi (80 km) of the proposed Red Sands SEZ, there are 4,041 acres (16 km^2) of intermittent lake (Lake Lucero), 776 acres (3 km^2) of perennial lake (Caballo Reservoir), and 263 acres (1 km^2) of dry lake. There are 487 mi (784 km) of intermittent stream, 108 mi (174 km) of perennial stream (primarily the

Rio Grande), and 11 mi (18 km) of canals within 50 mi (80 km) of the proposed SEZ. In addition, there are scattered wetlands, many of which are associated with the Rio Grande River. The White Sands National Monument is also located within 50 mi (80 km) of the SEZ. White Sands contains playa lakes and interdunal areas containing encysted macroinvertebrates during dry periods that become active and reproduce when these areas fill with water. These temporary invertebrate communities in turn provide a food source for the hundreds of migratory shore and water birds that pass through the monument.

12.3.11.4.2 Impacts

Section 5.10.3.2 discusses the types of impacts that could occur on aquatic habitats and biota because of the development of utility-scale solar energy facilities. Effects particularly relevant to aquatic habitats and communities include water withdrawal and changes in water, sediment, and contaminant inputs associated with runoff. The consequences of these habitat changes for aquatic biota are described in detail in Section 5.10.3.

No permanent streams, water bodies, or wetlands are present within the area of direct effects, but there are intermittent streams and wetlands that may be affected by ground disturbance and sedimentation associated with solar energy development within the proposed Red Sands SEZ. However, the intermittent surface water features within the SEZ are typically dry and not likely to contain aquatic habitat. A perennial lake (Holloman Lake) and several intermittent streams and wetlands are present within the area of indirect effects, and disturbance of land areas within the SEZ could increase the transport of soil into these features via waterborne and airborne pathways. The intermittent streams and wetlands in the area of indirect effects are typically dry. Therefore, no impacts on aquatic habitat and biota in these features are expected, although more detailed site surveys for biota in ephemeral and intermittent surface waters would be necessary to determine whether solar energy development activities would result in direct or indirect impacts on aquatic biota. Soil deposition could adversely affect the aquatic biota in Holloman Lake. The introduction of waterborne sediments into Holloman Lake and the intermittent streams and wetlands within the SEZ and the area of indirect effects could be minimized by using common mitigation measures such as settling basins, silt fences, or directing water draining from the developed areas away from streams. The intermittent streams in the area of direct and indirect effects do not drain into any permanent surface water, which reduces the potential for sedimentation in permanent surface water features outside of the SEZ and the area of indirect effects.

As identified in Section 5.10.3, water quality in aquatic habitats could be affected by the introduction of contaminants such as fuels, lubricants, or pesticides/herbicides during site characterization, construction, operation, or decommissioning for a solar energy facility. Within the proposed Red Sands SEZ, there is the potential for contaminants to enter intermittent and ephemeral washes and wetlands, especially if heavy machinery were used in or near the feature. However, aquatic habitat and biota are not likely to be present in intermittent and ephemeral surface water, and the potential for introducing contaminants could be minimized by avoiding these features during solar energy development within the SEZ. The potential for introducing contaminants into permanent surface waters would be small, given the relatively large distance of any permanent surface waters from the SEZ (approximately 3 mi [5 km]) and the lack of connectivity between washes within the SEZ and any permanent surface water.

In arid environments, reductions in the quantity of water in aquatic habitats are of particular concern. Water quantity in aquatic habitats could be affected if significant amounts of surface water or groundwater were utilized for power plant cooling water, for washing mirrors, or for other needs. There is the potential that groundwater withdrawals could reduce surface water levels in the man-made Holloman Lake. Groundwater withdrawals also have the potential to directly or indirectly reduce the aquatic habitat available for groundwater-dependent seasonal aquatic invertebrate communities in the White Sands National Monument. However, additional details regarding the volume of water required and the types of organisms present in potentially affected water bodies would be required in order to further evaluate the potential for reduced water levels in surrounding surface water features from water withdrawals.

12.3.11.4.3 SEZ-Specific Design Features and Design Feature Effectiveness

The implementation of required programmatic design features described in Appendix A, Section A.2.2, would greatly reduce or eliminate the potential for effects on aquatic biota and aquatic habitats from development and operation of solar energy facilities. While some SEZ-specific design features are best established when specific project details are being considered, design features that can be identified at this time include the following:

- Appropriate engineering controls should be implemented to minimize the amount of ground disturbance, contaminants, surface water runoff, and fugitive dust that reaches intermittent streams and wetlands within the SEZ.

- Appropriate engineering controls should be implemented to minimize the amount of surface water runoff and fugitive dust that reaches Holloman Lake and the intermittent streams and wetlands outside of the SEZ.

If these SEZ-specific design features are implemented in addition to programmatic design features and if the utilization of water from groundwater or surface water sources is adequately controlled to maintain sufficient water levels in aquatic habitats, the potential impacts on aquatic biota and habitats from solar energy development at the Red Sands SEZ would be negligible.

12.3.12 Special Status Species (Threatened, Endangered, Sensitive, and Rare Species)

This section addresses special status species that are known to occur, or for which suitable habitat occurs, within the potentially affected area of the proposed Red Sands SEZ. Special status species include the following types of species[4]:

- Species listed as threatened or endangered under the ESA;
- Species that are proposed for listing, under review, or are candidates for listing under the ESA;
- Species that are listed by the BLM as sensitive;
- Species that are listed by the State of New Mexico[5]; and
- Species that have been ranked by the State of New Mexico as S1 or S2, or species listed as of concern by the State of New Mexico or the USFWS (hereafter referred to as "rare" species).

Special status species known to occur within 50 mi (80 km) of the center of the Red Sands SEZ (i.e., the SEZ region) were determined from natural heritage records available through NatureServe Explorer (NatureServe 2010), information provided by the BLM Las Cruces District Office (Hewitt 2009b), New Mexico Rare Plant Technical Council (1999), BISON-M (NMDGF 2010), NHNM (McCollough 2009), SWReGAP (USGS 2004, 2005a, 2007), and the USFWS ECOS (USFWS 2010). Information reviewed consisted of county-level occurrences as determined from NatureServe and BISON-M, quad-level occurrences provided by the NHNM, as well as modeled land cover types and predicted suitable habitats for the species within the 50-mi (80-km) region as determined from SWReGAP. The 50-mi (80-km) SEZ region intersects Chaves, Doña Ana, Lincoln, Otero, and Sierra Counties in New Mexico. However, the SEZ and affected area occur only in Otero County. Additional information on the approach used to identify species that could be affected by development within the SEZ is provided in Appendix M.

12.3.12.1 Affected Environment

The affected area considered in this assessment included the areas of direct and indirect effects. The area of direct effects was defined as the area that would be physically modified during project development (i.e., where ground-disturbing activities would occur). For the

[4] See Section 4.6.4 for definitions of these species categories. Note that some of the categories of species included here do not fit BLM's definition of special status species as defined in BLM Manual 6840 (BLM 2008). These species are included here to ensure broad consideration of species that may be most vulnerable to impacts.

[5] State listed species for the state of New Mexico are those plants listed as endangered under the Endangered Plant Species Act (NMSA 1978 § 75-6-1) or wildlife listed as threatened or endangered under the Wildlife Conservation Act (NMSA 1978 § 17-2-37).

Red Sands SEZ, the area of direct effect included only the SEZ itself. Because of the proximity of existing infrastructure, the impacts of construction and operation of transmission lines outside of the SEZ are not assessed, assuming that the existing transmission infrastructure might be used to connect some new solar facilities to load centers, and that additional project-specific analysis would be conducted for new transmission construction or line upgrades. Similarly, the impacts of construction or upgrades to access roads were not assessed for this SEZ because of the proximity of I-10 (see Section 12.3.1.2 for a discussion of development assumptions for this SEZ). The area of indirect effects was defined as the area within 5 mi (8 km) of the SEZ boundary. Indirect effects considered in the assessment included effects from groundwater withdrawals, surface runoff, dust, noise, lighting, and accidental spills from the SEZ, but did not include ground-disturbing activities. For the most part, the potential magnitude of indirect effects would decrease with increasing distance away from the SEZ. This area of indirect effects was identified on the basis of professional judgment and was considered sufficiently large to bound the area that would potentially be subject to indirect effects. The affected area includes both the direct and indirect effects areas.

The primary land cover habitat type within the affected area is Chihuahuan coppice dune and sand flat scrub (see Section 12.3.10). Potentially unique habitats in the affected area in which special status species may reside include grassland, woodland, cliff and rock outcrop, desert dune, playa, wash, riparian, and aquatic habitats. No permanent aquatic habitats are known to occur on the SEZ; however, permanent open water habitats occur in the area of indirect effects on the Holloman Lake and the Raptor Lake Recreation Area about 3 mi (4.8 km) from the SEZ boundary. About 1,600 acres (6 km^2) of desert playa habitat occurs on the SEZ. Desert playa, riparian, and marsh habitats occur in the area of indirect effects within 5 mi (8 km) outside of the SEZ boundary.

All special status species that are known to occur within the Red Sands SEZ region (i.e., within 50 mi [80 km] of the center of the SEZ) are listed, with their status, nearest recorded occurrence, and habitats in Appendix J. Forty-three of these species could be affected by solar energy development on the SEZ, based on recorded occurrences or the presence of potentially suitable habitat in the affected area. These species, their status, and their habitats are presented in Table 12.3.12.1-1. For many of the species listed in the table (especially plants), their predicted potential occurrence in the affected area is based only on a general correspondence between mapped land cover types and descriptions of species habitat preferences. This overall approach to identifying species in the affected area probably overestimates the number of species that actually occur in the affected area. For many of the species identified as having potentially suitable habitat in the affected area, the nearest known occurrence is more than 20 mi (32 m) from the SEZ.

Based on NHNM records and information provided by the BLM Las Cruces District Office, occurrences for the following 17 special status species intersect the affected area of the Red Sands SEZ: Alamo beardtongue, golden columbine, grama grass cactus, Sacramento Mountains prickly-poppy, Scheer’s pincushion cactus, Villard pincushion cactus, White Sands pupfish, Texas horned lizard, American peregrine falcon, Baird’s sparrow, black tern, gray vireo, interior least tern, northern aplomado falcon, western burrowing owl, white-faced ibis, and spotted bat. These species are indicated in bold text in Table 12.3.12.1-1.

TABLE 12.3.12.1-1 Habitats, Potential Impacts, and Potential Mitigation for Special Status Species That Could Be Affected by Solar Energy Development on the Proposed Red Sands SEZ

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Maximum Area of Potential Habitat Affected[c]: Outside SEZ (Indirect Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Plants						
Alamo beard-tongue[h]	***Penstemon alamosensis***[h]	FWS-SC; NM-SC	Sacramento and San Andres Mountains in Dona Ana and Otero Counties, New Mexico, as well as the Hueco Mountains in El Paso County, Texas, in sheltered rocky areas, canyon sides, and canyon bottoms on limestone substrate. Elevations range between 4,300 and 5,300 ft.[i] Known to occur in the affected area about 4 mi[j] northeast of the Red Sands SEZ. About 15,300 acres[k] of potentially suitable habitat occurs in the SEZ region.	0 acres	23 acres of potentially suitable habitat (0.2% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Burgess' scale broom	*Lepidospartum burgessii*	BLM-S; NM-E; FWS-SC; NM-S1	Stabilized gypsum dunes in Chihuahuan Desert Scrub and grassland communities. Elevations range between 3,500 and 3,700 ft. About 2,120,800 acres of potentially suitable habitat occurs in the SEZ region.	14,000 acres of potentially suitable habitat lost (0.7% of available potentially suitable habitat)	114,000 acres of potentially suitable habitat (5.4% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the area of direct effect; translocation of individuals from area of direct effect; or compensatory mitigation of direct effects on occupied habitats could reduce impacts. Note that these same potential mitigation measures apply to all special status plants.

TABLE 12.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Maximum Area of Potential Habitat Affected[c]: Outside SEZ (Indirect Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Plants (Cont.)						
Glass Mountain coralroot	*Hexalectris nitida*	BLM-S; NM-E; FWS-SC; NM-S1	Deep canyons in leaf litter and under oak trees at elevations near 4,300 ft. Known to occur in Otero County, New Mexico. About 312,700 acres of potentially suitable habitat occurs in the SEZ region.	0 acres	124 acres of potentially suitable habitat (<0.1% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Golden columbine	***Aquilegia chrysantha* var. *chaplinei***	FWS-SC; NM-SC; NM-S2	Limestone seeps and springs in montane scrub or riparian canyon bottoms at elevations between 4,700 and 5,500 ft. Quad-level occurrences intersect the affected area within 5 mi east of the SEZ. About 27,500 acres of potentially suitable habitat occurs in the SEZ region.	0 acres	150 acres of potentially suitable habitat (0.5% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Grama grass cactus	***Sclerocactus papyracanthus***	BLM-S	Pinyon-juniper woodlands and desert grasslands on sandy soils at elevations between 4,900 and 7,200 ft. Known to occur on the SEZ and in portions of the area of indirect effects north of the SEZ. About 1,451,700 acres of potentially suitable habitat occurs in the SEZ region.	8,075 acres of potentially suitable habitat lost (0.6% of available potentially suitable habitat)	35,150 acres of potentially suitable habitat (2.4% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance to desert grassland habitats on the SEZ could reduce impacts. See Burgess' scale broom for a list of potential mitigation measures applicable to all special status plant species.

TABLE 12.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Maximum Area of Potential Habitat Affected[c]: Outside SEZ (Indirect Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Plants (Cont.)						
Kuenzler's hedgehog cactus	*Echinocereus fendleri* var. *kuenzleri*	ESA-E; NM-E; NM-S1	Endemic to southern New Mexico from the Capitan, Guadalupe, and Sacramento Mountains. Gentle, gravelly to rocky slopes and benches on limestone in Great Plains grasslands, oak woodlands, and pinyon-juniper woodlands. Elevation ranges between 5,200 and 6,600 ft. Nearest recorded occurrences are about 38 mi east of the SEZ. About 133,000 acres of potentially suitable habitat occurs in the SEZ region.	0 acres	23 acres of potentially suitable habitat (<0.1% of available potentially suitable habitat)	Small overall impact; no direct impact. The potential for impact and need for mitigation should be determined in consultation with the USFWS and NMDGF.
Marble Canyon rockcress	*Sibara grisea*	BLM-S; FWS-SC; NM-SC	Rock crevices and at the bases of limestone cliffs in chaparral and pinyon-juniper woodland communities at elevations between 4,500 and 6,000 ft. Known to occur in Otero County, New Mexico. About 563,700 acres of potentially suitable habitat occurs in the SEZ region.	0 acres	23 acres of potentially suitable habitat (<0.1% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
New Mexico rock daisy	*Perityle staurophylla* var. *staurophylla*	BLM-S; FWS-SC; NM-SC	Crevices of limestone cliffs and boulders at elevations between 4,900 and 7,000 ft. Known to occur in Otero County, New Mexico. About 15,300 acres of potentially suitable habitat occurs in the SEZ region.	0 acres	23 acres of potentially suitable habitat (<0.1% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.

TABLE 12.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Maximum Area of Potential Habitat Affected[c]: Outside SEZ (Indirect Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Plants (Cont.)						
Sacramento Mountains prickly-poppy	***Argemone pleiacantha* ssp. *pinnatisecta***	ESA-E; NM-E; NM-S2	Endemic to the Sacramento Mountains in Otero County, New Mexico, on loose, gravelly soils of open disturbed sites in canyon bottoms, on slopes, and along roadsides. Elevation ranges between 4,200 and 7,100 ft. Known to occur in the affected area about 4 mi east of the Red Sands SEZ. About 57,650 acres of potentially suitable habitat occurs in the SEZ region.	0 acres	7,650 acres of potentially suitable habitat (13.3% of available potentially suitable habitat)	Small overall impact; no direct impact. The potential for impact and need for mitigation should be determined in consultation with the USFWS and NMDGF.
Scheer's pincushion cactus	*Coryphantha scheeri* var. *valida*	NM-E; FWS-SC; NM-S2	Desert grassland and Chihuahuan Desert scrub communities, and occasionally on rocky benches, washes, or bajadas. Elevation ranges between 3,300 and 3,600 ft. Quad-level occurrences intersect the affected area about 5 mi west of the SEZ. About 3,423,850 acres of potentially suitable habitat occurs in the SEZ region.	18,000 acres of potentially suitable habitat lost (0.5% of available potentially suitable habitat)	202,400 acres of potentially suitable habitat (5.9% of available potentially suitable habitat)	Small overall impact. See Burgess' scale broom for a list of potential mitigation measures applicable to all special status plant species.
Villard pincushion cactus	***Escobaria villardii***	BLM-S; NM-E; FWS-SC; NM-S2	Franklin and Sacramento Mountains in Otero and Dona Ana Counties, New Mexico, on loamy soils of desert grassland and on broad limestone benches at elevations between 4,500 and 6,500 ft. Known to occur in the affected area about 4 mi east of the SEZ. About 1,451,700 acres of potentially suitable habitat occurs in the SEZ region.	8,075 acres of potentially suitable habitat lost (0.6% of available potentially suitable habitat)	35,150 acres of potentially suitable habitat (2.4% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance to desert grassland habitats on the SEZ could reduce impacts. See Burgess' scale broom for a list of other potential mitigation measures applicable to all special status plant species.

TABLE 12.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Maximum Area of Potential Habitat Affected[c]: Outside SEZ (Indirect Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Plants (Cont.)						
Wright's marsh thistle	*Cirsium wrightii*	BLM-S; NM-E; FWS-SC; NM-S2	Wet, alkaline soils in springs, seeps, and marshy areas of streams and ponds. Elevation ranges between 3,450 and 8,500 ft. Known to occur in Otero County, New Mexico. About 126,400 acres of potentially suitable habitat occurs in the SEZ region.	1,600 acres of potentially suitable habitat lost (1.3% of available potentially suitable habitat)	3,890 acres of potentially suitable habitat (3.1% of available potentially suitable habitat)	Moderate overall impact. Avoiding or minimizing disturbance to desert playa habitat on the SEZ could reduce impacts. See Burgess' scale broom for a list of other potential mitigation measures applicable to all special status plant species.
Invertebrates						
Blunt ambersnail	*Oxyloma retusum*	NM-S1	Marshy riparian habitats in association with wetland plants. Known to occur in Otero County, New Mexico. About 22,500 acres of potentially suitable habitat occurs in the SEZ region.	0 acres	50 acres of potentially suitable habitat (0.3% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Boisduval's blue butterfly	*Icaricia icarioides*	FWS-SC	Desert sand dunes, mountain meadows, riparian areas, open woodlands, and sagebrush-dominated landscapes. Known to occur in Otero County, New Mexico. About 1,650,200 acres of potentially suitable habitat occurs in the SEZ region.	7,700 acres of potentially suitable habitat lost (0.5% of available potentially suitable habitat)	87,900 acres of potentially suitable habitat (5.3% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance to sand dunes and desert playa habitats on the SEZ could reduce impacts. In addition, pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the area of direct effect or compensatory mitigation of direct effects on occupied habitats could reduce impacts.

TABLE 12.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Maximum Area of Potential Habitat Affected[c]: Outside SEZ (Indirect Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Invertebrates (Cont.)						
Hebard's blue-winged desert grasshopper	*Anconia hebardi*	NM-SC	Open sand dune habitats. Known to occur in Otero County, New Mexico. About 823,850 acres of potentially suitable habitat occurs in the SEZ region.	6,100 acres of potentially suitable habitat lost (0.7% of available potentially suitable habitat)	84,000 acres of potentially suitable habitat (10.2% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance to sand dunes on the SEZ could reduce impacts. In addition, pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the area of direct effect or compensatory mitigation of direct effects on occupied habitats could reduce impacts.
Obese thorn snail	*Carychium exiguum*	NM-S2	Damp habitats such as marshy riparian areas, floodplains, and ponds. Known to occur in Otero County, New Mexico. About 22,500 acres of potentially suitable habitat occurs in the SEZ region.	0 acres	50 acres of potentially suitable habitat (0.3% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Samalayuca Dune grasshopper	*Cibolacris samalayucae*	NM-SC	Open sand dune habitats. Known to occur in Otero County, New Mexico. About 823,850 acres of potentially suitable habitat occurs in the SEZ region.	6,100 acres of potentially suitable habitat lost (0.7% of available potentially suitable habitat)	84,000 acres of potentially suitable habitat (10.2% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance to sand dunes on the SEZ could reduce impacts. In addition, pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the area of direct effect or compensatory mitigation of direct effects on occupied habitats could reduce impacts.

TABLE 12.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Maximum Area of Potential Habitat Affected[c]: Outside SEZ (Indirect Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Fish						
White Sands pupfish	***Cyprinodon tularosa***	NM-T; FWS-SC; NM-S1	Endemic to the Tularosa Basin in southern New Mexico. Restricted to Malpais Spring and Lost River in Otero County, Salt Creek in Sierra County, and Mound Springs in Lincoln County. Shallow pools and calm spring runs over mud-silt and sand-gravel substrates. Quad-level occurrences intersect the affected area about 5 mi west of the SEZ. About 900 acres of potentially suitable habitat occurs in the SEZ region.	0 acres	300 acres of potentially suitable habitat (33.3% of available potentially suitable habitat)	Small to large overall impact; no direct impact. Suitable habitat for this species in the Lost River could be affected by groundwater withdrawals on the SEZ. Avoiding or limiting groundwater withdrawals on the SEZ could reduce impacts on this species.
Reptiles						
Texas horned lizard	***Phrynosoma cornutum***	BLM-S	Flat, open, generally dry habitats with little plant cover, except for desert scrub, bunchgrass, and cactus. Occurs in areas of loose soil that is sandy, loamy, or rocky. Quad-level occurrences intersect the affected area about 5 mi west of the SEZ. About 3,683,000 acres of potentially suitable habitat occurs in the SEZ region.	22,500 acres of potentially suitable habitat lost (0.6% of available potentially suitable habitat)	193,250 acres of potentially suitable habitat (5.2% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the area of direct effect; translocation of individuals from areas of direct effect; or compensatory mitigation of direct effects on occupied habitats could reduce impacts.

TABLE 12.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Maximum Area of Potential Habitat Affected[c]: Outside SEZ (Indirect Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Birds						
American peregrine falcon	***Falco peregrinus anatum***	BLM-S; NM-T	Year-round resident in the SEZ region. Open habitats, including deserts, shrublands, and woodlands that are associated with high, near vertical cliffs and bluffs above 200 ft. When not breeding, activity is concentrated in areas with ample prey, such as farmlands, marshes, lakes, rivers, and urban areas. Quad-level occurrences intersect the affected area about 5 mi north of the SEZ. About 2,425,300 acres of potentially suitable habitat occurs in the SEZ region.	2,050 acres of potentially suitable foraging habitat lost (0.1% of available potentially suitable habitat)	42,050 acres of potentially suitable habitat (1.7% of available potentially suitable habitat)	Small overall impact. Direct impact on foraging habitat only. Avoidance of direct impacts on all foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effect.
Baird's sparrow	***Ammodramus bairdii***	BLM-S; NM-T; FWS-SC; NM-S1	Winter resident in the project area in open grasslands and overgrown fields. Quad-level occurrences intersect the affected area about 5 mi west of the SEZ. About 1,513,700 acres of potentially suitable habitat occurs in the SEZ region.	8,100 acres of potentially suitable foraging habitat lost (0.5% of available potentially suitable habitat)	35,150 acres of potentially suitable foraging habitat (2.3% of available potentially suitable habitat)	Small overall impact on foraging habitat only. Avoiding or minimizing disturbance to desert grasslands on the SEZ could reduce impacts. Pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the area of direct effect or compensatory mitigation of direct effects on occupied habitats could reduce impacts.

TABLE 12.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Outside SEZ (Indirect Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Birds (Cont.)						
Bald eagle	*Haliaeetus leucocephalus*	BLM-S; NM-T; FWS-SC	Winter resident in the SEZ region. Near large bodies of water or free-flowing rivers with abundant fish and waterfowl prey. Winters near open water. May occasionally forage in arid shrubland habitats. Known to occur in Otero County, New Mexico. About 2,343,500 acres of potentially suitable habitat occurs in the SEZ region.	7,900 acres of potentially suitable foraging habitat lost (0.3% of available potentially suitable habitat)	43,100 acres of potentially suitable habitat (1.8% of available potentially suitable habitat)	Small overall impact on foraging habitat only. Avoidance of direct impacts on all foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effect.
Bell's vireo	*Vireo bellii*	NM-T; FWS-SC; NM-S2	Summer breeding resident in the SEZ region. Dense shrublands or woodlands along lower elevation riparian areas among willows, scrub oak, and mesquite. May nest in any successional stage with dense understory vegetation. Known to occur in Otero County, New Mexico. About 206,000 acres of potentially suitable habitat occurs in the SEZ region.	6,850 acres of potentially suitable foraging or nesting habitat lost (3.3% of available potentially suitable habitat)	35,150 acres of potentially suitable habitat (17.1% of available potentially suitable habitat)	Moderate overall impact on foraging and nesting habitat. Pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats, especially nesting habitats in the area of direct effect or compensatory mitigation of direct effects on occupied habitats could reduce impacts.
Black tern	***Chlidonias niger***	BLM-S; FWS-SC	Migratory transient in the project area. Wet grasslands, marshes, flooded agricultural fields, playa margins, and open water habitats in desert lowland areas. Quad-level occurrences intersect the affected area about 5 mi north of the SEZ. About 900 acres of potentially suitable habitat occurs in the SEZ region.	0 acres	300 acres of potentially suitable habitat (33.3% of available potentially suitable habitat)	Small overall impact; no direct impact. Species may only occur in the affected area as a migratory transient. No species-specific mitigation is warranted.

TABLE 12.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Maximum Area of Potential Habitat Affected[c]: Outside SEZ (Indirect Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Birds (Cont.)						
Ferruginous hawk	*Buteo regalis*	BLM-S; NM-S2	Winter resident in the project area in grasslands, sagebrush, and saltbrush habitats, as well as the periphery of pinyon-juniper woodlands throughout the project area. Known to occur in Otero County, New Mexico. About 27,600 acres of potentially suitable habitat occurs in the SEZ region.	0 acres	225 acres of potentially suitable habitat (0.8% of available potentially suitable habitat)	Small overall impact on foraging habitat only; no direct impact. No species-specific mitigation is warranted.
Gray vireo	***Vireo vicinior***	NM-T; NM-S2	Summer breeding resident in the SEZ region. Semiarid, shrubby habitats, including mesquite, brushy pinyon-juniper woodlands, chaparral, desert scrub, thorn scrub, oak-juniper woodland, mesquite, and dry chaparral. Nests in shrubs or trees. Quad-level occurrences intersect the affected area about 5 mi west of the SEZ. About 851,000 acres of potentially suitable habitat occurs in the SEZ region.	215 acres of potentially suitable foraging or nesting habitat lost (<0.1% of available potentially suitable habitat)	9,435 acres of potentially suitable habitat (1.1% of available potentially suitable habitat)	Small overall impact on foraging and nesting habitat. Pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats, especially nesting habitats, in the area of direct effect or compensatory mitigation of direct effects on occupied habitats could reduce impacts.
Interior least tern	***Sterna antillarum athalassos***	ESA-E; NM-E; NM-S1	Migratory transient in the SEZ region. Beaches and sandbars of large rivers and lakes; open water habitats and playas in the southwest. Quad-level occurrences intersect the affected area about 5 mi east of the SEZ. About 900 acres of potentially suitable habitat occurs in the SEZ region.	0 acres	300 acres of potentially suitable habitat (33.3% of available potentially suitable habitat)	Small overall impact; no direct impact. Species may only occur in the affected area as a migratory transient. No species-specific mitigation is warranted. The potential for impact and need for mitigation should be determined in consultation with the USFWS and NMDGF.

TABLE 12.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Maximum Area of Potential Habitat Affected[c]: Outside SEZ (Indirect Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Birds (Cont.)						
Loggerhead shrike	*Lanius ludovicianus*	BLM-S	A year-round resident in the SEZ region in open country with scattered trees and shrubs, savanna, desert scrub, and occasionally open woodlands. Nests in grasslands or pasture areas in shrubs or small trees. Known to occur in Otero County, New Mexico. About 4,444,000 acres of potentially suitable habitat occurs in the SEZ region.	19,100 acres of potentially suitable foraging or nesting habitat lost (0.4% of available potentially suitable habitat)	188,000 acres of potentially suitable habitat (4.2% of available potentially suitable habitat)	Small overall impact on foraging and nesting habitat. Pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats, especially nesting habitats, in the area of direct effect or compensatory mitigation of direct effects on occupied habitats could reduce impacts.
Northern aplomado falcon	***Falco femoralis septentrionalis***	ESA-E; NM-E; NM-S1	Year-round resident in the SEZ region. Open rangeland and savanna, semiarid grasslands with scattered trees, mesquite, and yucca. Nests in old stick nests of other raptor species in trees or shrubs in areas of desert grassland. Known to occur in the affected area of the Red Sands SEZ within 3 mi west of the SEZ. About 2,515,250 acres of potentially suitable habitat occurs in the SEZ region.	12,900 acres of potentially suitable foraging or nesting habitat lost (0.5% of available potentially suitable habitat)	95,200 acres of potentially suitable habitat (3.8% of available potentially suitable habitat)	Small overall impact on foraging and nesting habitat. Avoiding or minimizing disturbance to desert grasslands on the SEZ could reduce impacts. Pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats, especially nesting habitats, in the area of direct effect or compensatory mitigation of direct effects on occupied habitats could reduce impacts. The potential for impact and need for mitigation should be determined in consultation with the USFWS and NMDGF.

TABLE 12.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Maximum Area of Potential Habitat Affected[c]: Outside SEZ (Indirect Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Birds (Cont.)						
Osprey	*Pandion haliaetus*	NM-SC; NM-S2	Winter resident in the SEZ region. Rivers, lakes, and reservoirs. Nests on living or dead trees, and on man-made structures such as utility poles, wharf pilings, windmills, microwave towers, chimneys, and channel markers. Nests are usually near or above water. Known to occur in Otero County, New Mexico. About 77,650 acres of potentially suitable habitat occurs in the SEZ region.	0 acres	325 acres of potentially suitable habitat (0.4% of available potentially suitable habitat)	Small overall impact; no direct impact. No species-specific mitigation is warranted.
Western burrowing owl	***Athene cunicularia hypugaea***	BLM-S; FWS-SC; NM-SC	Year-round resident in the SEZ region. Open grasslands and prairies, as well as disturbed sites such as golf courses, cemeteries, and airports throughout the SEZ region. Nests in burrows constructed by mammals (prairie dog, badger, etc.). Quad-level occurrences intersect the affected area within 5 mi west and north of the SEZ. About 3,733,800 acres of potentially suitable habitat occurs in the SEZ region.	21,000 acres of potentially suitable foraging or nesting habitat lost (0.6% of available potentially suitable habitat)	196,800 acres of potentially suitable habitat (5.3% of available potentially suitable habitat)	Small overall impact on foraging and nesting habitat. Pre-disturbance surveys and avoiding or minimizing disturbance to occupied burrows and habitats in the area of direct effect or compensatory mitigation of direct effects on occupied habitats could reduce impacts.
White-faced Ibis	***Plegadis chihi***	BLM-S; NM-SC; NM-S2	Winter resident or migrant in the SEZ region. Marshes, swamps, ponds, rivers, and riparian areas. Quad-level occurrences intersect the affected area within 5 mi west and north of the SEZ. About 900 acres of potentially suitable habitat occurs in the SEZ region.	0 acres	300 acres of potentially suitable habitat (33.3% of available potentially suitable habitat)	Small overall impact; no direct impact. Species may only occur in the affected area as a migratory transient. No species-specific mitigation is warranted.

TABLE 12.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Maximum Area of Potential Habitat Affected[c]: Outside SEZ (Indirect Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Mammals						
Arizona myotis	*Myotis occultus*	BLM-S; NM-SC	Year-round resident in the SEZ region. Ponderosa pine and oak-pine woodlands near water; riparian habitats, and desert areas. Usually associated with large bodies of water. Roosts in buildings, mines, and dead trees. Known to occur in Otero County, New Mexico. About 4,841,100 acres of potentially suitable habitat occurs in the SEZ region.	21,000 acres of potentially suitable foraging habitat lost (0.4% of available potentially suitable habitat)	200,400 acres of potentially suitable habitat (4.1% of available potentially suitable habitat)	Small overall impact; direct impact on foraging habitat only. Avoidance of direct impacts on all foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effect.
Big free-tailed bat	*Nyctinomops macrotis*	BLM-S; NM-S2	Year-round resident in the SEZ region. Forages primarily in coniferous forests and arid shrublands. Roosts in rock crevices on cliff faces or in buildings. Known to occur in Otero County, New Mexico. About 4,820,500 acres of potentially suitable habitat occurs in the SEZ region.	22,500 acres of potentially suitable foraging habitat lost (0.5% of available potentially suitable habitat)	201,500 acres of potentially suitable habitat (4.2% of available potentially suitable habitat)	Small overall impact; direct impact on foraging habitat only. Avoidance of direct impacts on all foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effect.
Black-tailed prairie dog	*Cynomys ludovicianus*	FWS-SC; NM-SC; NM-S2	Dry, flat or gently sloping, open grasslands with relatively sparse vegetation, including areas grazed by cattle or in vacant lots in residential areas. Known to occur in Otero County, New Mexico. About 1,269,500 acres of potentially suitable habitat occurs in the SEZ region.	6,650 acres of potentially suitable habitat lost (0.5% of available potentially suitable habitat)	31,850 acres of potentially suitable habitat (2.5% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance to desert grasslands on the SEZ could reduce impacts. Pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats and burrows in the area of direct effect or compensatory mitigation of direct effects on occupied habitats could reduce impacts.

TABLE 12.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Maximum Area of Potential Habitat Affected[c]: Outside SEZ (Indirect Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Mammals (Cont.)						
Desert pocket gopher	*Geomys arenarius*	FWS-SC	Loose soils of disturbed areas or sandy areas along rivers, ponds, or canals. Known to occur in Otero County, New Mexico. About 2,688,000 acres of potentially suitable habitat occurs in the SEZ region.	7,500 acres of potentially suitable habitat lost (0.3% of available potentially suitable habitat)	130,200 acres of potentially suitable habitat (4.8% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the area of direct effect or compensatory mitigation of direct effects on occupied habitats could reduce impacts.
Fringed myotis	*Myotis thysanodes*	BLM-S	Summer or year-round resident in project area. Wide range of habitats including lowland riparian, desert shrub, pinyon-juniper, and sagebrush habitats. Roosts in buildings and caves. Known to occur in Otero County, New Mexico. About 4,026,300 acres of potentially suitable habitat occurs in the SEZ region.	13,100 acres of potentially suitable foraging habitat lost (0.3% of available potentially suitable habitat)	116,600 acres of potentially suitable habitat (2.9% of available potentially suitable habitat)	Small overall impact; direct impact on foraging habitat only. Avoidance of direct impacts on all foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effect.
Long-legged myotis	*Myotis volans*	BLM-S	Year-round resident in the SEZ region. Montane coniferous forests, riparian, and desert habitats. Hibernates in caves and mines. Roosts in abandoned buildings, rock crevices, and under bark of trees. Known to occur in Otero County, New Mexico. About 3,981,600 acres of potentially suitable habitat occurs in the SEZ region.	13,100 acres of potentially suitable foraging habitat lost (0.3% of available potentially suitable habitat)	109,400 acres of potentially suitable habitat (2.7% of available potentially suitable habitat)	Small overall impact; direct impact on foraging habitat only. Avoidance of direct impacts on all foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effect.

TABLE 12.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Maximum Area of Potential Habitat Affected[c]: Outside SEZ (Indirect Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Mammals (Cont.)						
Spotted bat	***Euderma maculatum***	BLM-S; NM-T; NM-S2	Year-round resident in the foothills and desert regions of the southwestern United States. Arid deserts, grasslands, and mixed coniferous forests at elevations below 10,000 ft. Roosts in caves, rock crevices, and buildings. Quad-level occurrences intersect the affected area about 5 mi north of the SEZ. About 919,500 acres of potentially suitable habitat occurs in the SEZ region.	250 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	20,750 acres of potentially suitable habitat (2.3% of available potentially suitable habitat)	Small overall impact; direct impact on foraging habitat only. Avoidance of direct impacts on all foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effect.
Townsend's big-eared bat	*Corynorhinus townsendii*	BLM-S; FWS-SC; NM-SC	Summer or year-round resident in the project area. Forests and shrubland habitats below 9,000 ft elevation throughout the SEZ region. Roosts and hibernates in caves, mines, and buildings. Known to occur in Otero County, New Mexico. About 3,809,000 acres of potentially suitable habitat occurs in the SEZ region.	13,000 acres of potentially suitable foraging habitat lost (0.3% of available potentially suitable habitat)	108,600 acres of potentially suitable habitat (2.9% of available potentially suitable habitat)	Small overall impact; direct impact on foraging habitat only. Avoidance of direct impacts on all foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effect.
Western small-footed myotis	*Myotis ciliolabrum*	BLM-S	Summer or year-round resident in the project area. Woodlands and riparian habitats at elevations below 9,000 ft. Roosts in caves, buildings, mines, and crevices of cliff faces. Known to occur in Otero County, New Mexico. About 4,663,600 acres of potentially suitable habitat occurs in the SEZ region.	19,200 acres of potentially suitable foraging habitat lost (0.4% of available potentially suitable habitat)	191,400 acres of potentially suitable habitat (4.1% of available potentially suitable habitat)	Small overall impact; direct impact on foraging habitat only. Avoidance of direct impacts on all foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effect.

TABLE 12.3.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Maximum Area of Potential Habitat Affected[c]: Outside SEZ (Indirect Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Mammals (Cont.)						
White sands woodrat	*Neotoma micropus leucophaea*	FWS-SC	Known only from the White Sands region in Otero County, New Mexico, in desert grasslands, shrublands, and riparian areas. About 1,250,000 acres of potentially suitable habitat occurs in the SEZ region.	19,280 acres of potentially suitable habitat lost (1.5% of available potentially suitable habitat)	188,400 acres of potentially suitable habitat (15.1% of available potentially suitable habitat)	Moderate overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the area of direct effect or compensatory mitigation of direct effects on occupied habitats could reduce impacts.
Yellow-faced pocket gopher	*Cratogeomys castanops*	NM-S2	Deep sandy or silty soils that are relatively free of rocks. Prefers deep firm soils; rich soils of river valleys and streams, agricultural land (orchards, gardens, potato fields and other croplands), and meadows. Also in mesquite-creosotebush habitat. Known to occur in Otero County, New Mexico. About 2,263,800 acres of potentially suitable habitat occurs in the SEZ region.	13,000 acres of potentially suitable habitat lost (0.6% of available potentially suitable habitat)	103,600 acres of potentially suitable habitat (4.6% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the area of direct effect or compensatory mitigation of direct effects on occupied habitats could reduce impacts.

[a] BLM-S = listed as a sensitive species by the BLM; ESA-C = candidate for listing under the ESA; ESA-E = listed as endangered under the ESA; FWS-SC = USFWS species of concern; NM-E = listed as endangered by the State of New Mexico; NM-T = listed as threatened by the State of New Mexico; NM-S1 = ranked as S1 in the state of New Mexico; NM-S2 = ranked as S2 in the state of New Mexico; NM-SC = species of concern in the state of New Mexico.

[b] For plant species, potentially suitable habitat was determined by using SWReGAP land cover types. For terrestrial vertebrate species, potentially suitable habitat was determined by using SWReGAP habitat suitability and land cover models. Area of potentially suitable habitat for each species is presented for the SEZ region, which is defined as the area within 50 mi (80 km) of the SEZ center.

Footnotes continued on next page.

TABLE 12.3.12.1-1 (Cont.)

[c] Maximum area of potentially suitable habitat that could be affected relative to availability within the SEZ region. Habitat availability for each species within the region was determined by using SWReGAP habitat suitability and land cover models. This approach probably overestimates the amount of suitable habitat in the project area. Impacts of access road and transmission line construction, upgrade, or operation are not assessed in this evaluation because of the proximity of existing infrastructure to the SEZ.

[d] Direct effects within the SEZ consist of the ground-disturbing activities associated with construction and the maintenance of an altered environment associated with operations.

[e] Area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary where ground-disturbing activities would not occur. Indirect effects include effects from surface runoff, dust, noise, lighting, and so on from project development. The potential degree of indirect effects would decrease with increasing distance away from the SEZ.

[f] Overall impact magnitude categories were based on professional judgment and are as follows: (1) *small*: ≤1% of the population or its habitat would be lost and the activity would not result in a measurable change in carrying capacity or population size in the affected area; (2) *moderate*: >1 but ≤10% of the population or its habitat would be lost and the activity would result in a measurable but moderate (not destabilizing) change in carrying capacity or population size in the affected area; (3) *large*: >10% of a population or its habitat would be lost and the activity would result in a large, measurable, and destabilizing change in carrying capacity or population size in the affected area. Note that much greater weight was given to the magnitude of direct effects because those effects would be difficult to mitigate. Programmatic design features would reduce most indirect effects to negligible levels.

[g] Species-specific mitigation measures are suggested here, but final mitigation measures should be developed in consultation with state and federal agencies and should be based on pre-disturbance surveys.

[h] Species in bold text have been recorded or have designated critical habitat within 5 mi (8 km) of the SEZ boundary.

[i] To convert ft to m, multiply by 0.3048.

[j] To convert mi to km, multiply by 1.609.

[k] To convert acres to km^2, multiply by 0.004047.

12.3.12.1.1 Species Listed under the Endangered Species Act That Could Occur in the Affected Area

In their scoping comments on the proposed Red Sands SEZ, the USFWS (Stout 2009) expressed concern for impacts of project development within the SEZ on habitat for the northern aplomado falcon—a species listed as endangered under the ESA. In addition, three other species listed under the ESA may occur in the affected area of the Red Sands SEZ based on the presence of potentially suitable habitat or known occurrences in the area: Kuenzler's hedgehog cactus, Sacramento Mountains prickly-poppy, and interior least tern. These species are discussed below and information on their habitat is presented in Table 12.3.12.1-1; additional basic information on life history, habitat needs, and threats to populations of these species is provided in Appendix J.

Kuenzler's Hedgehog Cactus

The Kuenzler's hedgehog cactus is listed as endangered under the ESA. This species is endemic to southern New Mexico from the Capitan, Guadalupe, and Sacramento Mountains on gravelly to rocky slopes in woodland habitats such as oak-pine and pinyon-juniper communities. Nearest recorded occurrences of this species are about 38 mi (61 km) east of the SEZ. The USFWS did not identify the Kuenzler's hedgehog cactus in their scoping comments on the proposed Red Sands SEZ (Stout 2009). According to the SWReGAP land cover model, rocky cliffs and outcrops that may be potentially suitable habitat for this species do not occur on the SEZ; however, about 23 acres (0.1 km^2) of potentially suitable rocky cliffs and outcrops may occur in the area of indirect effects (Table 12.3.12.1-1). Critical habitat for this species has not been designated.

Sacramento Mountains Prickly-Poppy

The Sacramento Mountains prickly-poppy is a perennial herb listed as endangered under the ESA. This species is endemic to the Sacramento Mountains in Otero County, New Mexico, where it occurs on loose, gravelly soils of open disturbed sites in canyon bottoms, slopes, and along roadsides. This species is known to occur in the affected area of the Red Sands SEZ, within 4 mi (6 km) east of the SEZ (Figure 12.3.12.1-1; Table 12.3.12.1-1). The USFWS did not identify the Sacramento Mountains prickly-poppy in their scoping comments on the proposed Red Sands SEZ (Stout 2009). According to the SWReGAP land cover model, low- and moderately disturbed areas that may be potentially suitable habitat for this species do not occur on the SEZ; however, about 7,650 acres (31 km^2) of potentially suitable disturbed habitat may occur in the area of indirect effects (Table 12.3.12.1-1). Critical habitat for this species has not been designated.

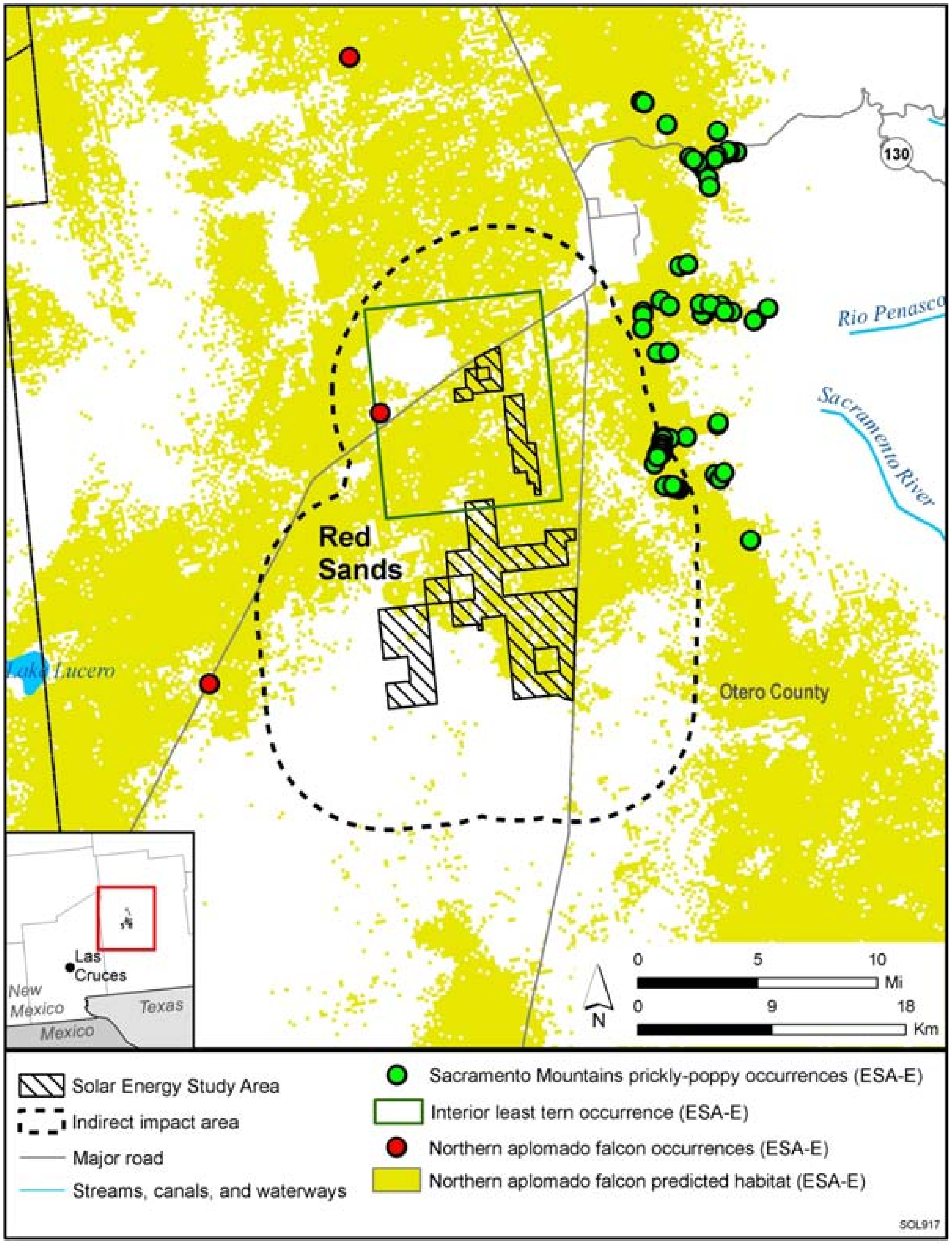

FIGURE 12.3.12.1-1 Known or Potential Occurrences of Species Listed as Endangered or Threatened under the ESA, Candidates for Listing under the ESA, or Species under Review for ESA Listing in the Affected Area of the Proposed Red Sands SEZ (Sources: Hewitt 2009b; USGS 2007)

Interior Least Tern

The interior least tern is a migratory shorebird with distinct breeding and wintering areas. Most breeding occurs on interior rivers, primarily along the major tributaries of the Mississippi River drainage from eastern Montana south to Texas and east to western Illinois, Missouri, Arkansas, and Louisiana. Wintering is thought to occur on beaches in Central and South America. This species may occur as a migratory transient in the state of New Mexico and throughout the southwestern United States. Within the SEZ region, interior least terns have been observed at beaches and sandbars of large rivers and reservoirs, as well as open water habitats and playas in desert regions. Quad-level occurrences for this species intersect the affected area of the Red Sands SEZ within 5 mi (8 km) east of the SEZ (Figure 12.3.12.1-1; Table 12.3.12.1-1). The USFWS did not identify the interior least tern in their scoping comments on the proposed Red Sands SEZ (Stout 2009), and, according to the SWReGAP habitat suitability model, suitable habitat for this species does not occur in the affected area. However, on the basis of the SWReGAP land cover model, about 300 acres (1 km^2) of potentially suitable open water and emergent marshland habitat occurs in the area of indirect effects outside of the SEZ (Table 12.3.12.1-1). Transient individuals may be observed in these habitats. On the basis of SWReGAP habitat suitability and land cover models, there is no suitable habitat for this species on the SEZ. Critical habitat for this species has not been designated.

Northern Aplomado Falcon

The northern aplomado falcon is a raptor listed as endangered under the ESA. This species is known to occur in Chihuahuan grassland habitats in southern New Mexico, western Texas, and northern Mexico. Suitable habitats include rangeland, savannas, and semiarid grasslands with scattered trees, mesquite (*Prosopis glandulosa*), and *Yucca* spp. Within these areas, the northern aplomado falcon feeds primarily on other small birds and infrequently on small mammals and reptiles. Nests are located in old nests of other bird species (usually raptors or ravens).

In their scoping comments on the Red Sands SEZ, the USFWS discussed the potential for the northern aplomado falcon to occur in the affected area. Natural and reintroduced populations may occur within the SEZ region (Stout 2009). Reintroductions of northern aplomado falcons in southern New Mexico under Section 10(j) of the ESA began in 2006. According to the USFWS, the northern aplomado falcon may occur on the SEZ and throughout the affected area of the proposed Red Sands SEZ in areas of Chihuahuan Desert grassland, especially where scattered yucca, mesquite, and cactus are present. According to a field-validated habitat suitability model provided by the BLM Las Cruces District Office (Hewitt 2009b), suitable grassland habitat for this species occurs on the SEZ and in the area of indirect effects. The species is known to occur in the affected area about 3 mi (5 km) west of the SEZ (Figure 12.3.12.1-1; Table 12.3.12.1-1). According to the SWReGAP habitat suitability model, about 12,900 acres (52 km^2) and 95,200 acres (385 km^2) of potentially suitable habitat may occur on the SEZ and within the area of indirect effects, respectively. Critical habitat for this species has not been designated.

12.3.12.1.2 Species That Are Candidates for Listing under the ESA

In their scoping comments on the proposed Red Sands SEZ (Stout 2009), the USFWS did not mention any species that are candidates for listing under the ESA that may be impacted by solar energy development on the Red Sands SEZ. On the basis of known occurrences and the presence of potentially suitable habitat, there are no species that are candidates for ESA listing that may occur in the affected area of the Red Sands SEZ.

12.3.12.1.3 Species That Are under Review for Listing under the ESA

In their scoping comments on the proposed Red Sands SEZ (Stout 2009), the USFWS did not mention any species that are under review for listing under the ESA that may be impacted by solar energy development on the Red Sands SEZ. On the basis of known occurrences and the presence of potentially suitable habitat, there are no species under review for ESA listing that may occur in the affected area of the Red Sands SEZ.

12.3.12.1.4 BLM-Designated Sensitive Species

There are 23 BLM-designated sensitive species that may occur in the affected area of the Red Sands SEZ (Table 12.3.12.1-1), including the following: (1) plants: Burgess' scale broom, Glass Mountain coralroot, grama grass cactus, Marble Canyon rockcress, New Mexico rock daisy, Villard pincushion cactus, and Wright's marsh thistle; (2) reptiles: Texas horned lizard; (3) birds: American peregrine falcon, Baird's sparrow, bald eagle, black tern, ferruginous hawk, loggerhead shrike, western burrowing owl, and white-faced ibis; and (4) mammals: Arizona myotis, big free-tailed bat, fringed myotis, long-legged myotis, spotted bat, Townsend's big-eared bat, and western small-footed myotis. Of these BLM-designated sensitive species with potentially suitable habitat in the affected area, occurrences of the following species intersect the affected area of the Red Sands SEZ: grama grass cactus, Villard pincushion cactus, Texas horned lizard, American peregrine falcon, Baird's sparrow, black tern, western burrowing owl, white-faced ibis, and spotted bat. Habitats in which BLM-designated sensitive species are found, the amount of potentially suitable habitat in the affected area, and known locations of the species relative to the SEZ are presented in Table 12.3.12.1-1. Additional information on these species as related to the SEZ is provided in the following paragraphs. Additional life history information for these species is provided in Appendix J.

Burgess' Scale Broom

The Burgess' scale broom is a perennial shrub known from southern Otero County, New Mexico, and adjacent western Texas. It occurs on stabilized gypsum dunes in Chihuahuan Desert scrub and grassland communities at elevations between 3,500 and 7,500 ft (1,066 and 2,286 m). According to the SWReGAP land cover model, potentially suitable desert scrub and grassland habitat may occur on the SEZ and in other portions of the affected area (Table 12.3.12.1-1).

Glass Mountain Coralroot

The Glass Mountain coralroot is a perennial herb known from southern New Mexico and adjacent western Texas. It occurs in deep canyon regions among leaf litter under oak trees at elevations near 4,300 ft (1,310 m). This species is known to occur in Otero County, New Mexico. According to the SWReGAP land cover model, potentially suitable canyon or woodland habitat does not occur on the SEZ. However, potentially suitable woodland habitat may occur in the area of indirect effects within 5 mi (8 km) of the SEZ (Table 12.3.12.1-1).

Grama Grass Cactus

The grama grass cactus is a perennial shrub-like cactus known from southern Arizona, New Mexico, and Texas. It occurs in pinyon-juniper woodlands and desert grasslands on sandy soils. This species is known to occur on the Red Sands SEZ and in portions of the area of indirect effects within 5 mi (8 km) of the SEZ. According to the SWReGAP land cover model, potentially suitable desert grassland habitat may occur on the SEZ and in other portions of the affected area (Table 12.3.12.1-1).

Marble Canyon Rockcress

The Marble Canyon rockcress is an annual herb known from southern New Mexico and Texas. It occurs in rock crevices and at the bases of limestone cliffs in chaparral and pinyon-juniper communities at elevations between 4,500 and 6,000 ft (1,350 and 1,800 m). This species is known to occur in Otero County, New Mexico. According to the SWReGAP land cover model, potentially suitable rocky cliff and outcrop habitat does not occur on the SEZ. However, potentially suitable habitat may occur in portions of the area of indirect effects within 5 mi (8 km) of the SEZ (Table 12.3.12.1-1).

New Mexico Rock Daisy

The New Mexico rock daisy is a perennial herb that is endemic to south-central New Mexico. It occurs in crevices of limestone cliffs and boulders at elevations between 4,900 and 7,000 ft (1,500 and 2,100 m). This species is known to occur in Otero County, New Mexico. According to the SWReGAP land cover model, potentially suitable rocky cliff and outcrop habitat does not occur on the SEZ. However, potentially suitable habitat may occur in portions of the area of indirect effects within 5 mi (8 km) of the SEZ (Table 12.3.12.1-1).

Villard Pincushion Cactus

The Villard pincushion cactus is a perennial shrub-like cactus known from the Franklin and Sacramento Mountains in southern New Mexico. It occurs on loamy soils on limestone benches in desert grassland at elevations between 4,500 and 6,500 ft (1,370 and 2,000 m). This species is known to occur in the affected area of the Red Sands SEZ, within 4 mi (6 km) east of the SEZ. According to the SWReGAP land cover model, potentially suitable desert grassland habitat may occur on the SEZ and other portions of the affected area (Table 12.3.12.1-1).

Wright's Marsh Thistle

The Wright's marsh thistle is a perennial herb known from southern New Mexico, western Texas, and adjacent Chihuahua, Mexico. It occurs on moist alkaline soils near springs, seeps, and marshy areas along streams and ponds. This species is known to occur in Otero County, New Mexico. According to the SWReGAP land cover model, potentially suitable desert playa habitat may occur on the SEZ and other portions of the affected area (Table 12.3.12.1-1).

Texas Horned Lizard

The Texas horned lizard is widespread in the south-central United States and northern Mexico. This lizard inhabits open arid and semiarid regions on sandy substrates and sparse vegetation. Vegetation in suitable habitats includes grasses, cacti, or scattered brush or scrubby trees. Nearest quad-level occurrences of this species intersect the affected area about 5 mi (8 km) west of the SEZ. According to the SWReGAP habitat suitability model, potentially suitable habitat for this species occurs on the SEZ and throughout portions of the affected area (Table 12.3.12.1-1).

American Peregrine Falcon

The American peregrine falcon occurs throughout the western United States in areas with high vertical cliffs and bluffs that overlook large open areas such as deserts, shrublands, and woodlands. Nests are usually constructed on rock outcrops and cliff faces. Foraging habitat varies from shrublands and wetlands to farmland and urban areas. Nearest quad-level occurrences of this species intersect the affected area about 5 mi (8 km) north of the SEZ. According to the SWReGAP habitat suitability model, potentially suitable year-round foraging and nesting habitat for the American peregrine falcon may occur within the affected area of the Red Sands SEZ. On the basis of an evaluation of SWReGAP land cover types, however, potentially suitable nesting habitat (cliffs or outcrops) does not occur on the SEZ.

Baird's Sparrow

The Baird's sparrow is a small neotropical migrant songbird with relatively small distinct breeding and wintering ranges. Breeding occurs in prairie grasslands of southern Canada, Montana, North Dakota, South Dakota, and Minnesota. Wintering occurs in dense grasslands in southern Texas, New Mexico, and northern Mexico. This species is known to occur in Otero County, New Mexico, where it is considered to be a winter resident, and quad-level occurrences of this species intersect the affected area of the Red Sands SEZ within 5 mi (8 km) west of the

SEZ. According to the SWReGAP habitat suitability model, potentially suitable wintering habitat for the Baird's sparrow may occur within the affected area of the Red Sands SEZ.

Bald Eagle

The bald eagle primarily occurs in riparian habitats associated with larger permanent water bodies such as lakes, rivers, and reservoirs. However, it may occasionally forage in arid shrubland habitats. This species is a winter resident in Otero County, New Mexico. According to the SWReGAP habitat suitability model, potentially suitable winter foraging habitat for this species may occur in the affected area of the Red Sands SEZ (Table 12.3.12.1-1).

Black Tern

The black tern is a migratory shorebird with distinct breeding and wintering areas. Most breeding occurs in the northern United States and Canada in marshes, meadows, lakeshores, and riparian areas along rivers and streams. Wintering occurs on beaches, estuaries, and reservoirs in Central and South America. This species may occur as a migratory transient in New Mexico and throughout the southwestern United States. Within the region, black terns have been observed at beaches and sandbars of large rivers and reservoirs, as well as open water habitats and playas in desert regions. Quad-level occurrences for this species intersect the affected area of the Red Sands SEZ about 5 mi (8 km) north of the SEZ (Figure 12.3.12.1-1, Table 12.3.12.1-1). According to the SWReGAP habitat suitability model, suitable habitat for this species does not occur in the affected area. However, on the basis of the SWReGAP land cover model, potentially suitable open water and emergent marshland habitat occurs in the area of indirect effects (Table 12.3.12.1-1). Transient individuals may be observed in these habitats. On the basis of SWReGAP habitat suitability and land cover models, there is no suitable habitat for this species on the SEZ.

Ferruginous Hawk

The ferruginous hawk occurs throughout the western United States. According to the SWReGAP habitat suitability model, only potentially suitable winter foraging habitat for this species occurs within the affected area of the Red Sands SEZ. This species inhabits open grasslands, sagebrush flats, desert scrub, and the edges of pinyon-juniper woodlands. This species is known to occur in Otero County, New Mexico. According to the SWReGAP habitat suitability model, suitable habitat for this species does not occur on the SEZ; however, potentially suitable foraging habitat occurs in portions of the area of indirect effects outside of the SEZ (Table 12.3.12.1-1).

Loggerhead Shrike

The loggerhead shrike is a migratory bird that occurs as a year-round resident in the southwestern United States. This species inhabits open country with scattered trees and shrubs, such as savannas, desert shrublands, and open woodlands. Individuals are often observed perching on poles, wires, or fence posts. Nesting occurs in grasslands or pasture areas in shrubs or small trees. This species is known to occur in Otero County, New Mexico. According to the SWReGAP habitat suitability model, potentially suitable foraging and breeding habitat may occur on the SEZ and in other portions of the affected area (Table 12.3.12.1-1).

Western Burrowing Owl

The western burrowing owl forages in grasslands, shrublands, open disturbed areas, and nests in burrows usually constructed by mammals. According to the SWReGAP habitat suitability model for the western burrowing owl, potentially suitable year-round foraging and nesting habitat may occur in the affected area of the Red Sands SEZ. This species is known to occur in Otero County, New Mexico, and quad-level occurrences for this species intersect the affected area of the Red Sands SEZ (Figure 12.3.12.1-1; Table 12.3.12.1-1). Potentially suitable foraging and breeding habitat is expected to occur on the SEZ and in other portions of the affected area (Table 12.3.12.1-1). The availability of nest sites (burrows) within the affected area has not been determined, but shrubland habitat that may be suitable for either foraging or nesting occurs throughout the affected area.

White-Faced Ibis

The white-faced ibis is a migratory wading bird with distinct breeding and wintering areas. Breeding primarily occurs in temperate areas of western North America in marshes, swamps, and riverine systems. Wintering occurs in marshes, meadows, riverine systems, and meadows from southern California and Arizona, coastal Texas and Louisiana, south to Central and South America. This species may occur as a migratory transient in the state of New Mexico, where individuals have been observed at irrigated agricultural fields, open water areas, and desert playa habitats. Quad-level occurrences for this species intersect the affected area of the Red Sands SEZ (Figure 12.3.12.1-1; Table 12.3.12.1-1). According to the SWReGAP habitat suitability model, suitable habitat for this species does not occur in the affected area. However, on the basis of the SWReGAP land cover model, potentially suitable open water and emergent marshland habitat occurs in the area of indirect effects (Table 12.3.12.1-1). Transient individuals may be observed in these habitats. On the basis of SWReGAP habitat suitability and land cover models, there is no suitable habitat for this species on the SEZ.

Arizona Myotis

The Arizona myotis is a year-round resident in the Red Sands SEZ region, occurring primarily in woodland and riparian habitats. Suitable habitats for this species include ponderosa pine and oak-pine woodlands near water. The species also occasionally forages in desert shrubland areas. The species roosts in buildings, mines, and dead trees. This species is known to occur in Otero County, New Mexico. The SWReGAP habitat suitability model for the Arizona myotis indicates that potentially suitable foraging habitat may occur on the SEZ and in other portions of the affected area (Table 12.3.12.1-1). On the basis of an evaluation of SWReGAP land cover types, there is no potentially suitable roosting habitat (rocky cliffs and outcrops) on the SEZ, but about 23 acres (0.1 km^2) of potentially suitable roosting habitat occurs in the area of indirect effects.

Big Free-Tailed Bat

The big free-tailed bat is a year-round resident in the Red Sands SEZ region, where it forages in a variety of habitats, including coniferous forests and desert shrublands. The species roosts in rock crevices or in buildings. This species is known to occur in Otero County, New Mexico. The SWReGAP habitat suitability model for the big free-tailed bat indicates that potentially suitable foraging habitat may occur on the SEZ and in other portions of the affected area (Table 12.3.12.1-1). On the basis of an evaluation of SWReGAP land cover types, no potentially suitable roosting habitat (rocky cliffs and outcrops) occurs on the SEZ, but about 23 acres (0.1 km^2) of potentially suitable roosting habitat occurs in the area of indirect effects.

Fringed Myotis

The fringed myotis is a year-round resident in the Red Sands SEZ region, occurring in a variety of habitats, including riparian, shrubland, sagebrush, and pinyon-juniper woodlands. The species roosts in buildings and caves. This species is known to occur in Otero County, New Mexico. The SWReGAP habitat suitability model for the fringed myotis indicates that potentially suitable foraging habitat may occur on the SEZ and in other portions of the affected area (Table 12.3.12.1-1). On the basis of an evaluation of SWReGAP land cover types, there is no potentially suitable roosting habitat (rocky cliffs and outcrops) on the SEZ, but about 23 acres (0.1 km^2) of potentially suitable roosting habitat occurs in the area of indirect effects.

Long-Legged Myotis

The long-legged myotis is a year-round resident in the Red Sands SEZ region, where it is primarily known from montane coniferous forests. The species is also known to forage in desert shrublands. The species roosts in buildings, caves, mines, and rock crevices. This species is known to occur in Otero County, New Mexico. The SWReGAP habitat suitability model for the long-legged myotis indicates that potentially suitable foraging habitat may occur on the SEZ and in other portions of the affected area (Table 12.3.12.1-1). On the basis of an evaluation of SWReGAP land cover types, no potentially suitable roosting habitat (rocky cliffs and outcrops) occurs on the SEZ, but about 23 acres (0.1 km^2) of potentially suitable roosting habitat occurs in the area of indirect effects.

Spotted Bat

The spotted bat is a year-round resident in the Red Sands SEZ region, occurring in desert shrublands, grasslands, and mixed coniferous forests. The species roosts in caves, rock crevices, and buildings. Quad-level occurrences of this species intersect the affected area of the Red Sands SEZ. The SWReGAP habitat suitability model for the spotted bat indicates that potentially suitable foraging habitat may occur on the SEZ and in other portions of the affected area (Table 12.3.12.1-1). On the basis of an evaluation of SWReGAP land cover types, there is no potentially suitable roosting habitat (rocky cliffs and outcrops) on the SEZ, but about 23 acres (0.1 km^2) of potentially suitable roosting habitat occurs in the area of indirect effects.

Townsend's Big-Eared Bat

The Townsend's big-eared bat is a year-round resident in the Red Sands SEZ region, where it forages in a wide variety of desert and non-desert habitats. The species roosts in caves, mines, tunnels, buildings, and other man-made structures. This species is known to occur in Otero County, New Mexico. The SWReGAP habitat suitability model for the Townsend's big-eared bat indicates that potentially suitable foraging habitat may occur on the SEZ and in other portions of the affected area (Table 12.3.12.1-1). On the basis of an evaluation of SWReGAP land cover types, there is no potentially suitable roosting habitat (rocky cliffs and outcrops) on the SEZ, but about 23 acres (0.1 km^2) of potentially suitable roosting habitat occurs in the area of indirect effects.

Western Small-Footed Myotis

The western small-footed myotis is a year-round resident in the Red Sands SEZ region, occupying a wide variety of desert and non-desert habitats, including cliffs and rock outcrops, grasslands, shrubland, and mixed woodlands. The species roosts in caves, mines, tunnels, buildings, other man-made structures, and beneath boulders or loose bark. This species is known to occur in Otero County, New Mexico. The SWReGAP habitat suitability model for the western small-footed myotis indicates that potentially suitable foraging habitat may occur on the SEZ and in other portions of the affected area (Table 12.3.12.1-1). On the basis of an evaluation of SWReGAP land cover types, no potentially suitable roosting habitat (rocky cliffs and outcrops) occurs on the SEZ, but about 23 acres (0.1 km^2) of potentially suitable roosting habitat occurs in the area of indirect effects.

12.3.12.1.5 State-Listed Species

There are 16 species listed by the State of New Mexico that may occur in the Red Sands SEZ affected area (Table 12.3.12.1-1). These state-listed species include the following: (1) plants: Burgess' scale broom, Glass Mountain coralroot, Kuenzler's hedgehog cactus, Sacramento Mountains prickly-poppy, Scheer's pincushion cactus, Villard pincushion cactus, and Wright's marsh thistle; (2) fish: White Sands pupfish; (3) birds: American peregrine falcon, Baird's sparrow, bald eagle, Bell's vireo, gray vireo, interior least tern, and northern aplomado falcon; and (4) mammal: spotted bat. All of these species are protected in New Mexico under the Endangered Plant Species Act (NMSA 1978 § 75-6-1) or the Wildlife Conservation Act (NMSA 1978 § 17-2-37). Of these species, the following four have not been previously described because of their status under the ESA or BLM (Sections 12.3.12.1.1 or 12.3.12.1.4): Scheer's pincushion cactus, White Sands pupfish, Bell's vireo, and gray vireo. These species as related to the SEZ are described in this section and Table 12.3.12.1-1. Additional life history information for these species is provided in Appendix J.

Scheer's Pincushion Cactus

The Scheer's pincushion cactus occurs from southeastern Arizona, southern New Mexico, and western Texas. This species is listed as endangered by the State of New Mexico. It occurs in Chihuahuan Desert shrubland and grassland communities, and occasionally along washes or bajadas. Quad-level occurrences for this species intersect the affected area of the Red Sands SEZ within 5 mi (8 km) west of the SEZ. According to the SWReGAP land cover model, potentially suitable desert shrubland and grassland habitat occurs on the SEZ and other portions of the affected area (Table 12.3.12.1-1).

White Sands Pupfish

The White Sands pupfish is a small fish species endemic to the Tularosa Basin in southern New Mexico, where it is known from four isolated spring systems. This species is listed as threatened by the State of New Mexico. Populations occur in the Salt Creek drainage, including Malpais Spring, which occurs in Otero, Sierra, and Lincoln Counties within the White Sands Missile Range. The White Sands pupfish was also presumably introduced at Holloman Air Force Base and the White Sands National Monument near Alamogordo in a spring-fed section of the Lost River near Malone Draw. A population is also known to occur in Mound Spring associated with the Salt Creek drainage. This species is known to occur along the Lost River within the White Sands Missile Range and White Sands National Monument about 5 mi (8 km) west of the SEZ. These spring-fed habitats for the White Sands pupfish are supported by groundwater in the Tularosa Basin that may also be used to support solar energy development within the Red Sands SEZ (Table 12.3.12.1-1).

Bell's Vireo

The Bell's vireo is a small neotropical migrant songbird that is widespread in the central and southwestern United States and northern Mexico. This species is listed as threatened by the state of New Mexico. According to the SWReGAP habitat suitability model, this species may occur throughout the SEZ region as a summer breeding resident. Breeding and foraging habitat for the Bell's vireo consists of dense shrub-scrub vegetation such as riparian woodlands where there is an abundance of willows, scrub-oak communities, and mesquite woodlands. This species is known to occur in Otero County, New Mexico, and potentially suitable foraging or nesting habitat may occur on the SEZ or in other portions of the affected area (Table 12.3.12.1-1).

Gray Vireo

The gray vireo is a small neotropical migrant songbird that is known from the southwestern United States and northern Mexico. This species is listed as threatened by the State of New Mexico. According to the SWReGAP habitat suitability model, this species may occur throughout the SEZ region as a summer breeding resident. Breeding and foraging habitat for the gray vireo consists of semiarid shrublands, pinyon-juniper woodlands, oak-scrub woodlands, and chaparral habitats. Quad-level occurrences of this species intersect the affected area of the Red Sands SEZ. Potentially suitable foraging or nesting habitat for this species may occur on the SEZ or in other portions of the affected area (Table 12.3.12.1-1).

12.3.12.1.6 Rare Species

There are 36 rare species (i.e., state rank of S1 or S2 in New Mexico or considered a species of concern by the USFWS or State of New Mexico) that may be affected by solar energy development on the Red Sands SEZ (Table 12.3.12.1-1). Eleven of these rare species have not been discussed previously. These include the following: (1) plants: Alamo beardtongue and golden columbine; (2) invertebrates: blunt ambersnail, Boisduval's blue butterfly, Hebard's blue-winged desert grasshopper, obese thorn snail, and Samalayuca Dune grasshopper; (3) birds: osprey; and (4) mammals: black-tailed prairie dog, desert pocket gopher, White Sands woodrat, and yellow-faced pocket gopher. These species as related to the SEZ are described in Table 12.3.12.1-1.

12.3.12.2 Impacts

The potential for impacts on special status species from utility-scale solar energy development within the proposed Red Sands SEZ is addressed in this section. The types of impacts that special status species could incur from construction and operation of utility-scale solar energy facilities are discussed in Section 5.10.4.

The assessment of impacts on special status species is based on available information on the presence of species in the affected area as presented in Section 12.3.12.1 and following the analysis approach described in Appendix M. It is assumed that, prior to development, surveys would be conducted to determine the presence of special status species and their habitats in and near areas where ground-disturbing activities would occur. Additional NEPA assessments, ESA consultations, and coordination with state natural resource agencies may be needed to address project-specific impacts more thoroughly. These assessments and consultations could result in additional required actions to avoid, minimize, or mitigate impacts on special status species (see Section 12.3.12.3).

Solar energy development within the Red Sands SEZ could affect a variety of habitats (see Sections 12.3.9 and 12.3.10). These impacts on habitats could in turn affect special status species that are dependent on those habitats. Based on NHNM records and information provided by the BLM Las Cruces District Office, occurrences for the following 17 special status species intersect the Red Sands affected area: Alamo beardtongue, golden columbine, grama grass cactus, Sacramento Mountains prickly-poppy, Scheer's pincushion cactus, Villard pincushion cactus, White Sands pupfish, Texas horned lizard, American peregrine falcon, Baird's sparrow, black tern, gray vireo, interior least tern, northern aplomado falcon, western burrowing owl, white-faced ibis, and spotted bat. Suitable habitat for each of these species may occur in the affected area. Other special status species may occur on the SEZ or within the affected area on the basis of the presence of potentially suitable habitat. As discussed in Section 12.3.12.1, this approach to identifying the species that could occur in the affected area probably overestimates the number of species that actually occur there, and may therefore overestimate impacts on some special status species.

Impacts on special status species could occur during all phases of development (construction, operation, and decommissioning and reclamation) of a utility-scale solar energy project within the SEZ. Construction and operation activities could result in short- or long-term impacts on individuals and their habitats, especially if these activities take place in areas where special status species are known to or could occur. As presented in Section 12.3.1.2, impacts of access road and transmission line construction, upgrade, or operation are not assessed in this evaluation because of the proximity of existing infrastructure to the SEZ.

Direct impacts would result from habitat destruction or modification. It is assumed that direct impacts would occur only within the SEZ where ground-disturbing activities are expected to occur. Indirect impacts could result from surface water and sediment runoff from disturbed areas, fugitive dust generated by project activities, accidental spills, harassment, and lighting. No ground-disturbing activities associated with project development are anticipated to occur within the area of indirect effects. Decommissioning of facilities and reclamation of disturbed areas after operations cease could result in short-term negative impacts on individuals and habitats adjacent to project areas, but long-term benefits would accrue if original land contours and native plant communities were restored in previously disturbed areas.

The successful implementation of programmatic design features (discussed in Appendix A, Section A.2.2) would reduce direct impacts on some special status species, especially those that depend on habitat types that can be easily avoided (e.g., desert dunes, washes, and grasslands). Indirect impacts on special status species could be reduced to negligible levels by implementing appropriate programmatic design features, especially those engineering controls that would reduce groundwater consumption, runoff, sedimentation, spills, and fugitive dust.

12.3.12.2.1 Impacts on Species Listed under the ESA

In their scoping comments on the proposed Red Sands SEZ (Stout 2009), the USFWS expressed concern for impacts of project development within the SEZ on the northern aplomado falcon—a bird species listed as endangered under the ESA. In addition, three other species listed under the ESA may be affected by solar energy development on the Red Sands SEZ—Kuenzler's hedgehog cactus, Sacramento Mountains prickly-poppy, and interior least tern. Impacts on these species are discussed below and summarized in Table 12.3.12.1-1.

Kuenzler's Hedgehog Cactus

The Kuenzler's hedgehog cactus is listed as endangered under the ESA and is endemic to southern New Mexico on rocky slopes and woodland habitats such as oak-pine and pinyon-juniper communities. It is known to occur in Otero County, New Mexico, and nearest known occurrences are about 38 mi (61 km) east of the Red Sands SEZ. According to the SWReGAP land cover model, potentially suitable rocky cliff and outcrop habitat for this species does not occur on the SEZ. However, about 23 acres (0.1 km^2) of suitable habitat occurs in the area of potential indirect effects; this area represents less than 1.0% of the available suitable habitat in the region (Table 12.3.12.1-1).

The overall impact on the Kuenzler's hedgehog cactus from construction, operation, and decommissioning of utility-scale solar energy facilities within the Red Sands SEZ is considered small because no potentially suitable habitat for this species occurs in the area of direct effects, and only indirect effects are possible. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

If deemed necessary, mitigation for the Kuenzler's hedgehog cactus, including a survey protocol, avoidance measures, minimization measures, and, potentially, compensatory mitigation, should be developed in consultation with the USFWS in accordance with Section 7 of the ESA. Consultation with the New Mexico Department of Game and Fish (NMDGF) should also occur to determine any state mitigation requirements.

Sacramento Mountains Prickly-Poppy

The Sacramento Mountains prickly-poppy is listed as endangered under the ESA and is endemic to the Sacramento Mountains in Otero County, New Mexico. This species inhabits disturbed areas such as canyon bottoms, slopes, and roadsides. This species is known to occur in the affected area of the Red Sands SEZ, within 4 mi (6 km) east of the SEZ (Figure 12.3.12.1-1; Table 12.3.12.1-1). According to the SWReGAP land cover model, low- and moderately disturbed areas that may be potentially suitable habitat for this species do not occur on the SEZ. However, about 7,650 acres (31 km^2) of this potentially suitable habitat occurs in the area of potential indirect effects; this area represents about 13.3% of the available suitable habitat in the region (Table 12.3.12.1-1).

The overall impact on the Sacramento Mountains prickly-poppy from construction, operation, and decommissioning of utility-scale solar energy facilities within the Red Sands SEZ is considered small because no potentially suitable habitat for this species occurs in the area of direct effects, and only indirect effects are possible. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

If deemed necessary, mitigation for the Sacramento Mountains prickly-poppy, including a survey protocol, avoidance measures, minimization measures, and, potentially, compensatory mitigation, should be developed in consultation with the USFWS in accordance with Section 7 of the ESA. Consultation with the New Mexico Department of Game and Fish (NMDGF) should also occur to determine any state mitigation requirements.

Interior Least Tern

The interior least tern is listed as endangered under the ESA and is known to breed on sandy beaches and shorelines of large rivers and reservoirs in the central and midwestern United States; it is known to occur in the southwestern United States only as a migratory transient. Within New Mexico, interior least terns have been observed at beaches and sandbars of large rivers and reservoirs, as well as open water habitats and playas in desert regions. Quad-level occurrences for this species intersect the affected area of the Red Sands SEZ within 5 mi (8 km) east of the SEZ (Figure 12.3.12.1-1; Table 12.3.12.1-1). According to the SWReGAP land cover and habitat suitability models, suitable habitat for this species does not occur on the SEZ, and the SWReGAP habitat suitability model does not indicate potentially suitable habitat anywhere within the area of indirect effects. However, on the basis of the SWReGAP land cover model, about 300 acres (1 km^2) of open water and emergent marshland habitat occurs in the area of indirect effects; this area represents about 33.3% of the available open water and emergent marshland habitat in the region (Table 12.3.12.1-1).

The overall impact on the interior least tern from construction, operation, and decommissioning of utility-scale solar energy facilities within the Red Sands SEZ is considered small because no potentially suitable habitat for this species occurs in the area of direct effects, and only indirect effects are possible. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

If deemed necessary, mitigation for the interior least tern, including development of a survey protocol, avoidance measures, minimization measures, and, potentially, compensatory mitigation, should be developed in consultation with the USFWS in accordance with Section 7 of the ESA. Consultation with the New Mexico Department of Game and Fish (NMDGF) should also occur to determine any state mitigation requirements.

Northern Aplomado Falcon

The northern aplomado falcon inhabits Chihuahuan grasslands in southern New Mexico, western Texas, and northern Mexico and is known to occur about 3 mi (5 km) west of the Red Sands SEZ (Figure 12.3.12.1-1). According to the SWReGAP habitat suitability model, about 12,900 acres (52 km^2) of potentially suitable habitat occurs within the SEZ and could be directly affected by construction and operations of solar energy development on the Red Sands SEZ. This direct effects area represents about 0.5% of available suitable habitat in the region. About 95,200 acres (385 km^2) of suitable habitat occurs in the area of potential indirect effects; this area represents about 3.8% of the available suitable habitat in the region (Table 12.3.12.1-1). In addition, a field-verified habitat suitability model provided by the BLM Las Cruces District Office indicates that suitable grassland habitat for this species is known to occur on the SEZ. On the basis of this information, it is concluded that portions of the Red Sands SEZ may provide suitable habitat for the northern aplomado falcon.

The overall impact on the northern aplomado falcon from construction, operation, and decommissioning of utility-scale solar energy facilities within the Red Sands SEZ is considered small because the amount of potentially suitable foraging and nesting habitat for this species in the area of direct effects represents less than 1% of potentially suitable foraging habitat in the SEZ region. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts on this species to negligible levels.

Avoiding or minimizing disturbance to desert grassland habitat on the SEZ could reduce direct impacts on the northern aplomado falcon to negligible levels. Impacts could also be reduced by conducting pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats (especially nests) in the area of direct effects. If avoidance or minimization is not a feasible option, a compensatory mitigation plan could be developed and implemented to mitigate direct effects on occupied habitats. Compensation could involve the protection and enhancement of existing occupied or suitable habitats to compensate for habitats lost to development. A comprehensive mitigation strategy that used one or both of these options could be designed to completely offset the impacts of development. The need for mitigation, other than programmatic design features, should be determined by conducting pre-disturbance surveys for the species and its habitat in the area of direct effects.

Development of actions to reduce impacts (e.g., reasonable and prudent alternatives, reasonable and prudent measures, and terms and conditions) on the northern aplomado falcon, including development of a survey protocol, avoidance measures, minimization measures, and, potentially, compensatory mitigation, should be developed in consultation with the USFWS per Section 7 of the ESA. This consultation may also be used to develop incidental take statements per Section 10 of the ESA (if necessary). Consultation with NMDGF should also occur to determine any state mitigation requirements.

12.3.12.2.2 Impacts on Species That Are Candidates for Listing under the ESA

In their scoping comments on the proposed Red Sands SEZ (Stout 2009), the USFWS did not mention any species that are candidates for listing under the ESA that may be impacted by solar energy development on the Red Sands SEZ. On the basis of known occurrences and the presence of potentially suitable habitat, there are no species that are candidates for ESA listing that may occur in the affected area of the Red Sands SEZ.

12.3.12.2.3 Impacts on Species That Are under Review for Listing under the ESA

In their scoping comments on the proposed Red Sands SEZ (Stout 2009), the USFWS did not mention any species that are under review for listing under the ESA that may be impacted by solar energy development on the Red Sands SEZ. On the basis of known occurrences and the presence of potentially suitable habitat, there are no species under review for ESA listing that may occur in the affected area of the Red Sands SEZ.

12.3.12.2.4 Impacts on BLM-Designated Sensitive Species

There are 23 BLM-designated sensitive species that were not previously discussed as listed under the ESA, candidates, or under review for ESA listing that may be affected by solar energy development on the Red Sands SEZ. Impacts on these BLM-designated sensitive species are discussed below.

Burgess' Scale Broom

The Burgess' scale broom occurs in Otero County, New Mexico, and potentially suitable habitat occurs in the affected area of the Red Sands SEZ. According to the SWReGAP land cover model, about 14,000 acres (57 km^2) of potentially suitable desert shrub and grassland habitat on the SEZ may be directly affected by construction and operations of solar energy development (Table 12.3.12.1-1). This direct effects area represents about 0.7% of available suitable habitat in the region. About 114,000 acres (461 km^2) of potentially suitable desert shrubland and grassland habitat occurs in the area of potential indirect effects; this area represents about 5.4% of the available potentially suitable habitat in the SEZ region (Table 12.3.12.1-1).

The overall impact on the Burgess' scale broom from construction, operation, and decommissioning of utility-scale solar energy facilities within the Red Sands SEZ is considered small because less than 1% of potentially suitable habitat for this species occurs in the area of direct effects. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

Avoidance of all potentially suitable habitat for the Burgess' scale broom is not a feasible way to mitigate impacts because potentially suitable habitat is widespread throughout the area of direct effect and readily available in other portions of the SEZ region. For this species and other special status plants, impacts could be reduced by conducting pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the area of direct effects. If avoidance or minimization is not a feasible option, plants could be translocated from the area of direct effects to protected areas that would not be affected directly or indirectly by future development. Alternatively, or in combination with translocation, a compensatory mitigation plan could be developed and implemented to mitigate direct effects on occupied habitats. Compensation could involve the protection and enhancement of existing occupied or suitable habitats to compensate for habitats lost to development. A comprehensive mitigation strategy that used one or more of these options could be designed to completely offset the impacts of development.

Glass Mountain Coralroot

The Glass Mountain coralroot occurs in Otero County, New Mexico, and potentially suitable habitat occurs in the affected area of the Red Sands SEZ. According to the SWReGAP land cover model, potentially suitable canyon and woodland habitat does not occur on the SEZ. However, about 124 acres (0.5 km^2) of potentially suitable canyon and woodland habitat occurs in the area of indirect effects; this area represents less than 0.1% of the available suitable habitat in the SEZ region (Table 12.3.12.1-1).

The overall impact on the Glass Mountain coralroot from construction, operation, and decommissioning of utility-scale solar energy facilities within the Red Sands SEZ is considered small because no potentially suitable habitat for this species occurs in the area of direct effects, and only indirect effects are possible. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

Grama Grass Cactus

The grama grass cactus is known to occur on the Red Sands SEZ and in other portions of the affected area. About 8,075 acres (33 km^2) of potentially suitable desert grassland habitat on the SEZ may be directly affected by construction and operations of solar energy development (Table 12.3.12.1-1). This direct effects area represents 0.6% of available suitable habitat in the region. About 35,150 acres (142 km^2) of potentially suitable grassland habitat occurs in the area of potential indirect effects; this area represents about 2.4% of the available suitable habitat in the SEZ region (Table 12.3.12.1-1).

The overall impact on the grama grass cactus from construction, operation, and decommissioning of utility-scale solar energy facilities within the Red Sands SEZ is considered small because less than 1% of potentially suitable habitat for this species occurs in the area of direct effects. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels. Avoiding or minimizing disturbance to desert grassland habitat in the area of direct effects and the implementation of mitigation measures described previously for the Burgess' scale broom could reduce direct impacts on this species to negligible levels. The need for mitigation, other than programmatic design features, should be determined by conducting pre-disturbance surveys for the species and its habitat on the SEZ.

Marble Canyon Rockcress

The Marble Canyon rockcress occurs in Otero County, New Mexico. According to the SWReGAP land cover model, potentially suitable rocky cliff and outcrop and pinyon-juniper habitats for this species do not occur on the SEZ. However, about 23 acres (0.1 km^2) of potentially suitable habitat occurs in the area of indirect effects within 5 mi (8 km) of the SEZ; this area represents less than 0.1% of the available suitable habitat in the SEZ region (Table 12.3.12.1-1).

The overall impact on the Marble Canyon rockcress from construction, operation, and decommissioning of utility-scale solar energy facilities within the Red Sands SEZ is considered small because no potentially suitable habitat for this species occurs in the area of direct effects, and only indirect effects are possible. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

New Mexico Rock Daisy

The New Mexico rock daisy occurs in Otero County, New Mexico. According to the SWReGAP land cover model, potentially suitable rocky cliff and outcrop habitat for this species does not occur on the SEZ. However, about 23 acres (0.1 km^2) of potentially suitable habitat occurs in the area of indirect effects within 5 mi (8 km) of the SEZ; this area represents less than 0.1% of the available suitable habitat in the SEZ region (Table 12.3.12.1-1).

The overall impact on the New Mexico rock daisy from construction, operation, and decommissioning of utility-scale solar energy facilities within the Red Sands SEZ is considered small because no potentially suitable habitat for this species occurs in the area of direct effects, and only indirect effects are possible. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

Villard Pincushion Cactus

The Villard pincushion cactus is known to occur about 4 mi (6 km) east of the SEZ, and potentially suitable habitat occurs in the affected area. About 8,075 acres (33 km^2) of potentially suitable desert grassland habitat on the SEZ may be directly affected by construction and operations of solar energy development (Table 12.3.12.1-1). This direct effects area represents 0.6% of available suitable habitat in the region. About 35,150 acres (142 km^2) of potentially suitable grassland habitat occurs in the area of potential indirect effects; this area represents about 2.4% of the available suitable habitat in the SEZ region (Table 12.3.12.1-1).

The overall impact on the Villard pincushion cactus from construction, operation, and decommissioning of utility-scale solar energy facilities within the Red Sands SEZ is considered small because less than 1% of potentially suitable habitat for this species occurs in the area of direct effects. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels. Avoiding or minimizing disturbance to desert grassland habitat in the area of direct effects and the implementation of mitigation measures described previously for the Burgess' scale broom could reduce direct impacts on this species to negligible levels. The need for mitigation, other than programmatic design features, should be determined by conducting pre-disturbance surveys for the species and its habitat on the SEZ.

Wright's Marsh Thistle

The Wright's marsh thistle occurs in Otero County, New Mexico, and potentially suitable habitat may occur in the affected area of the Red Sands SEZ. About 1,600 acres (6 km^2) of potentially suitable desert playa habitat on the SEZ may be directly affected by construction and operations of solar energy development (Table 12.3.12.1-1). This direct effects area represents 1.3% of available suitable habitat in the region. About 3,890 acres (16 km^2) of potentially suitable grassland habitat occurs in the area of potential indirect effects; this area represents about 3.1% of the available suitable habitat in the SEZ region (Table 12.3.12.1-1).

The overall impact on the Wright's marsh thistle from construction, operation, and decommissioning of utility-scale solar energy facilities within the Red Sands SEZ is considered moderate because more than 1% but less than 10% of potentially suitable habitat for this species occurs in the area of direct effects. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels. Avoiding or minimizing disturbance to desert playa habitat in the area of direct effects and the implementation of mitigation measures described previously for the Burgess' scale broom could reduce direct impacts on this species to negligible levels. The need for mitigation, other than programmatic design features, should be determined by conducting pre-disturbance surveys for the species and its habitat on the SEZ.

Texas Horned Lizard

The Texas horned lizard is known to occur in the affected area of the Red Sands SEZ. About 22,500 acres (91 km^2) of potentially suitable habitat on the SEZ could be directly affected by construction and operations (Table 12.3.12.1-1). This direct impact area represents about 0.6% of potentially suitable habitat in the SEZ region. About 193,250 acres (782 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents about 5.2% of the potentially suitable habitat in the SEZ region (Table 12.3.12.1-1).

The overall impact on the Texas horned lizard from construction, operation, and decommissioning of utility-scale solar energy facilities within the Red Sands SEZ is considered small because the amount of potentially suitable foraging habitat for this species in the area of direct effects represents less than 1% of potentially suitable habitat in the SEZ region. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts on this species to negligible levels.

Avoidance of all potentially suitable habitats to mitigate impacts on the Texas horned lizard is not feasible because potentially suitable desertscrub habitat is widespread throughout the area of direct effect. However, direct impacts could be reduced by conducting pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the area of direct effects. If avoidance or minimization is not a feasible option, individuals could be translocated from the area of direct effects to protected areas that would not be affected directly or indirectly by future development. Alternatively, or in combination with translocation, a compensatory mitigation plan could be developed and implemented to mitigate direct effects on occupied habitats.

Compensation could involve the protection and enhancement of existing occupied or suitable habitats to compensate for habitats lost to development. A comprehensive mitigation strategy that used one or more of these options could be designed to completely offset the impacts of development.

American Peregrine Falcon

The American peregrine falcon is a year-round resident in the Red Sands SEZ region and is known to occur in the affected area. About 2,050 acres (8 km^2) of potentially suitable habitat on the SEZ could be directly affected by construction and operations (Table 12.3.12.1-1). This direct impact area represents 0.1% of potentially suitable habitat in the SEZ region. About 42,050 acres (170 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents about 1.7% of the potentially suitable habitat in the SEZ region (Table 12.3.12.1-1). Most of this area could serve as foraging habitat (open shrublands). On the basis of an evaluation of SWReGAP land cover data, potentially suitable nest sites for this species (rocky cliffs and outcrops) do not occur on the SEZ, but about 23 acres (0.1 km^2) of this habitat may occur in the area of indirect effects.

The overall impact on the American peregrine falcon from construction, operation, and decommissioning of utility-scale solar energy facilities within the Red Sands SEZ is considered small because direct effects would only occur on potentially suitable foraging habitat, and the amount of this habitat in the area of direct effects represents less than 1% of potentially suitable foraging habitat in the SEZ region. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts on this species to negligible levels. Avoidance of all potentially suitable foraging habitats is not a feasible way to mitigate impacts because potentially suitable habitat is widespread throughout the area of direct effect and readily available in other portions of the SEZ region.

Baird's Sparrow

The Baird's sparrow is a winter (non-breeding) resident in the Red Sands SEZ region and is known to occur in the affected area. About 8,100 acres (33 km^2) of potentially suitable foraging habitat on the SEZ could be directly affected by construction and operations (Table 12.3.12.1-1). This direct impact area represents 0.5% of potentially suitable habitat in the SEZ region. About 35,150 acres (142 km^2) of potentially suitable foraging habitat occurs in the area of indirect effects; this area represents about 2.3% of the potentially suitable habitat in the SEZ region (Table 12.3.12.1-1).

The overall impact on the Baird's sparrow from construction, operation, and decommissioning of utility-scale solar energy facilities within the Red Sands SEZ is considered small because direct effects would only occur on potentially suitable foraging habitat, and the amount of this habitat in the area of direct effects represents less than 1% of potentially suitable foraging habitat in the SEZ region. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts on this species to negligible levels.

Avoiding or minimizing disturbance to desert grassland habitat on the SEZ could reduce direct impacts on the Baird's sparrow to negligible levels. In addition, impacts could be reduced by conducting pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the area of direct effects. If avoidance or minimization is not a feasible option, a compensatory mitigation plan could be developed and implemented to mitigate direct effects on occupied habitats. Compensation could involve the protection and enhancement of existing occupied or suitable habitats to compensate for habitats lost to development. A comprehensive mitigation strategy that used one or both of these options could be designed to completely offset the impacts of development.

Bald Eagle

The bald eagle is a winter resident in the Red Sands SEZ region, and only potentially suitable foraging habitat is expected to occur in the affected area. About 7,900 acres (32 km^2) of potentially suitable habitat on the SEZ could be directly affected by construction and operations (Table 12.3.12.1-1). This direct impact area represents 0.3% of potentially suitable habitat in the SEZ region. About 43,100 acres (174 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents about 1.8% of the potentially suitable habitat in the SEZ region (Table 12.3.12.1-1). Most of the suitable foraging habitat on the SEZ and in the area of indirect effects consists of desert shrubland and grassland.

The overall impact on the bald eagle from construction, operation, and decommissioning of utility-scale solar energy facilities within the Red Sands SEZ is considered small because the amount of potentially suitable foraging habitat for this species in the area of direct effects represents less than 1% of potentially suitable foraging habitat in the SEZ region. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts on this species to negligible levels. Avoidance of all potentially suitable foraging habitats is not a feasible way to mitigate impacts because potentially suitable habitat is widespread throughout the area of direct effect and readily available in other portions of the SEZ region.

Black Tern

The black tern is a migratory transient in the southwestern United States, including the affected area of the Red Sands SEZ. According to the SWReGAP land cover and habitat suitability models, suitable habitat for this species does not occur on the SEZ, and the SWReGAP habitat suitability model does not indicate potentially suitable habitat anywhere within the area of indirect effects. However, on the basis of the SWReGAP land cover model, about 300 acres (1 km^2) of open water and emergent marshland habitat occurs in the area of indirect effects; this area represents about 33.3% of the available open water and emergent marshland habitat in the region (Table 12.3.12.1-1).

The overall impact on the black tern from construction, operation, and decommissioning of utility-scale solar energy facilities within the Red Sands SEZ is considered small because no potentially suitable habitat for this species occurs in the area of direct effects, and only indirect effects are possible. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

Ferruginous Hawk

The ferruginous hawk is a winter resident in the Red Sands SEZ region, and potentially suitable foraging habitat is expected to occur in the affected area. According to the SWReGAP habitat suitability model, suitable habitat for this species does not occur within the area of direct effects. However, about 225 acres (1 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents about 0.8% of the potentially suitable habitat in the SEZ region (Table 12.3.12.1-1).

The overall impact on the ferruginous hawk from construction, operation, and decommissioning of utility-scale solar energy facilities within the Red Sands SEZ is considered small because no potentially suitable habitat for this species occurs in the area of direct effects, and only indirect effects are possible. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

Loggerhead Shrike

The loggerhead shrike is a year-round resident in the Red Sands SEZ region, and potentially suitable habitat occurs in the affected area. About 19,100 acres (77 km^2) of potentially suitable desert shrubland and grassland habitat on the SEZ could be directly affected by construction and operations (Table 12.3.12.1-1). This direct impact area represents 0.4% of potentially suitable habitat in the SEZ region. About 188,000 acres (761 km^2) of potentially suitable desert shrubland and grassland habitat occurs in the area of indirect effects; this area represents about 4.2% of the potentially suitable habitat in the SEZ region (Table 12.3.12.1-1). These areas represent potentially suitable foraging and nesting habitats.

The overall impact on the loggerhead shrike from construction, operation, and decommissioning of utility-scale solar energy facilities within the Red Sands SEZ is considered small because less than 1% of potentially suitable habitat for this species occurs in the area of direct effects. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

Avoidance of all potentially suitable habitats (desert shrublands and grasslands) is not a feasible means of mitigating impacts on the loggerhead shrike because potentially suitable shrubland habitat is widespread throughout the area of direct effect and in other portions of the SEZ region. Impacts could be reduced by conducting pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats (especially nests) in the area of direct effects. If avoidance or minimization is not a feasible option, a compensatory mitigation plan could be developed and implemented to mitigate direct effects on suitable habitats. Compensation could involve the protection and enhancement of existing occupied or suitable habitats to compensate for habitats lost to development. A comprehensive mitigation strategy that used one or both of these options could be designed to completely offset the impacts of development.

Western Burrowing Owl

The western burrowing owl is a year-round resident in the Red Sands SEZ region, and the species is known to occur in the affected area. About 21,000 acres (85 km^2) of potentially suitable habitat on the SEZ could be directly affected by construction and operations (Table 12.3.12.1-1). This direct impact area represents 0.6% of potentially suitable habitat in the SEZ region. About 196,800 acres (796 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents about 5.3% of the potentially suitable habitat in the SEZ region (Table 12.3.12.1-1). Most of this area could serve as foraging and nesting habitat (shrublands). The abundance of burrows suitable for nesting in the affected area has not been determined.

The overall impact on the western burrowing owl from construction, operation, and decommissioning of utility-scale solar energy facilities within the Red Sands SEZ is considered small because the amount of potentially suitable habitat for this species in the area of direct effects represents less than 1% of potentially suitable habitat in the SEZ region. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

Avoidance of all potentially suitable habitats is not a feasible way to mitigate impacts on the western burrowing owl because potentially suitable desert shrub habitats are widespread throughout the area of direct effect and is readily available in other portions of the SEZ region. Impacts on the western burrowing owl could be reduced to negligible levels through the implementation of programmatic design features and by conducting pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats in the area of direct effects. If avoidance or minimization is not a feasible option, a compensatory mitigation plan could be developed and implemented to mitigate direct effects on occupied habitats. Compensation could involve the protection and enhancement of existing occupied or suitable habitats to compensate for habitats lost to development. A comprehensive mitigation strategy that used one or both of these options could be designed to completely offset the impacts of development. The need for mitigation, other than programmatic design features, should be determined by conducting pre-disturbance surveys for the species and its habitat in the area of direct effects.

White-Faced Ibis

The white-faced ibis is a migratory transient wading bird species in the Red Sands SEZ region, and potentially suitable habitat may occur in the affected area. According to the SWReGAP land cover and habitat suitability models, suitable habitat for this species does not occur on the SEZ, and the SWReGAP habitat suitability model does not indicate potentially suitable habitat anywhere within the area of indirect effects. However, on the basis of the SWReGAP land cover model, about 300 acres (1 km^2) of open water and emergent marshland habitat occurs in the area of indirect effects; this area represents about 33.3% of the available open water and emergent marshland habitat in the region (Table 12.3.12.1-1).

The overall impact on the white-faced ibis from construction, operation, and decommissioning of utility-scale solar energy facilities within the Red Sands SEZ is considered small because no potentially suitable habitat for this species occurs in the area of direct effects, and only indirect effects are possible. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

Arizona Myotis

The Arizona myotis is a year-round resident within the Red Sands SEZ region, and potentially suitable habitat may occur in the affected area of the SEZ. According to the SWReGAP habitat suitability model, about 21,000 acres (85 km^2) of potentially suitable habitat on the SEZ could be directly affected by construction and operations (Table 12.3.12.1-1). This direct impact area represents 0.4% of potentially suitable habitat in the SEZ region. About 200,400 acres (811 km^2) of potentially suitable foraging habitat occurs in the area of indirect effect; this area represents about 4.1% of the available suitable habitat in the region (Table 12.3.12.1-1). Most of the potentially suitable habitat in the affected area is foraging habitat represented by desert shrubland. An evaluation of SWReGAP land cover data indicates that potentially suitable roost habitat (rocky cliffs and outcrops) does not occur on the SEZ, but about 23 acres (0.1 km^2) of potentially suitable roost habitat may occur in the area of indirect effects.

The overall impact on the Arizona myotis from construction, operation, and decommissioning of utility-scale solar energy facilities within the Red Sands SEZ is considered small because the amount of potentially suitable foraging habitat for this species in the area of direct effects represents less than 1% of potentially suitable foraging habitat in the SEZ region. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts on this species to negligible levels. Avoidance of all potentially suitable foraging habitat is not a feasible way to mitigate impacts because potentially suitable foraging habitat is widespread throughout the area of direct effect and is readily available in other portions of the SEZ region.

Big Free-Tailed Bat

The big free-tailed bat is a year-round resident within the Red Sands SEZ region, and potentially suitable habitat may occur in the affected area of the SEZ. According to the SWReGAP habitat suitability model, about 22,500 acres (91 km^2) of potentially suitable habitat on the SEZ could be directly affected by construction and operations (Table 12.3.12.1-1). This direct impact area represents 0.5% of potentially suitable habitat in the SEZ region. About 201,500 acres (815 km^2) of potentially suitable foraging habitat occurs in the area of indirect effect; this area represents about 4.2% of the available suitable habitat in the region (Table 12.3.12.1-1). Most of the potentially suitable habitat in the affected area is foraging habitat represented by desert shrubland. On the basis of an evaluation of SWReGAP land cover data, potentially suitable roost habitat (rocky cliffs and outcrops) does not occur on the SEZ, but about 23 acres (0.1 km^2) of such habitat may occur in the area of indirect effects.

The overall impact on the big free-tailed bat from construction, operation, and decommissioning of utility-scale solar energy facilities within the Red Sands SEZ is considered small because the amount of potentially suitable foraging habitat for this species in the area of direct effects represents less than 1% of potentially suitable foraging habitat in the SEZ region. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts on this species to negligible levels. Avoidance of all potentially suitable foraging habitat is not a feasible way to mitigate impacts because potentially suitable foraging habitat is widespread throughout the area of direct effect and is readily available in other portions of the SEZ region.

Fringed Myotis

The fringed myotis is a year-round resident within the Red Sands SEZ region, and potentially suitable habitat may occur in the affected area of the SEZ. According to the SWReGAP habitat suitability model, about 13,100 acres (53 km^2) of potentially suitable habitat on the SEZ could be directly affected by construction and operations (Table 12.3.12.1-1). This direct impact area represents 0.3% of potentially suitable habitat in the SEZ region. About 116,600 acres (472 km^2) of potentially suitable foraging habitat occurs in the area of indirect effect; this area represents about 2.9% of the available suitable habitat in the region (Table 12.3.12.1-1). Most of the potentially suitable habitat in the affected area is foraging habitat represented by desert shrubland. On the basis of an evaluation of SWReGAP land cover data, potentially suitable roost habitat (rocky cliffs and outcrops) does not occur on the SEZ, but about 23 acres (0.1 km^2) of such habitat may occur in the area of indirect effects.

The overall impact on the fringed myotis from construction, operation, and decommissioning of utility-scale solar energy facilities within the Red Sands SEZ is considered small because the amount of potentially suitable foraging habitat for this species in the area of direct effects represents less than 1% of potentially suitable foraging habitat in the SEZ region. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts on this species to negligible levels. Avoidance of all potentially suitable foraging habitat is not a feasible way to mitigate impacts because potentially suitable foraging habitat is widespread throughout the area of direct effect and is readily available in other portions of the SEZ region.

Long-Legged Myotis

The long-legged myotis is a year-round resident within the Red Sands SEZ region, and potentially suitable habitat may occur in the affected area of the SEZ. According to the SWReGAP habitat suitability model, about 13,100 acres (53 km^2) of potentially suitable habitat on the SEZ could be directly affected by construction and operations (Table 12.3.12.1-1). This direct impact area represents 0.3% of potentially suitable habitat in the SEZ region. About 109,400 acres (443 km^2) of potentially suitable foraging habitat occurs in the area of indirect effect; this area represents about 2.7% of the available suitable habitat in the region (Table 12.3.12.1-1). Most of the potentially suitable habitat in the affected area is foraging habitat represented by desert shrubland. An evaluation of SWReGAP land cover data indicates that potentially suitable roost habitat (rocky cliffs and outcrops) does not occur on the SEZ, but about 23 acres (0.1 km^2) of such habitat may occur in the area of indirect effects.

The overall impact on the long-legged myotis from construction, operation, and decommissioning of utility-scale solar energy facilities within the Red Sands SEZ is considered small because the amount of potentially suitable foraging habitat for this species in the area of direct effects represents less than 1% of potentially suitable foraging habitat in the SEZ region. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts on this species to negligible levels. Avoidance of all potentially suitable foraging habitat is not a feasible way to mitigate impacts because potentially suitable foraging habitat is widespread throughout the area of direct effect and is readily available in other portions of the SEZ region.

Spotted Bat

The spotted bat is a year-round resident within the Red Sands SEZ region, and quad-level occurrences for this species are known to intersect the affected area. According to the SWReGAP habitat suitability model, about 250 acres (1 km^2) of potentially suitable habitat on the SEZ could be directly affected by construction and operations (Table 12.3.12.1-1). This direct impact area represents less than 0.1% of potentially suitable habitat in the SEZ region. About 20,750 acres (84 km^2) of potentially suitable foraging habitat occurs in the area of indirect effect; this area represents about 2.3% of the available suitable habitat in the region (Table 12.3.12.1-1). Most of the potentially suitable habitat in the affected area is foraging habitat represented by desert shrubland. An evaluation of SWReGAP land cover data indicates that potentially suitable roost habitat (rocky cliffs and outcrops) does not occur on the SEZ, but about 23 acres (0.1 km^2) of potentially suitable roost habitat may occur in the area of indirect effects.

The overall impact on the spotted bat from construction, operation, and decommissioning of utility-scale solar energy facilities within the Red Sands SEZ is considered small because the amount of potentially suitable foraging habitat for this species in the area of direct effects represents less than 1% of potentially suitable foraging habitat in the SEZ region. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts on this species to negligible levels. Avoidance of all potentially suitable foraging habitat is not a feasible way to mitigate impacts because potentially suitable foraging habitat is widespread throughout the area of direct effect and is readily available in other portions of the SEZ region.

Townsend's Big-Eared Bat

The Townsend's big-eared bat is a year-round resident within the Red Sands SEZ region, and potentially suitable habitat may occur in the affected area. According to the SWReGAP habitat suitability model, about 13,000 acres (53 km^2) of potentially suitable habitat on the SEZ could be directly affected by construction and operations (Table 12.3.12.1-1). This direct impact area represents 0.3% of potentially suitable habitat in the SEZ region. About 108,600 acres (439 km^2) of potentially suitable habitat occurs in the area of indirect effect; this area represents about 2.9% of the available suitable foraging habitat in the region (Table 12.3.12.1-1). Most of the potentially suitable habitat in the affected area is foraging habitat represented by desert shrubland. An evaluation of SWReGAP land cover data indicates that potentially suitable roost habitat (rocky cliffs and outcrops) does not occur on the SEZ, but about 23 acres (0.1 km^2) of such habitat may occur in the area of indirect effects.

The overall impact on the Townsend's big-eared bat from construction, operation, and decommissioning of utility-scale solar energy facilities within the Red Sands SEZ is considered small because the amount of potentially suitable foraging habitat for this species in the area of direct effects represents less than 1% of potentially suitable foraging habitat in the SEZ region. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts on this species to negligible levels. Avoidance of all potentially suitable foraging habitat is not a feasible way to mitigate impacts because potentially suitable foraging habitat is widespread throughout the area of direct effect and is readily available in other portions of the SEZ region.

Western Small-Footed Myotis

The western small-footed myotis is a year-round resident within the Red Sands SEZ region, and potentially suitable habitat may occur in the affected area. According to the SWReGAP habitat suitability model, about 19,200 acres (78 km^2) of potentially suitable habitat on the SEZ could be directly affected by construction and operations (Table 12.3.12.1-1). This direct impact area represents 0.4% of potentially suitable habitat in the SEZ region. About 191,400 acres (775 km^2) of potentially suitable habitat occurs in the area of indirect effect; this area represents about 4.1% of the available suitable foraging habitat in the region (Table 12.3.12.1-1). Most of the potentially suitable habitat in the affected area is foraging habitat represented by desert shrubland. An evaluation of SWReGAP land cover data indicates that potentially suitable roost habitat (rocky cliffs and outcrops) does not occur on the SEZ, but about 23 acres (0.1 km^2) of such habitat may occur in the area of indirect effects.

The overall impact on the western small-footed myotis from construction, operation, and decommissioning of utility-scale solar energy facilities within the Red Sands SEZ is considered small because the amount of potentially suitable foraging habitat for this species in the area of direct effects represents less than 1% of potentially suitable foraging habitat in the SEZ region. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts on this species to negligible levels. Avoidance of all potentially suitable foraging habitat is not a feasible way to mitigate impacts because potentially suitable foraging habitat is widespread throughout the area of direct effects and is readily available in other portions of the SEZ region.

12.3.12.2.5 Impacts on State-Listed Species

Sixteen species listed by the State of New Mexico may occur in the Red Sands SEZ affected area (Table 12.3.12.1-1). Of those species, impacts on the following four state-listed species have not been previously described: Scheer's pincushion cactus, White Sands pupfish, Bell's vireo, and gray vireo. Impacts on each of these species are discussed below and summarized in Table 12.3.12.1-1.

Scheer's Pincushion Cactus

The Scheer's pincushion cactus is known to occur in the affected area of the Red Sands SEZ, and potentially suitable habitat may occur on the site. According to the SWReGAP land cover model, about 18,000 acres (73 km^2) of potentially suitable desert shrubland and grassland habitat for this species on the SEZ could be directly affected by construction and operations (Table 12.3.12.1-1). This direct impact area represents 0.5% of potentially suitable habitat in the SEZ region. About 202,400 acres (819 km^2) of potentially suitable desert shrubland and grassland habitat occurs in the area of potential indirect effects; this area represents about 5.9% of the available suitable habitat in the SEZ region (Table 12.3.12.1-1).

The overall impact on the Scheer's pincushion cactus from construction, operation, and decommissioning of utility-scale solar energy facilities within the Red Sands SEZ is considered small because less than 1% of potentially suitable habitat for this species occurs in the area of direct effects. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels. Avoidance of all potentially suitable habitat is not feasible because suitable habitat (desert shrubland) is widespread in the area of direct effects. However, impacts may be reduced through the implementation of mitigation measures described previously for the Burgess' broom scale (Section 12.3.12.2.4). The need for mitigation, other than programmatic design features, should be determined by conducting pre-disturbance surveys for the species and its habitat in the area of direct effects.

White Sands Pupfish

The White Sands pupfish is endemic to the Tularosa Basin in southern New Mexico and nearest recorded occurrences and potentially suitable habitat intersect the affected area of the Red Sands SEZ. Suitable spring-fed habitats for this species in the Lost River and Salt Creek are supported in part by groundwater withdrawals from the Tularosa Basin, and groundwater from this basin may be used to support solar energy development on the Red Sands SEZ. An evaluation of SWReGAP land cover types indicates that suitable habitat for this species does not occur on the SEZ. However, about 300 acres (1 km^2) of potentially suitable open water and emergent marshland habitat may occur in the affected area of the Red Sands SEZ; this area represents about 33.3% of the available suitable habitat in the SEZ region (Table 12.3.12.1-1).

Impacts of groundwater depletion from solar energy development in the Red Sands SEZ cannot be quantified without identification of the cumulative amount of groundwater withdrawals needed to support development on the SEZ. Consequently, the overall impact on the White Sands pupfish could range from small to large, and would depend in part on the solar energy technology deployed, the scale of development within the SEZ, the type of cooling system used, and the degree of influence water withdrawals in the SEZ would have on drawdown and surface water discharges in habitats supporting this species (Table 12.3.12.1-1). Impacts on the White Sands pupfish could be minimized or eliminated by avoiding or limiting groundwater withdrawals from the Tularosa Basin to support solar energy development on the Red Sands SEZ.

Bell's Vireo

The Bell's vireo is widespread in the central and southwestern United States and is known to occur as a summer breeding resident in the Red Sands SEZ region. According to the SWReGAP habitat suitability model, about 6,850 acres (28 km^2) of potentially suitable habitat on the SEZ could be directly affected by construction and operations (Table 12.3.12.1-1). This direct impact area represents 3.3% of potentially suitable habitat in the SEZ region. About 35,150 acres (142 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents about 17.1% of the potentially suitable habitat in the SEZ region (Table 12.3.12.1-1). Most of the potentially suitable habitat on the SEZ and throughout the area of indirect effects could serve as foraging or nesting habitat where suitable dense shrub-scrub vegetation occurs.

The overall impact on the Bell's vireo from construction, operation, and decommissioning of utility-scale solar energy facilities within the Red Sands SEZ is considered moderate because more than 1% but less than 10% of potentially suitable habitat for this species occurs in the area of direct effects. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

Avoidance of all potentially suitable habitats is not a feasible way to mitigate impacts on the Bell's vireo because potentially suitable shrub-scrub habitat is widespread throughout the area of direct effect and is readily available in other portions of the SEZ region. Impacts on the Bell's vireo could be reduced by conducting pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats (especially nesting habitat) in the area of direct effects. If avoidance or minimization is not a feasible option, a compensatory mitigation plan could be developed and implemented to mitigate direct effects on occupied habitats. Compensation could involve the protection and enhancement of existing occupied or suitable habitats to compensate for habitats lost to development. A comprehensive mitigation strategy that used one or both of these options could be designed to completely offset the impacts of development.

Gray Vireo

The gray vireo is known from the southwestern United States and occurs as a summer breeding resident in the Red Sands SEZ region. According to the SWReGAP habitat suitability model, about 215 acres (1 km^2) of potentially suitable habitat on the SEZ could be directly affected by construction and operations (Table 12.3.12.1-1). This direct impact area represents less than 0.1% of potentially suitable habitat in the SEZ region. About 9,435 acres (38 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents about 1.1% of the potentially suitable habitat in the SEZ region (Table 12.3.12.1-1). Most of the potentially suitable habitat on the SEZ and throughout the area of indirect effects could serve as foraging or nesting habitat where suitable shrubs and trees occur.

The overall impact on the gray vireo from construction, operation, and decommissioning of utility-scale solar energy facilities within the Red Sands SEZ is considered small because less than 1% of potentially suitable habitat for this species occurs in the area of direct effects. The implementation of programmatic design features is expected to be sufficient to reduce indirect impacts to negligible levels.

Avoidance of all potentially suitable habitats is not a feasible means of mitigating impacts on the gray vireo because potentially suitable shrubland habitat is widespread throughout the area of direct effect and in other portions of the SEZ region. Impacts on the gray vireo could be reduced by conducting pre-disturbance surveys and avoiding or minimizing disturbance to occupied habitats (especially nesting habitat) in the area of direct effects. If avoidance or minimization is not a feasible option, a compensatory mitigation plan could be developed and implemented to mitigate direct effects on occupied habitats. Compensation could involve the protection and enhancement of existing occupied or suitable habitats to compensate for habitats lost to development. A comprehensive mitigation strategy that used one or both of these options could be designed to completely offset the impacts of development.

12.3.12.2.6 Impacts on Rare Species

Thirty-six rare species (i.e., state rank of S1 or S2 in New Mexico or a species considered of concern by the USFWS or State of New Mexico) may be affected by solar energy development on the Red Sands SEZ (Table 12.3.12.1-1). Impacts on 11 rare species have not been discussed previously. These include the following (1) plants: Alamo beardtongue and golden columbine; (2) invertebrates: blunt ambersnail, Boisduval's blue butterfly, Hebard's blue-winged desert grasshopper, obese thorn snail, and Samalayuca Dune grasshopper; (3) bird: osprey; and (4) mammals: black-tailed prairie dog, desert pocket gopher, White Sands woodrat, and yellow-faced pocket gopher. Impacts on these species are described in Table 12.3.12.1-1.

12.3.12.3 SEZ-Specific Design Features and Design Feature Effectiveness

The implementation of required programmatic design features described in Appendix A, Section A.2.2, would greatly reduce or eliminate the potential for effects of utility-scale solar energy development on special status species. While some SEZ-specific design features are best established when specific project details are being considered, some design features can be identified at this time, including the following:

- Pre-disturbance surveys should be conducted within the SEZ to determine the presence and abundance of special status species, including those identified in Table 12.3.12.1-1; disturbance to occupied habitats for these species should be avoided or minimized to the extent practicable. If avoiding or minimizing impacts on occupied habitats is not possible, translocation of individuals from areas of direct effect, or compensatory mitigation of direct effects on occupied habitats, could reduce impacts. A comprehensive mitigation strategy for special status species that used one or more of these options to offset the impacts of development should be developed in coordination with the appropriate federal and state agencies.

- Consultation with the USFWS and NMDGF should be conducted to address the potential for impacts on the following species currently listed as threatened or endangered under the ESA: Kuenzler's hedgehog cactus, Sacramento Mountains prickly-poppy, interior least tern, and northern aplomado falcon. Consultation would identify an appropriate survey protocol, avoidance and minimization measures, and, if appropriate, reasonable and prudent alternatives, reasonable and prudent measures, and terms and conditions for incidental take statements (if necessary).

- Avoiding or minimizing disturbance to desert grassland habitat on the SEZ could reduce or eliminate impacts on the following special status species: grama grass cactus, Villard pincushion cactus, Baird's sparrow, northern aplomado falcon, and black-tailed prairie dog.

- Avoiding or minimizing disturbance to sand dune habitat and sand transport systems on the SEZ could reduce or eliminate impacts on the following three special status species: Boisduval's blue butterfly, Hebard's blue-winged desert grasshopper, and Samalayuca Dune grasshopper.

- Avoiding or minimizing disturbance to playa habitat on the SEZ could reduce or eliminate impacts on the following two special status species: Wright's marsh thistle and Boisduval's blue butterfly.

- Avoidance or minimization of groundwater withdrawals from the Tularosa Basin to serve solar energy development on the SEZ could reduce or eliminate impacts on the White Sands pupfish. In particular, impacts on spring-fed habitats in the Lost River and Salt Creek could be reduced with the avoidance of groundwater withdrawals in the region.

- Harassment or disturbance of special status species and their habitats in the affected area should be mitigated. This can be accomplished by identifying any additional sensitive areas and implementing necessary protective measures based upon consultation with the USFWS and NMDGF.

If these SEZ-specific design features are implemented in addition to required programmatic design features, impacts on the special status and rare species could be reduced.

12.3.13 Air Quality and Climate

12.3.13.1 Affected Environment

12.3.13.1.1 Climate

The proposed Red Sands SEZ, with an average elevation of about 4,010 ft (1,220 m), is located in the west-central portion of Otero County in south-central New Mexico. The SEZ is in the central portion of Tularosa Basin, which extends about 150 mi (240 km) north-south, mostly in Otero County. The SEZ is located in the northern portion of the Chihuahuan Desert, the northern reaches of which protrude into New Mexico from north-central Mexico. The area experiences a high desert arid climate, characterized by warm summers, mild winters, light precipitation, a high evaporation rate, low relative humidity, abundant sunshine, and relatively large annual and diurnal temperature ranges (NCDC 2010a). Meteorological data collected at the Alamogordo White Sands Regional Airport, about 2 mi (3 km) northeast of the Red Sands SEZ boundary, and at the White Sands National Monument, about 7 mi (11 km) northwest, are summarized below.

A wind rose from the Alamogordo White Sands Regional Airport, based on data collected 33 ft (10 m) above the ground over the 5-year period 2005 to 2009, is presented in Figure 12.3.13.1-1 (NCDC 2010b). During this period, the annual average wind speed at the airport was about 6.5 mph (2.9 m/s); the prevailing wind direction was from the south-southeast (about 11.0% of the time) and secondarily from the south (about 10.6% of the time). South-southeasterly winds occurred more frequently throughout the year, except from late spring through early fall when southerly winds prevailed. Wind speeds categorized as calm (less than 1.1 mph [0.5 m/s]) occurred frequently (about 19.8% of the time) because of the stable conditions caused by strong radiative cooling from late night to sunrise. Average wind speeds by season were the highest in spring at 8.0 mph (3.6 m/s); lower in summer and winter at 6.4 mph (2.9 m/s) and 6.1 mph (2.7 m/s), respectively; and lowest in fall at 5.7 mph (2.5 m/s).

Elevation plays a larger role than does latitude in determining the temperature of any specific location in New Mexico (NCDC 2010a). For the period 1939 to 2010, the annual average temperature at the White Sands National Monument was 59.7°F (15.4°C) (WRCC 2010d). December was the coldest month, with an average minimum of 21.6°F (-5.8°C), and July was the warmest, with an average maximum of 97.1°F (36.2°C). In summer, daytime maximum temperatures over 90°F (32.2°C) are common, and minimums are in the 60s. The minimum temperatures recorded were below freezing (≤32°F [0°C]) during the colder months (from October to May with peaks of about 27 days in January and December), but subzero temperatures were very rare. During the same period, the highest temperature, 111°F (43.9°C), was reached in June 1981, and the lowest, –25°F (−31.7°C), in January 1962. In a typical year, about 113 days had a maximum temperature of at least 90°F (32.2°C), while about 126 days had minimum temperatures at or below freezing.

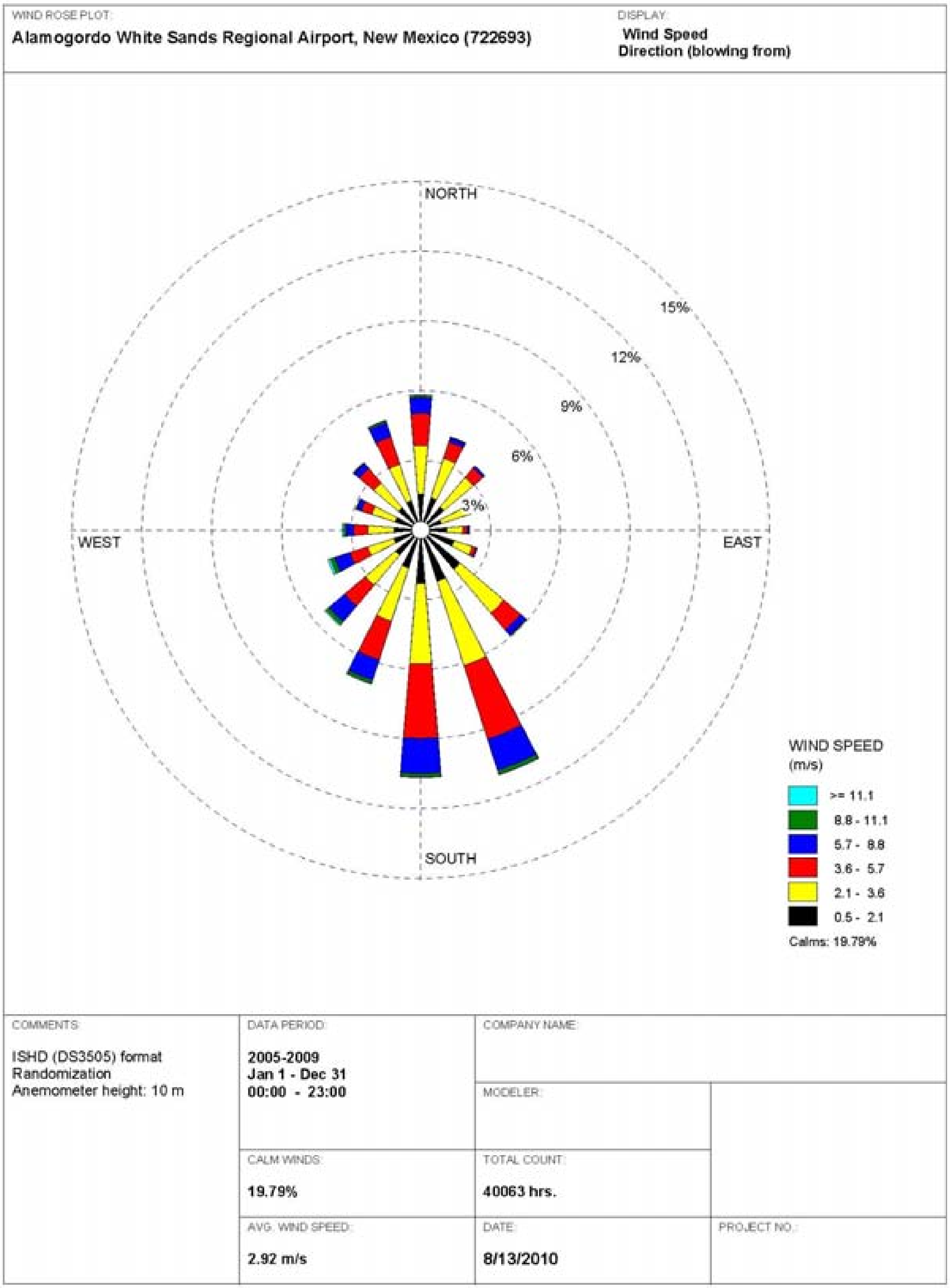

FIGURE 12.3.13.1-1 Wind Rose at 33 ft (10 m) at the Alamogordo White Sands Regional Airport, New Mexico, 2005 to 2009 (Source: NCDC 2010b)

In New Mexico, summer rains fall mostly during brief but frequently intense thunderstorms associated with general southeasterly circulation from the Gulf of Mexico (NCDC 2010a). In contrast, winter precipitation is caused mainly by frontal activity associated with general movement of Pacific Ocean storms. For the 1939 to 2010 period, annual precipitation at the White Sands National Monument averaged about 9.0 in. (22.9 cm) (WRCC 2010d). On average, 42 days a year have measurable precipitation (0.01 in. [0.025 cm] or more). Seasonally, precipitation is the highest in summer (nearly half of the annual total), lower in fall and winter, and the lowest in spring. Snow occurs from November to March, and the annual average snowfall at the White Sands National Monument was about 2.5 in. (6.4 cm), with the highest monthly snowfall of 17.5 in. (44.5 cm) in December 1987.

The proposed Red Sands SEZ is far from major water bodies (more than 420 mi [676 km] to the Gulf of California and 630 mi [1,014 km] to the Gulf of Mexico). Severe weather events are a rarity in Otero County, which encompasses the Red Sands SEZ (NCDC 2010c).

General, widespread floods seldom occur in New Mexico. Instead, floods associated with heavy thunderstorms may occur in small areas for a short time (NCDC 2010a). Since 1999, 26 floods (mostly flash floods) have been reported in Otero County; most of these occurred during summer months (NCDC 2010c). These floods caused no deaths or injuries but some property damage.

In Otero County, a total of 65 hail events have been reported since 1959, some of which caused property and crop damages. Hail measuring 3.0 in. (7.6 cm) in diameter was reported in 1999. In Otero County, one high wind event was reported in 1995, and 37 thunderstorm winds have been reported since 1957. Those up to a maximum wind speed of 115 mph (51 m/s) occur primarily during the summer months and cause some property and crop damages (NCDC 2010c).

No dust storm events were reported in Otero County (NCDC 2010c). However, the ground surface of the SEZ is covered predominantly with very fine sandy loams, loamy fine sands, and silt loams, which have relatively high dust storm potential. High winds can trigger large amounts of dust from areas of dry and loose soils and sparse vegetation in Otero County. Dust storms can deteriorate air quality and visibility and may have adverse effects on health, particularly for people with asthma or other respiratory problems. No dust storm data are available for Otero County, but dust storm data for Dona Ana County might be applicable to Otero County, considering such storms are prevalent all over the state. Dona Ana County experiences between 6 to 18 days per year when dust levels exceed federal health standards (NMED 2000). In this area, high winds are common during the months of January to April, and most dust storms last about 4 hours.

Because of the considerable distances to major water bodies, hurricanes never hit New Mexico. On rare occasion, remnants of a tropical storm system originating from the Pacific Ocean or the Gulf of Mexico may dump rains in the area, but there is no record of serious wind damage from these storms (NCDC 2010a). Historically, two tropical depressions passed within 100 mi (160 km) of the proposed Red Sands SEZ (CSC 2010). In the period from 1950 to April 2010, a total of 15 tornadoes (0.3 per year) were reported in Otero County (NCDC 2010c). Most tornadoes occurring in Otero County were relatively weak (i.e., 10 were F0, 4 were F1, and

1 was F2 on the Fujita tornado scale), and these tornadoes caused no death or injuries but some property damage. Most of these tornadoes occurred relatively far from the SEZ; the nearest one hit an area about 2.5 mi (4.0 km) north of the SEZ.

12.3.13.1.2 Existing Air Emissions

Otero County has a few industrial emission sources around Alamogordo, all of which are located within 5 mi (8 km) from the proposed Red Sands SEZ, but their emissions are relatively small. Several major roads, such as U.S. 54, 70, and 82, and several state routes are located in Otero County. Thus, onroad mobile source emissions are relatively substantial compared with industrial emission sources in Otero County. Data on annual emissions of criteria pollutants and VOCs in Otero County are presented in Table 12.3.13.1-1 for 2002 (WRAP 2009). Emission data are classified into six source categories: point, area, onroad mobile, nonroad mobile, biogenic, and fire (wildfires, prescribed fires, agricultural fires, structural fires). In 2002, fire sources were primary contributors to total emissions of SO_2 (about 41%), CO (about 40%), and $PM_{2.5}$ (about 73%), and secondary contributors to PM_{10} (about 47%). Onroad sources were major contributors to NO_x emissions (about 36%). Biogenic sources (i.e., vegetation—including trees, plants, and crops—and soils) that release naturally occurring emissions contributed secondarily to CO emissions (about 28%) and accounted for most VOC emissions (about 97%). Area sources were major contributors to PM_{10} (about 50%) and secondary contributors to $PM_{2.5}$ (about 23%). Nonroad sources were secondary contributors to SO_2 and NO_x emissions. In Otero County, point emissions sources were minor contributors to criteria pollutants and VOCs.

TABLE 12.3.13.1-1 Annual Emissions of Criteria Pollutants and VOCs in Otero County, New Mexico, Encompassing the Proposed Red Sands SEZ, 2002[a]

Pollutant[b]	Emissions (tons/yr)[c]
SO_2	340
NO_x	4,571
CO	55,046
VOCs	116,227
PM_{10}	4,654
$PM_{2.5}$	2,557

[a] Includes point, area, onroad and nonroad mobile, biogenic, and fire emissions.

[b] Notation: CO = carbon monoxide; NO_x = nitrogen oxides; $PM_{2.5}$ = particulate matter with a diameter of ≤2.5 μm; PM_{10} = particulate matter with a diameter of ≤10 μm; SO_2 = sulfur dioxide; and VOCs = volatile organic compounds.

[c] To convert tons to kilograms, multiply by 907.

Source: WRAP (2009).

In 2010, New Mexico is projected to produce about 89.4 MMt of *gross*[6] CO_2e[7] emissions, which is about 1.3% of total U.S. GHG emissions in 2008 (Bailie et al. 2006). Gross GHG emissions in New Mexico increased by about 31% from 1990 to 2010, compared to 14% growth in U.S. GHG emissions during the period from 1990 to 2008. In 2010, about 89.1% of GHG emissions in New Mexico is from energy sector: electric production (about 37.2%),

[6] Excluding GHG emissions removed as a result of forestry and other land uses and excluding GHG emissions associated with exported electricity.

[7] This is a measure used to compare the emissions from various GHGs on the basis of their global warming potential, defined as the cumulative radiative forcing effects of a gas over a specified time horizon resulting from the emission of a unit mass of gas relative to a reference gas, CO_2. The CO_2e for a gas is derived by multiplying the mass of the gas by the associated global warming potential.

transportation (about 19.7%), fossil fuel industry (about 22.7%), and fuel use in the residential, commercial, and industrial sectors combined (about 9.5%). New Mexico's *net* emissions in 2010 were about 68.5 MMt CO_2e, considering carbon sinks from forestry activities and agricultural soils throughout the state. The EPA (2009a) also estimated 2005 emissions in New Mexico. Its estimate of CO_2 emissions from fossil fuel combustion was 59.0 MMt, which was a little lower than the state's estimate. Electric power generation and transportation accounted for about 53.8% and 26.0% of the CO_2 emissions total, respectively, while the residential, commercial, and industrial sectors accounted for the remainder (about 20.2%).

12.3.13.1.3 Air Quality

New Mexico has established more stringent standards than NAAQS for SO_2, NO_2, and CO, but no standards for O_3, PM (PM_{10} and $PM_{2.5}$), or Pb (EPA 2010a; Title 20, Chapter 2, Part 3 of the *New Mexico Administrative Code* [20.2.3 NMAC]). In addition, the state has adopted standards for hydrogen sulfide and total reduced sulfur and still retains a standard for TSP, which was formerly a criteria pollutant but was replaced by PM_{10} in 1987.

Otero County is located administratively within the El Paso-Las Cruces-Alamogordo Interstate Air Quality Control Region (AQCR 153) (Title 40, Part 81, Section 82 of the *Code of Federal Regulations* [40 CFR 81.82]), along with three other counties in New Mexico (Dona Ana, Lincoln, and Sierra) and six counties in Texas. Otero County, encompassing the proposed Red Sands SEZ, is designated as being in unclassifiable/attainment for all criteria pollutants (40 CFR 81.332). The entire state is designated as an unclassifiable/attainment area for all criteria pollutants, except for a small portion of southeastern Dona Ana County around Anthony, which is adjacent to El Paso, Texas, and has been designated nonattainment for PM_{10} since 1991.

No ambient air-monitoring stations exist in Otero County.[8] Considering that Otero County is downwind of Dona Ana County, ambient concentration data for Dona Ana County are presented as being representative of the proposed Red Sands SEZ for all criteria pollutants except Pb. For CO, O_3, PM_{10} and $PM_{2.5}$, concentration data from monitoring stations in and around Las Cruces are presented. The locations of those stations range from 43 mi (69 km) to 49 mi (79 km) southwest of the SEZ. For SO_2 and NO_2, concentration data from Sunland Park, which is located about 63 mi (101 km) south-southwest of the SEZ, are presented. Concentration levels for O_3, PM_{10}, and $PM_{2.5}$ in southeastern Dona Ana County (e.g., Anthony and Sunland Park) have frequently exceeded these standards. Ambient air quality in Anthony and Sunland Park, which are small cities, is affected by the adjacent metropolitan areas of El Paso, Texas, and Ciudad Juarez, Mexico, and by the Chihuahuan Desert. In contrast, ambient air quality for the proposed Red Sands SEZ represented by measurements in Las Cruces is fairly good. The background concentration levels for SO_2, NO_2, CO, 1-hour O_3, annual PM_{10}, and $PM_{2.5}$ for the Red Sands SEZ from 2004 through 2008 were less than or equal to 68% of their respective standards, as shown in Table 12.3.13.1-2 (EPA 2010b). However, the monitored

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8 In 2007, PM_{10} concentrations were monitored at the elementary school in the Mescalero Apache Tribal Lands at the request of parents because there was a crusher operation nearby.

8-hour O_3 concentrations were approaching the applicable standard (about 93%). Concentrations for 24-hour PM_{10} were below its standard (about 94%) during the period 2004 through 2007. However, the 24-hour PM_{10} standard was exceeded in 2008 because of a higher number of dust storm episodes than usual. No measurement data for Pb are available for Otero County, but Pb levels are expected to be low, considering that the most recent Pb concentration in Albuquerque in 2004[9] was only 2% of its standard.

The PSD regulations (see 40 CFR 52.21), which are designed to limit the growth of air pollution in clean areas, apply to a major new source or modification of an existing major source within an attainment or unclassified area (see Section 4.11.2.3). As a matter of policy, the EPA recommends that the permitting authority notify the Federal Land Managers when a proposed PSD source would locate within 62 mi (100 km) of a sensitive Class I area. Several Class I areas are located in New Mexico and Texas, one of which is situated within the 62-mi (100-km) range of the proposed SEZ. The nearest is White Mountain WA (40 CFR 81.421), about 38.5 mi (62 km) north-northeast of the Red Sands SEZ. This Class I area is not located directly downwind of prevailing winds at the Red Sands SEZ (Figure 12.3.13.1-1). The next nearest Class I areas include Bosque del Apache WA, Guadalupe Mountains NP in Texas, and Carlsbad Caverns NP, which are located about 75 mi (121 km) north-northwest, 75 mi (121 km) southeast, and 86 mi (138 km) east-southeast of the SEZ, respectively.

12.3.13.2 Impacts

Potential impacts on ambient air quality associated with a solar project would be of most concern during the construction phase. Impacts on ambient air quality from fugitive dust emissions resulting from soil disturbances are anticipated, but they would be of short duration. During the operations phase, only a few sources with generally low levels of emissions would exist for any of the four types of solar technologies evaluated. A solar facility would either not burn fossil fuels or burn only small amounts during operation. (For facilities using HTFs, fuel could be used to maintain the temperature of the HTFs for more efficient daily start-up.) Conversely, use of solar facilities to generate electricity would displace air emissions that would otherwise be released from fossil fuel power plants.

Air quality impacts shared by all solar technologies are discussed in detail in Section 5.11.1, and technology-specific impacts are discussed in Section 5.11.2. Impacts specific to the proposed Red Sands SEZ are presented in the following sections. Any such impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2, and through any additional mitigation applied. Section 12.3.13.3 below identifies SEZ-specific design features of particular relevance to the Red Sands SEZ.

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[9] Pb measurements have been discontinued since 2004 in the state of New Mexico due to continuously low readings after the phaseout of leaded gasoline.

TABLE 12.3.13.1-2 NAAQS, SAAQS, and Background Concentration Levels Representative of the Proposed Red Sands SEZ in Otero County, New Mexico, 2004 to 2008

				Background Concentration Level	
Pollutant[a]	Averaging Time	NAAQS	SAAQS	Concentration[b,c]	Measurement Location, Year[d]
SO_2	1-hour	75 ppb[e]	NA[f]	NA	NA
	3-hour	0.5 ppm	NA	0.006 ppm (1.2%; NA)	Sunland Park, 2005
	24-hour	0.14 ppm	0.10 ppm	0.004 ppm (2.9%; 4.0%)	Sunland Park, 2004
	Annual	0.030 ppm	0.02 ppm	0.001 ppm (3.3%; 5.0%)	Sunland Park, 2006
NO_2	1-hour	100 ppb[g]	NA	NA	NA
	24-hour	NA	0.10 ppm	NA	NA
	Annual	0.053 ppm	0.05 ppm	0.011 ppm (21%; 22%)	Sunland Park, 2004
CO	1-hour	35 ppm	13.1 ppm	3.8 ppm (11%; 29%)	Las Cruces, 2004
	8-hour	9 ppm	8.7 ppm	2.7 ppm (30%; 31%)	Las Cruces, 2006
O_3	1-hour	0.12 ppm[h]	NA	0.082 ppm (68%; NA)	Las Cruces, 2006
	8-hour	0.075 ppm	NA	0.070 ppm (93%; NA)	Las Cruces, 2006
PM_{10}	24-hour	150 $\mu g/m^3$	NA	175 $\mu g/m^3$ (117%; NA)	Las Cruces, 2008
	Annual	50 $\mu g/m^3$ [i]	NA	25 $\mu g/m^3$ (50%; NA)	Las Cruces, 2008
$PM_{2.5}$	24-hour	35 $\mu g/m^3$	NA	15.0 $\mu g/m^3$ (43%; NA)	Las Cruces, 2007
	Annual	15.0 $\mu g/m^3$	NA	6.6 $\mu g/m^3$ (44%; NA)	Las Cruces, 2006
Pb	Calendar quarter	1.5 $\mu g/m^3$	NA	0.03 $\mu g/m^3$ (2.0%; NA)	Albuquerque, Bernalillo Co., 2004[k]
	Rolling 3-month	0.15 $\mu g/m^3$ [j]	NA	NA	NA

[a] Notation: CO = carbon monoxide; NO_2 = nitrogen dioxide; O_3 = ozone; Pb = lead; $PM_{2.5}$ = particulate matter with a diameter of ≤2.5 µm; PM_{10} = particulate matter with a diameter of ≤10 µm; and SO_2 = sulfur dioxide.

[b] Monitored concentrations are the highest for calendar-quarter Pb; second-highest for all averaging times less than or equal to 24-hour averages, except fourth-highest daily maximum for 8-hour O_3 and the 98th percentile for 24-hour $PM_{2.5}$; and arithmetic mean for annual SO_2, NO_2, PM_{10}, and $PM_{2.5}$.

[c] First and second values in parentheses are background concentration levels as a percentage of NAAQS and SAAQS, respectively. Calculation of 1-hour SO_2, 1-hour NO_2, and rolling 3-month Pb to NAAQS was not made, because no measurement data based on new NAAQS are available.

[d] All monitoring stations listed, except Pb monitoring station, are located in Dona Ana County.

[e] Effective August 23, 2010.

[f] NA = not applicable or not available.

[g] Effective April 12, 2010.

[h] The EPA revoked the 1-hour O_3 standard in all areas, although some areas have continuing obligations under that standard (“anti-backsliding”).

Footnotes continued on next page.

TABLE 12.3.13.1-2 (Cont.)

[i] Effective December 18, 2006, the EPA revoked the annual PM_{10} standard of 50 µg/m^3 but annual PM_{10} concentrations are presented for comparison purposes.

[j] Effective January 12, 2009.

[k] This location with the highest observed concentrations in the state of New Mexico is not representative of the Red Sands SEZ; it is presented to show that Pb is not generally a concern in New Mexico.

Sources: EPA (2010a,b); *New Mexico Administrative Code* 20.2.3.

12.3.13.2.1 Construction

The Red Sands SEZ site has a relatively flat terrain; thus only a minimum number of site preparation activities, perhaps with no large-scale earthmoving operations, would be required. However, fugitive dust emissions from soil disturbances during the entire construction phase would be a major concern because of the large areas that would be disturbed in a region that experiences windblown dust problems. Fugitive dusts, which are released near ground level, typically have more localized impacts than similar emissions from an elevated stack with additional plume rise induced by buoyancy and momentum effects.

Methods and Assumptions

Air quality modeling for PM_{10} and $PM_{2.5}$ emissions associated with construction activities was performed using the EPA-recommended AERMOD model (EPA 2009b). Details for emissions estimation, the description of AERMOD, input data processing procedures, and modeling assumption are described in Section M.13 of Appendix M. Estimated air concentrations were compared with the applicable NAAQS levels at the site boundaries and nearby communities and with PSD increment levels at nearby Class I areas.[10] However, no receptors were modeled for PSD analysis at the nearest Class I area, White Mountain WA, because it is about 38.5 mi (62 km) from the SEZ, which is over the maximum modeling distance of 31 mi (50 km) for the AERMOD. Rather, several regularly spaced receptors in the direction of the White Mountain WA were selected as surrogates for the PSD analysis. For the Red Sands SEZ, the modeling was conducted based on the following assumptions and input:

- Uniformly distributed emissions from 3,000 acres (12.1 km^2) each, and 6,000 acres (24.3 km^2) in total, in the northeastern and eastern portions of the SEZ, close to the nearest residence and the nearby towns, such as Boles Acres, Alamogordo, and Holloman Air Force Base,

[10] To provide a quantitative assessment, the modeled air impacts of construction were compared to the NAAQS levels and the PSD Class I increment levels. Although the Clean Air Act exempts construction activities from PSD requirements, a comparison with the Class I increment levels was used to quantify potential impacts. Only monitored data can be used to determine the attainment status. Modeled data are used to assess potential problems and as a consideration in the permitting process.

- Surface hourly meteorological data from the Alamogordo White Sands Regional Airport[11] and upper air sounding data from Santa Teresa for the 2005 to 2009 period, and

- A regularly spaced receptor grid over a modeling domain of 62 × 62 mi (100 km × 100 km) centered on the proposed SEZ, and additional discrete receptors at the SEZ boundaries.

Results

The modeling results for concentration increments and total concentrations (modeled plus background concentrations) for both PM_{10} and $PM_{2.5}$ that would result from construction-related fugitive emissions are summarized in Table 12.3.13.2-1. Maximum 24-hour PM_{10} concentration

TABLE 12.3.13.2-1 Maximum Air Quality Impacts from Emissions Associated with Construction Activities for the Proposed Red Sands SEZ

			Concentration (μg/m³)				Percentage of NAAQS	
Pollutant[a]	Averaging Time	Rank[b]	Maximum Increment[b]	Background[c]	Total	NAAQS	Increment	Total
PM_{10}	24 hours	H6H	717	175	892	150	478	595
	Annual	–[d]	104	25.0	129	50	208	258
$PM_{2.5}$	24 hours	H8H	41.4	15.0	56.4	35	118	161
	Annual	–	10.4	6.6	17.0	15.0	69	113

[a] $PM_{2.5}$ = particulate matter with a diameter of ≤2.5 μm; PM_{10} = particulate matter with a diameter of ≤10 μm.

[b] Concentrations for attainment demonstration are presented. H6H = highest of the sixth-highest concentrations at each receptor over the 5-year period. H8H = highest of the multiyear average of the eighth-highest concentrations at each receptor over the 5-year period. For the annual average, multiyear averages of annual means over the 5-year period are presented. Maximum concentrations are predicted to occur at the site boundaries.

[c] See Table 12.3.13.1-2.

[d] A dash indicates not applicable.

[11] The number of missing hours at the Alamogordo White Sands Regional Airport amounts to about 16.8% of the total hours, which may not be acceptable for regulatory applications because that percentage exceeds the 10% limit defined by the EPA. However, because the wind patterns at Alamogordo White Sands Regional Airport are more representative of wind at the Red Sands SEZ than the wind patterns at other airports (which have more complete data but are located in different topographic features), the former values were used for this screening analysis.

increments modeled to occur at the site boundaries would be an estimated 717 μg/m^3, which far exceeds the relevant standard level of 150 μg/m^3. Total 24-hour PM_{10} concentrations of 892 μg/m^3 would also exceed the standard level at the SEZ boundary. In particular, PM_{10} concentrations are predicted to be about 300 μg/m^3 at the nearest residence, which is adjacent to the east-central SEZ boundary and about 0.3 mi (0.5 km) west of U.S. 54. High PM_{10} concentrations of about 250 μg/m^3 are also predicted at the Holloman Air Force Base housing complex. However, high PM_{10} concentrations would be limited to the immediate areas surrounding the SEZ boundary and would decrease quickly with distance. Predicted maximum 24-hour PM_{10} concentration increments would be about 40 to 60 μg/m^3 at Boles Acres (closest town to the SEZ), about 10 to 30 μg/m^3 at Alamogordo, about 15 μg/m^3 at Tularosa, and about 8 μg/m^3 at La Luz. Annual average modeled concentration increments and total concentrations (increment plus background) for PM_{10} at the SEZ boundary would be about 104 μg/m^3 and 129 μg/m^3, respectively, which are higher than the NAAQS level of 50 μg/m^3, which was revoked by the EPA in December 2006. Annual PM_{10} increments would be much lower—about 40 μg/m^3 at the nearest residence, about 20 μg/m^3 at the Holloman Air Force Base housing complex, about 2 to 4 μg/m^3 at Boles Acres, about 1 to 2 μg/m^3 at Alamogordo, and less than 0.8 μg/m^3 at Tularosa and La Luz.

Total 24-hour $PM_{2.5}$ concentrations would be 56.4 μg/m^3 at the SEZ boundary, which is higher than the NAAQS level of 35 μg/m^3; modeled increments contribute nearly three times background concentration to this total. The total annual average $PM_{2.5}$ concentration would be 17.0 μg/m^3, which is somewhat higher than the NAAQS level of 15.0 μg/m^3. At the nearest residence, predicted maximum 24-hour and annual $PM_{2.5}$ concentration increments would be about 17 and 4.0 μg/m^3, respectively.

Predicted 24-hour and annual PM_{10} concentration increments at the surrogate receptors for the nearest Class I Area—White Mountain WA—would be about 7.0 and 0.5 μg/m^3, or 87% and 12% of the PSD increments for the Class I area, respectively. These surrogate receptors are more than 16 mi (25 km) from the White Mountain WA, and thus predicted concentrations in White Mountain WA would be lower than the above values (about 56% of the PSD increments for 24-hour PM_{10}), considering the same decay ratio with distance.

In conclusion, predicted 24-hour and annual PM_{10} and $PM_{2.5}$ concentration levels could exceed the standard levels at the SEZ boundaries and in the immediate surrounding areas during the construction of solar facilities. To reduce potential impacts on ambient air quality and in compliance with programmatic design features, aggressive dust control measures would be used. Potential air quality impacts on nearby communities would be much lower. Modeling indicates that emissions from construction activities are not anticipated to exceed Class I PSD PM_{10} increments at the nearest federal Class I area (White Mountain WA). Construction activities are not subject to the PSD program, and the comparison provides only a screen for gauging the magnitude of the impact. Accordingly, it is anticipated that impacts of construction activities on ambient air quality would be moderate and temporary.

Emissions from the engine exhaust from heavy construction equipment and vehicles have the potential to cause impacts on AQRVs (e.g., visibility and acid deposition) at the nearby federal Class I areas. However, SO_x emissions from engine exhaust would be very low, because programmatic design features would require use of ultra-low-sulfur fuel with a sulfur content of 15 ppm. NO_X emissions from engine exhaust would be primary contributors to potential impacts on AQRVs. If requested by an FLM in response to a permit application, site-specific analyses for AQRVs would need to be done. Construction-related emissions are temporary in nature and thus would cause some unavoidable but short-term impacts.

For this analysis, the impacts of construction and operation of transmission lines outside of the SEZ were not assessed, assuming that an existing regional 115-kV transmission line might be used to connect some new solar facilities to load centers, and that additional project-specific analysis would be done for new transmission construction or line upgrades. However, some construction of transmission lines could occur within the SEZ. Potential impacts on ambient air quality would be a minor component of construction impacts in comparison with solar facility construction and would be temporary in nature.

12.3.13.2.2 Operations

Emission sources associated with the operation of a solar facility would include auxiliary boilers; vehicle (commuter, visitor, support, and delivery) traffic; maintenance (e.g., mirror cleaning and repair and replacement of damaged mirrors); and drift from cooling towers for the parabolic trough or power tower technology if wet cooling was implemented (drift constitutes low-level PM emissions).

The types of emissions caused by and offset by operation of a solar facility are discussed in Appendix M, Section M.13.4.

Estimates of potential air emissions displaced by solar project development at the Red Sands SEZ are presented in Table 12.3.13.2-2. Total power generation capacity ranging from 2,002 to 3,603 MW is estimated for the Red Sands SEZ for various solar technologies (see Section 12.3.2). The estimated amount of emissions avoided for the solar technologies evaluated depends only on the megawatts of conventional fossil fuel–generated power displaced, because a composite emission factor per megawatt-hour of power by conventional technologies is assumed (EPA 2009c). It is estimated that if the Red Sands SEZ was fully developed, emissions avoided would range from 10 to 18% of total emissions of SO_2, NO_X, Hg, and CO_2 from electric power systems in the state of New Mexico (EPA 2009c). Avoided emissions would be up to 7.1% of total emissions from electric power systems in the six-state study area. When compared with all source categories, power production from the same solar facilities would displace up to 11% of SO_2, 4.2% of NO_X, and 9.7% of CO_2 emissions in the state of New Mexico (EPA 2009a; WRAP 2009). These emissions would be up to 1.2% of total emissions from all source categories in the six-state study area. Power generation from fossil fuel–fired power plants accounts for over 97% of the total electric power generated in New Mexico. The contribution of coal combustion is about 85%, followed by natural gas combustion of about 12%. Thus, solar facilities built in the Red Sands SEZ could displace relatively more fossil fuel emissions than those built in other states that rely less on fossil fuel–generated power.

TABLE 12.3.13.2-2 Annual Emissions from Combustion-Related Power Generation Avoided by Full Solar Development of the Proposed Red Sands SEZ

Area Size (acres)	Capacity (MW)[a]	Power Generation (GWh/yr)[b]	Emissions Displaced (tons/yr; 10^3 tons/yr for CO_2)[c]			
			SO_2	NO_x	Hg	CO_2
22,520	2,002–3,603	3,507–6,313	3,147–5,665	7,831–14,096	0.12–0.21	3,490–6,282
Percentage of total emissions from electric power systems in New Mexico[d]			10–18%	10–18%	10–18%	10–18%
Percentage of total emissions from all source categories in New Mexico[e]			6.2–11%	2.4–4.2%	–[f]	5.4–9.7%
Percentage of total emissions from electric power systems in the six-state study area[d]			1.3–2.3%	2.1–3.8%	3.9–7.1%	1.3–2.4%
Percentage of total emissions from all source categories in the six-state study area[e]			0.67–1.2%	0.29–0.52%	–	0.42–0.75%

[a] It is assumed that the SEZ would eventually have development on 80% of the lands and that a range of 5 acres (0.020 km^2) per MW (for parabolic trough technology) to 9 acres (0.036 km^2) per MW (power tower, dish engine, and PV technologies) would be required.

[b] A capacity factor of 20% was assumed.

[c] Composite combustion-related emission factors for SO_2, NO_x, Hg, and CO_2 of 1.79, 4.47, 6.6×10^{-5}, and 1,990 lb/MWh, respectively, were used for the state of New Mexico.

[d] Emission data for all air pollutants are for 2005.

[e] Emission data for SO_2 and NO_x are for 2002, while those for CO_2 are for 2005.

[f] A dash indicates not estimated.

Sources: EPA (2009a,c); WRAP (2009).

As discussed in Section 5.11.1.5, the operation of associated transmission lines would generate some air pollutants from activities such as periodic site inspections and maintenance. However, these activities would occur infrequently, and the amount of emissions would be small. In addition, transmission lines could produce minute amounts of O_3 and its precursor NO_x associated with corona discharge (i.e., the breakdown of air near high-voltage conductors), which is most noticeable for high-voltage lines during rain or very humid conditions. Since the proposed Red Sands SEZ is located in an arid desert environment, these emissions would be small, and potential impacts on ambient air quality associated with transmission lines would be negligible, considering the infrequent occurrences and small amount of emissions from corona discharges.

12.3.13.2.3 Decommissioning/Reclamation

As discussed in Section 5.11.1.4, decommissioning/reclamation activities are similar to construction activities but are on a more limited scale and of shorter duration. Potential impacts on ambient air quality would be correspondingly less than those from construction activities. Decommissioning activities would last for a short period, and their potential impacts would be moderate and temporary. The same mitigation measures adopted during the construction phase would also be implemented during the decommissioning phase (Section 5.11.3).

12.3.13.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features are required. Limiting dust generation during construction and operations at the proposed Red Sands SEZ (such as by increased watering frequency or road paving or treatment) is a required design feature under BLM's Solar Energy Program. These extensive fugitive dust control measures would keep off-site PM levels as low as possible during construction.

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12.3.14 Visual Resources

12.3.14.1 Affected Environment

The proposed Red Sands SEZ is located in Otero County in southern New Mexico. The southern border of the SEZ is 43.7 mi (70.3 km) north of Texas the Texas border. The SEZ occupies 22,520 acres (91.1 km^2) and extends approximately 8.3 mi (13.4 km) east to west and nearly 15.0 mi (24.1 km) north to south. The SEZ is within the Chihuahuan desert physiographic province, typified by alternating mountains and valleys. Flat valley basins form broad expanses of desert, generally with grassland and shrubland vegetative cover (EPA 2010c). Red Sands SEZ is located within the EPA's Chihuahuan Basins and Playas Level IV ecoregion. The SEZ ranges in elevation from 3,990 ft (1,216 m) in the central portion to 4,115 ft (1,254 m) in the northern portion.

The SEZ is located in the Tularosa Valley, between the White Sands Missile Range and Ft. Bliss McGregor Range. U.S. 70 runs southwest to northeast on the west and north sides of the SEZ, with U.S. 54 running north–south close to the east side of the SEZ. The Twin Buttes lie just inside and beyond the western boundary of the SEZ, and Lone Butte is located within the central portion of the SEZ. The Sacramento Mountains are located east of the SEZ and include peaks generally over 9,000 ft (2,700 m) in elevation. West of the SEZ, beyond White Sands National Monument and Alkali Flat, lie the San Andres Mountains, with elevations of 5,000 to 7,000 ft (1,500 to 2,100 m). From north to south into Texas, the broad Tularosa Valley extends more than 110 mi (180 km) and is about 35 mi (56 km) wide. The SEZ and surrounding areas are shown in Figure 12.3.14.1-1.

The SEZ is located within a flat, generally treeless valley, with the strong horizon line and the Sacramento Escarpment being the dominant visual features in much of the SEZ; however, the forms of Twin Buttes and Lone Butte are dominant visual features in the central portions of the SEZ. Other, smaller buttes are local visual landmarks. The surrounding mountains are generally tan in color, or dark green where forested at higher elevations, but with distant mountains appearing blue to purple. On the valley floor, where vegetation is absent, tan-colored sand is evident, but some areas have dense enough vegetation that the greens and olive greens of creosotebush, yucca, and cacti are the dominant colors.

Vegetation is generally sparse in much of the SEZ, with scrubland and desert grassland dominating the desert floor within the SEZ. During a July 2009 site visit, the vegetation presented a limited range of greens (mostly olive green of creosotebushes, and darker greens of taller shrubs) with some browns, golds, and grays (from lower shrubs and grasses). Textures ranged from medium to coarse in shrublands, to fine in grasslands, with generally low visual interest. Yuccas add small vertical accents where present, as well as some color contrasts from their lighter green foliage.

No permanent surface water is present within the SEZ; however, playas and other depressions are visible in or near the SEZ. One large inundated playa was observed just east of the SEZ during the 2009 site visit, adding visual interest for nearby portions of the SEZ.

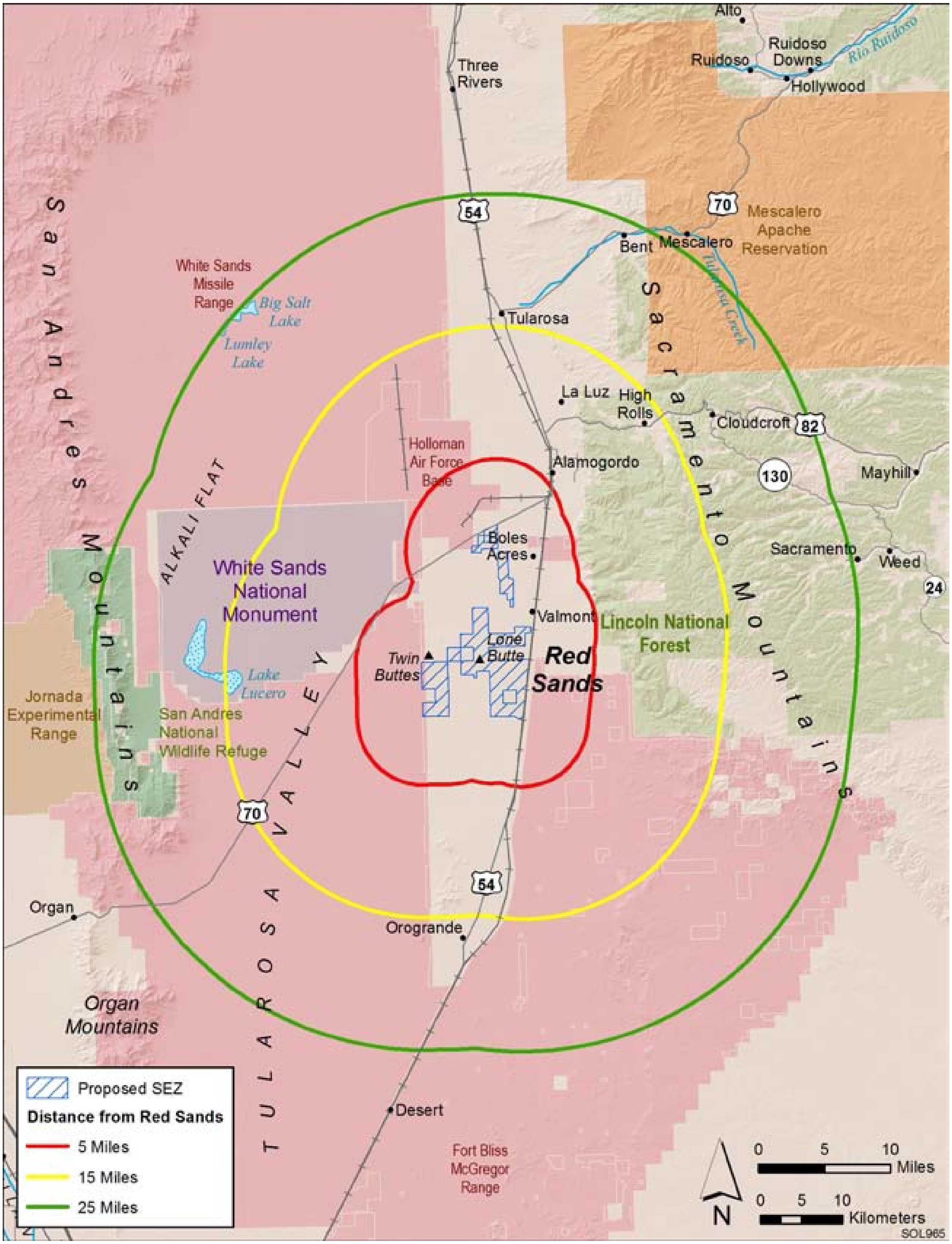


FIGURE 12.3.14.1-1 Proposed Red Sands SEZ and Surrounding Lands

Cultural disturbances visible within the SEZ include dirt and gravel roads, existing transmission towers, a gravel pit, and grazing facilities. These cultural modifications generally detract from the scenic quality of the SEZ; however, the SEZ is large enough that from many locations within the SEZ, these features are either not visible or are so distant as to have minimal effects on views. From most locations within the SEZ, the landscape is generally natural in appearance, with little visible disturbance.

The general lack of topographic relief, water, and physical variety results in low scenic value within the SEZ itself; however, because of the flatness of the landscape, the lack of trees, and the breadth of the desert floor, the SEZ presents a vast panoramic landscape with sweeping views of the Sacramento Escarpment and San Andres Mountains that add significantly to the scenic values within the SEZ viewshed. In particular, the Sacramento Escarpment provides a dramatic visual backdrop to views toward the east from the SEZ and lands west of the SEZ. The varied and irregular forms and colors of the Escarpment and the San Andres Mountains provide visual contrasts to the strong horizontal line, green vegetation, and tan-colored sand of the valley floor, particularly when viewed from nearby locations within the SEZ. Panoramic views of the SEZ are shown in Figures 12.3.14.1-2, 12.3.14.1-3, and 12.3.14.1-4.

The BLM conducted a VRI for the SEZ and surrounding lands in 2010 (BLM 2010b). The VRI evaluates BLM-administered lands based on scenic quality; sensitivity level, in terms of public concern for preservation of scenic values in the evaluated lands; and distance from travel routes or KOPs. Based on these three factors, BLM-administered lands are placed into one of four Visual Resource Inventory Classes, which represent the relative value of the visual resources. Class I and II are the most valued; Class III represents a moderate value; and Class IV represents the least value. Class I is reserved for specially designated areas, such as national wildernesses and other congressionally and administratively designated areas where decisions have been made to preserve a natural landscape. Class II is the highest rating for lands without special designation. More information about VRI methodology is available in Section 5.12 and in *Visual Resource Inventory*, BLM Manual Handbook 8410-1 (BLM 1986a).

The VRI map for the SEZ and surrounding lands is shown in Figure 12.3.14.1-5. The VRI values for the SEZ and immediate surroundings are VRI Classes III and II, indicating moderate and high relative visual values. More than 90% of the SEZ is VRI Class III, indicating moderate scenic values. Three small areas are VRI II areas: an area surrounding Lone Butte in the southern part of the SEZ, a site sensitive to native Americans; a small portion of the SEZ near Twin Buttes, in the far southwestern portion of the SEZ; and another area with playas in the far northern portion of the SEZ near U.S. 70. The inventory indicates moderate scenic quality for the SEZ and its immediate surroundings, with low scores for color, vegetation, scarcity, and cultural modification; a moderate score for adjacent scenery and the presence of water; and moderate to low score for landform. The inventory noted that the area of the SEZ is a panoramic landscape containing buttes, with lakes north of the SEZ, but that cultural disturbances visible in the SEZ area detracted slightly from the scenic quality. The inventory indicates moderate sensitivity for the SEZ and its immediate surroundings (except for Lone Butte). and noted its visibility from White Sands National Monument and Lincoln National Forest. Although rating as a low level of use, the VRI noted that Lone Butte is culturally significant to Native Americans and visible from most of the valley, and it therefore is an area with high sensitivity.

FIGURE 12.3.14.1-2 Approximately 120° Panoramic View of the Proposed Red Sands SEZ from the Southeastern Corner of the SEZ Facing Northwest, San Andres Mountains at Left

FIGURE 12.3.14.1-3 Approximately 180° Panoramic View of the Proposed Red Sands SEZ from the Central Portion of the SEZ Facing Northeast, with Lone Butte at Left and Sacramento Escarpment at Center

FIGURE 12.3.14.1-4 Approximately 120° Panoramic View of the Proposed Red Sands SEZ from the Western Portion of the SEZ Facing Southwest, Including Twin Buttes at Right and San Andres Mountains at Left Center

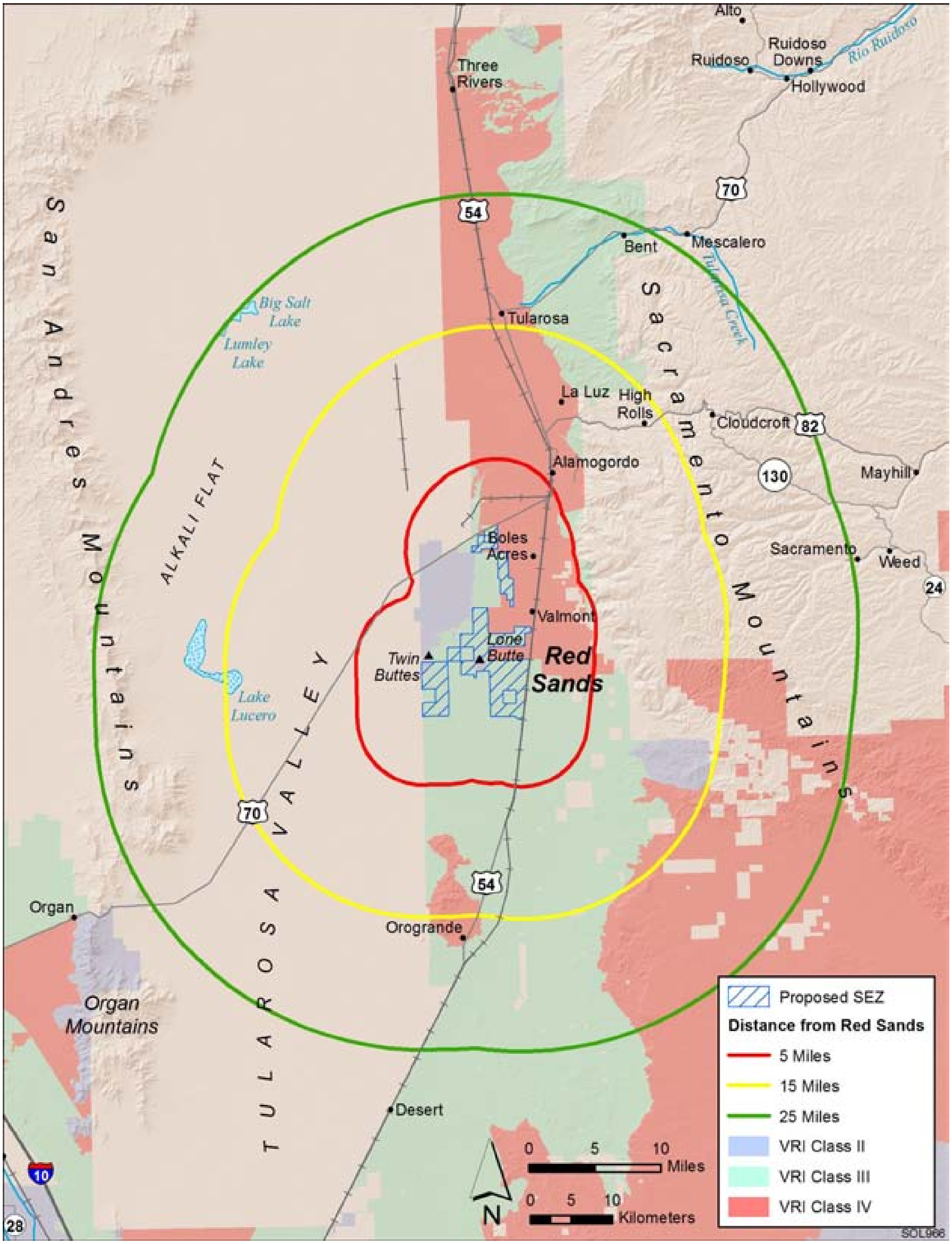


FIGURE 12.3.14.1-5 Visual Resource Inventory Values for the Proposed Red Sands SEZ and Surrounding Lands

Lands within the 25-mi (40-km), 650-ft (198-m) viewshed of the SEZ contain 25,263 acres (102.24 km^2) of VRI Class II areas, primarily northwest and southeast of the SEZ; 263,066 acres (1064.59 km^2) of Class III areas, primarily south of the SEZ; and 170,414 acres (689.64 km^2) of VRI Class IV areas, concentrated primarily to the north and southeast of the SEZ.

Portions of the SEZ are managed as visual resource management (VRM) Class III along U.S. 70 and U.S. 54, and as VRM Class IV elsewhere. VRM Class III objectives include partial retention of landscape character and permit moderate modification of the existing character of the landscape. Class IV permits major modification of the existing character of the landscape. The VRM map for the SEZ and surrounding lands is shown in Figure 12.3.14.1.2-6. More information about the BLM VRM program is available in Section 5.12 and in *Visual Resource Management,* BLM Manual Handbook 8400 (BLM 1984).

12.3.14.2 Impacts

The potential for impacts from utility-scale solar energy development on visual resources within the proposed Red Sands SEZ and surrounding lands, as well as the impacts of related facilities (e.g., access roads and transmission lines) outside of the SEZ, is presented in this section.

Site-specific impact assessment is needed to systematically and thoroughly assess visual impact levels for a particular project. Without precise information about the location of a project, a relatively complete and accurate description of its major components, and their layout, it is not possible to precisely assess the visual impacts associated with the facility. However, if the general nature and location of a facility are known, a more generalized assessment of potential visual impacts can be made by describing the range of expected visual changes and discussing contrasts typically associated with these changes. In addition, a general analysis can identify sensitive resources that may be at risk if a future project is sited in a particular area. Detailed information about the methodology employed for the visual impact assessment used in this PEIS, including assumptions and limitations, is presented in Appendix M.

Potential Glint and Glare Impacts. Similarly, the nature and magnitude of potential glint- and glare-related visual impacts for a given solar facility are highly dependent on viewer position, sun angle, the nature of the reflective surface and its orientation relative to the sun and the viewer, atmospheric conditions, and other variables. The determination of potential impacts from glint and glare from solar facilities within a given proposed SEZ would require precise knowledge of these variables, and is not possible given the scope of the PEIS. Therefore, the following analysis does not describe or suggest potential contrast levels arising from glint and glare for facilities that might be developed within the SEZ; however, it should be assumed that glint and glare are possible visual impacts from *any* utility-scale solar facility, regardless of size, landscape setting, or technology type. The occurrence of glint and glare at solar facilities could potentially cause large though temporary increases in brightness and visibility of the facilities. The visual contrast levels projected for sensitive visual resource areas discussed in the following analysis do not account for potential glint and glare effects; however, these effects would be

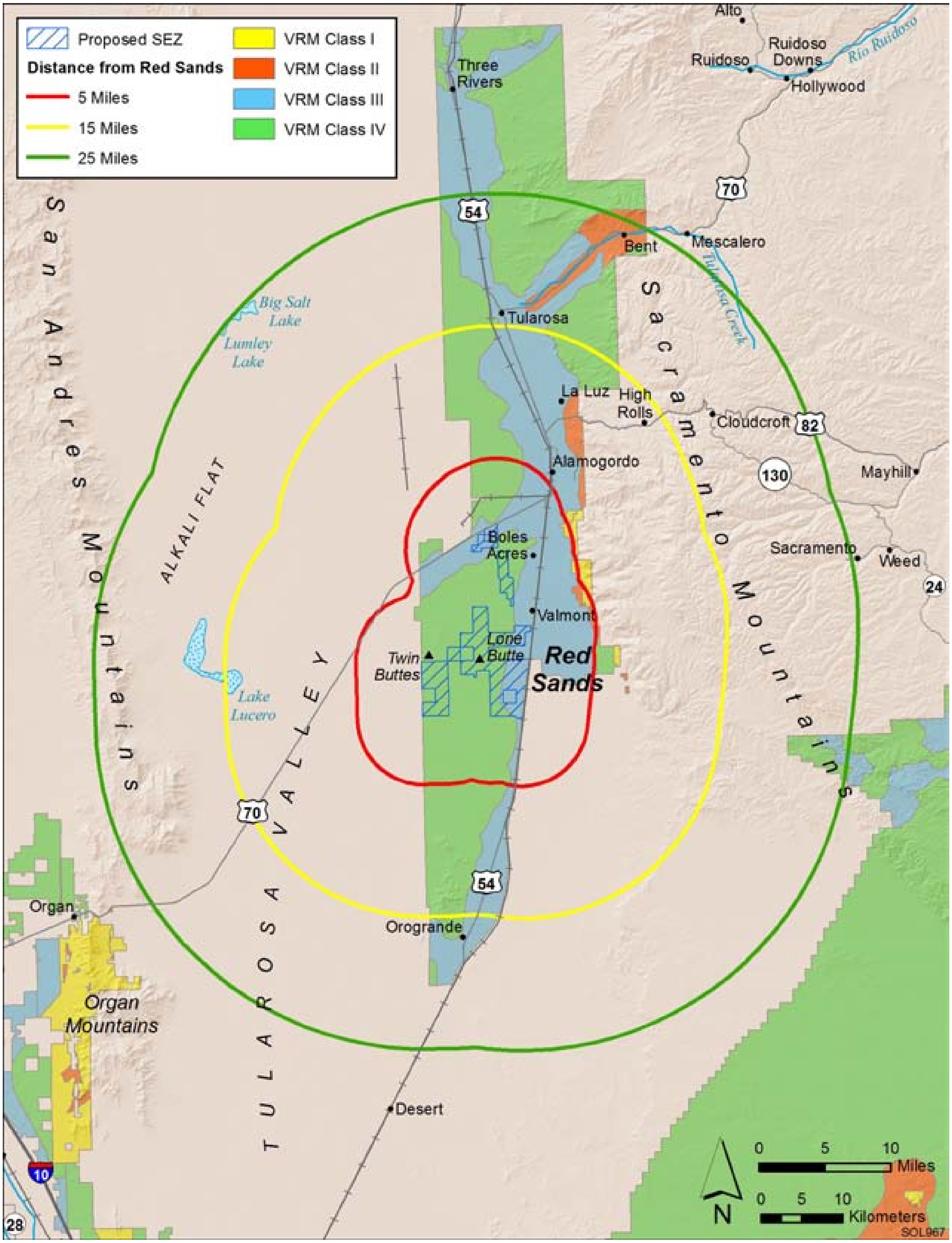


FIGURE 12.3.14.1-6 Visual Resource Management Classes for the Proposed Red Sands SEZ and Surrounding Lands

incorporated into a future site-and project-specific assessment that would be conducted for specific proposed utility-scale solar energy projects. For more information about potential glint and glare impacts associated with utility-scale solar energy facilities, see Section 5.12 of this PEIS.

12.3.14.2.1 Impacts on the Proposed Red Sands SEZ

Some or all of the SEZ could be developed for one or more utility-scale solar energy projects, utilizing one or more of the solar energy technologies described in Appendix F. Because of the industrial nature and large size of utility-scale solar energy facilities, large visual impacts on the SEZ would occur as a result of the construction, operation, and decommissioning of solar energy projects. In addition, large impacts could occur at solar facilities utilizing highly reflective surfaces or major light-emitting components (solar dish, parabolic trough, and power tower technologies), with lesser impacts associated with reflective surfaces expected from PV facilities. These impacts would be expected to involve major modification of the existing character of the landscape and would likely dominate the views nearby. Additional, and potentially large impacts would occur as a result of the construction, operation, and decommissioning of related facilities, such as access roads and electric transmission lines. While the primary visual impacts associated with solar energy development within the SEZ would occur during daylight hours, lighting required for utility-scale solar energy facilities would be a potential source of visual impacts at night, both within the SEZ and on surrounding lands.

Common and technology-specific visual impacts from utility-scale solar energy development, as well as impacts associated with electric transmission lines, are discussed in Section 5.12 of this PEIS. Impacts would last throughout construction, operation, and decommissioning, and some impacts could continue after project decommissioning. Visual impacts resulting from solar energy development in the SEZ would be in addition to impacts from solar energy development and other development that may occur on other public or private lands within the SEZ viewshed, and are subject to cumulative effects. For discussion of cumulative impacts, see Section 12.3.22.4.13 of this PEIS.

The changes described above would be expected to be consistent with BLM VRM objectives for VRM Class IV, as seen from nearby KOPs. More information about impact determination using the BLM VRM program is available in Section 5.12 and in *Visual Resource Contrast Rating*, BLM Manual Handbook 8431-1 (BLM 1986b).

Implementation of the programmatic design features intended to reduce visual impacts (described in Appendix A, Section A.2.2) would be expected to reduce visual impacts associated with utility-scale solar energy development within the SEZ; however, the degree of effectiveness of these design features could be assessed only at the site- and project-specific level. Given the large scale, reflective surfaces, and strong regular geometry of utility-scale solar energy facilities and the lack of screening vegetation and landforms within the SEZ viewshed, siting the facilities away from sensitive visual resource areas and other sensitive viewing areas would be the primary means of mitigating visual impacts. The effectiveness of other visual impact mitigation measures would generally be limited, but would be important to reduce visual contrasts to the greatest extent possible.

12.3.14.2.2 Impacts on Lands Surrounding the Proposed Red Sands SEZ

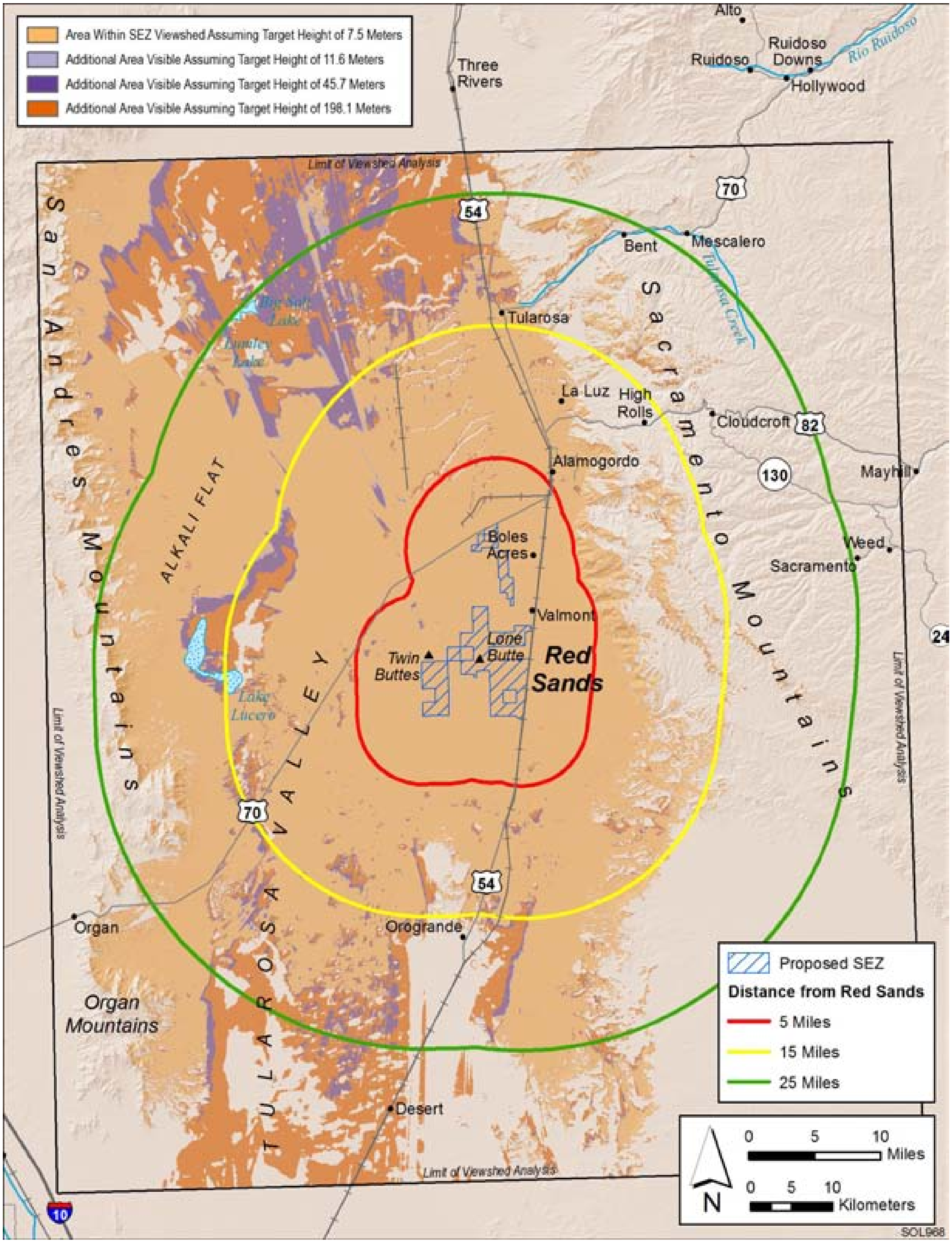
Because of the large size of utility-scale solar energy facilities and the generally flat, open nature of the proposed SEZ, lands outside the SEZ would be subjected to visual impacts related to construction, operation, and decommissioning of utility-scale solar energy facilities. The affected areas and extent of impacts would depend on a number of visibility factors and viewer distance (for a detailed discussion of visibility and related factors, see Section 5.12). A key component in determining impact levels is the intervisibility between the project and potentially affected lands; if topography, vegetation, or structures screen the project from viewer locations, there is no impact.

Preliminary viewshed analyses were conducted to identify which lands surrounding the proposed SEZ would have views of solar facilities in at least some portion of the SEZ (see Appendix M for information on the assumptions and limitations of the methods used). Four viewshed analyses were conducted, assuming four different heights representative of project elements associated with potential solar energy technologies: PV and parabolic trough arrays (24.6 ft [7.5 m]), solar dishes and power blocks for CSP technologies (38 ft [11.6 m]), transmission towers and short solar power towers (150 ft [45.7 m]), and tall solar power towers (650 ft [198.1 m]). Viewshed maps for the SEZ for all four solar technology heights are presented in Appendix N.

Figure 12.3.14.2-1 shows the combined results of the viewshed analyses for all four solar technologies. The colored segments indicate areas with clear lines of sight to one or more areas within the SEZ and from which solar facilities within these areas of the SEZ would be expected to be visible, assuming the absence of screening vegetation or structures and adequate lighting and other atmospheric conditions. The light brown areas are locations from which PV and parabolic trough arrays located in the SEZ could be visible. Solar dishes and power blocks for CSP technologies would be visible from the areas shaded in light brown and the additional areas shaded in light purple. Transmission towers and short solar power towers would be visible from the areas shaded light brown, light purple, and the additional areas shaded in dark purple. Power tower facilities located in the SEZ could be visible from areas shaded light brown, light purple, dark purple, and at least the upper portions of power tower receivers would be visible from the additional areas shaded in medium brown.

For the following visual impact discussion, the tall solar power tower (650 ft [198.1 m]) and PV and parabolic trough array (24.6 ft [7.5 m]) viewsheds are shown in figures and discussed in the text. These heights represent the maximum and minimum landscape visibility for solar energy technologies analyzed in the PEIS. Viewsheds for solar dish and CSP technology power blocks (38 ft [11.6 m]), and transmission towers and short solar power towers (150 ft [45.7 m]) are presented in Appendix N. The visibility of these facilities would fall between that for tall power towers and PV and parabolic trough arrays.

1



2 **FIGURE 12.3.14.2-1 Viewshed Analyses for the Proposed Red Sands SEZ and Surrounding**
3 **Lands, Assuming Solar Technology Heights of 24.6 ft (7.5 m), 38 ft (11.6 m), 150 ft (45.7 m),**
4 **and 650 ft (198.1 m) (shaded areas indicate lands from which solar development within the**
5 **SEZ could be visible)**

Impacts on Selected Federal-, State-, and BLM-Designated Sensitive Visual Resource Areas

Figure 12.3.14.2-2 shows the results of a GIS analysis that overlays selected federal, state, and BLM-designated sensitive visual resource areas onto the combined tall solar power tower (650 ft [198.1 m]) and PV and parabolic trough array (24.6 ft [7.5 m]) viewsheds in order to illustrate which of these sensitive visual resource areas would have views of solar facilities within the SEZ and therefore potentially would be subject to visual impacts from those facilities. Distance zones that correspond with BLM's VRM system-specified foreground-middleground distance (5 mi [8 km]), background distance (15 mi [24 km]), and a 25-mi (40-km) distance zone are shown as well, in order to indicate the effect of distance from the SEZ on impact levels, which are highly dependent on distance.

The scenic resources included in the analyses were as follows:

- National Parks, National Monuments, National Recreation Areas, National Preserves, National Wildlife Refuges, National Reserves, National Conservation Areas, National Historic Sites;

- Congressionally authorized Wilderness Areas;

- Wilderness Study Areas;

- National Wild and Scenic Rivers;

- Congressionally authorized Wild and Scenic Study Rivers;

- National Scenic Trails and National Historic Trails;

- National Historic Landmarks and National Natural Landmarks;

- All-American Roads, National Scenic Byways, State Scenic Highways, and BLM- and USFS-designated scenic highways/byways;

- BLM-designated Special Recreation Management Areas; and

- ACECs designated because of outstanding scenic qualities.

Potential impacts on specific sensitive resource areas visible from and within 25 mi (40 km) of the proposed Red Sands SEZ are discussed below. The results of this analysis are also summarized in Table 12.3.14.2-1. Further discussion of impacts on these areas is available in Sections 12.3.3 (Specially Designated Areas and Lands with Wilderness Characteristics) and 12.3.17 (Cultural Resources) of the PEIS.

The following visual impact analysis describes *visual contrast levels* rather than *visual impact levels*. *Visual contrasts* are changes in the landscape as seen by viewers, including

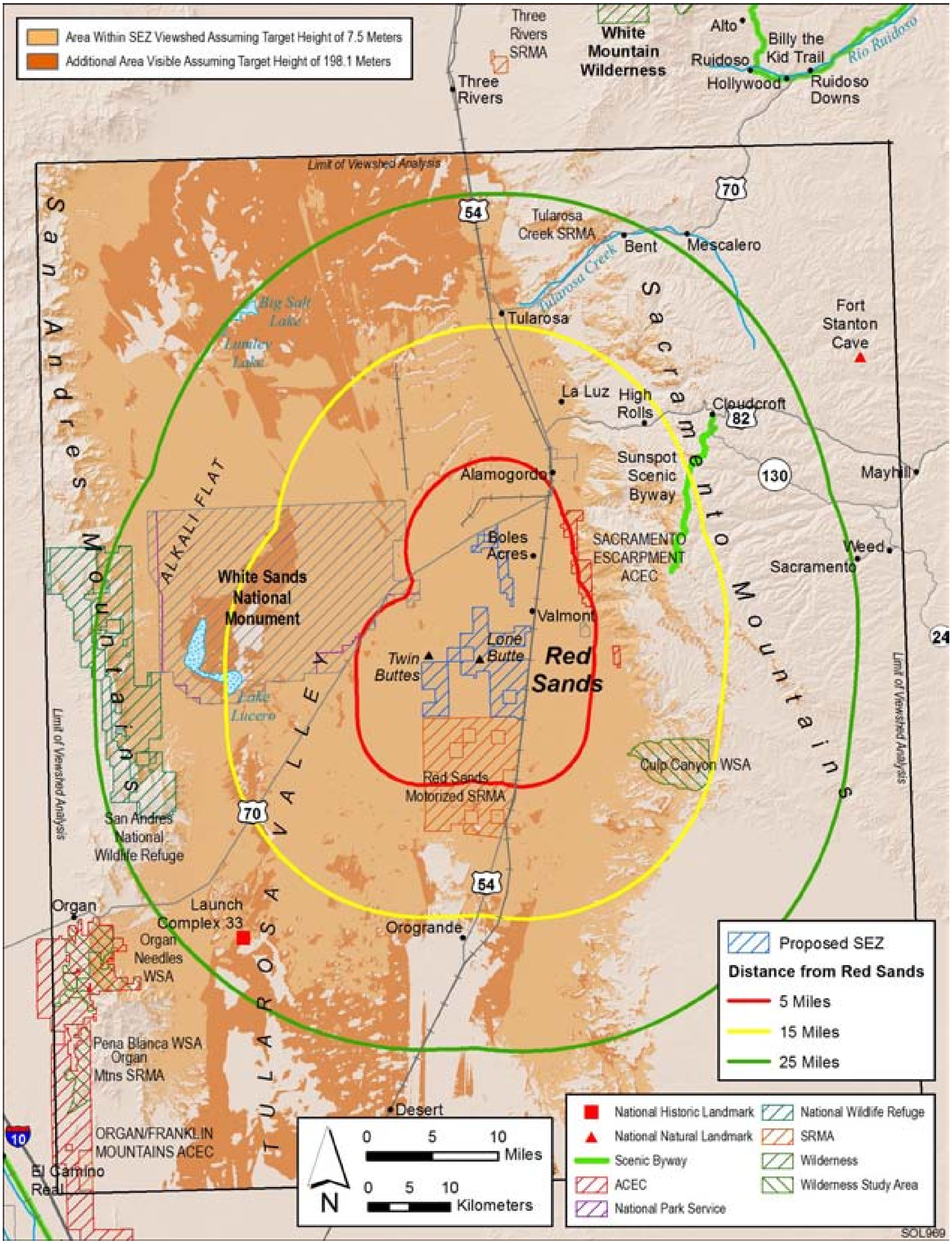


FIGURE 12.3.14.2-2 Overlay of Selected Sensitive Visual Resource Areas onto Combined 650-ft (198.1-m) and 24.6-ft (7.5-m) Viewsheds for the Proposed Red Sands SEZ

TABLE 12.3.14.2-1 Selected Potentially Affected Sensitive Visual Resources within 25-mi (40-km) Viewshed of the Proposed Red Sands SEZ, Assuming a Target Height of 650 ft (198.1 m)

		Feature Area or Linear Distance		
			Visible between	
Feature Type	Feature Name (Total Acreage/Linear Distance)[a]	Visible within 5 mi	5 and 15 mi	15 and 25 mi
WSA	Culp Canyon (11,276 acres [a])	0	6,385 acres (57%)[b]	0
ACEC designated for outstanding scenic values	Sacramento Escarpment (4,867 acres)	1,391 acres (29%)	3,406 acres (70%)	0
National Monument	White Sands National Monument (152,363 acres)	1,835 acres (1%)	86,343 acres (57%)	58,927 acres (39%)
National Wildlife Refuge	San Andres National Wildlife Refuge (60,141 acres)	0	0	24,687 acres (41%)
National Historic Landmark	Launch Complex 33	NA[c]	NA	Yes
Scenic Byway	Sunspot	0	0.2 mi	0

[a] To convert acres to km^2, multiply by 0.004047. To convert ft to mi, multiply by 1.609.

[b] Percentage of total feature acreage or road length viewable.

[c] NA = not applicable.

changes in the forms, lines, colors, and textures of objects. A measure of *visual impact* includes potential human reactions to the visual contrasts arising from a development activity, based on viewer characteristics, including attitudes and values, expectations, and other characteristics that are viewer- and situation-specific. Accurate assessment of visual impacts requires knowledge of the potential types and numbers of viewers for a given development and their characteristics and expectations, specific locations where the project might be viewed from, and other variables that were not available or not feasible to incorporate in the PEIS analysis. These variables would be incorporated into a future site-and project-specific assessment that would be conducted for specific proposed utility-scale solar energy projects. For more discussion of visual contrasts and impacts, see Section 5.12 of the PEIS.

GOOGLE EARTH™ VISUALIZATIONS

The visual impact analysis discussion in this section utilizes three-dimensional Google Earth™ perspective visualizations of hypothetical solar facilities placed within the SEZ. The visualizations include simplified wireframe models of a hypothetical solar power tower facility. The models were placed at various locations within the SEZ as visual aids for assessing the approximate size and viewing angle of utility-scale solar facilities. The visualizations are intended to show the apparent size, distance, and configuration of the SEZ, as well as the apparent size of a typical utility-scale solar power tower project and its relationship to the surrounding landscape, as viewed from potentially sensitive visual resource areas within the viewshed of the SEZ.

The visualizations are not intended to be realistic simulations of the actual appearance of the landscape or of proposed utility-scale solar energy projects. The placement of models within the SEZ did not reflect any actual planned or proposed projects within the SEZ and did not take into account engineering or other constraints that would affect the siting or choice of facilities for this particular SEZ. The number of facility models placed in the SEZ does not reflect the 80% development scenario analyzed in the PEIS, but it should be noted that the discussion of expected visual contrast levels does account for the 80% development scenario. A solar power tower was chosen for the models because the unique height characteristics of power tower facilities make their visual impact potential extend beyond other solar technology types.

National Monument

- *White Sands National Monument*—The White Sands National Monument is 152,363 acres (616.591 km^2) and located 4.1 mi (6.6 km) west of the SEZ at the point of closest approach. An 8 mi (13 km) scenic drive leads from the Visitors Center to the dune field. The scenic drive—like most of the monument—is in the viewshed of the SEZ, and thus solar facilities within the SEZ could potentially be seen from the scenic drive.

  As shown in Figure 12.3.14.2-2, within 25 mi *(*40 km), solar energy facilities within the SEZ could be visible from nearly the entire national monument. Areas of the national monument within the 25-mi (40-km) radius of analysis with potential visibility of solar facilities in the SEZ total about 147,105 acres (595.313 km^2) in the 650-ft (198.1-m) viewshed, or 97% of the total national monument acreage, and 114,542 acres (463.54 km^2) is in the 24.6-ft (7.5-m) viewshed, or 75% of the total ACEC acreage. The visible area of the national monument extends to nearly 24 mi (39 km) from the western boundary of the SEZ.

  The national monument is very flat, and at nearly the same or slightly lower elevation than the SEZ, so while nearly the entire national monument is within the viewshed of the SEZ, the angle of view from the national monument to the SEZ is very low, which would reduce visibility of solar facilities, especially low-height facilities, from many parts of the national monument. The southeastern and far eastern portions of the national monument would be more subject to contrasts from solar facilities in the SEZ, not only because they are closer to the SEZ, but also because they are less subject to screening of low-height solar facilities by small undulations in topography between the national monument and the SEZ.

Figure 12.3.14.2-3 is a Google Earth visualization of the SEZ as seen from a water tower in the portion of the national monument southeast of U.S. 70, about 0.8 mi (1.3 km) east of the National Monument Visitor Center on U.S. 70. The viewpoint is about 5.5 mi (8.9 km) from the nearest point on the western side of the SEZ. The viewpoint is elevated about 35 ft (11 m) with respect to the nearest point in the SEZ. The visualization includes simplified wireframe models of a hypothetical solar power tower facility. The models were placed within the SEZ as a visual aid for assessing the approximate size and viewing angle of utility-scale solar facilities. The receiver towers depicted in the visualization are properly scaled models of a 459-ft (140-m) power tower with an 867-acre (3.5-km^2) field of 12-ft (3.7-m) heliostats, each representing about 100 MW of electric generating capacity. Eight models were placed in the SEZ for this and other visualizations shown in this section of the PEIS. In the visualizations, the SEZ area is depicted in orange, the heliostat fields in blue.

The visualization suggests that from this short distance to the SEZ, the SEZ would be too large to be encompassed in one view, and viewers would need to turn their heads to scan across the whole visible portion of the SEZ. Because the viewpoint is only slightly elevated with respect to the SEZ, however, the vertical angle of view is very low, and solar facilities within the SEZ would appear in a very narrow band at the base of the Sacramento Escarpment to the west. Note that in this visualization, some power towers are difficult to see against the dark background of the escarpment as portrayed in Google Earth, but in reality, the operating receivers would be very bright light sources that could be visually conspicuous against a dark background. Six power towers are shown in the visualization.

The collector/reflector arrays of solar facilities within the SEZ would be seen edge-on, which would greatly reduce their apparent size and conceal their strong regular geometry. They would repeat the line of the horizon in this strongly horizontal landscape, which would tend to reduce visual contrasts from the arrays. Taller solar facility components such as transmission towers would likely be visible, and in the closest parts of the SEZ, they could attract visual attention. Other ancillary facilities, such as buildings, cooling towers, STGs, and plumes (if present) would likely be visible in the nearer portions of the SEZ projecting above the solar collector/reflector arrays. Their forms, lines, and colors could contrast with the strongly horizontal lines of the collector/reflector arrays and the surrounding landscape.

Operating power towers in the farther portions of the SEZ would likely be visible as points of light atop discernable tower structures against the backdrop of the Sacramento Escarpment, or the distant mountains south of the

FIGURE 12.3.14.2-3 Google Earth Visualization of the Proposed Red Sands SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from a Point in the Northern Portion of the White Sands National Monument

SEZ. Operating power towers in the closest portion of the SEZ would be much brighter, and could be large enough to appear as cylinders or other nonpoint light sources. They could attract visual attention, with the tower structures plainly visible beneath the receivers, against the backdrop of the Sacramento Escarpment. If sufficiently tall, the towers could have red flashing lights at night, or white or red flashing strobe lights that could be visually conspicuous, but other lights would likely be visible in the area. Other lighting associated with solar facilities could be visible as well.

Visual contrast levels observed at this location would be highly dependent on the presence or absence of power towers, and to a lesser extent other tall solar facility components in the nearer portions of the SEZ. Absent these taller facility components, contrast levels would be expected to be weak. However, the SEZ appears so large from this viewpoint that, if multiple power towers were present, the towers could stretch across much of the Sacramento Escarpment across the valley, with moderate or even strong contrast levels likely.

Figure 12.3.14.2-4 is a Google Earth visualization of the SEZ as seen from the National Monument Visitor Center on U.S. 70. The viewpoint is about 6.1 mi (9.8 km) from the nearest point on the western side of the SEZ, and is about 35 ft (11 m) lower in elevation than the nearest point in the SEZ.

Similar to the view shown in Figure 12.3.14.2-3, the SEZ would be far too large to be encompassed in one view, and viewers would need to turn their heads to scan across the whole visible portion of the SEZ. Because the viewpoint is at a slightly lower elevation than the SEZ, however, the vertical angle of view is extremely low, and solar facilities within the SEZ would appear in a very narrow band at the base of the Sacramento Escarpment to the west. Note that in this visualization, some power towers are difficult to see against the dark background of the escarpment as portrayed in Google Earth, but in reality, the operating receivers would be very bright light sources that could be visually conspicuous against a dark background. Six power towers are shown in the visualization.

The view from the Visitor Center would be very similar to that seen from the viewpoint shown in Figure 12.3.14.2-3, but expected contrast levels would be slightly lower because of the increased distance to the SEZ and the slightly lower viewpoint.

Similar to the viewpoint shown in Figure 12.3.14.2-3, visual contrast levels observed at this location would be highly dependent on the presence or absence of power towers, and to a lesser extent other tall solar facility components in the nearer portions of the SEZ. Absent these taller facility components, contrast levels would be expected to be weak, but if multiple power towers were present, the SEZ appears so large from this viewpoint that

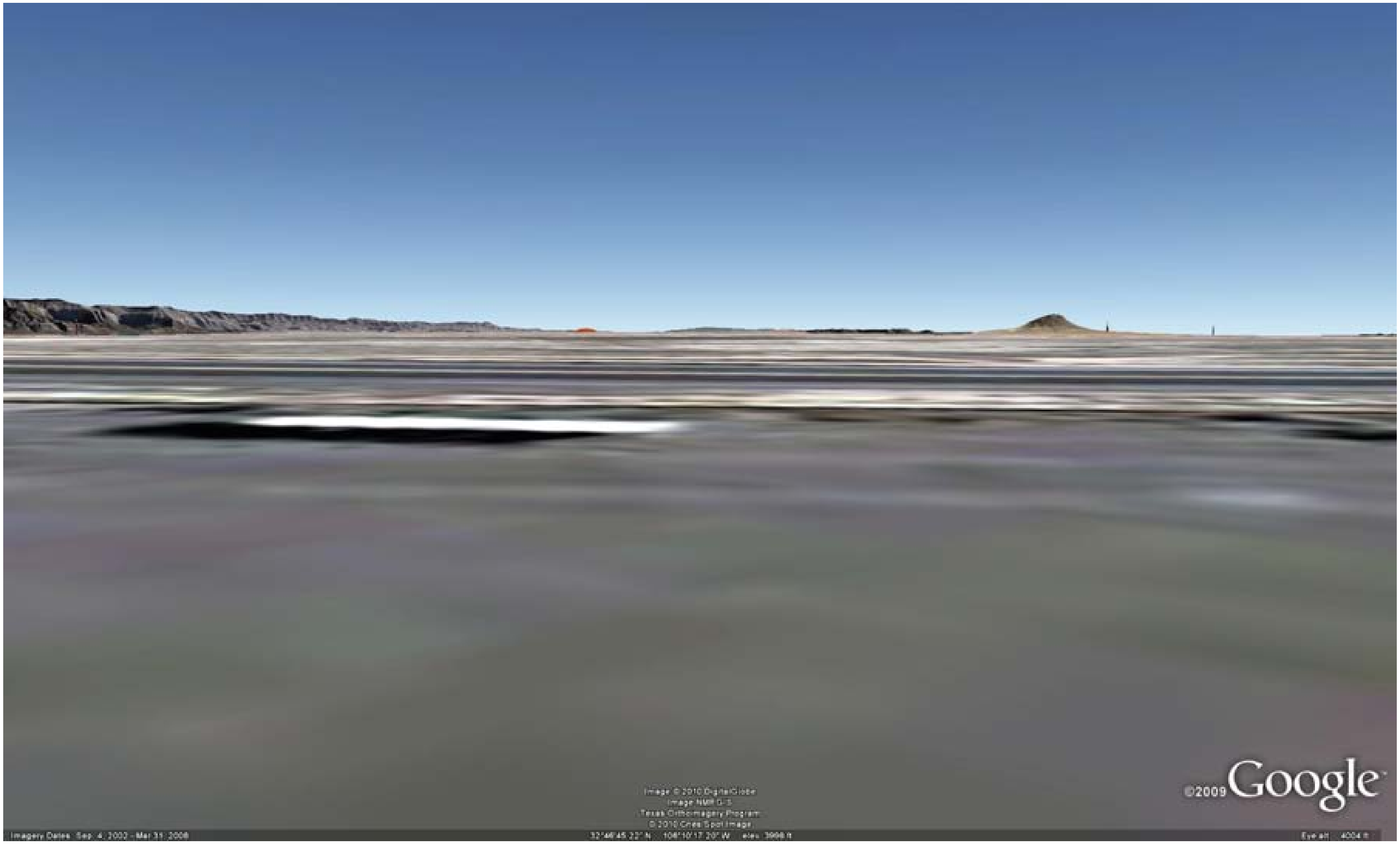


FIGURE 12.3.14.2-4 Google Earth Visualization of the Proposed Red Sands SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from the White Sands National Monument Visitor Center on U.S. 70

the towers could stretch across much of the Sacramento Escarpment across the valley, with moderate or even strong contrast levels likely. At night, if more than 200 ft (61 m) tall, power towers would have navigation warning lights that could be visible from this location..

Figure 12.3.14.2-5 is a Google Earth visualization of the SEZ as seen from the National Monument Nature Center on Dune Drive. The viewpoint is about 11 mi (18 km) from the nearest point on the western side of the SEZ. The viewpoint is about 40 ft (12 m) lower in elevation than the nearest point in the SEZ.

The SEZ would be too large to be encompassed in one view, and viewers would need to turn their heads to scan across the whole visible portion of the SEZ. Again, because the viewpoint is at a slightly lower elevation than the SEZ, the vertical angle of view is extremely low, and solar facilities within the SEZ would appear in a very narrow band at the base of the Sacramento Escarpment to the west. Note that in this visualization, some power towers are difficult to see against the dark background of the escarpment as portrayed in Google Earth, but in reality, the operating receivers would be bright light sources that could be visually conspicuous against a dark background. Seven power towers are shown in the visualization.

The view from the Nature Center would be generally similar to that seen from the viewpoint shown in Figure 12.3.14.2-4, but with some minor differences arising from the substantially increased distance to the SEZ. Power towers in portions of the SEZ farthest from the viewpoint could be more than 15 mi (24 km) away, so the tower structures may be visible but unlikely to attract notice. Expected contrast levels would be somewhat lower because of the substantially increased distance to the SEZ.

Similar to the other viewpoints, visual contrast levels from solar facilities in the SEZ observed at the Nature Center would be highly dependent on the presence or absence of power towers, and to a lesser extent other tall solar facility components in the nearer portions of the SEZ. Absent these taller facility components, contrast levels would be expected to be weak. However, the SEZ appears large enough from this viewpoint that, if multiple power towers were present, the towers could stretch across much of the Sacramento Escarpment across the valley, and moderate contrast levels would be possible.

Locations farther west in the interior of the national monument are generally at similar elevations to the viewpoints discussed above, but are farther from the SEZ. Expected contrast levels would largely be a function of distance, with weak contrast levels expected for the western portions of the national monument.

FIGURE 12.3.14.2-5 Google Earth Visualization of the Proposed Red Sands SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from the White Sands National Monument Nature Center on Dune Drive

In summary, although portions of the national monument are within a relatively short distance from the SEZ, and there are generally open views of the SEZ from the national monument, the very low vertical angle of view between the national monument and the SEZ makes expected visual contrast levels highly dependent on the presence of power towers in the northern and northwestern portions of the SEZ. Were only low-height facilities present in these portions of the SEZ, expected contrast levels could be weak. Under the 80% development scenario analyzed in the PEIS, however, expected contrast levels from solar facilities in the SEZ could be strong for locations in the national monument closest to the SEZ, with weak or moderate contrast levels experienced at locations farther west in the national monument.

Wilderness Study Area

- *Culp Canyon*—Culp Canyon is an 11,276-acre (45.632-km^2) wilderness study area (WSA) located 8.4 mi (13.5 km) southeast of the SEZ. The area is valued for its outstanding opportunities for solitude and primitive, unconfined recreation such as hiking, hunting, horseback riding, and backpacking (BLM 2005).

  As shown in Figure 12.3.14.2-2, within 25 mi (40 km) of the SEZ, solar energy facilities within the SEZ could be visible from substantial portions of the WSA (about 6,385 acres [25.84 km^2] in the 650-ft [198.1-m] viewshed, or 57% of the total WSA acreage, and 5,701 acres [23.07 km^2] in the 25-ft [7.5-m] viewshed, or 51% of the total WSA acreage). The visible area of the WSA extends from the point of closest approach to about 15 mi (24 km) from the southeastern boundary of the SEZ.

  Figure 12.3.14.2-6 is a Google Earth visualization of the SEZ as seen from an unnamed peak in the far northwestern portion of Culp Canyon WSA, about 9.5 mi (15.3 km) from the southeast corner of the SEZ. The viewpoint in the visualization is about 860 ft (260 m) higher in elevation than the SEZ. Because of the long distance to the SEZ, the angle of view would be very low, and from this location collector/reflector arrays for solar facilities within the SEZ would be seen nearly edge-on. This would reduce their apparent size, conceal their strong regular geometry, and make them appear to repeat the strong horizon line, reducing apparent visual contrast. However, because of the large size of the SEZ, and its orientation with respect to the viewpoint, the SEZ would occupy most of the horizontal field of view, and would appear in a narrow but long band at the base of the San Andres Mountains.

  Taller ancillary facilities, such as buildings, transmission structures, and cooling towers; and plumes (if present) could be visible projecting above the collector/reflector arrays, at least for facilities in the closer portions of the SEZ. The ancillary facilities could create form and line contrasts with the

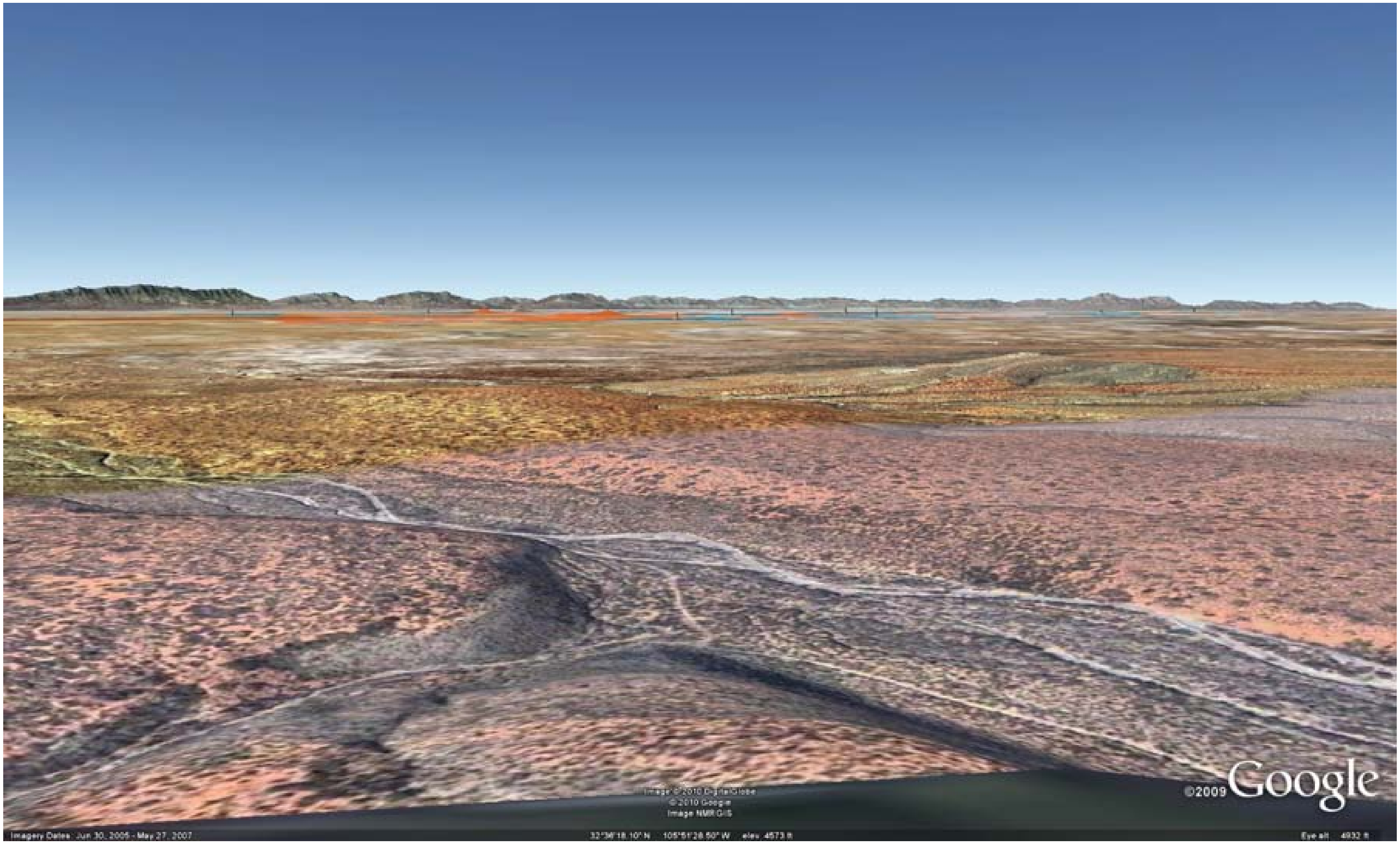


FIGURE 12.3.14.2-6 Google Earth Visualization of the Proposed Red Sands SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from a Point in the Northwestern Portion of the Culp Canyon WSA

strongly horizontal, regular, and repeating forms and lines of the collector/reflector arrays.

Operating power towers throughout the SEZ would likely be visible. Power towers in the southernmost portions of the SEZ would likely appear as bright points of light atop discernible tower structures. For power towers further north in the SEZ, the receivers would appear less bright, and the tower structures might be visible but might not be noticed by casual viewers.

If sufficiently tall, the towers could have red flashing lights at night, or white or red flashing strobe lights that would likely be visible from this location. Other lighting associated with solar facilities could be visible as well, especially for facilities in the southern portion of the SEZ.

Under the 80% development scenario analyzed in the PEIS, and depending on project location within the SEZ, the types of solar facilities and their designs, and other visibility factors, strong visual contrasts from solar energy development within the SEZ would be expected at this location. Lower levels of visual contrast would be expected for most other viewpoints in the WSA, as they would generally be farther from the SEZ and at lower elevation than this viewpoint.

ACEC Designated for Outstandingly Remarkable Scenic Values

- *Sacramento Escarpment*—The 4,867-acre (19.70-km^2) Sacramento Escarpment ACEC is located 4.4 mi (7.1 km) east of the SEZ at the closest point of approach. The ACEC was designated in for its scenic, special status species, biological, and riparian values.

  As shown in Figure 12.3.14.2-2, because the ACEC almost exclusively occupies very steep slopes close to the SEZ, nearly the entire ACEC has open, elevated views of the SEZ. Approximately 4,797 acres (19.4 km^2), or 99% of the ACEC, is within the 650-ft (198.1-m) viewshed of the SEZ and 4,786 acres (19.4 km^2), or 98% of the total ACEC acreage, is in the 24.6-ft (7.5-m) viewshed. The visible area of the ACEC extends approximately 7.0 mi (11.3 km) from the eastern boundary of the SEZ to the southern portion of the ACEC.

  The following discussion examines potential visual impacts of solar development within the Red Sands Proposed SEZ on viewpoints within the Sacramento Escarpment ACEC, rather than impacts on views of the Sacramento Escarpment ACEC from viewpoints outside the ACEC. Discussion of potential impacts on views of the Sacramento Escarpment ACEC from viewpoints outside the ACEC can be found under the analyses for other local sensitive viewing areas, including White Sands National Monument and U.S. 70.

Figure 12.3.14.2-7 is a Google Earth visualization of the SEZ as seen from a point in the northern portion of the ACEC east of Calle de Paz in Alamogordo. The viewpoint is partway up the escarpment along an unpaved road (accessed from Old El Paso Highway) leading up to a tank, and is about 5.3 mi (8.6 km) east-northeast of the nearest point in the SEZ in the far northern portion of the SEZ. The viewpoint is about 570 ft (170 m) higher in elevation than the SEZ. The closest power tower model in the visualization (at the far right) is about 6.2 mi (10.0 km) from the viewpoint.

The visualization suggests that at this short distance from the SEZ, the SEZ would be too large to be encompassed in one view, and viewers would need to turn their heads to scan across the whole visible portion of the SEZ. The view would be across the urbanized and visually cluttered landscape of the community of Boles Acres and southern Alamogordo, and across U.S. 54.

Despite the somewhat elevated viewpoint, the viewing angle is low, and where visible, collector/reflector arrays of solar facilities in the SEZ would be seen at a low angle, reducing their apparent size somewhat. The angle of view is not low enough, however, that the tops of the collector/reflector arrays would not be visible, so their strong regular geometry could be evident, at least for nearby facilities, and there would be increased potential for reflections from the tops of the collectors and reflectors.

Ancillary facilities, such as buildings, transmission towers, cooling towers; and plumes, if present, would likely be visible projecting above the collector/reflector arrays, at least in the nearby portions of the SEZ. Their forms, lines, and colors, as well as their reflective properties, could add to visual contrasts with the generally horizontal surrounding landscape.

Operating power towers in the farther portions of the SEZ would likely be visible as points of light against a backdrop of the valley floor. If located in the closest portions of the SEZ, however, they could appear as substantially brighter light sources atop plainly discernable tower structures, and could strongly attract visual attention. If sufficiently tall, the towers could have red flashing lights at night, or white or red flashing strobe lights that would likely be conspicuous for nearby facilities, but many other lights would likely be visible in the area. Other lighting associated with solar facilities in the SEZ could be visible as well.

The low angle of view would reduce visibility of solar facilities in the SEZ somewhat, but the SEZ would cross more than the normal horizontal field of view, and solar facilities in the northern portion of the SEZ would be close enough to cause large visual contrasts. Under the 80% development scenario

FIGURE 12.3.14.2-7 Google Earth Visualization of the Proposed Red Sands SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from a Point in the Northern Portion of the Sacramento Escarpment ACEC

analyzed in the PEIS, while contrast levels would depend on project location within the SEZ, the types of solar facilities and their designs, and other visibility factors, strong visual contrasts from solar energy development within the SEZ would be expected for this viewpoint in the ACEC.

Figure 12.3.14.2-8 is a Google Earth visualization of the SEZ as seen from nearly the highest elevation in the ACEC, a remote point east of Boles Acres. The viewpoint is at the top of the escarpment, at an elevation of about 6,500 ft (2,000 m) AMSL, or about 2,400 ft (730 m) above the SEZ. The viewpoint is about 5.8 mi (9.3 km) east of the nearest point in the SEZ in the northern portion of the SEZ. The closest power tower model in the visualization (at the far right) is about 6.3 mi (10.1 km) from the viewpoint.

The visualization suggests that at this short distance from the SEZ, the SEZ would be too large to be encompassed in one view, and viewers would need to turn their heads to scan across the whole visible portion of the SEZ. The view would be across the urbanized and visually cluttered landscape of the community of Boles Acres, and across U.S. 54.

Because of the elevated viewpoint and relatively short distance to the SEZ, the viewing angle is high enough that the tops of collector/reflector arrays of solar facilities in nearer portions of the SEZ would be clearly visible, so their strong regular geometry could be evident, and there would be increased potential for reflections from the tops of the collectors and reflectors.

Ancillary facilities, such as buildings, transmission towers, cooling towers, and plumes, if present, would likely be visible projecting above the collector/reflector arrays, at least in the nearby portions of the SEZ. The ancillary facilities could create form and line contrasts with the strongly horizontal, regular, and repeating forms and lines of the collector/reflector arrays. Color and texture contrasts would also be possible, but their extent would depend on the materials and surface treatments utilized in the facilities.

Operating power towers in the farther portions of the SEZ would likely be visible as points of light atop plainly discernable tower structures, against a backdrop of the valley floor. If located in the closer portions of the SEZ, operating power towers could appear as substantially brighter light sources, and could strongly attract visual attention. If sufficiently tall, the towers could have red flashing lights at night, or white or red flashing strobe lights that would likely be conspicuous for nearby facilities, but many other lights would likely be visible in the area. Other lighting associated with solar facilities in the SEZ could be visible as well.

Because of the relatively high viewing angle, and because the SEZ would cross more than the normal horizontal field of view, solar facilities in the central and northern portions of the SEZ would be close enough to cause large

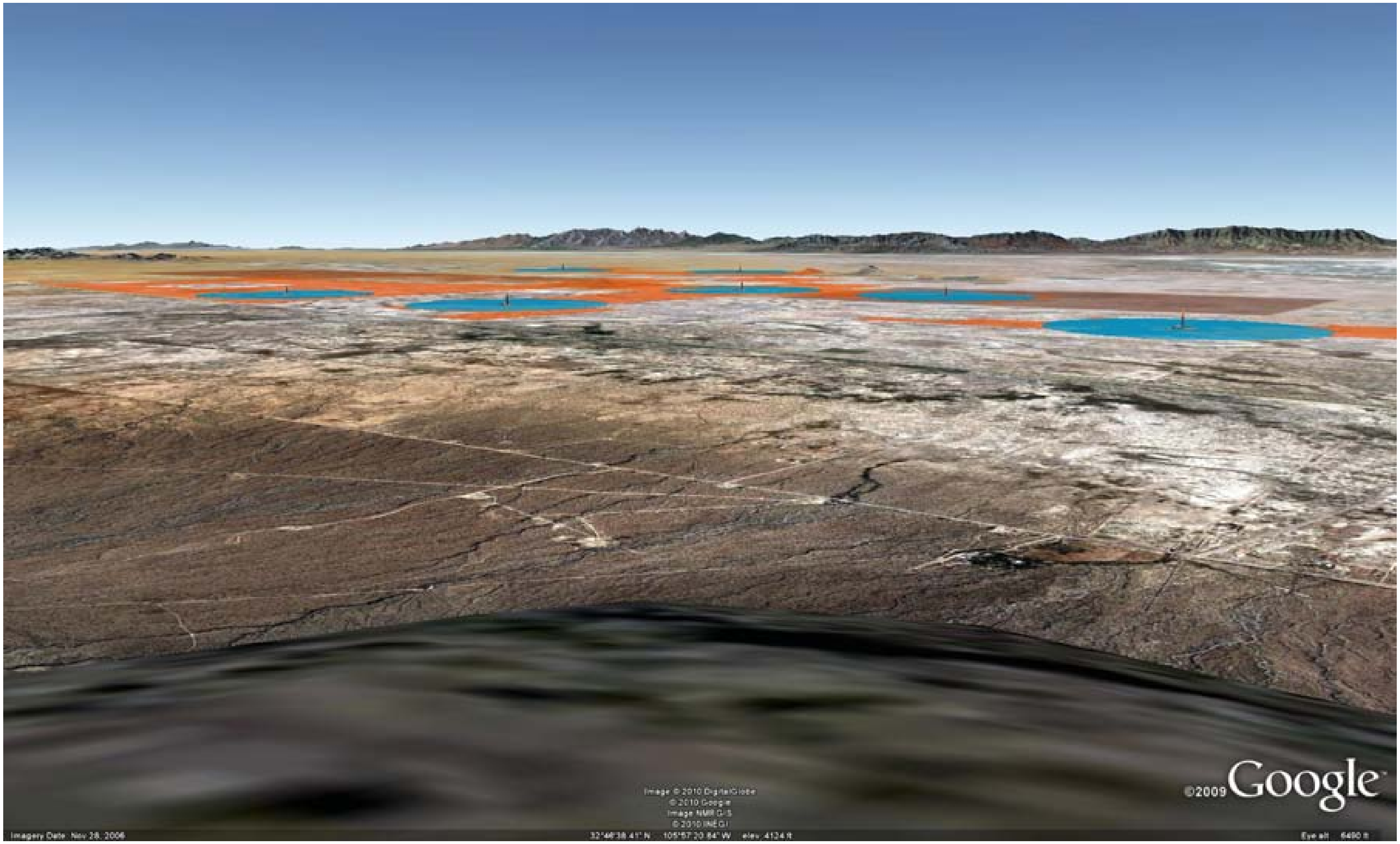


FIGURE 12.3.14.2-8 Google Earth Visualization of the Proposed Red Sands SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from a High-Elevation Viewpoint in the Central Portion of the Sacramento Escarpment ACEC

visual contrasts. Under the 80% development scenario analyzed in the PEIS, while contrast levels would depend on project location within the SEZ, the types of solar facilities and their designs, and other visibility factors, strong visual contrasts from solar energy development within the SEZ would be expected for this viewpoint in the ACEC.

Figure 12.3.14.2-9 is a Google Earth visualization of the SEZ as seen from a point in the southern portion of the ACEC in San Andres Canyon, east of Pasa Por Aqui Lane. The viewpoint is partway up the escarpment at the end of an unpaved road running part way up the canyon. The viewpoint is about 5.6 mi (9.1 km) east of the nearest point in the SEZ, and is about 580 ft (180 m) higher in elevation than the SEZ. The closest power tower model in the visualization (at the far right) is about 6.1 mi (9.8 km) from the viewpoint.

Because the viewpoint is within a canyon, the canyon walls would “frame” the view of the SEZ, greatly restricting visibility of the SEZ. The view would be across the urbanized strip along U.S. 54. The portion of the SEZ visible in this “framed” view is only 1 mi (1.6 km) east to west, so it would appear as a narrow horizontal strip across the valley floor under the San Andres Mountains.

Despite the somewhat elevated viewpoint, the viewing angle is low, and where visible, collector/reflector arrays of solar facilities in the SEZ would be seen at a low angle, reducing their apparent size somewhat. The angle of view is not low enough, however, that the tops of the collector/reflector arrays would not be visible, so their strong regular geometry could be evident, and there would be increased potential for reflections from the tops of the collectors and reflectors.

Ancillary facilities, such as buildings, transmission towers, cooling towers, and plumes, if present, would likely be visible projecting above the collector/reflector arrays. Their forms, lines, and colors, as well as their reflective properties, could add to visual contrasts with the generally horizontal surrounding landscape.

Operating power towers in the visible portions of the SEZ would appear as very bright light sources, atop plainly discernable tower structures, and in this framed view would be likely to strongly attract visual attention. If sufficiently tall, the towers could have red flashing lights at night, or white or red flashing strobe lights that would likely be conspicuous from this viewpoint, though other lights would likely be visible in the area. Other lighting associated with solar facilities in the SEZ could be visible as well.

The low angle of view would reduce visibility of solar facilities in the SEZ somewhat, but the SEZ would be framed by the canyon walls in this view, and because of this, could dominate views westward from this location. Under the

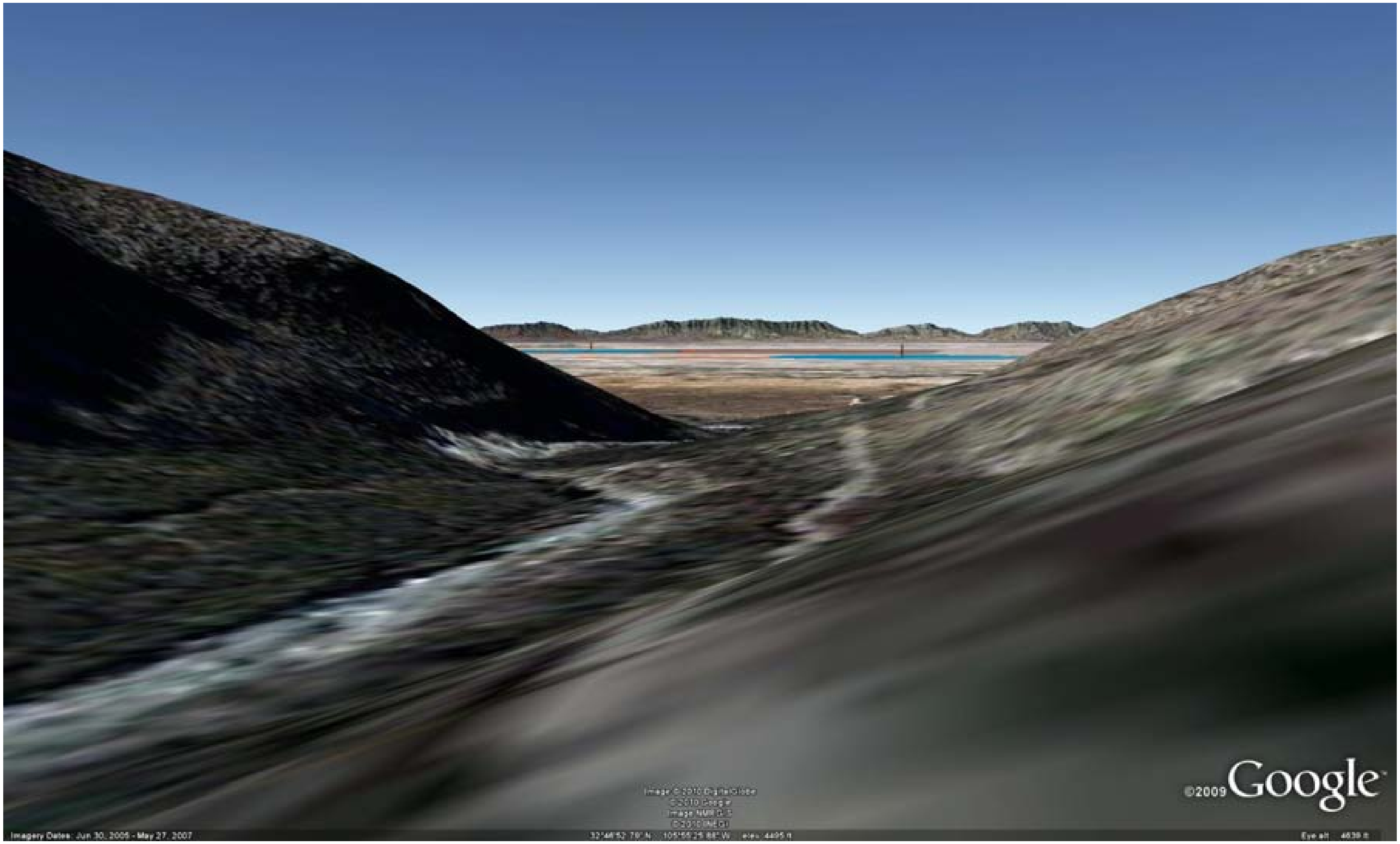


FIGURE 12.3.14.2-9 Google Earth Visualization of the Proposed Red Sands SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from San Andres Canyon in the Southern Portion of the Sacramento Escarpment ACEC

80% development scenario analyzed in the PEIS, while contrast levels would depend on project location within the SEZ, the types of solar facilities and their designs, and other visibility factors, strong visual contrasts from solar energy development within the SEZ would be expected for this viewpoint in the ACEC.

In summary, the ACEC is close to the proposed SEZ, and the entire SEZ is visible from the elevated viewpoints in the ACEC. Although the vertical angle of view is generally low as viewed from the ACEC, from many locations in the ACEC the SEZ would appear large enough that it could not be encompassed in one view, resulting in strong visual contrast levels for most viewpoints in the ACEC. Lower, but often still strong visual contrast levels, would be evident from viewpoints recessed into canyons running up the escarpment, due in part to the framing of views of solar facilities within the SEZ by canyon walls.

National Wildlife Refuge

- *San Andres*—The 60,141-acre (243.38-km^2) San Andres NWR is about 19 mi (31 km) west of the SEZ at the closest point of approach. With the exception of occasional special guided tours for education or research groups, the San Andres National Wildlife Refuge remains closed to the public for safety and security concerns. The Refuge is completely surrounded by the 2.2-million-acre (8,903-km^2) White Sands Missile Range.

  The NWR occupies the crest of the southern San Andres Mountains. As shown in Figure 12.3.14.2-2, visibility of solar facilities in the SEZ would be limited to the east-facing slopes of the San Andres Mountains in the NWR. About 24,687 acres (99.9 km^2), or 41% of the NWR, are within the 650-ft (198.1-m) viewshed of the SEZ, and 24,384 acres (98.7 km^2), also 41% of the NWR, are within the 24.6-ft (7.5-m) viewshed. The portions of the NWR within the viewshed extend from the point of closest approach to approximately 24 mi (39 km) from the SEZ.

  Figure 12.3.14.2-10 is a Google Earth visualization of the SEZ (highlighted in orange) as seen from an unnamed ridge in the eastern portion of the NWR, about 1.8 mi (2.8 km) south of San Andres Canyon, and about 0.5 mi (0.8 km) southeast of Dripping Springs. The viewpoint is about 23 mi (36 km) from the SEZ and 935 ft (285 m) higher in elevation than the SEZ.

  The visualization suggests that at this distance, the SEZ would occupy a very small portion of the field of view. From this location, collector/reflector arrays for solar facilities within the SEZ would be seen nearly edge-on, which would reduce their apparent size, conceal their strong regular geometry, and make

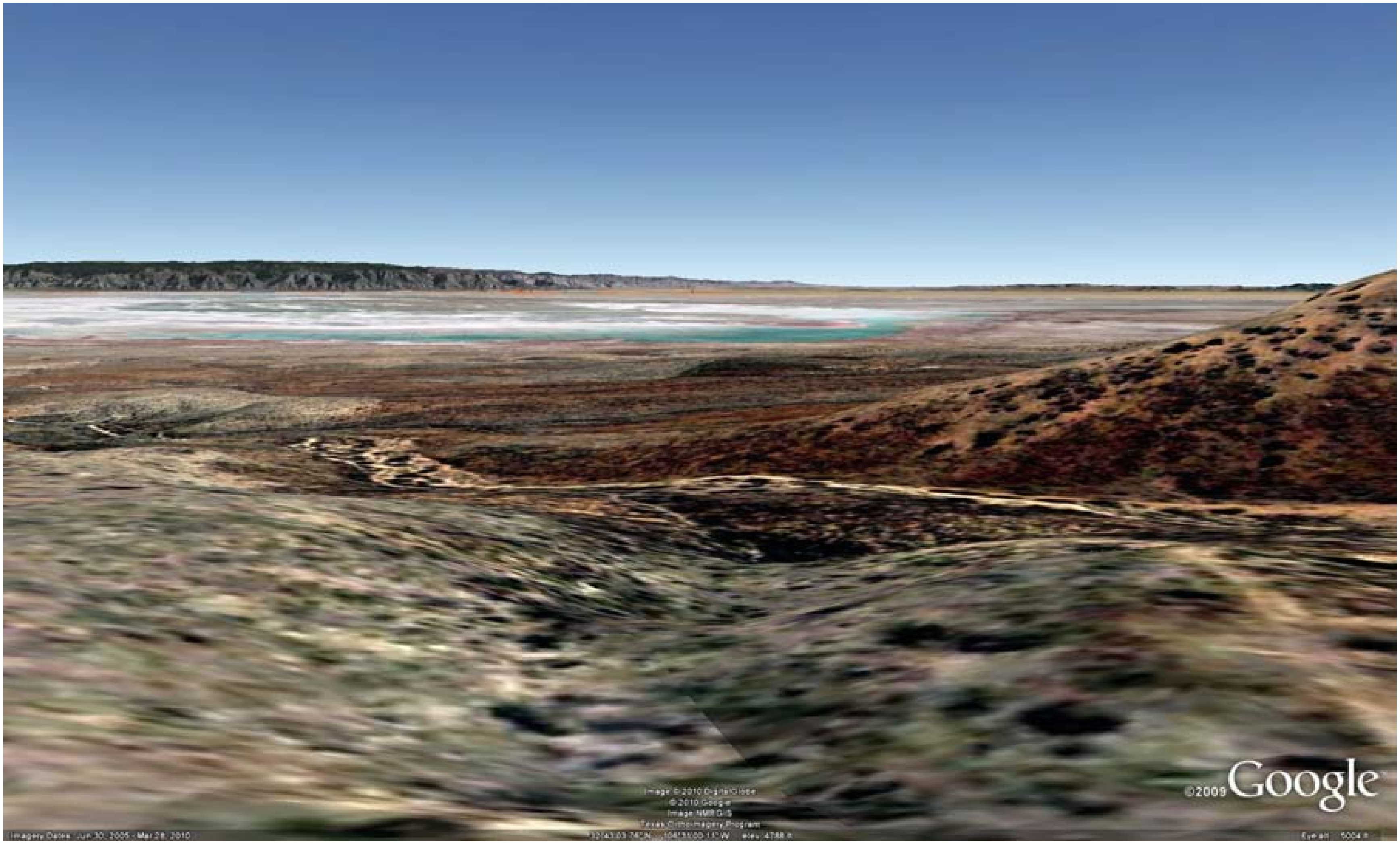


FIGURE 12.3.14.2-10 Google Earth Visualization of the Proposed Red Sands SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from an Unnamed Ridge within the San Andres Mountains NWR

them appear to repeat the strong horizon line, reducing apparent visual contrast.

Operating power towers within the SEZ would be visible from this location. At almost 23 mi (36 km), the receivers would likely appear as distant points of light to the east, against the backdrop of the base of the Sacramento Mountains or the Tularosa Valley floor. If sufficiently tall, the towers could have red flashing lights at night, or white or red flashing strobe lights that would likely be visible. Other lighting associated with solar facilities could be visible as well.

Visual contrasts associated with solar energy development within the SEZ would depend on solar facility type, size, and location within the SEZ, as well as other visibility factors. Under the 80% development scenario analyzed in this PEIS, weak levels of visual contrast would be expected for views from this location.

Figure 12.3.14.2-11 is a Google Earth visualization of the SEZ (highlighted in orange) as seen from the northernmost summit of Bennett Mountain, just south of Bighorn Springs in the southern portion of the NWR. The viewpoint is at the point of closest approach from the NWR to the SEZ at slightly more than 19 mi (31 km) and has an open view of the SEZ. The viewpoint is about 2,600 ft (790 m) higher in elevation than the SEZ.

The visualization suggests that because of the large size of the SEZ, and its orientation with respect to the viewpoint, the SEZ would occupy most of the horizontal field of view, and would appear in a narrow band at the base of the Sacramento Mountains. Despite the elevated viewpoint, the vertical angle of view to the SEZ is low enough that collector/reflector arrays for solar facilities within the SEZ would be seen nearly edge-on. The low-angle view would reduce their apparent size, conceal their strong regular geometry, and make them appear to repeat the strong horizon line, reducing apparent visual contrast.

Operating power towers within the SEZ would be visible from this location. At almost 20 mi (32 km), the receivers would likely appear as distant points of light to the east, against the backdrop of the base of the Sacramento Mountains or the Tularosa Valley floor. There would be potential for glint and glare from power tower heliostats and the collector/reflector arrays of other solar technologies. If sufficiently tall, the towers could have red flashing lights at night, or white or red flashing strobe lights that would likely be visible.

Visual contrasts associated with solar energy development within the SEZ would depend on solar facility type, size, and location within the SEZ, as well as other visibility factors. Under the 80% development scenario analyzed in

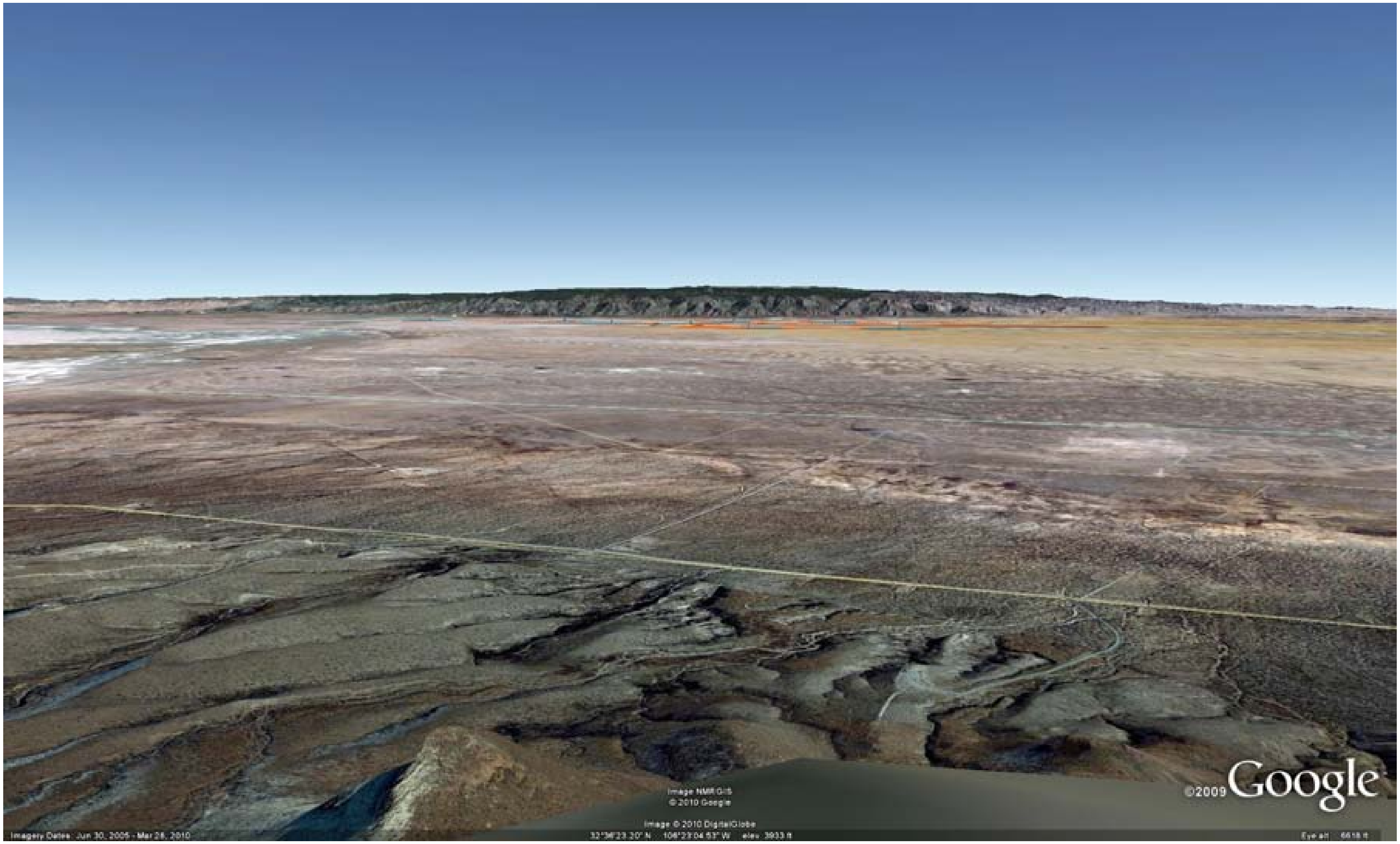


FIGURE 12.3.14.2-11 Google Earth Visualization of the Proposed Red Sands SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from Viewpoint within the San Andres Mountains NWR

this PEIS, weak levels of visual contrast would be expected for views from this location.

Visual contrasts associated with solar energy development within the SEZ would depend on viewer location within the NWR; solar facility type, size, and location within the SEZ; and other visibility factors. Under the 80% development scenario analyzed in this PEIS, weak levels of visual contrast would be expected. The highest contrast levels would be expected for high-elevation viewpoints in the NWR, with lower contrasts expected for lower-elevation viewpoints in the NWR.

National Historic Landmark

- *Launch Complex 33*—Launch Complex 33 is a national historic landmark about 22 mi (35 km) southwest of the SEZ at the point of closest approach. It is within the White Sands Missile Range and contains two important structures: the old Army Blockhouse and the launching crane, known as the Gantry Crane.

  Launch Complex 33 is at an elevation slightly below the lowest point in the SEZ, and at nearly 22 mi (35 km) from the SEZ, the vertical angle of view to solar facilities within the SEZ would be very low. If solar facilities were located in the far southwestern portion of the SEZ, they could potentially be visible from Launch Complex 33. If power towers were visible, when operating, the receivers could appear as distant points of light against the backdrop of the Sacramento Escarpment. At night, if more than 200 ft (61 m) tall, power towers would have navigation warning lights that could potentially be visible from Launch Complex 33. Given the very low angle of view and the long distance to the SEZ, solar facilities within the SEZ would be unlikely to be seen by casual observers; however, even if power towers were visible within the SEZ, minimal visual contrast levels would be expected.

Scenic Byway

- *Sunspot*—Sunspot is a congressionally designated scenic byway that extends 14 mi (22.5 km) through the Lincoln National Forest. This route runs along the front rim of the Sacramento Mountains, providing panoramic scenic views of the Tularosa Basin and the sand dunes of White Sands National Monument.

  The scenic byway passes within 12 mi (19 km) of the SEZ at the point of closest approach east of the SEZ. Approximately 0.2 mi (0.3 km) of the byway are within the 650-ft (198.1-m) viewshed of the SEZ, and the distance within the viewshed to the SEZ ranges from 12.5 mi (20.1 km), east of the SEZ, to 12.7 mi (20.4 km).

> As the scenic highway descends a short slope in Cathey Canyon, about 1.3 mi (2.1 km) from the community of Sunspot, facing the Tularosa Valley, the upper portions of power towers in particular locations in the southern portion of the SEZ might be visible briefly (for approximately 15 seconds). The area along the roadway is heavily wooded, and it is possible that views of the SEZ are entirely screened by vegetation; however, if not, solar facilities in only a very small portion of the SEZ could be in view, and for such a brief period of time that visual impacts would be minimal.

Additional scenic resources exist at the national, state, and local levels, and impacts may occur on both federal and nonfederal lands, including sensitive traditional cultural properties important to Tribes. Note that in addition to the resource types and specific resources analyzed in this PEIS, future site-specific NEPA analyses would include state and local parks, recreation areas, other sensitive visual resources, and communities close enough to the proposed project to be affected by visual impacts. Selected other lands and resources are included in the discussion below.

In addition to impacts associated with the solar energy facilities themselves, sensitive visual resources could be affected by other facilities that would be built and operated in conjunction with the solar facilities. With respect to visual impacts, the most important associated facilities would be access roads and transmission lines, the precise location of which cannot be determined until a specific solar energy project is proposed. Currently a 115-kV transmission line is within the proposed SEZ, so construction and operation of a transmission line outside the proposed SEZ would not be required. However, construction of transmission lines within the SEZ to connect facilities to the existing line would be required. For this analysis, the impacts of construction and operation of transmission lines outside of the SEZ were not assessed, assuming that an existing 115-kV transmission line might be used to connect some new solar facilities to load centers, and that additional project-specific analysis would be done for new transmission construction or line upgrades. Note that depending on project- and site-specific conditions, visual impacts associated with access roads, and particularly transmission lines, could be large. Detailed information about visual impacts associated with transmission lines is presented in Section 5.7.1. A detailed site-specific NEPA analysis would be required to determine visibility and associated impacts precisely for any future solar projects, based on more precise knowledge of facility location and characteristics.

Impacts on Selected Other Lands and Resources

Lone Butte. Lone Butte is culturally significant to Native Americans and a prominent landmark visible from most of the Tularosa Valley. Lone Butte is located with the south-central portion of the SEZ, 3.7 mi (5.9 km) west of U.S. 54.

Because of the very close proximity of the Lone Butte to potential solar facilities within the SEZ, under the 80% development scenario analyzed in the PEIS, strong visual contrasts would be expected for viewers located at or near Lone Butte. Furthermore, the presence of solar facilities in the immediate vicinity of the butte could impair direct views of the butte from surrounding areas, as well as creating strong visual contrasts with the butte's natural-appearing form, lines, colors, and textures.

U.S. 70. U.S. 70, generally a four-lane highway, runs in a northeast–southwest direction to Tularosa, where it joins U.S. 54 into Alamogordo. From Las Cruces, U.S. 70 travels generally northeast, with a portion running along the southeast boundary of White Sands National Monument. As shown in Figure 12.3.14.2-2, approximately 62 mi (100 km) of U.S. 70 are within the SEZ 25-mi (40-km) viewshed, nearly all of which are within the 24.6-ft (7.5-m) SEZ viewshed. This distance would equate to about 55 minutes total viewing time at highway speeds. Eastbound travelers on U.S. 70 could have views of solar facilities within the SEZ from almost any point on the road east of the crest of the Organ Mountains to a few miles east of Tularosa. The AADT value for U.S. 70 in the vicinity of the SEZ is between 7,700 and 9,100 vehicles (NM DOT 2009).

For eastbound U.S. 70 travelers from Las Cruces, the solar facilities in the SEZ could come into view about 6 mi (10 km) east of Organ, as they entered the SEZ 25-mi (40-km) viewshed. The SEZ would be visible across the wide expanse of the Tularosa Valley, about 45 degrees to the left of the direction of travel. Views would be elevated about 850 ft (260 m) above the SEZ when the SEZ first came into view, but would decrease rapidly as vehicles descended the eastern slope of the Organ Mountains. At night, if more than 200 ft (61 m) tall, power towers would have navigation warning lights that could potentially be visible from these distances on U.S. 70, though there could be other lights visible in the vicinity of the SEZ as well. Visual contrasts from solar facilities at this long distance would be weak, but would gradually rise as travelers approached the SEZ, although the loss of elevation as vehicles traveled eastward would decrease the vertical angle of view, partially offsetting the increased contrast from being closer to the SEZ.

After about 2 mi (3 km), U.S. 70 turns toward the northeast so that vehicles would face the SEZ more directly, but as elevation drops rapidly in this segment of the roadway, there would not be a substantial increase in impacts from the change in direction. After about another 3 mi (5 km), the road would turn northeast again, so that the direction of travel would be slightly northward of the SEZ. After several miles (close to about 15 mi [24 km] from the SEZ), there would be a decrease in contrasts because the elevation of the roadway would drop slightly below that of the SEZ, so that the vertical angle of view between the road and the SEZ would be extremely low. In fact, solar facilities within most of the SEZ would not be visible because of screening by intervening terrain; however, the receivers of operating power towers could be visible against the backdrop of the Sacramento Escarpment, including the Sacramento Escarpment ACEC. At this distance, the tower structures under the receivers might be visible, but might not be noticeable to casual viewers. If sufficiently tall, the towers could have red flashing lights at night, or white or red flashing strobe lights that could be visually conspicuous, but other lights would likely be visible in the area. Other lighting associated with solar facilities could be visible as well.

By about 10 mi (16 km) from the SEZ, the SEZ would occupy most of the horizontal field of view, and while the vertical angle of view would still be extremely low, depending on the number and location of power towers within the SEZ, visual contrasts could approach moderate levels, if multiple power towers were located in the western portions of the SEZ, and visible across much the north–south axis of the SEZ. If there were very few or no operating power towers present, or they were located far from U.S. 70 in the SEZ, contrast levels would likely remain at weak levels.

Contrast levels would continue to rise as travelers passed along the boundary of White Sands National Monument. As U.S. 70 approaches the National Monument Visitor Center, the roadway is within a relatively short distance of the SEZ (less than 5 mi [8 km]), and there are generally open views of the SEZ from U.S. 70. The very low vertical angle of view between the road and the SEZ makes expected visual contrast levels highly dependent on the presence of power towers in the northern and northwestern portions of the SEZ. Were only low-height facilities present in these portions of the SEZ, expected contrast levels could remain at weak levels. Under the 80% development scenario analyzed in the PEIS, however, expected contrast levels from solar facilities in the SEZ could be strong for those portions of U.S. 70 in this stretch of the roadway closest to the SEZ. At night, if more than 200 ft (61 m) tall, power towers would have navigation warning lights that could be conspicuous from this area. Other lighting associated with solar facilities could be visible as well. Figure 12.3.14.2-4 (see the White Sands National Monument impact analysis above) is a visualization of the SEZ from the National Monument Visitor Center on U.S. 70.

After passing the National Monument Visitor Center, U.S. 70 approaches the northernmost part of the SEZ, reaching it at about 8.2 mi (13.2 km) east of the National Monument Visitor Center, just beyond Holloman Air Force Base. U.S. 70 passes through 0.9 mi (1.4 km) of the SEZ just inside the northernmost boundary of the SEZ. As eastbound U.S. 70 travelers approached the boundary of the SEZ, solar facilities within the SEZ would be in full view. The SEZ would occupy more than the entire field of view to the southeast, so travelers would have to turn their heads to scan across the full SEZ. Facilities located within the far northern portion of the SEZ could strongly attract the eye and would likely dominate views from U.S. 70.

Visual contrast would increase further as travelers on U.S. 70 entered the SEZ. If power tower facilities were located in the SEZ, the receivers could appear as brilliant light sources on either side of the highway and would likely strongly attract views. Farther on down the roadway, if solar facilities were located on both the north and south sides of I-10, the banks of solar collectors on both sides could form a visual “tunnel,” which travelers would pass through briefly. If solar facilities were located close to the roadway, given the 80% development scenario analyzed in this PEIS, they would be expected to dominate views from I-10 and would create strong visual contrasts. After travelers pass through the section of SEZ, the SEZ would still be very close to I-10 on one side of the highway or the other. Impact levels would be dependent on the presence of solar facilities in areas near the roadway and on solar facility characteristics.

Figure 12.3.14.2-12 is a Google Earth perspective visualization of the SEZ as seen from U.S. 70 within the SEZ, approximately 0.3 mi (0.4 km) east of the intersection of the highway

FIGURE 12.3.14.2-12 Google Earth Visualization of the Proposed Red Sands SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from U.S. 70 within the SEZ

and the SEZ, facing south–southwest toward a power tower model 1.3 mi (2 km) south of the viewpoint. Other power towers are visible to the south. The visualization suggests that from this location, solar facilities within the SEZ would be in full view. The SEZ would occupy more than the entire field of view, so travelers would have to turn their heads to scan across the full SEZ. Facilities located within the far northern portion of the SEZ would strongly attract the eye and would be likely to dominate views from U.S. 70. From this viewpoint, solar collector/reflector arrays would be seen nearly edge-on and would repeat the horizontal line of the plain in which the SEZ is situated; this would tend to reduce visual line contrast, but for the closest facilities, the collector/reflector arrays would likely appear large enough that they would no longer be seen as horizontal lines against the natural-appearing backdrop. Their strong regular geometry and structural details would likely be discernable.

Ancillary facilities, such as buildings, transmission towers, cooling towers; and plumes, if present, would likely be visible projecting above the collector/reflector arrays. Their forms and lines, as well as reflective properties, could add to visual contrasts with the strongly horizontal arrays and surrounding landscape. Color and texture contrasts would also be likely, but their extent would depend on the materials and surface treatments utilized in the facilities.

As travelers approach and pass through the SEZ, depending on the solar technologies present, facility layout, and mitigation measures employed, there would be the potential for reflections from facility components, which could cause visual discomfort for travelers and be distracting to drivers. These potential impacts could be reduced by siting reflective components away from the roadway, employing various screening mechanisms, and/or adjusting the mirror operations to reduce potential impacts. However, because of their height, the receivers of power towers located close to the roadway could be difficult to screen.

Views of the Sacramento Escarpment and the mountain ranges south of the valley could be partially screened by solar facilities, depending on the layout of solar facilities within the SEZ. Because of the potentially very short distance from solar facilities to U.S. 70, strong visual contrasts could result, depending on solar project characteristics and location within the SEZ.

After eastbound travelers on U.S. 70 passed out of the SEZ to the northeast, visual contrast levels and associated perceived impacts would decrease rapidly because solar facilities within the SEZ would be behind and to the right of the eastbound vehicles, so that the frequency and duration of views would decrease substantially. As vehicles entered the urbanized Alamogordo area about 2 mi (3 km) northeast of the SEZ, structures and vegetation would be more likely to screen views of the SEZ, further decreasing frequency and duration of views. About 5 mi northeast of the SEZ, U.S. 70 turns north, and contrasts would drop even further as distance from the SEZ increased.

Travelers heading west on U.S. 70 would in general be subjected to the same types of visual contrasts, but the order would be reversed, and this could change the perceived impact levels. Because of differences in topography between the eastern and western approaches to the SEZ, for westbound travelers on U.S. 70, the approach to the SEZ within the SEZ viewshed would be shorter in both time and distance. Contrast levels would rise much faster than for eastbound travelers on U.S. 70, as eastbound travelers would have the SEZ in view, with gradually rising contrast levels, for much longer.

Solar facilities within the SEZ could be visible as far a few miles east of the community of Tularosa on U.S. 70. From Tularosa to just beyond Alamogordo, U.S. 70 and U.S. 54 share the same route, and the following remarks would apply to both highways. Tularosa is located approximately 16.2 mi (26.1 km) from the nearest point in the SEZ, and is elevated about 350 ft (110 m) with respect to the SEZ. Where open views toward the SEZ existed from U.S. 70/U.S. 54 in Tularosa, the SEZ would occupy a small portion of the horizontal field of view. Because of the long distance to the SEZ, the vertical angle of view to the SEZ would be very low, with weak visual contrasts expected from solar facilities within the SEZ.

La Luz is located approximately 10.5 mi (16.9 km) from the nearest point in the SEZ, and is elevated about 650 ft (200 m) with respect to the SEZ. Where open views toward the SEZ existed from U.S. 70/U.S. 54 in La Luz, the SEZ would occupy a moderate portion of the horizontal field of view. Because of the relatively long distance, the angle of view to the SEZ would be low, and weak visual contrasts from solar facilities within the SEZ would be expected.

Alamogordo is located approximately 4.8 mi (7.7 km) from the nearest point in the SEZ; however, some subdivisions are as close as 2.2 mi (3.5 km), although U.S. 70 and U.S. 54 would have already split off from each other this close to the SEZ. Screening by structures and vegetation would reduce visibility of solar development in many locations within Alamogordo, but where open views existed from the housing units closest to the SEZ, the SEZ would occupy most of the horizontal field of view. Because the vertical angle of view to the SEZ from the roadway would be very low, expected contrast levels would be heavily dependent on the presence and number of power tower and other tall solar facility components in the SEZ close to the roadway. However, moderate visual contrasts would be expected for some locations within Alamogordo, with strong visual contrasts likely within a few miles of the SEZ, after U.S. 70 splits off from U.S. 54.

As discussed above, contrast levels would peak at strong levels as U.S. 70 passed through the SEZ southwest of Alamogordo. About 12 mi (19 km) southwest of the White Sands National Monument Visitor Center, impact levels would drop off, as westbound travelers on U.S. 70 would pass the SEZ, and view frequency and duration would begin to decrease rapidly.

In summary, approximately 62 mi (100 km) of U.S. 70 are within the SEZ 25-mi (40-km) viewshed, nearly all of which is within the 24.6-ft (7.5-m) SEZ viewshed. Solar facilities could be in view for about 55 minutes total viewing time at highway speeds for travelers on U.S. 70, but for most travelers, view duration would be much briefer. Eastbound travelers on U.S. 70 would see a gradual buildup of visual contrasts from solar facilities in the SEZ as they crossed the Tularosa Valley from southwest to northeast, while westbound travelers would see contrasts build up more quickly as they approached the SEZ from the north. Travelers in both directions could see strong contrasts from solar development within the SEZ as U.S. 70 passed through the SEZ south of Alamogordo.

U.S. 54. U.S. 54, a four-lane divided highway, runs in a north–south direction through the Tularosa Valley in the SEZ viewshed, from Tularosa to just north of the unincorporated community of Orogrande. The AADT value for U.S. 54 in the vicinity of the SEZ ranges from about 6,500 vehicles south of Alamogordo to 14,000 vehicles where U.S. 54 and U.S. 70 are together, between Alamogordo and Tularosa (NM DOT 2009).

As shown in Figure 12.3.14.2-2, about 57 mi (92 km) of U.S. 54 is within the SEZ viewshed, and solar facilities within the SEZ could be in full view from some portions of U.S. 54 as travelers approached from both directions. U.S. 54 is within the SEZ 7.5-m (24.6-ft) viewshed for 53 mi (85 km). This distance would equate to about 45 minutes total viewing time at highway speeds.

Southbound travelers on U.S. 54 could first see solar facilities within the SEZ north of the community of Tularosa, about 8.4 mi (13.5 km) north of where U.S. 54 joins U.S. 70 in Tularosa, and about 24 mi (39 km) straight north of the SEZ. Visual contrasts from solar facilities within the SEZ for this stretch of U.S. 54 are described above (see impact discussion for U.S. 70).

After passing through Alamogordo, U.S. 54 roughly parallels but gradually very closely approaches the eastern boundary of the SEZ. Figure 12.3.14.2-13 is a Google Earth perspective visualization of the SEZ as seen from U.S. 54 at Boles Acres just south of 2nd Street, approximately 2.5 mi (4.0 km) east of the SEZ, facing southwest toward a power tower model 3.1 mi (5.1 km) southwest of the viewpoint. Other power towers are visible to the south. The visualization suggests that, from this location, solar facilities within the SEZ would be in full view. The SEZ would occupy more than the entire field of view, so travelers would have to turn their heads to scan across the full SEZ. Facilities located within the closest portions of the SEZ would strongly attract visual attention. From this viewpoint, solar collector/reflector arrays would be seen nearly edge-on and would repeat the horizontal line of the plain in which the SEZ is situated; this would tend to reduce visual line contrast. Ancillary facilities, such as buildings, transmission towers, and cooling towers, and plumes, if present, would likely be visible projecting above the collector/reflector arrays. Their forms, lines, and colors, as well as their reflective properties, could add to visual contrasts with the strongly horizontal arrays and surrounding landscape.

If operating power towers were located in nearby portions of the SEZ, they would likely appear as very bright cylindrical or other shape light sources atop plainly discernable tower structures. They would likely strongly attract visual attention, and if tall enough to require hazard navigation lighting, could be conspicuous from this viewpoint at night.

Views of the San Andres Mountains across the Tularosa Valley could be partially screened by solar facilities, depending on the types and layouts of solar facilities within the SEZ. Because of the potentially short distance from solar facilities to U.S. 54, strong visual contrasts could be observed from this viewpoint, depending on solar project numbers, characteristics, and locations within the SEZ.

FIGURE 12.3.14.2-13 Google Earth Visualization of the Proposed Red Sands SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from U.S. 54 at Boles Acres

For travelers on U.S. 54, visual contrast levels would peak in a 7-mi (11-km) stretch of the road starting about 10 mi (16 km) south of the junction of U.S. 54 and U.S. 70, where U.S. 54 closely approaches and then abuts the SEZ. Figure 12.3.14.2-14 is a Google Earth perspective visualization of the SEZ as seen from the perspective of a northbound traveler on U.S. 54 almost 14 mi (23 km) south of the U.S. 54–U.S. 70 junction, immediately adjacent to the SEZ. The view faces northwest toward a power tower model 1.0 mi (5.1 km) from the viewpoint. Other power towers are visible to the north. The visualization suggests that from this viewpoint, solar collector/reflector arrays would be seen nearly edge-on and would repeat the horizontal line of the plain in which the SEZ is situated; this would tend to reduce visual line contrast, but for the closest facilities, the collector/reflector arrays would likely appear large enough that they would no longer be seen as horizontal lines against the natural-appearing backdrop. Their strong regular geometry and structural details would likely be discernable.

Ancillary facilities, such as buildings, transmission towers, and cooling towers, and plumes, if present, would likely be visible projecting above the collector/reflector arrays. Their forms, lines, and colors, as well as their reflective properties, could add to visual contrasts with the strongly horizontal arrays and surrounding landscape.

If operating power towers were located in nearby portions of the SEZ, they would likely appear as brilliant white cylindrical or other shape light sources atop plainly discernable tower structures. They would likely strongly attract visual attention, and would be expected to dominate views from the roadway. At night, if more than 200 ft (61 m) tall, power towers would have navigation warning lights that could be very conspicuous from the roadway. Other lighting associated with solar facilities would likely be visible as well.

As travelers approach and pass through the SEZ, depending on the solar technologies present, facility layout, and mitigation measures employed, there would be the potential for substantial levels of reflections from facility components, which could cause visual discomfort for travelers and be distracting to drivers. These potential impacts could be reduced by siting reflective components away from the roadway, employing various screening mechanisms, and/or adjusting the mirror operations to reduce potential impacts. However, because of their height, the receivers of power towers located close to the roadway could be difficult to screen.

Views of the San Andres Mountains across the valley could be partially screened by solar facilities, depending on the layout of solar facilities within the SEZ. Because of the potentially very short distance of solar facilities from U.S. 54, strong visual contrasts could result, depending on solar project characteristics and location within the SEZ.

Travelers heading north on U.S. 54 would in general be subjected to the same types of visual contrasts as southbound travelers, but the order would be reversed, and this could change the perceived impact levels. Northbound travelers on U.S. 54 would approach the SEZ across a largely uninhabited landscape, relatively free of cultural distances, while southbound travelers would approach the SEZ through several communities and a much more visually cluttered landscape. Northbound travelers on U.S. 54 might therefore perceive higher levels of impact associated with the greater contrast levels they would see between the SEZ and the surrounding landscape than southbound travelers.

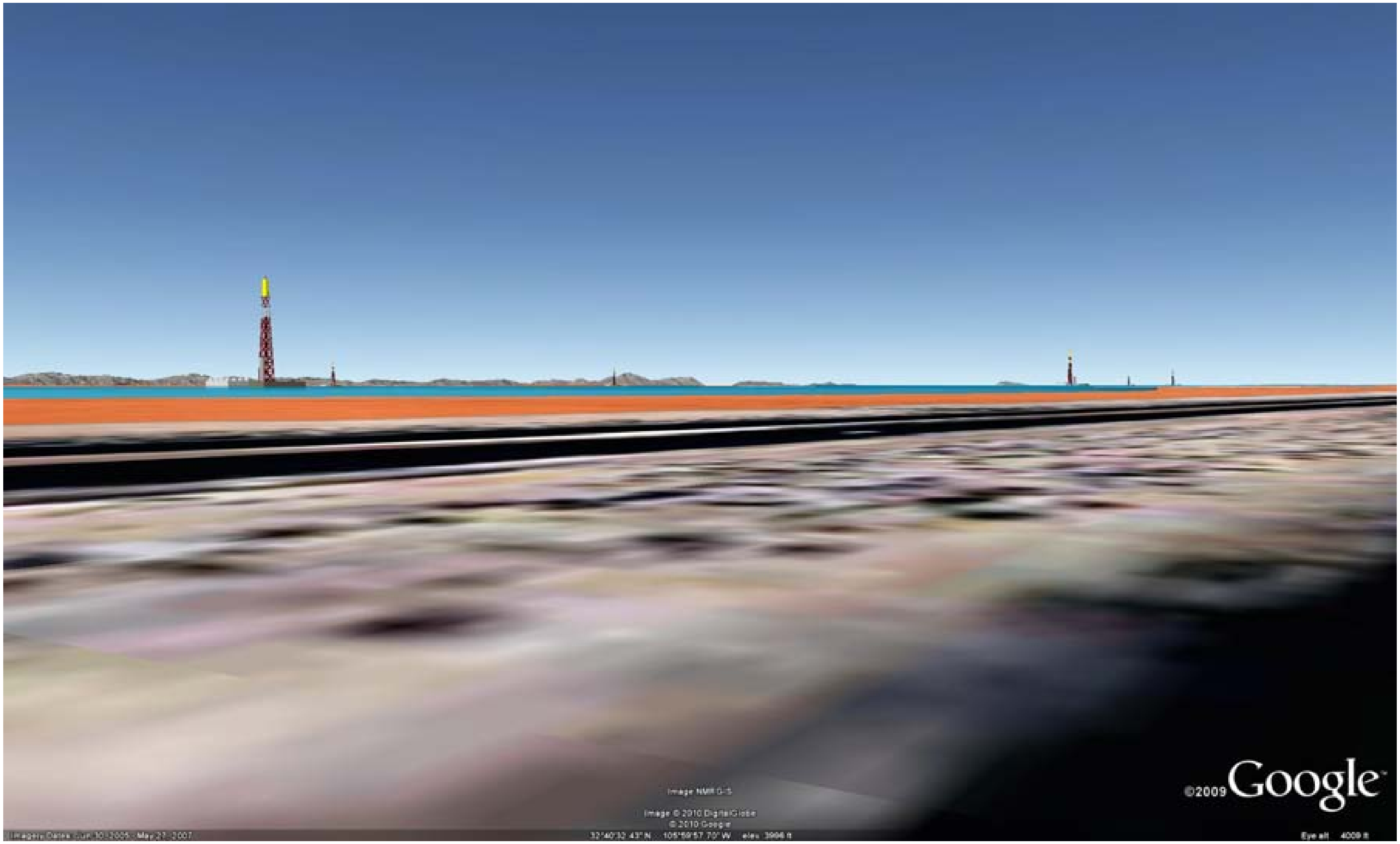


FIGURE 12.3.14.2-14 Google Earth Visualization of the Proposed Red Sands SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from U.S. 54 Adjacent to the SEZ Boundary

In summary, approximately 57 mi (92 km) of U.S. 54 are within the SEZ 25-mi (40-km) viewshed. Solar facilities could be in view for about 45 minutes total viewing time at highway speeds for travelers on U.S. 54, but for most travelers, view duration would be much briefer. Travelers on U.S. 54 would see a gradual buildup of visual contrasts from solar facilities in the SEZ as they approached the SEZ from either direction. Travelers in both directions could see strong contrasts from solar development within the SEZ where U.S. 54 borders the proposed SEZ south of Boles Acres.

Communities of Alamogordo, Boles Acres, La Luz, and Tularosa. The viewshed analyses indicate potential visibility of solar facilities within the SEZ from the communities of Tularosa, La Luz, Alamogordo, Boles Acres, and Valmont. All of these communities are located in the Tularosa Valley.

Note that screening by small undulations in topography, vegetation, buildings, or other structures would likely restrict or eliminate visibility of the SEZ and associated solar facilities from many locations within these communities, but detailed future site-specific NEPA analysis is required to determine visibility precisely. However, note that even with existing screening, solar power towers, cooling towers, plumes, transmission lines and towers, or other tall structures associated with the development could potentially be tall enough to exceed the height of screening in some areas and cause visual impacts on these communities.

Alamogordo is located approximately 4.8 mi (7.7 km) from the nearest point in the SEZ; however, some subdivisions are as close as 2.2 mi (3.5 km). Screening by structures and vegetation would reduce visibility of solar development in many locations within Alamogordo, but where open views existed from housing units closest to the SEZ, the SEZ would occupy most of the horizontal field of view.

Figure 12.3.14.2-15 is a Google Earth visualization of the SEZ (highlighted in orange) as seen from the closest subdivision to the SEZ in or near Alamogordo, near the intersection of Airport Road and Post Avenue. The viewpoint is at the point of closest approach from the Alamogordo urban area to the SEZ, 2.2 mi (3.5 km). The viewpoint is about 60 ft (18 m) higher in elevation than the SEZ. The closest power tower model in the visualization is 3.2 mi (5.2 km) from this viewpoint.

The visualization suggests that from this short distance to the SEZ, the SEZ would be too large to be encompassed in one view, and viewers would need to turn their heads to scan across the whole visible portion of the SEZ. The vertical angle of view to the SEZ is low enough that collector/reflector arrays for solar facilities within the SEZ would be seen nearly edge-on. The low-angle view would reduce their apparent size, conceal their strong regular geometry, and make them appear to repeat the strong horizon line, reducing apparent visual contrast. Ancillary facilities, such as buildings, STGs, cooling towers, transmission facilities, and plumes (if present) would likely be visible projecting over the tops of collector/reflector arrays in the nearer portions of the SEZ, and their forms, lines, colors, and potential reflectivity could contrast with the strong horizontal lines of collector/reflector arrays, as well as the surrounding landscape.

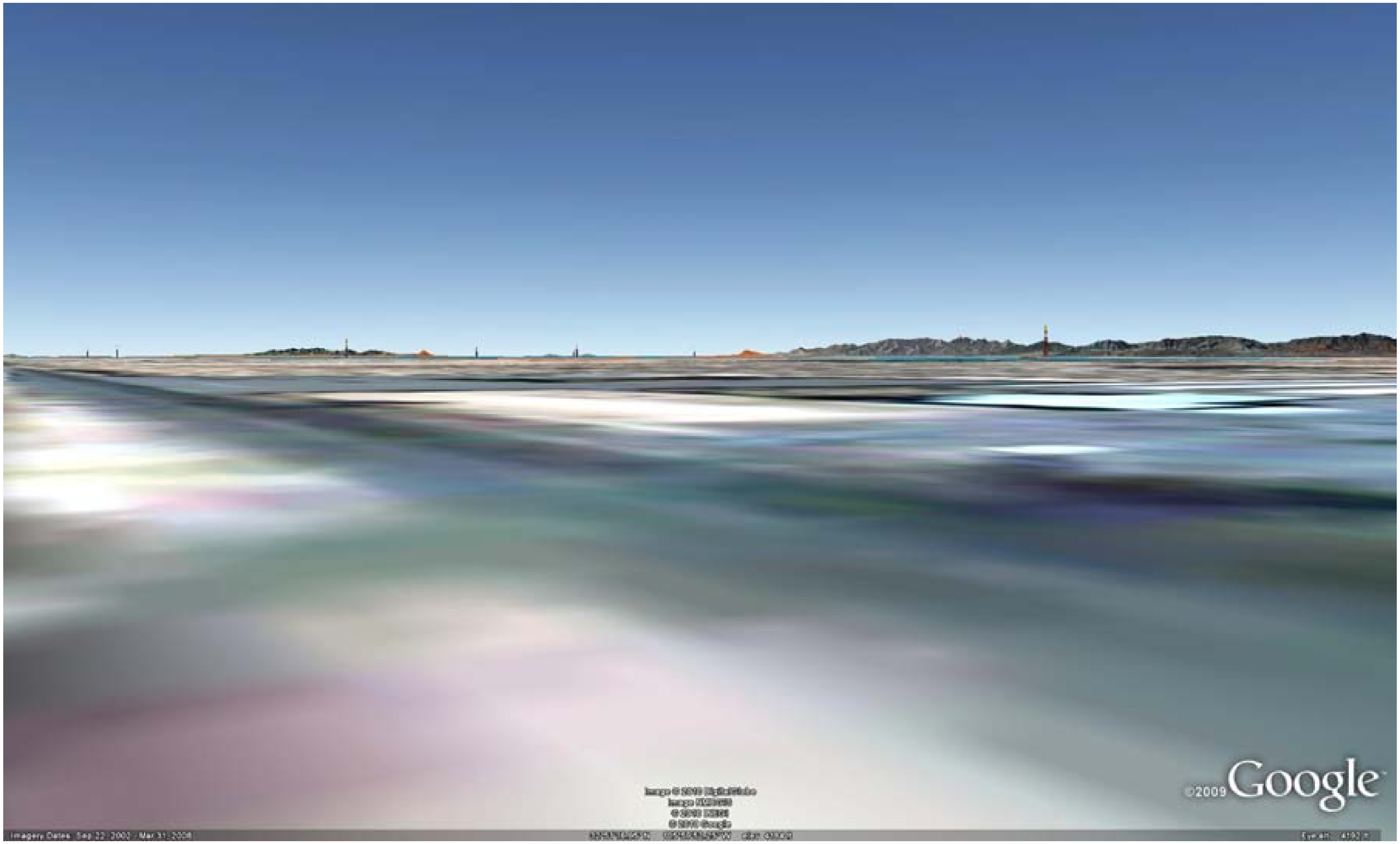


FIGURE 12.3.14.2-15 Google Earth Visualization of the Proposed Red Sands SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from Subdivision in Alamogordo

Operating power towers within the SEZ would be visible from this location. If power towers were located in the closest portion of the SEZ, they could appear as brilliant cylindrical white lights or lights of other shape atop easily discernable tower structures, and would strongly command visual attention. If sufficiently tall, the towers could have red flashing lights at night, or white or red flashing strobe lights that would likely be conspicuous, though there would be many other lights visible in this area. Other lighting associated with solar facilities could be visible as well.

Visual contrasts associated with solar energy development within the SEZ would depend on solar facility type, size, and location within the SEZ, as well as other visibility factors. Under the 80% development scenario analyzed in this PEIS, strong levels of visual contrast would be expected for views from this location.

Because of the very short distance to the SEZ, under the 80% development scenario analyzed in the PEIS, strong visual contrasts from solar facilities within the SEZ would be expected for those parts of Alamogordo closest to the SEZ. Moderate contrast levels would be expected for locations farther north in Alamogordo that would have unobstructed views of solar facilities within the SEZ.

Boles Acres is located approximately 1.9 mi (3.1 km) east from the nearest point in the SEZ, and is elevated about 40 ft (12 m) with respect to the SEZ. Where open views toward the SEZ existed in Boles Acres, the SEZ would be too large to be encompassed in one view, and viewers would need to turn their heads to scan across the whole visible portion of the SEZ. Because of the very short distance to the SEZ, under the 80% development scenario analyzed in the PEIS, strong visual contrasts from solar facilities within the SEZ would be expected. See Figure 12.3.14.2-13 (under U.S. 54 impact discussion above) for a view of the SEZ from U.S. 54 at Boles Acres.

La Luz is located approximately 11 mi (18 km) from the nearest point in the SEZ, and is elevated about 650 ft (200 m) with respect to the SEZ. Where open views toward the SEZ existed in La Luz, the SEZ would occupy a moderate portion of the horizontal field of view. Because of the relatively long distance, the angle of view to the SEZ would be low, decreasing contrasts associated with solar facilities. Under the 80% development scenario analyzed in the PEIS, weak visual contrasts from solar facilities within the SEZ would be expected.

Tularosa is located approximately 16 mi (26 km) from the nearest point in the SEZ, and is elevated about 350 ft (110 m) with respect to the SEZ. Where open views toward the SEZ existed in Tularosa, the SEZ would occupy a small portion of the horizontal field of view. Because of the long distance to the SEZ, the vertical angle of view to the SEZ would be very low, decreasing contrasts associated with solar facilities. Under the 80% development scenario analyzed in the PEIS, weak visual contrasts from solar facilities within the SEZ would be expected.

Other Impacts. In addition to the impacts described for the resource areas above, nearby residents and visitors to the area may experience visual impacts from solar energy facilities located within the SEZ (as well as any associated access roads and transmission lines) from their residences, or as they travel area roads, including but not limited to U.S. 70 and U.S. 54, as noted above. The range of impacts experienced would be highly dependent on viewer location, project types, locations, sizes, and layouts, as well as the presence of screening, but under the 80% development scenario analyzed in the PEIS, from some locations, strong visual contrasts from solar development within the SEZ could potentially be observed.

12.3.14.2.3 Summary of Visual Resource Impacts for the Proposed Red Sands SEZ

Under the 80% development scenario analyzed in the PEIS, the SEZ would contain multiple solar facilities utilizing differing solar technologies, as well as a variety of roads and ancillary facilities. The array of facilities could create a visually complex landscape that would contrast strongly with the strongly horizontal landscape of the flat valley in which the SEZ is located. Large visual impacts on the SEZ and surrounding lands within the SEZ viewshed would be associated with solar energy development within the Red Sands SEZ because of major modification of the character of the existing landscape. There is the potential for additional impacts from construction and operation of transmission lines and access roads within the SEZ.

The SEZ is in an area of moderate scenic quality; however, it is within the viewshed of a number of sensitive visual resource areas, including wilderness study area, a national monument, and a BLM-designated scenic ACEC. With the exception of the Sacramento Escarpment ACEC, these areas are insufficiently elevated with respect to the SEZ to afford commanding views of solar facilities within the SEZ; however, a number of the sensitive areas are close enough to the nearly 23,000-acre (93-km^2) SEZ that solar facilities in the SEZ could stretch across much of the field of view from many viewpoints within these areas, potentially creating panoramic views of solar facilities across the landscape. As a result, a number of these sensitive resource areas could be subjected to moderate to strong visual contrasts from solar facilities within the SEZ.

Furthermore, because the northern and eastern sides of the SEZ are very close to Alamogordo and Boles Acres, solar facilities in those portions of the SEZ would be in full or partial view of those communities, as well as U.S. 70 and U.S. 54, which are the major highways in the area. These communities and major roads within the Tularosa Valley could be subjected to moderate to strong visual contrasts from solar development within the SEZ.

Under the 80% development scenario analyzed in the PEIS, the following sensitive visual resource areas would be expected to be subjected to strong visual contrast levels from solar facilities within the Red Sands SEZ:

- White Sands National Monument;

- Culp Canyon WSA; and

- Sacramento Escarpment ACEC.

The following selected visually sensitive other lands and resources could be subjected to strong contrast levels from solar facilities within the Red Sands SEZ:

- Lone Butte;

- U.S. 70; and

- U.S. 54.

The following selected communities in the Mesilla Valley could be subjected to strong contrast levels from solar facilities within the Red Sands SEZ:

- Alamogordo and

- Boles Acres.

In addition, visitors to the area, workers, and residents may be subjected to minimal to strong visual contrasts from solar energy facilities located within the SEZ (as well as any associated access roads and transmission lines) as they travel area roads.

12.3.14.3 SEZ-Specific Design Features and Design Feature Effectiveness

The presence and operation of large-scale solar energy facilities and equipment would introduce major visual changes into nonindustrialized landscapes and could create strong visual contrasts in line, form, color, and texture that could not easily be substantially mitigated. Implementation of programmatic design features intended to reduce visual impacts (described in Appendix A, Section A.2.2, of this PEIS) would be expected to reduce visual impacts associated with utility-scale solar energy development within the SEZ; however, the degree of effectiveness of these design features could be assessed only at the site- and project-specific level. Given the large scale, reflective surfaces, strong regular geometry of utility-scale solar energy facilities, and the lack of screening vegetation and landforms within the SEZ viewshed, siting the facilities away from sensitive visual resource areas and other sensitive viewing areas is the primary means of mitigating visual impacts. The effectiveness of other visual impact mitigation measures would generally be limited.

While the applicability and appropriateness of some measures would depend on site- and project-specific information that would only be available after a specific solar energy project had been proposed, there is an SEZ-specific design feature that can be identified for the Red Sands SEZ at this time:

- The development of power tower facilities within the SEZ should be prohibited.

Application of the SEZ-specific design feature above would substantially reduce visual impacts associated with solar energy development within the SEZ, and also would substantially reduce potential visual impacts on White Sands National Monument and the Sacramento Escarpment ACEC by reducing the potential for solar facilities to be visible from the national monument and by reducing the obstruction of views of the Sacramento Escarpment from the national monument and nearby areas. The measure would also reduce impacts on the communities within the Tularosa Valley by limiting impacts visible within these communities and on local roads, where potential visual impacts would be greatest because of the number of viewers and duration of views.

This design feature would substantially reduce impacts on the following sensitive visual resource areas:

- White Sands National Monument;
- Culp Canyon WSA;
- Sacramento Escarpment ACEC;
- Lone Butte;
- U.S. 70;
- U.S. 54;
- Community of Alamogordo; and
- Community of Boles Acres.

12.3.15 Acoustic Environment

12.3.15.1 Affected Environment

The proposed Red Sands SEZ is located in the west-central portion of Otero County in south-central New Mexico. Neither the State of New Mexico nor Otero County has established quantitative noise-limit regulations applicable to solar energy development.

U.S. 70 extends northeast–southwest along the northernmost boundary of the Red Sands SEZ, while U.S. 54 passes north–south along the southeastern boundary of the SEZ. Improved road access to the SEZ is limited, but numerous dirt roads, mostly ranch roads, run through the SEZ. The nearest railroad passes north-south along U.S. 54. Nearby airports include Alamogordo White Sands Regional Airport and Holloman Air Force Base, which are about 2 mi (3 km) east and west of the northern tip of the SEZ, respectively. Another airport is the Condron Army Air Field, about 26 mi (42 km) southwest of the SEZ. No major industrial activities occur around the SEZ, but transmission line and pipeline facilities, as well as facilities for livestock operations exist within the SEZ. Little sign of recreational use is evident in the SEZ, but small game hunting may occur there. Areas north and east of the SEZ are somewhat developed, with Boles Acres, Alamogordo, and Holloman Air Force Base located there. To the west, the SEZ borders White Sands Missile Range (WSMR), a major Department of Defense range and test facility. No sensitive receptor locations (e.g., hospitals, schools, or nursing homes) exist close to the proposed Red Sands SEZ. The nearest residence (apparently a ranch) is adjacent to the east-central SEZ boundary about 0.3 mi (0.5 km) west of U.S. 54. Many small and large population centers occur along U.S. 54 and 70 to the east and the north, including Boles Acres, Alamogordo, and Holloman Air Force Base.

The proposed Red Sands SEZ is mostly undeveloped, but because of the proximity to developed areas, the overall character of the area is considered rural to industrial. Noise sources around the SEZ include road traffic, railroad traffic, commercial/military aircraft flyover, grazing livestock, the WSMR, and community activities and events. Background noise levels in the most areas of the SEZ would be relatively high, considering the many kinds of noise sources around the SEZ. Noise surveys have been made associated with current activities at the WSMR, but to date, no environmental noise survey has been conducted around the proposed Red Sands SEZ. On the basis of the population density, the day-night average noise level (L_{dn} or DNL) is estimated to be 32 dBA for Otero County, the low end of the background noise level typical of a rural area (33 to 47 dBA L_{dn}) (Eldred 1982; Miller 2002).[12]

[12] Rural and undeveloped areas have sound levels in the range of 33 to 47 dBA as L_{dn} (Eldred 1982). Typically, nighttime levels are 10 dBA lower than daytime levels, and they can be interpreted as 33 to 47 dBA (mean 40 dBA) during daytime hours and 23 to 37 dBA (mean 30 dBA) during nighttime hours.

12.3.15.2 Impacts

Noise impacts associated with solar projects in the Red Sands SEZ could occur during all project phases. During the construction phase, potential noise impacts would be anticipated (albeit of short duration) at the nearest residence (just next to the east-central SEZ boundary) from operation of heavy equipment and vehicular traffic. During the operations phase, potential impacts also would be expected at nearby residences; the nature and magnitude of those impacts would depend on the solar technologies employed. Noise impacts shared by all solar technologies are discussed in detail in Section 5.13.1, and technology-specific impacts are presented in Section 5.13.2. Impacts specific to the proposed Red Sands SEZ are presented in this section. Any such impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2, and through any additional SEZ-specific design features applied (see Section 12.3.15.3 below). This section primarily addresses potential noise impacts on humans, although potential impacts on wildlife at nearby sensitive areas are discussed. Additional discussion on potential noise impacts on wildlife is presented in Section 5.10.2.

12.3.15.2.1 Construction

The proposed Red Sands SEZ has a relatively flat terrain; thus, minimal site preparation activities would be required, and associated noise levels would be lower than those during general construction (e.g., erecting building structures and installing equipment, piping, and electrical).

For the parabolic trough and power tower technologies, the highest construction noise levels would occur at the power block area, where key components (e.g., steam turbine/ generator) needed to generate electricity would be located. A maximum of 95 dBA at a distance of 50 ft (15 m) is assumed, if impact equipment such as pile drivers or rock drills is not being used. Typically, the power block area is located in the center of the solar facility, at a distance of more than 0.5 mi (0.8 km) from the facility boundary. Noise levels from construction of the solar array would be lower than 95 dBA. When geometric spreading and ground effects are considered, as explained in Section 4.13.1, noise levels would attenuate to about 40 dBA at a distance of 1.2 mi (1.9 km) from the power block area. This noise level is typical of daytime mean rural background levels. In addition, mid- and high-frequency noise from construction activities is significantly attenuated by atmospheric absorption under the low-humidity conditions typical of an arid desert environment and by temperature lapse conditions typical of daytime hours. Therefore, noise attenuation to a 40-dBA level would occur at distances somewhat shorter than 1.2 mi (1.9 km). If a 10-hour daytime work schedule is considered, the EPA guideline level of 55 dBA L_{dn} for residential areas (EPA 1974) would occur about 1,200 ft (370 m) from the power block area, which would be well within the facility boundary. For construction activities occurring near the closest residence of the east-central SEZ boundary, estimated noise levels at the nearest residences would be about 74 dBA,[13] which is well above the typical daytime mean rural background level of 40 dBA. In addition, an estimated 70-dBA L_{dn}[14] at this residence is well above the EPA guidance of 55 dBA L_{dn} for residential areas.

It is assumed that a maximum of two projects would be developed at any one time for SEZs greater than 10,000 acres (40.5 km^2) but less than 30,000 acres (121.4 km^2), such as the Red Sands SEZ. If two projects were to be built in the eastern portion of the SEZ near the closest residence, noise levels would be slightly higher than the above-mentioned values, lower than a just-noticeable increase of about 3 dBA over a single project.

In addition, noise impact analysis is considered at the specially designated areas within a 5-mi (8-km) range of the Red Sands SEZ, which is the farthest distance that noise, except extremely loud noise, would be discernable. There are two specially designated areas within the range where noise might be an issue: White Sands National Monument, which is about 4.1 mi (6.6 km) northwest of the SEZ; and Sacramento Mountains, which is about 4.7 mi (7.6 km) east of the SEZ. Considering the distances from the SEZ, construction noise from the SEZ is not likely to adversely affect wildlife or visitors in these specially designated areas (Manci et al. 1988), as discussed in Section 5.10.2. Thus, noise impacts for nearby specially designated areas were not modeled.

Depending on soil conditions, pile driving might be required for installation of solar dish engines. However, the pile drivers used, such as vibratory or sonic drivers, would be relatively small and quiet in contrast to the impulsive impact pile drivers frequently used at large-scale construction sites. Potential impacts on the nearest residence would be anticipated to be negligible, except when pile driving would occur near the residence (next to the east-central SEZ boundary).

It is assumed that most construction activities would occur during the day, when noise is better tolerated, than at night because of the masking effects of background noise. In addition, construction activities for a utility-scale facility are temporary in nature (typically a few years). Construction within the proposed Red Sands SEZ would cause some unavoidable but localized, short-term noise impacts on neighboring communities, even when construction activities would occur near the eastern SEZ boundary, close to the nearby residences.

Construction activities could result in various degrees of ground vibration, depending on the equipment and construction methods used. All construction equipment causes ground vibration to some degree, but activities that typically generate the most severe vibrations are high-explosive detonations and impact pile driving. As is the case for noise, vibration would diminish in strength with distance. For example, vibration levels at receptors beyond 140 ft (43 m) from a large bulldozer (87 VdB at 25 ft [7.6 m]) would diminish below the threshold of

[13] Typically, the heavy equipment operators would not allow public access any closer than 330 ft (100 m) for safety reasons. In other words, construction of solar facilities would not occur within this distance from the nearest residence.

[14] For this analysis, background levels of 40 and 30 dBA for daytime and nighttime hours, respectively, are assumed, which result in a day-night average noise level (L_{dn}) of 40 dBA.

perception for humans, which is about 65 VdB (Hanson et al. 2006). During the construction phase, no major construction equipment that can cause ground vibration would be used, and no residences or sensitive structures are located in close proximity. Therefore, no adverse vibration impacts are anticipated from construction activities, except when pile driving would occur close to the nearest residence.

For this analysis, the impacts of construction and operation of transmission lines outside of the SEZ were not assessed, assuming that an existing regional 115-kV transmission line might be used to connect some new solar facilities to load centers, and that additional project-specific analysis would be done for new transmission construction or line upgrades. However, some construction of transmission lines could occur within the SEZ. Potential noise impacts on nearby residences would be a minor component of construction impacts in comparison with solar facility construction and would be temporary in nature.

12.3.15.2.2 Operations

Noise sources common to all or most types of solar technologies include equipment motion from solar tracking; maintenance and repair activities (e.g., washing mirrors or replacing broken mirrors) at the solar array area; commuter/visitor/support/delivery traffic within and around the solar facility; and noises from control/administrative buildings, warehouses, and other auxiliary buildings/structures. Diesel-fired emergency power generators and firewater pump engines would be additional sources of noise, but their operations would be limited to several hours per month (for preventive maintenance and testing).

With respect to the main solar energy technologies, noise-generating activities in the PV solar array area would be minimal, related mainly to solar tracking, if used. On the other hand, dish engine technology, which employs collector and converter devices in a single unit, generally has the strongest noise sources.

For the parabolic trough and power tower technologies, most noise sources during operations would be in the power block area; sources would include the turbine generator (typically in an enclosure), pumps, boilers, and dry- or wet-cooling systems. The power block is typically located in the center of the facility. For a 250-MW parabolic trough facility with a cooling tower (Beacon Solar, LLC 2008), simple noise modeling indicates that noise levels would be more than 85 dBA around the power block, but about 51 dBA at the facility boundary, about 0.5 mi (0.8 km) from the power block area. For a facility located near the east-central SEZ boundary, the predicted noise level would be about 51 dBA at the nearest residence, just next to the SEZ boundary. That noise level is higher than the typical daytime mean rural background level of 40 dBA. If TES were not used (i.e., if the operation were limited to daytime, 12 hours only[15]), the EPA guideline level of 55 dBA (as L_{dn} for residential areas) would occur at about 1,370 ft (420 m) from the power block area and thus would not be exceeded outside of the proposed SEZ boundary. At the nearest residence, about 49 dBA L_{dn} would be estimated, which is below the EPA guideline of 55 dBA L_{dn} for residential areas. As for construction, if two

[15] Maximum possible operating hours at the summer solstice, but limited to 7 to 8 hours at the winter solstice.

parabolic trough and/or power tower facilities were operating close to the nearest residence, combined noise levels would be slightly higher than the above-mentioned values, lower than a just-noticeable increase of about 3 dBA over a single facility. However, day-night average noise levels higher than those estimated above by using simple noise modeling would be anticipated if TES were used during nighttime hours, as explained below and in Section 4.13.1.

On a calm, clear night typical of the proposed Red Sands SEZ setting, the air temperature would likely increase with height (temperature inversion) because of strong radiative cooling. Such a temperature profile tends to focus noise downward toward the ground. There would be little, if any, shadow zone[16] within 1 or 2 mi (1.6 or 3 km) of the noise source in the presence of a strong temperature inversion (Beranek 1988). In particular, such conditions add to the effect of noise being more discernable during nighttime hours, when the background noise levels are lowest. To estimate the day-night average noise level (L_{dn}), 6-hour nighttime generation with TES is assumed after 12-hour daytime generation. For nighttime hours under temperature inversion, 10 dB is added to noise levels estimated for the uniform atmosphere (see Section 4.13.1). On the basis of these assumptions, the estimated nighttime noise level at the nearest residence (just next to the SEZ boundary and about 0.5 mi [0.8 km] from the power block area for a solar facility) would be 61 dBA, which is well above the typical nighttime mean rural background level of 30 dBA. The day-night average noise level is estimated to be about 63 dBA L_{dn}, which is above the EPA guideline of 55 dBA L_{dn} for residential areas. The assumptions are conservative in terms of operating hours, and no credit was given to other attenuation mechanisms, so it is likely that noise levels would be lower than 63 dBA L_{dn} at the nearest residence, even if TES were used at a solar facility. As for construction, if two parabolic trough and/or power tower facilities were operating close to the nearest residence, combined noise levels would be slightly higher than the above-mentioned values, lower than a just-noticeable increase of about 3 dBA over a single facility. Consequently, operating parabolic trough or power tower facilities using TES and located near the SEZ boundary could result in adverse noise impacts on the nearest residence. In the permitting process, refined noise propagation modeling would be warranted along with measurement of current background noise levels.

The solar dish engine is unique among CSP technologies because it generates electricity directly and does not require a power block. A single, large solar dish engine has relatively low noise levels, but a solar facility might employ tens of thousands of dish engines, which would cause high noise levels around such a facility. For example, the proposed 750-MW SES Solar Two dish engine facility in California would employ as many as 30,000 dish engines (SES Solar Two, LLC 2008). At the proposed Red Sands SEZ, on the basis of the assumption of dish engine facilities of up to 2,002-MW total capacity (covering 80% of the total area, or 18,016 acres [72.9 km^2]), up to 80,070 25-kW dish engines could be employed. For a large dish engine facility, over a thousand step-up transformers would be embedded in the dish engine solar field, along with a substation; however, the noise from these sources would be masked by dish engine noise.

The composite noise level of a single dish engine would be about 88 dBA at a distance of 3 ft (0.9 m) (SES Solar Two, LLC 2008). This noise level would be attenuated to about 40 dBA

[16] A shadow zone is defined as the region in which direct sound does not penetrate because of upward diffraction.

(typical of the mean rural daytime environment) within 330 ft (100 m). However, the combined noise level from tens of thousands of dish engines operating simultaneously would be high in the immediate vicinity of the facility, for example, about 51 dBA at 1.0 mi (1.6 km) and 47 dBA at 2 mi (3 km) from the boundary of the square-shaped dish engine solar field. Both of these values are higher than the typical daytime mean rural background level of 40 dBA. However, these levels would occur at somewhat shorter distances than the aforementioned distances, considering noise attenuation by atmospheric absorption and temperature lapse during daytime hours. To estimate noise levels at the nearest residences, it was assumed that dish engines were placed all over the Red Sands SEZ at intervals of 98 ft (30 m). Under this assumption, the estimated noise level at the nearest residence, just next to the east-central SEZ boundary, would be about 58 dBA, which is well above the typical daytime mean rural background level of 40 dBA. On the basis of 12-hour daytime operation, the estimated 55 dBA L_{dn} at this residence is equivalent to the EPA guideline of 55 dBA L_{dn} for residential areas. Considering other noise attenuation mechanisms, noise levels at the nearest residence would be lower than the values estimated above. Noise from dish engines could cause adverse impacts on the nearby residences, depending on background noise levels and meteorological conditions. Thus, consideration of minimizing noise impacts is very important during the siting of dish engine facilities. Direct mitigation of dish engine noise through noise control engineering could also limit noise impacts.

During operations, no major ground-vibrating equipment would be used. In addition, no sensitive structures are located close enough to the proposed Red Sands SEZ to experience physical damage. Therefore, during operation of any solar facility, potential vibration impacts on surrounding communities and vibration-sensitive structures would be negligible.

Transformer-generated humming noise and switchyard impulsive noises would be generated during the operation of solar facilities. These noise sources would be located near the power block area, typically near the center of a solar facility. Noise from these sources would generally be limited within the facility boundary and not be heard at the nearest residence, assuming a 0.5-mi (0.8-km) distance to the facility boundary and to the nearest residence). Accordingly, potential impacts of these noise sources on the nearest residences would be minimal.

For impacts from transmission line corona discharge noise during rainfall events (discussed in Section 5.13.1.5), the noise levels at 50 ft (15 m) and 300 ft (91 m) from the center of 230-kV transmission line towers would be about 39 and 31 dBA (Lee et al. 1996), respectively, typical of daytime and nighttime mean background noise levels in rural environments. Corona noise includes high-frequency components, considered to be more annoying than low-frequency environmental noise. However, corona noise would not likely cause impacts unless a residence was located close to it (e.g., within 500 ft [152 m] of a 230-kV transmission line). The proposed Red Sands SEZ is located in an arid desert environment, and incidents of corona discharge are infrequent. Therefore, potential impacts on nearby residences from corona noise along transmission lines within the SEZ would be negligible.

12.3.15.2.3 Decommissioning/Reclamation

Decommissioning/reclamation requires many of the same procedures and equipment used in traditional construction. Decommissioning/reclamation activities would include dismantling of solar facilities and support facilities, such as buildings/structures and mechanical/electrical installations; disposal of debris; grading; and revegetation, as needed. Activities for decommissioning would be similar to those for construction but more limited. Potential noise impacts on surrounding communities would be correspondingly lower than those for construction activities. Decommissioning activities would be of short duration, and their potential impacts would be minor, except moderate for activities occurring near the residences, and temporary in nature. The same mitigation measures adopted during the construction phase could also be implemented during the decommissioning phase.

Similarly, potential vibration impacts on surrounding communities and vibration-sensitive structures during decommissioning of any solar facility would be lower than those during construction and thus negligible.

12.3.15.3 SEZ-Specific Design Features and Design Feature Effectiveness

The implementation of required programmatic design features described in Appendix A, Section A.2.2, would greatly reduce or eliminate the potential for noise impacts from development and operation of solar energy facilities. While some SEZ-specific design features are best established when specific project details are being considered, measures that can be identified at this time include the following:

- Noise levels from cooling systems equipped with TES should be managed so that levels at the nearest residences to the northern or eastern SEZ boundary are kept within applicable guidelines. This could be accomplished in several ways, for example, through placing the power block approximately 1 to 2 mi (1.6 to 3 km) or more from residences, limiting operations to a few hours after sunset, and/or installing fan silencers.

- Dish engine facilities within the Red Sands SEZ should be located more than 1 to 2 mi (1.6 to 3 km) from the nearby residences (i.e., the facilities should be located in the western or southern portion of the proposed SEZ). Direct noise control measures applied to individual dish engine systems could also be used to reduce noise impacts at nearby residences.

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12.3.16 Paleontological Resources

12.3.16.1 Affected Environment

The proposed Red Sands SEZ is composed primarily of a variety of Quaternary deposits less than 10,000 years old. The largest portion of the SEZ (10,119 acres [41 km^2], or 45%) consists of lacustrine and playa lake deposits (Qpl on geologic maps) in the center of the SEZ. These deposits are classified as PFYC Class 1 (on the basis of PFYC GIS data from the New Mexico State BLM Office [Hester 2009]). The north and east sections of the SEZ (8,348 acres [34 km^2], or 37%) are composed of Upper Middle Quaternary piedmont alluvial deposits (Qp) and are also classified as PFYC Class 1. The southwestern portion of the SEZ (3,893 acres [16 km^2], or 17%) is predominantly landslide deposits and colluvium (Qe/Qpl) with a PFYC of Class 2. The potential for fossil material in these deposits depends on the rock unit that has been displaced by the landslide. A small, 81-acre (0.3-km^2), parcel in the western portion of the SEZ composed of the Yeso Formation (Py), consisting of a depositional environment that is less likely to contain vertebrates, is also PFYC 2. Another small, 79-acre (0.3-km^2) parcel of intrusive igneous rocks (Tli) within the SEZ is unlikely to preserve fossil material and has been classified as PFYC Class 1.

A review of known localities of paleontological resources within New Mexico from the New Mexico State BLM Office indicated no known localities within the proposed Red Sands SEZ, or within 5 mi (8 km) of the SEZ. One locality about 6 mi (10 km) west of the SEZ contains a number of shark teeth (Ptychodus) in the Mancos Shale Formation. Additional paleontological localities in the vicinity are to the east in the Sacramento Mountains and to the south in the Jarilla Mountains.

12.3.16.2 Impacts

On the basis of the PFYC classification for this area, there is a low potential for impacts on significant paleontological resources in the proposed Red Sands SEZ. A more detailed look at the geological deposits of the SEZ and their depth is needed to verify the initial classification of the areas as PFYC 1 and 2. Further assessment of paleontological resources is not likely to be necessary; however, important resources could exist; and if identified, they would need to be managed on a case-by-case basis. Section 5.14 discusses the types of impacts that could occur if significant paleontological resources were found within the Red Sands SEZ. Impacts would be minimized through the implementation of required programmatic design features described in Appendix A, Section A.2.2.

Indirect impacts on paleontological resources outside of the SEZ, such as through looting or vandalism, are unknown but unlikely because any such resources would be below the surface and not readily accessed. Programmatic design features for controlling water runoff and sedimentation would prevent erosion-related impacts on buried deposits outside of the SEZ.

No new off-site access roads or transmission line ROWs are anticipated for the proposed Red Sands SEZ, assuming existing corridors would be used; thus no impacts on paleontological resources are anticipated from the creation of new access pathways. However, impacts on paleontological resources related to the creation of new corridors not assessed in this PEIS would be evaluated at the project-specific level if new road or transmission construction or line upgrades are to occur.

12.3.16.3 SEZ-Specific Design Features and Design Feature Effectiveness

Impacts would be minimized through the implementation of required programmatic design features as described in Appendix A, Section A.2.2.

The need for and the nature of any SEZ-specific design features would depend on the results of future paleontological investigations; however, based on the current level of information, a need for mitigation of PFYC Class 1 and 2 areas is not anticipated.

12.3.17 Cultural Resources

12.3.17.1 Affected Environment

12.3.17.1.1 Prehistory

The proposed Red Sands SEZ is located in the Tularosa Basin, in the northern portion of the Chihuahua Desert, within the basin and range province of south-central New Mexico. The earliest known use of the area was during the Paleoindian Period, sometime between 14,000 and 12,000 B.P. Usually associated with big game hunting, the people of this period are thought to have relied on hunting large migrating mammal species, such as *Bison antiquus*, that have since become extinct. Paleoindian sites are rare in southern New Mexico, and tend to be associated with dune fields or the margins of playas or *ciengas* (small, shallow wetlands). Stone tools in the possession of local private collectors indicate a full range of Paleoindian exploitation of the area. However, surveys of the area conducted by professional archaeologists have yielded few Paleoindian sites. Finds of Paleoindian projectile points, such as the fluted Folsom and Clovis points, are primarily isolated finds or are associated with multi-component sites. Within the vicinity of the proposed Red Sands SEZ, Paleoindian sites have been documented in the Tularosa Basin, and near Lake Lucero, 14 mi (23 km) west of the SEZ. It is likely that during Paleoindian times, the proposed Red Sands SEZ supported grasslands that would have been attractive to the large migrating mammals that were hunted by the Paleoindians (Kirkpatrick et al. 2001; Katz and Katz 1994).

The Archaic Period began around 9,000 B.P. and extended until about 1,800 B.P., and is sometimes referred to as the Cochise Culture or the Chihuahua Tradition (MacNeish and Beckett 1987). Sites dating to this period reflect a reliance on a broader subsistence base, with groups hunting a larger variety of small game, and utilizing a broader range of plant resources. A pattern emerges of base camps and widely scattered special use sites for gathering, hunting, processing, and manufacturing tools is indicative of a highly mobile lifeway. The number of recorded Archaic sites increases over time, as settlements become more permanent and population tends to aggregate in villages during the Late Archaic. During the Late Archaic as groups became more sedentary, evidence of agriculture and pottery become prevalent in the archaeological record. Sites in the Archaic Period are often associated with sand dunes, stands of mesquite, shallow playas, and rock outcrops. Features associated with Archaic Period sites include shallow pits, hearths, fire-cracked rock, and burned caliche. The Archaic archaeological assemblage also includes grinding stones, reflecting the increased use of plant resources, and stone projectile points, usually associated with *atlatl* darts. While not present at the proposed Red Sands SEZ, contemporary cave sites in south-central New Mexico have yielded basketry, cordage, sandals, fur, feathers, wood, stone artifacts, and early maize (BLM 1993). The area in and around the proposed Red Sands SEZ was likely suitable for Archaic Period groups, and camp sites or special use sites are likely to be present here (Kirkpatrick et al. 2001). Archaic period sites have been reported from adjacent areas of the White Sands Missile Range (WSMR 1998) and the McGregor Range (BLM 2005).

The Mogollon Culture is characteristic of the south-central New Mexico region during the Formative Period, which lasted from 1,800 to 550 B.P. The proposed Red Sands SEZ lies close to the boundary between the Mimbres Mogollon variant, the settlements of which were centered in the well-watered montane regions, and the Jornada Mogollon variant, which were more adapted to the desert. Mimbres influences can be seen in the region, but the proposed Red Sands SEZ is probably within the western reach of the Jornada culture. The major difference between the two Mogollon variants is in ceramics; the Mimbres developed a distinctive black-on-white pottery, while the Jornada made brown-ware-style pottery. Sedentism among the Jornada developed later than among the Mimbres; however, the aggregation of populations in villages increased throughout the Formative Period in both groups. The early or Mesilla phase of the Jornada (1,400 to 900 B.P.) continued the Archaic traditions of seed harvesting and processing, and hunting and gathering. Mesilla Phase pithouses are found in the arroyos leading to the Rio Grande. Typical sites consist of lithic scatters, brown-ware ceramics, and fire-cracked rock or burned caliche. Temporary camps continue to be located near playas and dune ridges. The proposed Red Sands SEZ is likely to have been exploited only intermittently during this time to harvest specific resources (Kirkpatrick et al. 2001).

The Dona Ana or Transitional Pueblo Phase of the Jornada Mogollon (900 to 800 B.P.) sees the shift from pithouse architecture to above ground pueblo structures and an associated change in subsistence and settlement patterns. Distinctions between this phase and the subsequent El Paso Phase are not always evident from surface materials. Pit structures disappear by the El Paso Phase (800 to 550 B.P.), when sites shift to adobe pueblos and primary residences located near rivers, or on valley bluffs. In general, there are fewer, but larger, pueblos built with room blocks around plazas that include ceremonial structures. There are fewer procurement sites, but hunting and gathering sites continue to be present in dune locations. Mimbres characteristics disappear by this phase and there is broad homogeneity with Arizona pueblos. It is likely that the proposed Red Sands SEZ was devoid of pueblos, which would have been located on arable land closer to the Rio Grande, and this area continued to be used as an area for hunting and gathering. Most of the pueblos were abandoned by 1400, with complete abandonment by 1450 (Kirkpatrick et al. 2001).

The reason for abandonment of the pueblos is not known. The larger population centers were forgone in favor of a highly mobile lifestyle based on hunting and gathering, with some limited agriculture as practiced by the southern Athabaskan-speaking Apache, who arrived in southern New Mexico by 1500. These and other ethnohistoric groups of the area are discussed in greater detail in the following section (Section 12.3.17.2).

12.3.17.1.2 Ethnohistory

The proposed Red Sands SEZ is located in the Tularosa Basin between the Sacramento and San Andres Mountains. Both of these ranges and the valley in between them fall into the traditional use area of the Mescalero Apache (Castetter and Opler 1936; Opler 1983b; Ball 2000), and may have been known to the neighboring Piro and Manso (Griffen 1983; Schroeder 1979).

Mescalero Apache

Traditionally, the Mescalero Apache were hunters and gatherers based in the mountains of southern New Mexico east of the Rio Grande, west Texas and northern Mexico. They were divided into two bands: the Edge of the Mountains People, located in the vicinity of the Sacramento and Sierra Blanca mountain ranges, and the Plains People, located father east, but they were culturally uniform throughout. Traditionally, they had no overarching political structure. They lived in matrilineal kin-based groups headed by charismatic leaders. Their home bases were chosen for defensibility; closeness to water, fuel, and forage; and access to a wide range of food sources. Although based in the mountains, they would range seasonally into lowland plains and valleys in search of buffalo and lowland plants, and to trade and raid. They were on good terms with their western neighbors, the Chiricahua Apache, but sometimes came into conflict with the plains tribes to the east, and were culturally influenced by their Pueblo neighbors to the north (Castetter and Opler 1936; Opler 1983b; Tweedie 1968).

As befitted their mobile lifestyle, Mescalero material culture was simple and light. Characteristic mountain dwellings or wickiups were dome-shaped structures covered with grass thatching, hides, or bark. When on the plains, skin tepees were transported by a simple travois. Pitch-covered woven jars served to hold water, and twined burden baskets were used when harvesting wild foods, along with coiled basketry winnowing trays and stone manos and metates. Implements for hunting and warfare included bows, arrows, slings, flint knives, clubs, and buckskin. Rope and cordage was woven from plant fiber (Castetter and Opler 1936; Opler 1983b; Sonnichsen 1973).

Like other southern Athapaskan speakers, the Mescalero Apache migrated to the Southwest from what is now Canada, arriving in the southwest before 1500. Dubbed Mescalero by the Spanish for their reliance on agave, or mescal, as a food source, their traditional use area remained constant from the earliest Spanish record of them in the seventeenth century through the third quarter of the nineteenth century. From their mountain retreats, they raided and harried Spanish colonists, turning the area east of the Rio Grande between El Paso and Socorro into the Jornada del Muerto, the "day's journey of the dead." They sided with the Pueblos in the revolt of 1680. Their presence in the area prevented colonization of the area throughout the eighteenth century, despite Spanish military expeditions into the Sacramento, Guadalupe, and Organ Mountains. Initially, the Spanish government recognized no Indian title to their lands, but they entered into a treaty with the Mescalero in 1810, granting them rations and the right to occupy sizable lands in Chihuahua and in New Mexico from El Paso to the Sacramento Mountains. The Mescalero took the side of the insurgents when Texas revolted against Mexico, and favored the Americans in their war with Mexico; however, this goodwill towards Americans was not to last (Opler 1983b).

Like the Spanish, the incoming Americans recognized no Indian land claims. At first, the American presence in New Mexico was small, but with the construction of good military roads, the discovery of mineral wealth in the west, and the tendency of troops mustered out of the Army after the war with Mexico to remain in the southwest, the American presence began to grow and conflicts with the Apache, who felt the loss of their lands and the plants and game that they relied on, increased. In the 1860s, 500 Mescaleros were confined at Bosque Redondo near

Fort Sumner on the Pecos River. With the addition of 9,000 Navajo, the population of the reserve far exceeded its carrying capacity. In November of 1865, all but nine of the Mescalero returned to their former lands. In 1873, a reservation was created by executive order for the Mescalero within their traditional use area. It included the eastern slopes of the White and Sacramento Mountains, and was briefly shared with the Jicarilla Apache. This reservation confined the Mescalero to the mountains, barring them from the lowlands during the winter. The boundaries of the reservation have been adjusted over the years to accommodate mining and other interests. Despite various attempts to disband the reservation, in 1922 Congress confirmed Indian title to the lands. Today, in addition to Mescalero descendants, the reservation includes descendants of Lipan Apache, driven from Mexico in 1903, and descendants of Chiricahua Apache freed from prisoner-of-war status in 1913. The three groups have blended over the years. They were granted the right to vote in 1948 and have developed cattle, timber, and recreation industries on the reservation (Opler 1983b).

Manso

The proposed SEZ also lies in the traditional range associated with the Manso. The Spanish first encountered the Manso, sometimes called Manso Apache, near present-day El Paso. They called them *manso*, tame or peaceful, because of their initial peaceful encounter. Little is known of their affiliation, but they may have been Apache allies (Griffen 1983; Opler 1983a). The Manso form one element of the Tigua community of Tortugas in Las Cruces, New Mexico, associated with the Pueblo of Ysleta del Sur in El Paso (Houser 1979).

Piro

The Piro are possible descendants of the Jornada Mogollon. When first encountered by Coronado in 1540, Piro pueblos stretched along the banks of the Rio Grande from Mogollon Gulch to the Rio Solado. They were farmers, employing both irrigation and rainfall agriculture. They grew the traditional maize, beans, and squash, along with cotton. Bison and turkey meat supplied protein. Their numbers appear to have declined in the ensuing century and by 1670 they were reduced to four pueblos. Left out of the conspiracy, they retreated south with the Spanish during the Pueblo Revolt of 1680. Many Piros remained in the south and have joined with Ysleta del Sur or the Tortugas community in Las Cruces (Schroeder 1979).

12.3.17.1.3 History

Spanish colonists arrived at the Rio Grande near El Paso de Norte in 1598 under the leadership of Don Juan de Oñate, and eventually continued northward along the river to Socorro, establishing a capital at the Tewa village of Ohke, more than 200 mi (320 km) north of the SEZ. Spanish settlement in New Mexico remained centered well north of the proposed Red Sands SEZ, and a new capital was established at Santa Fe in 1607. El Camino Real de Tierra Adentro (the Royal Road of the Interior), which passes about 43 mi (69 km) west of the proposed Red Sands SEZ, connected the capital with Chihuahua City and New Spain, generally following trails located just east of the Rio Grande that had been in use since prehistoric times. Every 10 to 15 mi (16 to 24 km) along this congressionally designated National Historic Trail, *parajes*, or campsites, were placed; however, because of the natural meandering of the river and agricultural development of the bottom lands, few of these campsites currently survive. The region between El Paso de Norte and Socorro remained unsettled by non-Native Americans, at least partly due to Apache hostility. This situation began to change with Mexican independence from Spanish colonial rule in 1821. Thereafter, Mexican farmers began to expand along the Rio Grande from El Paso, with the towns of Las Cruces and Dona Ana founded in the 1840s. The new border drawn between Mexico and the United States as a result of the Treaty of Guadalupe Hidalgo, which ended the Mexican-American War in 1848, left the town of Dona Ana in the United States. Those wishing to stay in the area but remain in Mexico developed the *parajes* of Mesilla into a settlement (NPS and BLM 2004).

The United States acquired most of what is now New Mexico by conquest in the Mexican-American War. In 1851, the United States established a military outpost at Fort Fillmore, near Mesilla, over 40 mi (64 km) west of the proposed Red Sands SEZ, to protect both American and Mexican settlers from Apache raids. However, even after the Treaty of Guadalupe Hidalgo was signed, the boundary between Mexico and New Mexico west of the Rio Grande remained in dispute. The conflict was resolved in 1853 as part of the Gadsden Purchase, when the United States purchased land from Mexico suitable for the construction of a continental railroad over a snow-free route. While the railroad did not materialize until the 1880s, beginning in 1858 the Butterfield Overland Mail provided stage service over a route similar to that of the railroad, about 45 mi (72 km) south of the SEZ.

With the establishment of an American military presence, settlement in south-central New Mexico steadily increased, along with ranching, homesteading, and mining. With the arrival of the railroad exploiting the southern transcontinental route and a series of wetter than normal years, significant growth in the ranching industry in the region occurred. The Southern Pacific Railroad, constructed by the Southern Pacific Company, built a spur that is adjacent to the eastern boundary of the SEZ. The town of Alamogordo, just 5 mi (8 km) north of the SEZ, was developed as a railroad junction in 1898, connecting a nearby mountain lumber railroad to this railroad. By World War II, ranching was in decline, and consequently, the government began purchasing large tracts of land for military testing and training. The White Sands Missile Range and the Fort Bliss McGregor Range are located less than a mile (1.6 km) to the east and west respectively, of the SEZ. The Trinity Site, the site of the first nuclear detonation, is located in the northern portion of the White Sands Missile Range, about 85 mi (137 km) north of the SEZ. Another military installation, Holloman Air Force Base, is situated less than a mile (1.6 km) northwest of the proposed Red Sands SEZ.

12.3.17.1.4 Traditional Cultural Properties—Landscape

While no specific features within the proposed Red Sands SEZ have been identified as culturally important by Native Americans, the Mescalero regard all mountains within their traditional range as sacred, and four specific mountains representative of the four directions are thought particularly sacred (Ball 2000). The San Andres Mountains 21 mi (33.5 km) west of the

SEZ and the Sacramento Mountains 7 mi (11.5 km) east of the proposed SEZ are known to have been traditional home bases for Mescalero Apache groups (Castettler and Opler 1936; Opler 1983b) and are likely to retain cultural importance. In general, mountains are seen as the homes of the Mountain People or Mountain Spirits who shield the Mescalero from disease and invasion. Because of the biodiversity found on their slopes, mountains have always played a dominant role in the Mescalero food quest. Some mountains are known as "medicine mountains" because of the diversity of medicinal plants to be found there. In general, the higher up in the mountains the plant is obtained, the more medicinally potent it is thought to be (Ball 2000).

White Mountain, 39 mi (63 km) north–northeast of the proposed SEZ, is a medicine mountain considered to be the heart of Mescalero territory and one of four sacred mountains that protect the Mescalero homeland. The others are the Guadalupe Mountains, 63 mi (101 km) southeast of the SEZ, the Three Sisters, to the west, and the Oscura Mountains, 60 mi (96.5 km) north–northwest of the SEZ (Ball 2000). Other peaks regarded as sacred are Salinas Peak, the highest peak in the San Andres Mountains and located 41 mi (67 km) to the northwest, and Capitan Peak, located in the Capitan Mountains, 62 mi (101 km) to the northeast. *Tsedažai,* rocks south of San Augustine Pass in the Organ Mountains, 28 mi (46 km) southwest of the proposed SEZ is a sacred place where the drumming of the Mountain People can be heard (Basehart 1960).

From the Mescalero perspective, the universe is suffused with supernatural power that individuals may acquire for healing, success in hunting, or other purposes. The power is made available through personified natural features and phenomena such as plants, animals, wind, lightning, or celestial bodies. This power, and its associated ceremony, is often acquired at its sacred home, usually in a cave in a sacred mountain (Opler 1983b; Ball 2000). Ancient artifacts may also be important. Stone projectile points found in the landscape were traditionally seen as the result of arrows sent by the Lightning People during thunderstorms (Opler 1983b).

12.3.17.1.5 Cultural Surveys and Known Archaeological and Historical Resources

The proposed Red Sands SEZ encompasses 22,520 acres (91 km^2), 1,494 acres (6 km^2) of which have been surveyed, covering about 7% of the total SEZ area. These surveys have resulted in the recording of 18 sites in the SEZ, at least five of which are prehistoric in nature (Hewitt 2009a; Fallis 2010). Four of these prehistoric sites are located in the southwestern portion of the proposed Red Sands SEZ. The four prehistoric sites include an artifact scatter with nine fire-cracked rock (FCR) features and an unmodified rock concentration, a ceramic and lithic scatter with three FCR features, a ceramic and lithic scatter with eight associated features, and a lithic scatter with 16 associated features. The other prehistoric site is located in the northeastern portion of the SEZ and is a ceramic and lithic scatter. Currently, the available information does not provide the eligibility status of these sites for their inclusion in the NRHP. The results of archaeological surveys in the proposed Red Sands SEZ suggest that dune and dune-blowout areas are among the most likely to yield archaeological remains, including artifacts from the earliest periods. The Lone Butte area has been identified as an area with important archeological resources where OHVs are restricted to existing roads and trails in order to protect cultural remains (BLM 1986c).

Within 5 mi (8 km) of the proposed Red Sands SEZ, about 11% of the surrounding area has been surveyed for cultural resources, with 21,504 acres (87 km^2) resulting in the recording of 849 sites within this buffer (Fallis 2010). Of these 849 sites, 490 are prehistoric in nature, consisting of 208 sites with structural remains. Seventy-six historic sites have been documented in the 5 mi (8 km) buffer surrounding the SEZ, of which 57 sites contain structural remains. There are 29 multi-component sites, 24 of which are structural in nature. The remaining 254 sites are of an unknown temporal range, although it is known that 97 consist of structural remains. As with the sites in the proposed Red Sands SEZ, the available information does not provide eligibility status for inclusion in the NRHP.

The BLM has designated several ACECs in the vicinity of the proposed Red Sands SEZ, as these resources have been determined to have valuable cultural resources that are in need of protection by the BLM; however, none of the cultural ACECs are located within 25 mi (40 km) of the SEZ. The nearest ACECs to the proposed SEZ with cultural values are the Organ/Franklin Mountain ACEC, 28 mi (45 km) southwest of the SEZ, designated to protect the biological, scenic, cultural, special status species, riparian, and recreational values associated with the ACEC area, and the Three Rivers Petroglyph ACEC, about 34 mi (55 km) north of the SEZ, designated to protect the cultural resources located there.

In the vicinity of the proposed Red Sands SEZ are several known cultural properties, the largest being the White Sands Missile Range, adjacent to the western and southern portions of the SEZ. Holloman Air Force Base is located to the northeast of the SEZ, and to the southeast of the SEZ is the Fort Bliss McGregor Range. Also adjacent to the eastern portion of the SEZ is the White Sands National Monument. Along portions of the eastern boundary of the proposed Red Sands SEZ is the historic, but still operational, Southern Pacific Railroad. The Kitt Peak National Observatory, commissioned in 1962, and the National Solar Observatory are located in the Sacramento Mountains, about 12 mi (19 km) to the east of the proposed Red Sands SEZ.

National Register of Historic Places

No properties listed in the NRHP are in the SEZ or located within 5 mi (8 km) of the SEZ. However, there are five sites in the SEZ that have been field-determined to be eligible for inclusion in the NRHP according to data provided by the BLM (Hewitt 2009a).

There are 28 properties in Otero County that are listed in the NRHP. The closest property to the SEZ is the White Sands Historic District, 6 mi (10 km) west. The town of Alamogordo, 6 mi (10 km) north of the SEZ, maintains seven properties in the NRHP. The town of La Luz, 11 mi (18 km) north of the SEZ, maintains five properties in the NRHP, and Cloudcroft, 20 mi (32 km) northeast of the SEZ, maintains four NRHP properties. These and other nearby NRHP properties within 25 mi (40 km) of the proposed SEZ are listed in Table 12.3.17.1-1. Launch Complex 33, a National Historic Landmark associated with the White Sands Missile Range, is located in Dona Ana County, 21 mi (34 km) to the southwest of the SEZ.

TABLE 12.3.17.1-1 National Register Properties within 25 mi (40 km) of the Red Sands SEZ in Otero and Dona Ana County

NRHP Site	Distance from SEZ
White Sands National Monument Historic District	6 mi (10 km)
U.S. Post Office-Alamogordo	6 mi (10 km)
Alamogordo Woman's Club	6 mi (10 km)
Jackson House	6 mi (10 km)
Auditorium and Recreation Building	6 mi (10 km)
Administration Building	6 mi (10 km)
Central Receiving Building	6 mi (10 km)
Infirmary Building	7 mi (11 km)
La Luz Historic District	11 mi (18 km)
Juan Garcia House	11 mi (18 km)
Queen Anne House	11 mi (18 km)
D.H. Sutherland House	11 mi (18 km)
La Luz Pottery Factory	12 mi (19 km)
Fresnal Shelter	Address Restricted
Tularosa Original Townsite District	16 mi (26 km)
Circle Cross Ranch Headquarters	17 mi (27 km)
Mexican Canyon Trestle	18 mi (29 km)
Hubble Canyon Log Chute	Address Restricted
Wills Canyon Spur Trestle	Address Restricted
Launch Complex 33	21 mi (34 km)

12.3.17.2 Impacts

Direct impacts on significant cultural resources could occur in the proposed Red Sands SEZ; however, further investigation is needed. A cultural resources survey of the entire area of potential effect (APE) of a proposed project, including consultation with affected Native American Tribes, would first need to be conducted to identify archaeological sites, historic structures and features, and traditional cultural properties, and an evaluation would need to follow to determine whether any are eligible for listing in the NRHP as historic properties. The proposed Red Sands SEZ has potential for containing significant cultural resources, especially in the dune and playa areas in the eastern portion of the SEZ. Section 5.15 discusses the types of effects that could occur on any significant cultural resources found to be present within the proposed Red Sands SEZ. Impacts would be minimized through the implementation of required programmatic design features as described in Appendix A, Section A.2.2. Programmatic design features assume that the necessary surveys, evaluations, and consultations will occur.

Visual impacts on several property types are possible within this SEZ. Several properties listed in the NRHP and a National Historic Landmark are within the 25-mi (40-km) viewshed distance from the SEZ. The Sacramento and San Andres ranges are also likely important to the Mescalero Apache (see Section 12.3.18) and could contain traditional cultural properties. Additional analysis on the visual effects of solar development on historic properties would be needed prior to any development. See Section 12.3.14 for an initial evaluation of visual effects.

Both El Camino Real de Tierra Adentro National Historic Trail and the Butterfield Trail are over 40 mi (64 km) from the proposed SEZ and would not be affected by solar development within this SEZ.

Additional dune areas with a high potential for sites are located adjacent to the SEZ. However, programmatic design features to reduce water runoff and sedimentation would reduce the likelihood of indirect impacts on cultural resources resulting from erosion outside the SEZ boundary (including ROWs).

No needs for new transmission lines or access corridors have currently been identified, assuming existing corridors would be used; therefore, no new areas of cultural concern would be made accessible as a result of development within the proposed Red Sands SEZ. Indirect impacts resulting from vandalism or theft of cultural resources is not anticipated related to new pathways, but could still occur along the facility boundary. Impacts on cultural resources related to the creation of new corridors not assessed in this PEIS would be evaluated at the project-specific level if new road or transmission construction or line upgrades are to occur.

12.3.17.3 SEZ-Specific Design Features and Design Feature Effectiveness

Programmatic design features to mitigate adverse effects on significant cultural resources, such as avoidance of significant sites and features and cultural awareness training for the workforce on the sensitivity of certain types of cultural resources, including resources of concern to Native Americans (see also Section 12.3.18), but also possible properties of significance to the Hispanic population in this area, are provided in Appendix A, Section A.2.2.

SEZ-specific design features would be determined in consultation with the New Mexico SHPO and affected Tribes and would depend on the results of future cultural investigations.

See Section 12.3.14.3 for recommended design features for reducing visual impacts on the White Sands National Monument. Similar design features can be used if other NRHP properties and their visual settings are determined to be adversely affected by solar development in the proposed SEZ. The Launch Complex 33 National Historic Landmark would not likely require additional mitigation. The following is an SEZ-specific design feature for historic properties:

- Coordination with White Sands National Monument and local historical societies is encouraged.

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12.3.18 Native American Concerns

Native Americans tend to view their environment holistically, and share environmental and socioeconomic concerns with other ethnic groups. For a discussion of issues of possible Native American concern shared with the population as a whole, several sections in this PEIS should be consulted. General topics of concern are addressed in Section 4.16. With regard to the proposed Red Sands SEZ, Section 12.3.17 discusses archaeological sites, structures, landscapes, and traditional cultural properties; Section 12.3.8 discusses mineral resources; Section 12.3.9.1.3 discusses water rights and water use; Section 12.3.10 discusses plant species; Section 12.3.11 discusses wildlife species; Section 12.3.13 discusses air quality; Section 12.3.14 discusses visual resources; and Sections 12.3.19 and 12.3.20 discuss socioeconomics and environmental justice, respectively. Issues of human health and safety are discussed in Section 5.21. This section focuses on concerns that are specific to Native Americans and to which Native Americans bring a distinct perspective.

All federally recognized Tribes with traditional ties to the proposed Red Sands SEZ have been contacted so that they could identify their concerns regarding solar energy development. The Tribes contacted who have traditional ties to the Red Sands SEZ are listed in Table 12.3.18-1. Appendix K lists all federally recognized Tribes contacted for this PEIS.

12.3.18.1 Affected Environment

The proposed Red Sands SEZ lies within the traditional range of the mountain-dwelling groups of the Mescalero Apache or "earth crevice people" (Opler 1983b). Neighboring groups such as the Chiricahua Apache, Manso, and Piro, may have been familiar with the area as well. The Indian Claims Commission included the area in the judicially established Mescalero Apache traditional territory (Royster 2008).

TABLE 12.3.18-1 Federally Recognized Tribes with Traditional Ties to the Proposed Red Sands SEZ

Tribe	Location	State
Fort Sill Apache Tribe of Oklahoma	Apache	Oklahoma
Jicarilla Apache Nation	Dulce	New Mexico
Mescalero Apache Tribe	Mescalero	New Mexico
San Carlos Apache Tribe	San Carlos	Arizona
White Mountain Apache Tribe	Whiteriver	Arizona
Ysleta del Sur Pueblo	El Paso	Texas

12.3.18.1.1 Territorial Boundaries

Mescalero Apache

The traditional territory of the Mescalero Apache encompassed southeastern New Mexico, southwestern Texas, and parts of the adjacent Mexican states of Chihuahua and Coahuila. In New Mexico, their range stretched eastward from the Rio Grande as far north as Socorro to the modern Texas border and beyond, although their base camps were located primarily west of the Pecos River. While the San Andres, Sacramento, and Guadalupe mountain ranges formed the core of their territory, hunting bison and trading with and raiding neighboring Tribes and Spanish and Euro-American settlements took them eastward onto the plains, northward as far as Santa Fe, and southward into northern Mexico. Descendants are to be found primarily on the Mescalero Apache reservation in New Mexico (Opler 1983b; Castetter and Opler 1936; Tweedie 1968).

Manso

The Manso were a smaller group affiliated with the Jano and Jocome. Traditionally, they inhabited a strip of land along the modern southern border of New Mexico stretching from the valley of the Rio Grande westward to the Cedar Mountains (Griffen 1983). Manso descendants may be found among the members of the Ysleta del Sur Pueblo and in the Tortuga Community in Las Cruces (Houser 1979).

Piro

The Piro Pueblos were originally located along the Rio Grande from Mogollon Gulch north to the Rio Solado. They moved south with the Spanish during the Pueblo Revolt of 1680 and settled near El Paso. Today Piro descendants can be found in the Ysleta del Sur Pueblo and in the Tortuga Community (Houser 1979; Schroeder 1979).

12.3.18.1.2 Plant Resources

This section focuses on those Native American concerns that have an ecological as well as cultural component. For many Native Americans, the taking of game or the gathering of plants or other natural resources may have been seen as both a sacred and secular act (Stoffle et al. 1990).

The proposed Red Sands SEZ is located on relatively dry, level valley bottom, flanked by the two of the mountain ranges traditionally inhabited by the Mescalero. The Mescalero Apache were primarily hunters and gathers. As such, it is likely that the plant and animal resources to be found on the proposed SEZ would have been exploited by the Mescalero, particularly during the winter months, when the higher elevations would have been snowbound. Agave was a principal source of wild plant food. Gathered in the spring, its crowns were roasted to form mescal, which when sun-dried was storable for long periods of time. The foothills of the nearby Sacramento Mountains were a traditional source of mescal and stool (Basehart 1960) and continue to be an important source of the agave or mescal spring harvest (BLM 2005). Later in the year, the Mescalero also gathered mesquite pods, cactus fruit, and a variety of berries as they ripened (Opler 1983b; Castetter and Opler 1936). Little is known of the Manso before they joined the Ysleta. Certainly thereafter they would have engaged in irrigation agriculture supplemented by hunting and gathering, as was the case with the Piro (Houser 1979; Schroeder 1979). The proposed Red Sands SEZ supports plants that would have been attractive to the Apache groups in the adjacent mountains and Puebloan groups along the Rio Grande.

The plant communities observed or likely to be present at the proposed Red Sands SEZ are discussed in Section 12.3.10. As shown in SWReGAP, the proposed Red Sands SEZ supports a patchwork of plant cover types. Chihuahuan Stabilized Coppice Dune and Sand Flat Scrub dominate in the southwestern portion of the proposed SEZ and are found in patches throughout. In the north, there are areas of Chihuahuan Mixed Salt Desert Scrub, interspersed with patches of Apacherian-Chihuahuan Semi-desert Grassland and Scrub, Chihuahuan Creosotebush Mixed Desert and Thorn Scrub, North American Warm Desert Pavement, and Chichuahuan Gypsophilous Grassland and Steppe (USGS 2005b). While vegetation is sparse most of the year, seasonal rains often result in a florescence of ephemeral herbaceous species.

Past ethnobotanical studies have shown that the Mescalero Apache traditionally made use of over a hundred native plants (Castetter and Opler 1936; Castetter 1935). Table 12.3.18.1-1

TABLE 12.3.18.1-1 Plant Species Important to Native Americans Observed or Likely To Be Present in the Proposed Red Sands SEZ

Common Name	Scientific Name	Status
Agave (mescal)	*Agave* spp.	Possible
Buckwheat	*Eriogonum* spp.	Possible
Bunch grass	*Sporobolus airoides*	Possible
Grama grass	*Bouteloua* spp.	Possible
Honey mesquite	*Prosopis Glandolosa*	Observed
Muhly	*Muhlenbergia* spp.	Possible
Oak	*Quercus* spp.	Possible
Prickly pear cactus	*Opuntia* spp.	Possible
Sage	*Artemisia trifolia*	Possible
Screwbean mesquite	*Prosopis pubescens*	Possible
Snakeweed	*Gutierrezia* sp.	Possible
Sotol	*Dasylirion wheeleri*	Possible
Sumac	*Rhus microphylla*	Possible
Yucca	*Yucca* spp.	Observed

Sources: Field visit; Opler (1983b); Castetter and Opler (1936); USGS (2005b).

lists plants traditionally used by the Mescalero that were either observed at the proposed Red Sands SEZ or are probable members of the cover type plant communities identified for the SEZ. These plants are the dominant species; however, other plants important to Native Americans could occur in the SEZ, depending on local conditions and the season. Much of the proposed Red Sands SEZ is flat, open terrain supporting desert scrub including creosotebush and mesquite. Other areas support native grasses. Cacti and agave are possible. Mesquite was among the most important food plants; its long bean-like pods were harvested in the summer, could be stored, and were widely traded.

12.3.18.1.3 Other Resources

Water issues are often of concern to Tribes in the arid southwest. The proposed SEZ is located in the eastern Tularosa sub-basin, down gradient from the Mescalero Apache reservation, in the mountains 16 mi (26 km) to the northwest. The Sacramento and White mountains are relatively well watered and the Mescalero receive much of their water from the Tularosa River upstream of the SEZ (Opler 1983b). However, Tribes are usually concerned with the availability and quality of ground water.

Located in the midst of the mountainous terrain favored by the Apache, it is likely that the Tularosa Basin, where the proposed Red Sands SEZ is situated, was a seasonal hunting ground. While the Apache favored highland hunting, they also sought the resources of the lowlands. Highland animals, such as deer, elk (wapiti), and bighorn sheep, the principal Mescalero game animals, are found in the adjacent Sacramento Mountains (Basehart 1960). Deer were an important source of food and of bone, sinew, and hide used to make a variety of implements. Deer were especially sought after in the fall, when meat and hides were thought to be best. Both white-tail and mule deer can also be found on valley floors. The proposed SEZ is within the range of both white-tail deer and mule deer. In the lowlands, the Mescalero ranged onto the plains to hunt bison and also hunted antelope. While bison are absent in the SEZ, it is within the range of pronghorn antelope. While big game was highly prized by the Mescalero, smaller animals, such as desert cottontail, woodrats, and squirrels (all potentially present in the SEZ), traditionally also added protein to their diet. They also hunted mink, beaver, muskrat, and weasel for their pelts. Birds such as eagles, turkeys, and turkey buzzards were sought for their feathers (Opler 1983a,b; Castetter and Opler 1936; USGS 2005b). Wildlife likely to be found in the proposed Red Sands SEZ is described in Section 12.3.11. Native American game species whose ranges include the SEZ are listed in Table 12.3.18.1-2.

In other parts of the Southwest, Native Americans have expressed concern over ecological segmentation, that is, development that fragments animal habitat and does not provide corridors for movement. They would prefer solar energy development take place on land that has already been disturbed, such as abandoned farmland, rather than on undisturbed ground (Jackson 2009).

TABLE 12.3.18.1-2 Animal Species used by Native Americans whose Range Includes the Proposed Red Sands SEZ

Common Name	Scientific Name	Status
Bald eagle	*Haliaeetus leucocephalus*	Winter
Black-tailed prairie-dog	*Cynomys ludevicianus*	All year
Desert cottontail	*Silvilagus audubonii*	All year
Golden eagle	*Aquila chrysaetos*	Possible
Mountain lion	*Puma concolor*	Possible
Mule deer	*Odocoileus hemionus*	All year
Pronghorn antelope	*Antilocarpus Americana*	Possible
Southern plains woodrat	*Neotoma micropus*	All year
Ringtail cat	*Bassariscus astutus*	All year
Weasel	*Mustela frenata*	All year
White-tailed deer	*Odocoileus virginianus*	All year

Sources: Opler (1983b); Castetter and Opler (1936); Basehart 1960; USGS (2005b).

12.3.18.2 Impacts

To date, no comments have been received from the Tribes specifically referencing the proposed Red Sands SEZ. However, the Tribal Historic Preservation Officer (THPO) for the Ysleta del Sur Pueblo, in response to the 2008 notification of the impending PEIS, stated that the Ysleta did not believe that the solar energy PEIS would adversely affect traditional, religious, or cultural sites important to Ysleta Pueblo, but did request that Ysleta Pueblo be consulted if any burials or Native American Graves Protection and Repatriation Act (NAGPRA) artifacts were encountered during the development and operation of solar facilities (Loera 2010).

The impacts that would be expected from solar energy development within the proposed Red Sands SEZ on resources important to Native Americans fall into two major categories: impacts on the landscape and impacts on discrete localized resources.

Potential landscape-scale impacts are those caused by the presence of an industrial facility within a sacred or culturally important landscape that includes sacred mountains and other geophysical features often tied together by a network of trails. Impacts may be visual—the intrusion of an industrial feature in sacred space; audible—noise from the construction, operation or decommissioning of a facility detracting from the traditional cultural values of the site; or demographic—the presence of a larger number of outsiders in the area that would increase the chance that the cultural importance of the area would be degraded by more foot and motorized traffic. The proposed Red Sands SEZ is not remote, pristine wilderness. It is already adjacent to developed land. It is located 5 mi (8 km) southwest of the town of Alamogordo. It is adjacent to the Alamogordo White Sands Regional Airport, across the highway from Holloman Air Force Base and bordered by U.S. 70 and U.S. 54. White Sands National Monument, 6 mi (10 km) from the proposed SEZ, preserves the landscape, but it also draws tourists to the area. The southern portion of the proposed SEZ is flanked by the White Sands Missile Range and the Fort Bliss McGregor Range, which, while they preclude civilian activities, are locations of weapons testing. The construction, operation, and decommissioning of a utility-scale solar energy facility would add incrementally to an already developed area. However, as consultation with the affected Tribes continues and project-specific analyses are undertaken, it is possible that there will be Native American concerns expressed over potential visual effects of solar energy development within the proposed SEZ on the landscape of their traditional homeland.

Localized effects could occur both within the proposed SEZ and in adjacent areas. Within the SEZ these effects would include the destruction or degradation of plant resources, destroying the habitat of and impeding the movement of culturally important animal species, destroying archaeological sites and burials, and the degradation or destruction of trails. Plant resources traditionally important to Native Americans are likely to exist in the SEZ. Any ground-disturbing activity associated with the development within the SEZ has the potential for destruction of localized resources. However, significant areas of mesquite and associate plants important to Native Americans would remain outside the SEZ, and anticipated overall effects on these plant populations would be small. As noted above, animal species important to Native Americans are shown in Table 12.3.18.1-2. While the construction of utility-scale solar energy facilities would reduce the amount of habitat available to many of these species, similar habitat is abundant and the effect on animal populations is likewise likely to be small.

Since solar energy facilities cover large tracts of land, even taking into account the implementation of design features, it is unlikely that avoidance of all resources important to Native Americans would be possible. Programmatic design features (see Appendix A, Section A.2.2) assume that the necessary cultural surveys, site evaluations, and Tribal consultations will occur. To the extent that the Mescalero rely on groundwater or groundwater-fed springs, significant drawdown at the SEZ could have some effect. However, this is unlikely since all groundwater in the basin is already allotted (see Section 12.3.9.1.3). Implementation of programmatic design features as discussed in Appendix A, Section A.2.2, should eliminate impacts on Tribes' reserved water rights and potential for groundwater contamination.

12.3.18.3 SEZ-Specific Design Features and Design Feature Effectiveness

Programmatic design features to address impacts of potential concern to Native Americans, such as avoidance of sacred sites, water sources, and tribally important plant and animal species, are provided in Appendix A, Section A.2.2.

The need for and nature of SEZ-specific design features regarding potential issues of concern would be determined during government-to-government consultation with affected Tribes listed in Table 12.3.18-1.

Mitigation of impacts on archaeological sites and traditional cultural properties is discussed in Section 12.3.17.3, in addition to the mitigation strategies for historic properties discussed in Section 5.15.

12.3.19 Socioeconomics

12.3.19.1 Affected Environment

This section describes current socioeconomic conditions and local community services within the region of influence (ROI) surrounding the proposed Red Sands SEZ. The ROI is a three-county area consisting of Dona Ana and Otero Counties in New Mexico and El Paso County in Texas. It encompasses the area in which workers are expected to spend most of their salaries and in which a portion of site purchases and nonpayroll expenditures are expected to take place for the construction, operation, and decommissioning phases of solar development in the proposed SEZ.

12.3.19.1.1 ROI Employment

In 2008, total employment in the ROI was 390,895 workers (Table 12.3.19.1-1). Over the period 1999 to 2008, annual average employment growth rates were higher in Dona Ana County (2.7%) and Otero County (2.4%) than in El Paso County (0.7%). At 1.2%, growth rates in the ROI as a whole were somewhat less than the average state rates for New Mexico (1.5%) and Texas (1.3%).

In 2006, the service sector provided the highest percentage of employment in the ROI at 53.4%, followed by wholesale and retail trade with 20.3% (Table 12.3.19.1-2). Smaller employment shares were held by manufacturing (7.6%), transportation and public utilities

TABLE 12.3.19.1-1 ROI Employment in the Proposed Red Sands SEZ

Location	1999	2008	Average Annual Growth Rate, 1999–2008 (%)
Dona Ana County, New Mexico	65,546	85,934	2.7
Otero County, New Mexico	19,898	25,237	2.4
El Paso County, Texas	261,213	279,724	0.7
ROI	346,657	390,895	1.2
New Mexico	793,052	919,466	1.5
Texas	9,766,299	11,126,436	1.3

Sources: U.S. Department of Labor (2009a,b).

TABLE 12.3.19.1-2 ROI Employment in the Proposed Red Sands SEZ by Sector, 2006

	Dona Ana County		Otero County		El Paso County		ROI	
Industry	Employment	% of Total	Employment	% of Total	Employment	% of Total	Employment	% of Total
Agriculture[a]	5,042	9.8	564	4.5	1,038	0.5	6,644	2.5
Mining	175	0.3	60	0.5	375	0.2	610	0.2
Construction	4,798	9.3	1,253	9.9	8,856	4.4	14,907	5.6
Manufacturing	2,586	5.0	187	1.5	17,401	8.6	20,174	7.6
Transportation and public utilities	1,240	2.4	458	3.6	12,159	2.0	13,857	5.2
Wholesale and retail trade	8,957	17.3	2,599	20.3	42,676	21.1	54,192	20.3
Finance, insurance, and real estate	2,430	4.7	644	5.1	10,574	5.2	13,648	5.1
Services	26,497	51.3	6,902	54.6	108,952	53.8	142,351	53.4
Other	14	0.0	10	0.1	75	0.0	99	0.0
Total	51,658		12,632		202,368		266,658	

[a] Agricultural employment includes 2007 data for hired farmworkers.

Sources: U.S. Bureau of the Census (2009a); USDA (2009a,b).

(5.2%), and finance, insurance and real estate (5.1%). For the counties within the ROI, the distribution of employment across sectors was similar to that of the ROI as a whole, with a slightly higher percentage of employment in agriculture (12.6%) and construction (9.3%), and slightly lower percentages in manufacturing (5.0%) and wholesale and retail trade (17.3%) in Dona Ana County compared to the ROI as a whole. Employment shares in Otero County in agriculture (4.5%) and construction (9.9%) were larger than in the ROI as a whole, while employment in transportation and public utilities (3.6%), and manufacturing (1.5%) was less important than in the overall ROI.

12.3.19.1.2 ROI Unemployment

Unemployment rates have varied across the three counties in the ROI. Over the period 1999 to 2008, the average rate in El Paso County was 7.0%, with lower rates of 5.8% in Dona Ana County, and 5.0% in Otero County (Table 12.3.19.1-3). The average rate in the ROI over this period was 6.7%, higher than the average state-wide rates for New Mexico (5.0%) and Texas (5.3%). Unemployment rates for the first five months of 2009 contrasted somewhat with rates for 2008 as a whole; in El Paso County the unemployment rate increased to 8.2%, while rates reached 5.8% and 4.9% in Dona Ana County and Otero County, respectively. The average rates for the ROI (7.5%), New Mexico (5.6%), and Texas (6.6%) were also higher during this period than the corresponding average rates for 2008.

12.3.19.1.3 ROI Urban Population

The population of the ROI in 2008 was 81% urban; the largest city, El Paso, had an estimated 2008 population of 609,248; other cities in the ROI include Las Cruces (90,908), Alamogordo (35,979) and Socorro (32,056) (Table 12.3.19.1-4). In addition, eight smaller cities in the ROI had 2008 populations of less than 20,000.

TABLE 12.3.19.1-3 ROI Unemployment Rates (%) for the Proposed Red Sands SEZ

Location	1999–2008	2008	2009[a]
Dona Ana County, New Mexico	5.8	4.4	5.8
Otero County, New Mexico	5.0	4.1	4.9
El Paso County, Texas	7.0	6.3	8.2
ROI	6.7	5.7	7.5
New Mexico	5.0	4.2	5.6
Texas	5.3	4.9	6.6

[a] Rates for 2009 are the average for January through May.

Sources: U.S. Department of Labor (2009a–c).

TABLE 12.3.19.1-4 ROI Urban Population and Income for the Proposed Red Sands SEZ

	Population			Median Household Income ($ 2008)		
City	2000	2008	Average Annual Growth Rate, 2000–2008 (%)	1999	2006–2008	Average Annual Growth Rate, 1999 and 2006–2008 (%)[a]
Alamogordo	35,582	35,979	0.1	39,820	41,037	0.3
Anthony	3,850	4,330	1.5	33,855	NA[b]	NA
Clint	980	970	–0.1	43,776	NA	NA
Cloudcroft	749	891	2.2	52,524	NA	NA
El Paso	563,662	609,248	1.0	41,360	36,649	–1.3
Hatch	1,673	1,641	–0.2	27,360	NA	NA
Horizon City	5,233	13,019	12.1	62,559	NA	NA
Las Cruces	74,267	90,908	2.6	39,108	37,402	–0.5
Mesilla	2,180	2,196	0.1	54,430	NA	NA
Socorro	27,152	32,056	2.1	31,012	NA	NA
Sunland Park	13,309	14,436	1.0	25,961	NA	NA
Tularosa	2,864	3,044	0.8	35,435	NA	NA

[a] Data are averages for the period 2006 to 2008.

[b] NA = not available.

Source: U.S. Bureau of the Census (2009b-d).

Population growth rates in the ROI have varied over the period 2000 to 2008 (Table 12.3.19.1-4). Horizon City grew at an annual rate of 12.1% during this period, with higher than average growth also experienced in Las Cruces (2.6%) and Socorro (2.1%). El Paso (1.0%) experienced a lower growth rate between 2000 and 2008, while Hatch (–0.2%) and Clint (–0.1%) experienced negative growth rates during this period.

12.3.19.1.4 ROI Urban Income

Median household incomes vary across cities in the ROI. Three cities for which data are available for 2006 to 2008—Alamogordo ($41,037), Las Cruces ($37,402) and El Paso ($36,649)—had median incomes in 2006 to 2008 that were lower than the state averages for New Mexico ($43,202) and Texas ($49,078) (Table 12.3.19.1-4).

Median household income growth rates between 1999 and 2006 to 2008 were small in Alamogordo (0.3%), and negative in Las Cruces (–0.5%) and El Paso (–1.3%). The average median household income growth rate for New Mexico as a whole over this period was -0.2%; for Texas the growth rate was -0.5%.

12.3.19.1.5 ROI Population

Table 12.3.19.1-5 presents recent and projected populations in the ROI and states as a whole. Population in the ROI stood at 1,047,566 in 2008, having grown at an average annual rate of 1.7% since 2000. Growth rates for the ROI have been has been similar to the state-wide rates for New Mexico (1.7%), and Texas (1.6%) over the same period.

Each county in the ROI has experienced growth in population since 2000. Dona Ana County recorded a population growth rate of 2.1% between 2000 and 2008; El Paso County grew by 1.7% over the same period; while Otero County grew at 0.6%. The ROI population is expected to increase to 1,242,376 by 2021, and to 1,266,668 by 2023.

12.3.19.1.6 ROI Income

Personal income in the ROI stood at $26.7 billion in 2007 and has grown at an annual average rate of 2.9% over the period 1998 to 2007 (Table 12.3.19.1-6). ROI personal income per capita also rose over the same period at a rate of 1.5%, increasing from $22,238 to $25,908. In 2007, per capita incomes were higher in El Paso County ($26,237) than in Dona Ana County ($25,493) and Otero County ($23,323). Personal income and per capita income growth rates have been higher in Dona Ana County, and lower in Otero County, than for the state of New Mexico as a whole. Personal income per capita was slightly higher in New Mexico

TABLE 12.3.19.1-5 ROI Population for the Proposed Red Sands SEZ

Location	2000	2008	Average Annual Growth Rate, 2000–2008 (%)	2021	2023
Dona Ana County, New Mexico	174,682	206,486	2.1	260,227	267,444
Otero County, New Mexico	62,298	65,373	0.6	71,344	71,931
El Paso County, Texas	679,622	775,707	1.7	910,804	927,293
ROI	916,602	1,047,566	1.7	1,242,376	1,266,668
New Mexico	1,819,046	2,085,115	1.7	2,573,667	2,640,712
Texas	20,851,820	23,711,019	1.6	28,255,284	28,925,856

Sources: U.S. Bureau of the Census (2009e,f); Texas Comptroller's Office (2009); University of New Mexico (2009).

TABLE 12.3.19.1-6 ROI Personal Income for the Proposed Red Sands SEZ

Location	1998	2007	Average Annual Growth Rate, 1998–2007 (%)
Dona Ana County			
Total income[a]	3.8	5.1	3.0
Per capita income ($)	22,254	25,493	1.4
Otero County			
Total income[a]	1.3	1.5	1.7
Per capita income ($)	20,976	23,323	1.1
El Paso County			
Total income[a]	15.0	20.1	3.0
Per capita income ($)	22,349	26,237	1.6
ROI			
Total income[a]	20.1	26.7	2.9
Per capita income ($)	22,238	25,908	1.5
New Mexico			
Total income[a]	48.8	62.4	2.5
Per capita income ($)	27,182	30,497	1.2
Texas			
Total income[a]	668.1	914.9	3.2
Per capita income ($)	25,186	37,808	1.7

[a] Unless reported otherwise, values are reported in $ billion 2008.

Sources: U.S. Department of Commerce (2009); U.S. Bureau of Census (2009e,f).

($30,497) as a whole in 2007 than in both New Mexico counties. In El Paso County, per capita income growth rates and per capita incomes were slightly lower than for Texas as a whole ($37,808).

Median household income in 2006 to 2008 varied from $35,637 in El Paso County to $39,903 in Otero County (U.S. Bureau of the Census 2009d).

12.3.19.1.7 ROI Housing

In 2007, nearly 360,800 housing units were located in the three counties, with more than 70% of these in El Paso County (Table 12.3.19.1-7). Owner-occupied units constituted about 65% of the occupied units in the three counties, with rental housing making up 35% of the total. At 20.6%, vacancy rates in 2007 were significantly higher in Otero County than in Dona Ana (11.3%) and El Paso County (9.2%). With an overall vacancy rate of 10.6% in the ROI, there were 38,396 vacant housing units in the ROI in 2007, of which 11,792 (7,422 in El Paso County, 2,690 in Dona Ana County, and 1,680 in Otero County) are estimated to be rental units that would be available to construction workers. There were 3,887 seasonal, recreational, or occasional-use units vacant at the time of the 2000 Census.

TABLE 12.3.19.1-7 ROI Housing Characteristics for the Proposed Red Sands SEZ

Parameter	2000	2007
Dona Ana County		
Owner occupied	40,248	44,251
Rental	19,348	23,913
Vacant units	5,654	8,641
Seasonal and recreational use	551	NA[a]
Total Units	65,210	76,805
Otero County		
Owner occupied	15,372	16,399
Rental	7,612	8,153
Vacant units	6,288	6,370
Seasonal and recreational use	2,451	NA
Total Units	65,210	30,922
El Paso County		
Owner occupied	133,624	149,345
Rental	76,398	80,310
Vacant units	14,425	23,385
Seasonal and recreational use	885	NA
Total Units	224,447	253,040
ROI Total		
Owner occupied	189,204	209,995
Rental	103,358	112,376
Vacant units	26,367	38,396
Seasonal and recreational use	3,887	NA
Total Units	318,929	360,767

[a] NA = data not available.

Sources: U.S. Bureau of the Census (2009h-j).

Housing stock in the ROI as a whole grew at an annual rate of 1.8% over the period 2000 to 2007, with 41,838 new units (Table 12.3.19.1-7).

The median value of owner-occupied housing in 2008 varied between $97,800 in El Paso County and $133,300 in Dona Ana County (U.S. Bureau of the Census 2009g).

12.3.19.1.8 ROI Local Government Organizations

The various local and county government organizations in the ROI are listed in Table 12.3.19.1-8. There are no Tribal governments located in the ROI. However, there are members of other Tribal groups located in the ROI, but whose Tribal governments are located in adjacent counties or states.

12.3.19.1.9 ROI Community and Social Services

This section describes educational, health care, law enforcement, and firefighting resources in the ROI.

TABLE 12.3.19.1-8 ROI Local Government Organizations and Social Institutions for the Proposed Red Sands SEZ

Governments	
City	
Alamogordo	Horizon City
Anthony	Las Cruces
Clint	Mesilla
Cloudcroft	Socorro
El Paso	Sunland Park
Hatch	Tularosa
County	
Dona Ana County	El Paso County
Otero County	
Tribal	
None	

Sources: U.S. Bureau of the Census (2009b); U.S. Department of the Interior (2010).

Schools

In 2007, a total of 346 public and private elementary, middle, and high schools were located in the three-county ROI (NCES 2009). Table 12.3.19.1-9 provides summary statistics for enrollment, educational staffing, and two indices of educational quality—student-teacher ratios and levels of service (number of teachers per 1,000 population). The student-teacher ratio in Dona Ana County schools (15.3) is slightly higher than for schools in Otero County (14.9) and El Paso County (14.9). The level of service is slightly higher in El Paso County (15.0), while there are significantly fewer teachers per 1,000 population in Otero County (8.3).

Health Care

While El Paso County has a much larger number of physicians (1,557) than the two other counties, the number of doctors per 1,000 population in is only slightly higher than in Dona Ana County and significantly larger than in Otero County (1.3) (Table 12.3.19.1-10). The smaller number of healthcare professionals in Otero County and Dona Ana County may mean that residents of these counties have poorer access to specialized healthcare; a substantial number of county residents might also travel to El Paso County for their medical care.

Public Safety

Several state, county, and local police departments provide law enforcement in the ROI. Otero County has 31 officers and would provide law enforcement services to the SEZ (Table 12.3.19.1-11), while Dona Ana County and El Paso County have 131 and 251 officers, respectively (Table 12.3.19.1-11). There are currently 695 professional firefighters in El Paso County, 195 in Dona Ana County, and only volunteers in Otero County (Table 12.3.19.1-11). Levels of service in police protection in El Paso County (0.3) are significantly lower than for the

TABLE 12.3.19.1-9 ROI School District Data for the Proposed Red Sands SEZ, 2007

Location	Number of Students	Number of Teachers	Student-Teacher Ratio	Level of Service[a]
Dona Ana County, New Mexico	39,320	2,578	15.3	12.8
Otero County, New Mexico	8,018	538	14.9	8.3
El Paso County, Texas	170,382	11,443	14.9	15.0
ROI	217,720	14,558	15.0	14.1

[a] Number of teachers per 1,000 population.

Source: NCES (2009).

TABLE 12.3.19.1-10 Physicians in the Proposed Red Sands SEZ ROI, 2007

Location	Number of Primary Care Physicians	Level of Service[a]
Dona Ana County, New Mexico	369	1.8
Otero County, New Mexico	84	1.3
El Paso County, Texas	1,557	2.0
ROI	2,010	1.9

[a] Number of physicians per 1,000 population.

Source: AMA (2009).

TABLE 12.3.19.1-11 Public Safety Employment in the Proposed Red Sands SEZ ROI

Location	Number of Police Officers[a]	Level of Service[b]	Number of Firefighters[c]	Level of Service
Dona Ana County, New Mexico	131	0.6	195	0.9
Otero County, New Mexico	31	0.5	0	0.0
El Paso County, Texas	251	0.3	695	0.9
ROI	413	0.4	890	0.8

[a] 2007 data.

[b] Number per 1,000 population.

[c] 2008 data; number does not include volunteers.

Sources: U.S. Department of Justice (2009c); Fire Departments Network (2009).

other two counties, while fire protection in Don Ana County and El Paso County are similar to that for the ROI as a whole (Table 12.3.19.1-11).

12.3.19.1.10 ROI Social Structure and Social Change

Community social structures and other forms of social organization within the ROI are related to various factors, including historical development, major economic activities, and sources of employment, income levels, race and ethnicity, and forms of local political organization. Although an analysis of the character of community social structures is beyond the scope of the current programmatic analysis, project-level NEPA analyses would include a description of ROI social structures, contributing factors, their uniqueness, and, consequently, the susceptibility of local communities to various forms of social disruption and social change.

Various energy development studies have suggested that once the annual population growth in smaller rural communities reached between 5 and 15%, alcoholism, depression, suicide, social conflict, divorce, and delinquency would increase and levels of community satisfaction would deteriorate (BLM 1980, 1983, 1996). Tables 12.3.19.1-12 and 12.3.19.1-13 present data for the ROI for a number of indicators of social change, including violent crime and property crime rates, alcoholism and illicit drug use, and mental health and divorce, that might be used to indicate social change.

Some variation exists in the level of crime across the ROI, with higher rates of property-related crime rates in Dona Ana County (29.9 per 1,000 population) and El Paso County (28.6) than in Otero County (20.2). Violent crime rates were the same in Dona Ana County and El Paso County (4.2 per 1,000 population), and lower in Otero County (2.0), meaning that overall crime rates in Dona Ana County (34.1) and El Paso County (32.8) were higher than in Otero County (22.2).

Other measures of social change—alcoholism, illicit drug use, and mental health—are not available at the county level and thus are presented for the SAMHSA region in which the ROI is located. There is some variation across the two regions in which the two counties are located, with slightly higher rates for alcoholism and mental illness in the region in which Dona Ana County and Otero County are located and the same rates of illicit drug use in both regions (Table 12.3.19.1-13).

TABLE 12.3.19.1-12 County and ROI Crime Rates[a] for the Proposed Red Sands SEZ ROI

	Violent Crime[b]		Property Crime[c]		All Crime	
Location	Offenses	Rate	Offenses	Rate	Offenses	Rate
Don Ana County, New Mexico	842	4.2	6,028	29.9	6,870	34.1
Otero County, New Mexico	124	2.0	1,281	20.2	1,405	22.2
El Paso County, Texas	3,068	4.2	21,147	28.6	24,215	32.8
ROI	4,034	4.0	28,456	28.4	32,490	32.4

[a] Rates are the number of crimes per 1,000 population.

[b] Violent crime includes murder and non-negligent manslaughter, forcible rape, robbery, and aggravated assault.

[c] Property crime includes burglary, larceny, theft, motor vehicle theft, and arson.

Sources: U.S. Department of Justice (2009a,b).

TABLE 12.3.19.1-13 Alcoholism, Drug Use, Mental Health, and Divorce in the Proposed Red Sands SEZ ROI

Geographic Area	Alcoholism[a]	Illicit Drug Use[a]	Mental Health[b]	Divorce[c]
New Mexico Region 5 (includes Dona Ana County and Otero County)	8.3	3.0	9.9	NA[d]
Texas Region 10 (includes El Paso County)	7.0	3.0	8.3	NA
New Mexico	NA	NA	NA	4.3
Texas	NA	NA	NA	3.3

[a] Data for alcoholism and drug use represent percentage of the population over 12 years of age with dependence on or abuse of alcohol or illicit drugs. Data are averages for 2004 to 2006.

[b] Data for mental health represent percentage of the population over 18 years of age suffering from serious psychological distress. Data are averages for 2002 to 2004.

[c] Divorce rates are the number of divorces per 1,000 population. Data are for 2007.

[d] NA = data not available.

Sources: SAMHSA (2009); CDC (2009).

12.3.19.1.11 ROI Recreation

Various areas in the vicinity of the proposed SEZ are used for recreational purposes, with natural, ecological, and cultural resources in the ROI attracting visitors for a range of activities, including hunting, fishing, boating, canoeing, wildlife watching, camping, hiking, horseback riding, mountain climbing, and sightseeing. These activities are discussed in Section 12.3.5.

Because the number of visitors using state and federal lands for recreational activities is not available from the various administering agencies, the value of recreational resources in these areas, based solely on the number of recorded visitors, is likely to be an underestimation. In addition to visitation rates, the economic valuation of certain natural resources can also be assessed in terms of the potential recreational destination for current and future users, that is, their nonmarket value (see Section 5.17.1.1.1).

Another method for evaluating the significance of recreation is to estimate the economic impact of the various recreational activities supported by natural resources on public land in the vicinity of the proposed solar facilities, by identifying sectors in the economy in which expenditures on recreational activities occur. Not all activities in these sectors are directly related to recreation on state and federal lands, with some activity occurring on private land (e.g., dude ranches, golf courses, bowling alleys, and movie theaters). Expenditures associated with recreational activities form an important part of the economy of the ROI. In 2007, 42,081 people were employed in the ROI in the various sectors identified as recreation-related, constituting 10.9% of total ROI employment (Table 12.3.19.1-14). Recreation spending also produced almost

TABLE 12.3.19.1-14 ROI Recreation Sector Activity in the Proposed Red Sands SEZ, 2007

ROI	Employment	Income ($ million)
Amusement and recreation services	740	14.6
Automotive rental	2,440	191.6
Eating and drinking places	32,522	462.0
Hotels and lodging places	2,066	41.3
Museums and historic sites	44	4.4
Recreational vehicle parks and campsites	110	2.3
Scenic tours	2,311	118.3
Sporting goods retailers	1,848	29.8
Total ROI	42,081	864.3

Source: MIG, Inc. (2010).

$864.3 million in income in the ROI in 2007. The primary sources of recreation-related employment were eating and drinking places.

12.3.19.2 Impacts

The following analysis begins with a description of the common impacts of solar development, including common impacts on recreation and on social change. These impacts would occur regardless of the solar technology developed in the SEZ. The impacts of solar development employing various solar energy technologies are analyzed in detail in subsequent sections.

12.3.19.2.1 Common Impacts

Construction and operation of a solar energy facility at the proposed Red Sands SEZ would produce direct and indirect economic impacts. Direct impacts would occur as a result of expenditures on wages and salaries, procurement of goods and services required for project construction and operation, and the collection of state sales and income taxes. Indirect impacts would occur as project wages and salaries, procurement expenditures, and tax revenues subsequently circulated through the economy of each state, thereby creating additional employment, income, and tax revenues. Facility construction and operation would also require in-migration of workers and their families into the ROI surrounding the site, which would affect population, rental housing, health service employment, and public safety employment. Socioeconomic impacts common to all utility-scale solar energy development are discussed in detail in Section 5.17. These impacts will be minimized through the implementation of programmatic design features described in Appendix A, Section A.2.2.

Recreation Impacts

Estimating the impact of solar facilities on recreation is problematic because it is not clear how solar development in the SEZ would affect recreational visitation and nonmarket values (i.e., the value of recreational resources for potential or future visits; see Appendix M). While it is clear that some land in the ROI would no longer be accessible for recreation, the majority of popular recreational locations would be precluded from solar development. It is also possible that solar development in the ROI would be visible from popular recreation locations, and that construction workers residing temporarily in the ROI would occupy accommodations otherwise used for recreational visits, thus reducing visitation and consequently affecting the economy of the ROI.

Social Change

Although an extensive literature in sociology documents the most significant components of social change in energy boomtowns, the nature and magnitude of the social impact of energy development in small rural communities are still unclear (see Section 5.17.1.1.4). While some degree of social disruption is likely to accompany large-scale in-migration during the boom phase, there is insufficient evidence to predict the extent to which specific communities are likely to be impacted, which population groups within each community are likely to be most affected, and the extent to which social disruption is likely to persist beyond the end of the boom period (Smith et al. 2001). Accordingly, because of the lack of adequate social baseline data, it has been suggested that social disruption is likely to occur once an arbitrary population growth rate associated with solar energy development projects has been reached, with an annual rate of between 5 and 10% growth in population assumed to result in a breakdown in social structures, with a consequent increase in alcoholism, depression, suicide, social conflict, divorce, delinquency, and deterioration in levels of community satisfaction (BLM 1980, 1983, 1996).

In overall terms, the in-migration of workers and their families into the ROI would represent an increase of 0.1 % in ROI population during construction of the trough technology, with smaller increases for the power tower, dish engine, and photovoltaic technologies, and during the operation of each technology. While it is possible that some construction and operations workers will choose to locate in communities closer to the SEZ, the lack of available housing in smaller rural communities in the ROI to accommodate all in-migrating workers and families, and insufficient range of housing choices to suit all solar occupations, many workers are likely to commute to the SEZ from larger communities elsewhere in the ROI. This would reduce the potential impact of solar development on social change. Regardless of the pace of population growth associated with the commercial development of solar resources, and the likely residential location of in-migrating workers and families in communities some distance from the SEZ itself, the number of new residents from outside the region of influence is likely to lead to some demographic and social change in small rural communities in the ROI. Communities hosting solar development are likely to be required to adapt to a different quality of life, with a transition away from a more traditional lifestyle involving ranching and taking place in small, isolated, close-knit, homogenous communities with a strong orientation toward personal and family relationships, toward a more urban lifestyle, with increasing cultural and ethnic diversity and increasing dependence on formal social relationships within the community.

Livestock Grazing Impacts

*C*attle ranching and farming supported 543 jobs, and $4.7 million in income in the ROI in 2007 (MIG, Inc. 2010). The construction and operation of solar facilities in the proposed SEZ could result in a decline in the amount of land available for livestock grazing, resulting in total (direct plus indirect) impacts of the loss of 14 jobs and $0.3 million in income in the ROI. There would also be a decline in grazing fees payable to the BLM and to the USFS by individual permittees based on the number of AUMs required to support livestock on public land. Assuming the 2008 fee of $1.35 per AUM, grazing fee losses would amount to $2,685 annually on land dedicated to solar development in the SEZ.

12.3.19.2.2 Technology-Specific Impacts

The potential socioeconomic impacts of solar energy development in the proposed SEZ were measured in terms of employment, income, state tax revenues (sales and income), BLM acreage rental and capacity fees, population in-migration, housing, and community service employment (education, health, and public safety). More information on the data and methods used in the analysis can be found in Appendix M.

The assessment of the impact of the construction and operation of each solar technology was based on SEZ acreage, assuming 80% of the area could be developed. To capture a range of possible impacts, solar facility size was estimated on the basis of the land requirements of various solar technologies, assuming that 9 acres/MW (0.04 km^2/MW) would be required for power tower, dish engine, and PV technologies, and 5 acres/MW (0.02 km^2/MW) would be required for solar trough technologies. Impacts of multiple facilities employing a given technology at each SEZ were assumed to be the same as impacts for a single facility with the same total capacity. Construction impacts were assessed for a representative peak year of construction, assumed to be 2021 for each technology. Construction impacts assumed that a maximum of two projects could be constructed within a given year, with a corresponding maximum land disturbance of up to 6,000 acres (24 km^2). For operations impacts, a representative first year of operations was assumed to be 2023 for each technology. The years of construction and operations were selected as representative of the entire 20-year study period because they are the approximate midpoint; construction and operations could begin earlier.

Solar Trough

Construction. Total construction employment impacts in the ROI (including direct and indirect impacts) from the use of solar trough technology would be up to 10,667 jobs (Table 12.3.19.2-1). Construction activities would constitute 2.2% of total ROI employment. A

TABLE 12.3.19.2-1 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Red Sands SEZ with Trough Facilities[a]

Parameter	Maximum Annual Construction Impacts	Annual Operations Impacts
Employment (no.)		
Direct	3,488	785
Total	10,667	1,312
Income[b]		
Total	587.0	45.1
Direct state taxes[b]		
Sales	27.5	0.4
Income	12.6	1.2
BLM Payments[b]		
Rental	NA[c]	2.1
Capacity[d]	NA	23.7
In-migrants (no.)	1,486	100
Vacant housing[e] (no.)	743	90
Local community service employment		
Teachers (no.)	22	1
Physicians (no.)	3	0
Public safety (no.)	2	0

[a] Construction impacts are based on the development at the site in a single year; it was assumed that several facilities with a combined capacity of up to 1,200 MW (corresponding to 6,000 acres [24 km^2] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 3,603 MW.

[b] Unless indicated otherwise, values are reported in $ million 2008.

[c] NA = not applicable.

[d] The BLM annual capacity payment was based on a fee of $6,570 per MW, established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010c), assuming a solar facility with no storage capability, and full build-out of the site. Projects with three or more hours of storage would generate higher payments, based on a fee of $7,884 per MW.

[e] Construction activities would affect vacant rental housing; operations activities would affect vacant owner-occupied housing.

solar development would also produce $587.0 million in income. Direct sales taxes would be $27.5 million; direct income taxes, $12.6 million.

Given the scale of construction activities and the likelihood of local worker availability in the required occupational categories, construction of a solar facility would mean that some in-migration of workers and their families from outside the ROI would be required, with 1,486 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) mean that the impact of solar facility construction on the number of vacant rental housing units would not be expected to be large, with 743 rental units expected to be occupied in the ROI. This occupancy rate would represent 4.4% of the vacant rental units expected to be available in the ROI.

In addition to the potential impact on housing markets, in-migration also would affect community service (education, health, and public safety) employment. An increase in such employment would be required to meet existing levels of service in the ROI. Accordingly, 22 new teachers, 3 physician, and 2 public safety employees (career firefighters and uniformed police officers) would be required in the ROI. These increases would represent 0.1% of total ROI employment expected in these occupations.

Operations. Total operations employment impacts in the ROI (including direct and indirect impacts) from a build-out using solar trough technologies would be 1,312 jobs (Table 12.3.19.2-1). Such a solar development would also produce $45.1 million in income. Direct sales taxes would be $0.4 million; direct income taxes, $1.2 million. Based on fees established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010c), acreage rental payments would be $2.1 million, and solar generating capacity payments would total at least $23.7 million.

Given the likelihood of local worker availability in the required occupational categories, operation of a solar facility would mean that some in-migration of workers and their families from outside the ROI would be required, with 100 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) mean that the impact of solar facility operation on the number of vacant owner-occupied housing units would not be expected to be large, with 90 owner-occupied units expected to be occupied in the ROI.

In addition to the potential impact on housing markets, in-migration would affect community service (health, education, and public safety) employment. An increase in such employment would be required to meet existing levels of service in the provision of these services in the ROI. Accordingly, one new teacher would be required in the ROI.

Power Tower

Construction. Total construction employment impacts in the ROI (including direct and indirect impacts) from the use of power tower technology would be up to 4,249 jobs (Table 12.3.19.2-2). Construction activities would constitute 0.9% of total ROI employment. Such a solar development would also produce $233.8 million in income. Direct sales taxes would be $10.9 million; direct income taxes, $5.0 million.

Given the scale of construction activities and the likelihood of local worker availability in the required occupational categories, construction of a solar facility would mean that some in-migration of workers and their families from outside the ROI would be required, with 592 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) mean that the impact of solar facility construction on the number of vacant rental housing units would not be expected to be large, with 296 rental units expected to be occupied in the ROI. This occupancy rate would represent 1.8% of the vacant rental units expected to be available in the ROI.

In addition to the potential impact on housing markets, in-migration would affect community service (education, health, and public safety) employment. An increase in such employment would be required to meet existing levels of service in the ROI. Accordingly, nine new teachers, one physician, and one public safety employee would be required in the ROI. These increases would represent less than 0.1% of total ROI employment expected in these occupations.

Operations. Total operations employment impacts in the ROI (including direct and indirect impacts) from a build-out using power tower technologies would be 574 jobs (Table 12.3.19.2-2). Such a solar development would also produce $18.5 million in income. Direct sales taxes would be less than $0.1 million; direct income taxes, $0.6 million. Based on fees established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010c), acreage rental payments would be $2.1 million, and solar generating capacity payments would total at least $13.2 million.

Given the likelihood of local worker availability in the required occupational categories, operation of a power tower facility would mean that some in-migration of workers and their families from outside the ROI would be required, with 52 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) mean that the impact of solar facility operation on the number of vacant owner-occupied housing units would not be expected to be large, with 46 owner-occupied units expected to be required in the ROI.

In addition to the potential impact on housing markets, in-migration would affect community service (education, health, and public safety) employment. An increase in such

TABLE 12.3.19.2-2 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Red Sands SEZ with Power Tower Facilities[a]

Parameter	Maximum Annual Construction Impacts	Annual Operations Impacts
Employment (no.)		
Direct	1,389	405
Total	4,249	574
Income[b]		
Total	233.8	18.5
Direct state taxes[b]		
Sales	10.9	<0.1
Income	5.0	0.6
BLM Payments[b]		
Rental	NA[c]	2.1
Capacity[d]	NA	13.2
In-migrants (no.)	592	52
Vacant housing[e] (no.)	296	46
Local community service employment		
Teachers (no.)	9	1
Physicians (no.)	1	0
Public safety (no.)	1	0

a Construction impacts are based on the development at the site in a single year; it was assumed that several facilities with a combined capacity of up to 667 MW (corresponding to 6,000 acres [24 km^2] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 2,002 MW.

b Unless indicated otherwise, values are reported in $ million 2008.

c NA = not applicable.

d The BLM annual capacity payment was based on a fee of $6,570 per MW, established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010c), assuming a solar facility with no storage capability, and full build-out of the site. Projects with three or more hours of storage would generate higher payments, based on a fee of $7,884 per MW.

e Construction activities would affect vacant rental housing; operations activities would affect vacant owner-occupied housing.

employment would be required to meet existing levels of service in the ROI. Accordingly, one new teacher would be required in the ROI.

Dish Engine

Construction. Total construction employment impacts in the ROI (including direct and indirect impacts) from the use of dish engine technology would be up to 1,727 jobs (Table 12.3.19.2-3). Construction activities would constitute 0.4 % of total ROI employment. Such a solar development would also produce $95.0 million in income. Direct sales taxes would be $4.5 million; direct income taxes, $2.0 million.

Given the scale of construction activities and the likelihood of local worker availability in the required occupational categories, construction of a dish engine facility would mean that some in-migration of workers and their families from outside the ROI would be required, with 241 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) mean that the impact of solar facility construction on the number of vacant rental housing units would not be expected to be large, with 120 rental units expected to be occupied in the ROI. This occupancy rate would represent 0.7% of the vacant rental units expected to be available in the ROI.

In addition to the potential impact on housing markets, in-migration would affect community service (education, health, and public safety) employment. An increase in such employment would be required to meet existing levels of service in the ROI. Accordingly, four new teachers would be required in the ROI. This increase would represent less than 0.1% of total ROI employment expected in this occupation.

Operations. Total operations employment impacts in the ROI (including direct and indirect impacts) from a build-out using dish engine technology would be 558 jobs (Table 12.3.19.2-3). Such a solar development would also produce $17.9 million in income. Direct sales taxes would be less than $0.1 million; direct income taxes, $0.6 million. Based on fees established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010c), acreage rental payments would be $2.1 million, and solar generating capacity payments would total at least $13.2 million.

Given the likelihood of local worker availability in the required occupational categories, operation of a dish engine solar facility would mean that some in-migration of workers and their families from outside the ROI would be required, with 50 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) mean that the impact of solar facility operation on the number of vacant owner-occupied housing units would not be expected to be large, with 45 owner-occupied units expected to be required in the ROI.

TABLE 12.3.19.2-3 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Red Sands SEZ with Dish Engine Facilities[a]

Parameter	Maximum Annual Construction Impacts	Annual Operations Impacts
Employment (no.)		
Direct	565	394
Total	1,727	558
Income[b]		
Total	95.0	17.9
Direct state taxes[b]		
Sales	4.5	<0.1
Income	2.0	0.6
BLM Payments[b]		
Rental	NA[c]	2.1
Capacity[d]	NA	13.2
In-migrants (no.)	241	50
Vacant housing[e] (no.)	120	45
Local community service employment		
Teachers (no.)	4	1
Physicians (no.)	0	0
Public safety (no.)	0	0

a Construction impacts are based on the development at the site in a single year; it was assumed that several facilities with a combined capacity of up to 667 MW (corresponding to 6,000 acres [24 km^2] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 2,002 MW.

b Unless indicated otherwise, values are reported in $ million 2008.

c NA = not applicable.

d The BLM annual capacity payment was based on a fee of $6,570 per MW, established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010c), assuming a solar facility with no storage capability, and full build-out of the site. Projects with three or more hours of storage would generate higher payments, based on a fee of $7,884 per MW.

e Construction activities would affect vacant rental housing; operations activities would affect vacant owner-occupied housing.

In addition to the potential impact on housing markets, in-migration would affect community service (education, health, and public safety) employment. An increase in such employment would be required to meet existing levels of service in the ROI. Accordingly, one new teacher would be required in the ROI.

Photovoltaic

Construction. Total construction employment impacts in the ROI (including direct and indirect impacts) from the use of PV technology would be up to 806 jobs (Table 12.3.19.2-4). Construction activities would constitute 0.2% of total ROI employment. Such a solar development would also produce $44.3 million in income. Direct sales taxes would be $2.1 million; direct income taxes, $1.0 million.

Given the scale of construction activities and the likelihood of local worker availability in the required occupational categories, construction of a solar facility would mean that some in-migration of workers and their families from outside the ROI would be required, with 112 persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) mean that the impact of solar facility construction on the number of vacant rental housing units would not be expected to be large, with 56 rental units expected to be occupied in the ROI. This occupancy rate would represent 0.3% of the vacant rental units expected to be available in the ROI.

In addition to the potential impact on housing markets, in-migration would affect community service (education, health, and public safety) employment. An increase in such employment would be required to meet existing levels of service in the ROI. Accordingly, two new teachers would be required in the ROI. This increase would represent less than 0.1% of total ROI employment expected in this occupation.

Operations. Total operations employment impacts in the ROI (including direct and indirect impacts) from a build-out using PV technologies would be 56 jobs (Table 12.3.19.2-4). Such a solar development would also produce $1.8 million in income. Direct sales taxes would be less than $0.1 million; direct income taxes, $0.1 million. Based on fees established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010c), acreage rental payments would be $2.1 million, and solar generating capacity payments would total at least $10.5 million.

Given the likelihood of local worker availability in the required occupational categories, operation of a PV solar facility would mean that some in-migration of workers and their families from outside the ROI would be required, with five persons in-migrating into the ROI. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile home parks) mean that the impact of solar facility operation on the number of vacant owner-occupied

TABLE 12.3.19.2-4 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Red Sands SEZ with PV Facilities[a]

Parameter	Maximum Annual Construction Impacts	Annual Operations Impacts
Employment (no.)		
Direct	263	39
Total	806	56
Income[b]		
Total	44.3	1.8
Direct state taxes[b]		
Sales	2.1	<0.1
Income	1.0	0.1
BLM Payments[b]		
Rental	NA[c]	2.1
Capacity[d]	NA	10.5
In-migrants (no.)	112	5
Vacant housing[e] (no.)	56	5
Local community service employment		
Teachers (no.)	2	0
Physicians (no.)	0	0
Public safety (no.)	0	0

[a] Construction impacts are based on the development at the site in a single year; it was assumed that several facilities with a combined capacity of up to 667 MW (corresponding to 6,000 acres [24 km^2] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 2,002 MW.

[b] Unless indicated otherwise, values are reported in $ million 2008.

[c] NA = not applicable.

[d] The BLM annual capacity payment was based on a fee of $5,256 per MW, established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010c), assuming full build-out of the site.

[e] Construction activities would affect vacant rental housing; operations activities would affect owner-occupied housing.

housing units would not be expected to be large, with five owner-occupied units expected to be required in the ROI.

No new community service employment would be required to meet existing levels of service in the ROI.

12.3.19.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features addressing socioeconomic impacts have been identified for the proposed Red Sands SEZ. Implementing the programmatic design features described in Appendix A, Section A.2.2, as required under BLM's Solar Energy Program would reduce the potential for socioeconomic impacts during all project phases.

12.3.20 Environmental Justice

12.3.20.1 Affected Environment

On February 11, 1994, the President signed E.O. 12898 "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," which formally requires federal agencies to incorporate environmental justice as part of their missions (*Federal Register*, Volume 59, page 7629, Feb. 11, 1994). Specifically, it directs them to address, as appropriate, any disproportionately high and adverse human health or environmental effects of their actions, programs, or policies on minority and low-income populations.

The analysis of the impacts of solar energy projects on environmental justice issues follows guidelines described in the Council on Environmental Quality's (CEQ's) *Environmental Justice Guidance under the National Environmental Policy Act* (CEQ 1997). The analysis method has three parts: (1) a description is undertaken of the geographic distribution of low-income and minority populations in the affected area; (2) an assessment is conducted to determine whether construction and operation would produce impacts that are high and adverse; and (3) if impacts are high and adverse, a determination is made as to whether these impacts disproportionately affect minority and low-income populations.

Construction and operation of solar energy projects in the proposed SEZ could affect environmental justice if any adverse health and environmental impacts resulting from either phase of development were significantly high and if these impacts disproportionately affected minority and low-income populations. If the analysis determines that health and environmental impacts are not significant, there can be no disproportionate impacts on minority and low-income populations. In the event impacts are significant, disproportionality would be determined by comparing the proximity of any high and adverse impacts with the location of low-income and minority populations.

The analysis of environmental justice issues associated with the development of solar facilities considered impacts within the SEZ and in a 50-mi (80-km) radius around the boundary of the SEZ. A description of the geographic distribution of minority and low-income groups in the affected area was based on demographic data from the 2000 Census (U.S. Bureau of the Census 2009k,l). The following definitions were used to define minority and low-income population groups:

- **Minority.** Persons are included in the minority category if they identify themselves as belonging to any of the following racial groups: (1) Hispanic, (2) Black (not of Hispanic origin) or African American, (3) American Indian or Alaska Native, (4) Asian, or (5) Native Hawaiian or Other Pacific Islander.

  Beginning with the 2000 Census, where appropriate, the census form allows individuals to designate multiple population group categories to reflect their ethnic or racial origins. In addition, persons who classify themselves as being of multiple racial origin may choose up to six racial groups as the basis of their racial origins. The term minority includes all persons, including those classifying themselves in multiple racial categories, except those who classify themselves as not of Hispanic origin and as White or “Other Race” (U.S. Bureau of the Census 2009k).

The CEQ guidance proposed that minority populations be identified where either (1) the minority population of the affected area exceeds 50% or (2) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis.

The PEIS applies both criteria in using the Census Bureau data for census block groups, wherein consideration is given to the minority population that is both greater than 50% and 20 percentage points higher than in the state (the reference geographic unit).

- **Low-Income.** Individuals who fall below the poverty line. The poverty line takes into account family size and age of individuals in the family. In 1999, for example, the poverty line for a family of five with three children below the age of 18 was $19,882. For any given family below the poverty line, all family members are considered as being below the poverty line for the purposes of analysis (U.S. Bureau of the Census 2009l).

The data in Table 12.3.20.1-1 show the minority and low-income composition of the total population in the proposed SEZ area based on 2000 Census data and CEQ guidelines. Individuals identifying themselves as Hispanic or Latino are included in the table as a separate entry. However, because Hispanics can be of any race, this number also includes individuals identifying themselves as being part of one or more of the population groups listed in the table.

A large number of minority and low-income individuals are located in the 50-mi (80-km) area around the boundary of the SEZ. Within the 50-mi (80-km) radius in New Mexico, 54.9% of the population is classified as minority, while 20.9% is classified as low-income. The number of minority individuals exceeds 50% of the total population in the area and exceeds the state average by 20 percentage points or more; thus, there is a minority population in the New Mexico portion of the SEZ area based on 2000 Census data and CEQ guidelines. The number of low-income individuals does not exceed the state average by 20 percentage points or more and does not exceed 50% of the total population in the area; thus, there are no low-income populations in the New Mexico portion of the 50-mi (80-km) area around the boundary of the SEZ.

Within the 50-mi (80-km) radius in Texas, 75.6% of the population is classified as minority, while 21.1% is classified as low income. The number of minority individuals exceeds 50% of the total population in the area and exceeds the state average by 20 percentage points or more; thus, there is a minority population in the Texas portion of the SEZ area based on 2000 Census data and CEQ guidelines. The number of low-income individuals does not exceed the state average by 20 percentage points or more and does not exceed 50% of the total

TABLE 12.3.20.1-1 Minority and Low-Income Populations within the 50-mi (80-km) Radius Surrounding the Proposed Red Sands SEZ

Parameter	New Mexico	Texas
Total population	231,243	15,051
White, non-Hispanic	104,266	3,673
Hispanic or Latino	111,594	9,278
Non-Hispanic or Latino minorities	15,383	2,100
One race	12,085	1,860
Black or African American	4,557	1,469
American Indian or Alaskan Native	4,722	56
Asian	1,940	257
Native Hawaiian or Other Pacific Islander	128	43
Some other race	738	35
Two or more races	3,298	240
Total minority	126,977	11,378
Low income	48,410	3,183
Percentage minority	54.9	75.6
State percentage minority	33.2	29.0
Percentage low-income	20.9	21.1
State percentage low-income	18.4	15.4

Source: U.S. Bureau of the Census (2009k,l).

population in the area; thus, there are no low-income populations in the Texas portion of the 50-mi (80-km) area around the boundary of the SEZ.

Figures 12.3.20.1-1 and 12.3.20.1-2 show the locations of the minority and low-income population groups within the 50-mi (80-km) area around the boundary of the SEZ.

12.3.20.2 Impacts

Environmental justice concerns common to all utility-scale solar energy development are described in detail in Section 5.18. These impacts will be minimized through the implementation of programmatic design features described in Appendix A, Section A.2.2, which address the

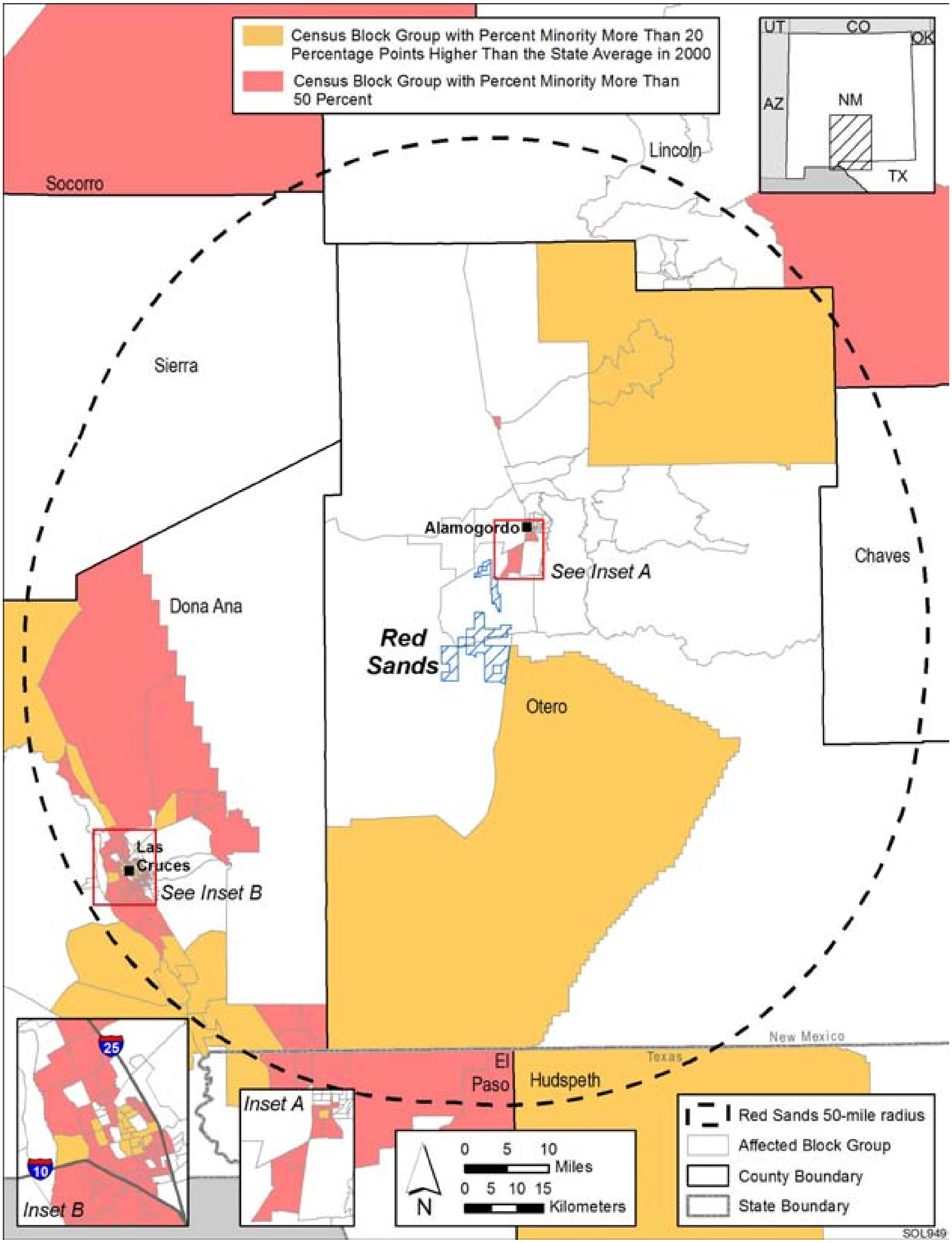

FIGURE 12.3.20.1-1 Minority Population Groups within the 50-mi (80-km) Area Surrounding the Proposed Red Sands SEZ

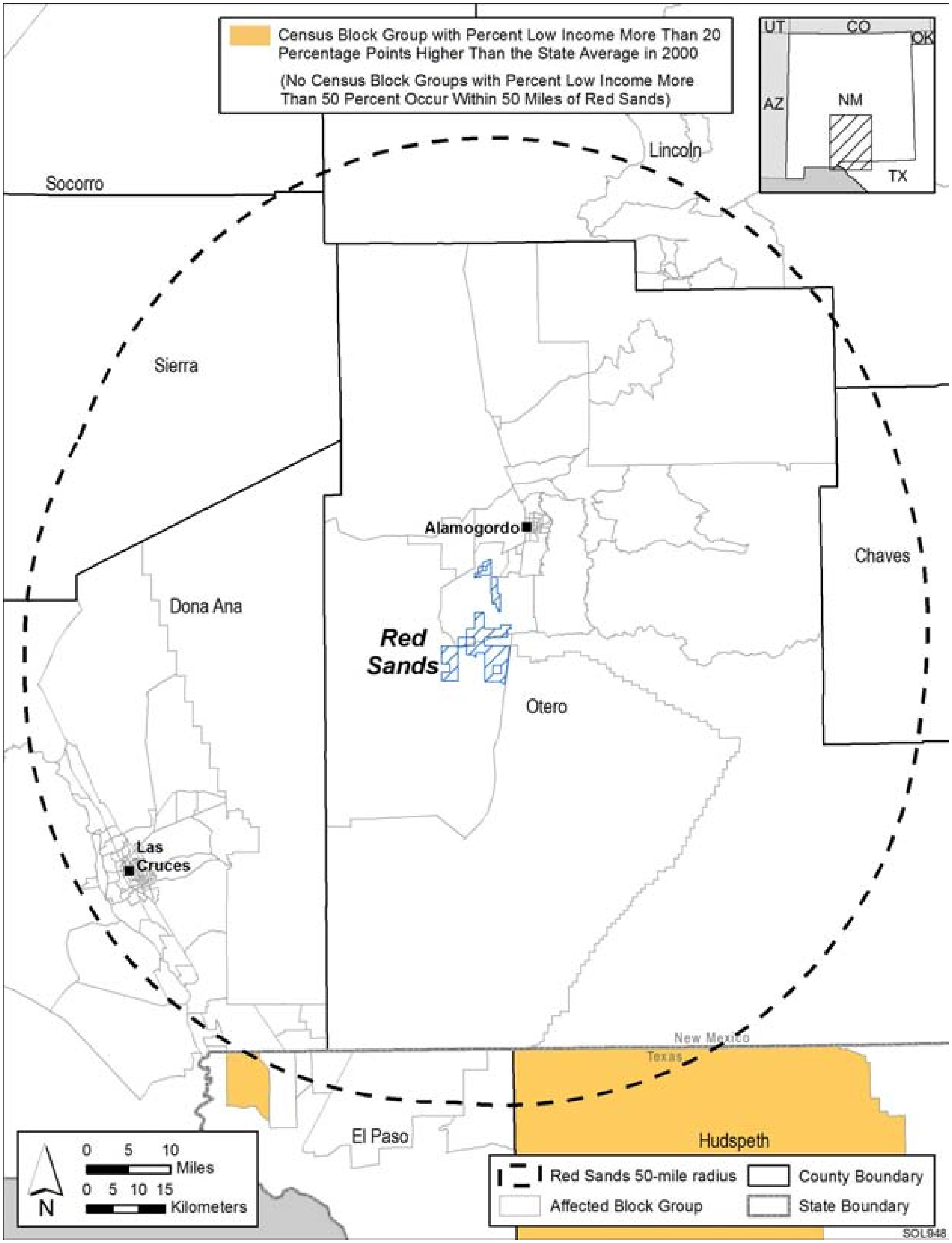

FIGURE 12.3.20.1-2 Low-Income Population Groups within the 50-mi (80-km) Radius Surrounding the Proposed Red Sands SEZ

underlying environmental impacts contributing to the concerns. The potentially relevant environmental impacts associated with solar facilities within the proposed SEZ include noise and dust during the construction of solar facilities; noise and EMF effects associated with solar project operations; the visual impacts of solar generation and auxiliary facilities, including transmission lines; access to land used for economic, cultural, or religious purposes; and effects on property values. These issues are areas of concern that might potentially affect minority and low-income populations. Minority populations have been identified within 50 mi (80 km) of the proposed SEZ; no low-income populations are present (Section 12.3.20.1).

Potential impacts on low-income and minority populations could be incurred as a result of the construction and operation of solar development involving each of the four technologies. Although impacts are likely to be small, there are minority populations, as defined by CEQ guidelines (Section 12.3.20.1), within the 50-mi (80-km) radius around the boundary of the SEZ; thus any adverse impacts of solar projects could disproportionately affect minority populations. Because there are low-income populations within the 50-mi (80-km) radius, according to CEQ guidelines, there could be impacts on low-income populations.

12.3.20.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features addressing environmental justice impacts have been identified for the proposed Red Sands SEZ. Implementing the programmatic design features described in Appendix A, Section A.2.2, as required under BLM's Solar Energy Program would reduce the potential for environmental justice impacts during all project phases.

12.3.21 Transportation

The proposed Red Sands SEZ is accessible by road, rail, and air networks. Two U.S. highways, one major railroad, and a small regional airport serve the area. General transportation considerations and impacts are discussed in Sections 3.4 and 5.19, respectively.

12.3.21.1 Affected Environment

The proposed Red Sands SEZ is southwest of the junction of U.S. 54 and U.S. 70 in Alamogordo, New Mexico, as shown in Figure 12.3.21.1-1. U.S. 70 borders portions of the northern edge of the SEZ and extends to Las Cruces, New Mexico, 70 mi (113 km) southwest of Alamogordo. U.S. 54 borders portions of the eastern edge of the SEZ and continues to El Paso, Texas, 90 mi (145 km) south of Alamogordo. Both U.S. 54 and U.S. 70 are four-lane divided highways in the area of the SEZ. A few local dirt roads cross the SEZ, with Old Las Cruces Highway extending east-west across the southern section of the SEZ. In the White Sands Resource Area RMP (BLM 1986c), the area in the SEZ is among the 1,526,180 acres (6,176 km^2) in the group of lands designated for OHV and vehicle use as “Open.” Annual average traffic volumes for the major roads are provided in Table 12.3.21.1-1.

The UP railroad serves the area. The railroad parallels U.S. 54 as it passes along the eastern side of the SEZ on its way to El Paso to the south and Kansas City, Kansas, to the northeast. The nearest rail stops are at Alamogordo and Omlee, directly east of the SEZ (UP Railroad 2009).

Four small and one larger airport open to the public are within a driving distance of less than 75 mi (121 km) of the proposed Red Sands SEZ, as listed in Table 12.3.21.1-2. With the exception of Alamogordo–White Sands Regional Airport, none of the small airports have regularly scheduled passenger service. The nearest public airport is Alamogordo–White Sands Regional Airport, about 2 mi (3 km) northeast of the SEZ along U.S. 70. The airport is served by New Mexico Airlines (City of Alamogordo 2010), with 379 passengers having departed from and 437 passengers having arrived at the airport in 2008 (BTS 2009). The nearest larger airport is in El Paso, about a 71-mi (114-km) drive south-southwest of the SEZ. The El Paso International Airport is served by a number of major U.S. airlines, with 1.90 million passengers having departed from and 1.88 million passengers having arrived at the airport in 2008 (BTS 2009). For the same year, 60.8 million lb (27.6 million kg) of freight were shipped from El Paso International Airport and 80.7 million lb (36.6 million kg) of freight were received.

Holloman Air Force Base is situated directly north of the proposed Red Sands SEZ on the north side of U.S. 70. Condron Army Air Field, within the White Sands Missile Range, is 25 mi (40 km) southwest of the proposed Red Sands SEZ.

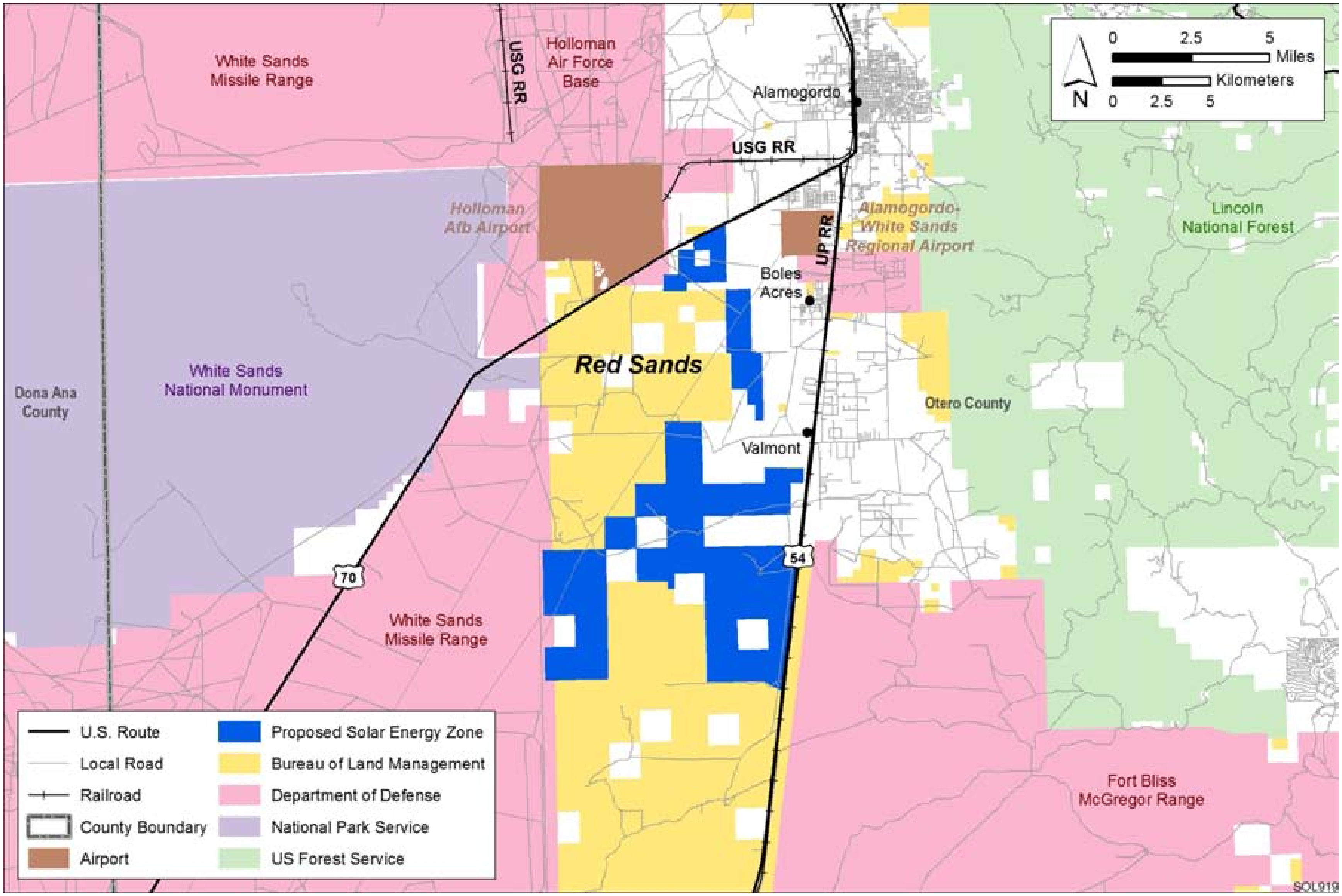

FIGURE 12.3.21.1-1 Local Transportation Network Serving the Proposed Red Sands SEZ

TABLE 12.3.21.1-1 2008 AADT on Major Roads near the Proposed Red Sands SEZ

Road	General Direction	Location	AADT (Vehicles)
U.S. Highway 54	North-south	South of Alamogordo/north of Valmont	6,430
		South of Valmont	3,760
U.S. Highway 54/70	North-south	North of Alamogordo	13,200
U.S. Highway 70	Southwest-northeast	Between Holloman Air Force Base and Alamogordo	14,600
		Southwest of Holloman Air Force Base	9,030

Source: NM DOT (2010).

12.3.21.2 Impacts

As discussed in Section 5.19, the primary transportation impacts are anticipated to be from commuting worker traffic. U.S. 54 and U.S. 70 provide the regional traffic corridors that would experience small impacts for single projects that may have up to 1,000 daily workers, with an additional 2,000 vehicle trips per day (maximum). Such an increase would range from less than 15% of the current traffic on U.S. 70 by the northeastern border of the SEZ between Holloman Air Force Base and Alamogordo to more than 50% of the current traffic on U.S. 54 as it passes the southern section of the SEZ. Light to moderate congestion impacts could occur on either highway, primarily near site access points.

Should up to two large projects with about 1,000 daily workers each be under development simultaneously, an additional 4,000 vehicle trips per day could be added to U.S. 54 and U.S. 70 in the vicinity of the SEZ, assuming ride-sharing programs were not implemented. This additional traffic would be about a 110% increase in the current average daily traffic level on segments of U.S. 54 near the southern portion of the SEZ, if all SEZ-related traffic used U.S. 54, and would have moderate impacts on traffic flow during peak commuter times. The extent of the problem would depend on the relative locations of the projects within the SEZ, where the worker populations originate, and the work schedules. Local road improvements would be necessary in any portion of the SEZ near U.S. 54 that might be developed so as not to overwhelm the local roads near any site access points. Traffic on U.S. 70 could also be moderately affected near site access points if design features were not implemented.

Solar development within the SEZ would affect public access along OHV routes designated open and available for public use. If open routes within a proposed project area were identified during project-specific analyses, they would be re-designated as closed (see Section 5.5.1 for more details on how routes coinciding with proposed solar facilities would be treated).

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TABLE 12.3.21.1-2 Airports Open to the Public in the Vicinity of the Proposed Red Sands SEZ

			Runway 1[a,b]			Runway 2[b]		
Airport	Location	Owner/Operator	Length (ft [m])	Type	Condition	Length (ft [m])	Type	Condition
Alamogordo-White Sands Regional	2 mi (3 km) west of the northern section of the SEZ along U.S. 70	City of Alamogordo	3,512 (1,070)	Dirt	Fair	7,006 (2,135)	Asphalt/ Porous Friction Courses	Good
Carrizozo Municipal	North of the SEZ on U.S. 54, about a 64 mi (103 km) drive	Town of Carrizozo	2,500 (762)	Dirt	Fair	4,900 (1,494)	Asphalt	Excellent
Las Cruces International	Approximately 70 mi (113 km) southwest of the SEZ taking U.S. 70 to I-10	City of Las Cruces	6,069 (1,850)	Asphalt	Good	7,499 (2,286)	Concrete/ Grooved	Excellent
			7,499 (2,286)	Asphalt	Fair	NA[c]	NA	NA
El Paso International	South-southwest of the SEZ taking U.S. 54 to El Paso, near I-10, about a 71 mi (114 km) drive	City of El Paso	5,499 (1,676)	Asphalt	Fair	9,025 (2,751)	Asphalt/ Grooved	Excellent
			12,020 (3,664)	Asphalt/ Grooved	Good	NA	NA	NA
Sierra Blanca Regional	71 mi (114 km) drive northeast of the SEZ	Village of Ruidoso	6,500 (1,981)	Asphalt	Good	8,099 (2,469)	Asphalt/ Porous Friction Courses	Fair

[a] Las Cruces International and El Paso International each have three runways. In each case, information on two of the runways is presented in the "Runway 1" column, and information on the third is in the "Runway 2" column.

[b] Source: FAA (2010).

[c] NA = not applicable.

12.3.21.3 SEZ-Specific Design Features and Design Feature Effectiveness

The programmatic design features described in Appendix A, Section A.2.2, including local road improvements, multiple site access locations, staggered work schedules, and ride-sharing, would all provide some relief from traffic congestion on local roads leading to the site. Depending on the location of solar facilities within the SEZ, more specific access locations and local road improvements could be implemented.

A proposed design feature specific to the proposed SEZ includes:

- Siting of power towers with respect to the air traffic associated with Alamogordo-White Sands Regional Airport and Holloman Air Force Base should be carefully considered so as not to pose a hazard to navigation or to interfere with Air Force operations.

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12.3.22 Cumulative Impacts

The analysis presented in this section addresses the potential cumulative impacts in the vicinity of the proposed Red Sands SEZ in Otero County, New Mexico. The CEQ guidelines for implementing NEPA define cumulative impacts as environmental impacts resulting from the incremental impacts of an action when added to other past, present, and reasonably foreseeable future actions (40 CFR 1508.7). The impacts of other actions are considered without regard to the agency (federal or nonfederal), organization, or person that undertakes them. The time frame of this cumulative impacts assessment could appropriately include activities that would occur up to 20 years in the future (the general time frame for PEIS analyses), but little or no information is available for projects that could occur in the vicinity of the proposed Red Sands SEZ further than 5 to 10 years in the future.

The Red Sands SEZ is about 7 mi (11 km) south of the city of Alamogordo, New Mexico. The nearest population center is the small community of Boles Acres (population 1,172 in 2000) located within 2 mi (3 km) east of the SEZ. The Holloman Air Force Base is adjacent and northwest of the SEZ, and the White Sands Missile Range is adjacent and west of the SEZ. Fort Bliss McGregor Range is within 1 mi (2 km) east of the SEZ. Within 50 mi (80 km) of the SEZ, are about five Wilderness Study Areas. The Lincoln National Forest is about 5 mi (8 km) east of the SEZ, and the White Sands National Monument is about 6 mi (10 km) west. The Mescalero Apache Reservation is about 18 mi (km) northeast of the SEZ. The San Andres National Wildlife Refuge is about 20 mi (32 km) west of the SEZ, and the Agricultural Research Service's Jornada Experimental Range is about 25 mi (40 km) west of the SEZ. In addition, the Red Sands SEZ is a little over 50 mi (80 km) from both the Afton and Mason Draw SEZs, and for some resource assessments, the geographic extent of effects for the three SEZs overlaps.

The geographic extent of the cumulative impacts analysis for each potentially affected resource on or near the proposed Red Sands SEZ is identified in Section 12.3.22.1. An overview of ongoing and reasonably foreseeable future actions is presented in Section 12.3.22.2. General trends in population growth, energy demand, water availability, and climate change are discussed in Section 12.3.22.3. Cumulative impacts for each resource area are discussed in Section 12.3.22.4.

12.3.22.1 Geographic Extent of the Cumulative Impacts Analysis

The geographic extent of the cumulative impacts analysis for each potentially affected resource evaluated on or near the proposed Red Sands SEZ is provided in Table 12.3.22.1-1. These geographic areas define the boundaries encompassing potentially affected resources. Their extent may vary on the basis of the nature of the resource being evaluated and the distance at which an impact may occur (thus, for example, the evaluation of air quality may have a greater regional extent of impact than visual resources). The DoD, the BLM, the USFS, and the Mescalero Apache Reservation administer most of the land around the SEZ. The BLM administers about 15% of the lands within a 50-mi (80-km) radius of the SEZ.

TABLE 12.3.22.1-1 Geographic Extent of the Cumulative Impacts Analysis by Resource Area for the Proposed Red Sands SEZ

Resource Area	Geographic Extent
Land Use	Otero, Dona Ana, Sierra, Socorro, Lincoln, and Chaves Counties in New Mexico; El Paso and Hudspeth Counties in Texas
Specially Designated Areas and Lands with Wilderness Characteristics	Within a 25-mi (40-km) radius of the Red Sands SEZ
Rangeland Resources	
Grazing	Grazing allotments within 5 mi (8 km) of the Red Sands SEZ
Wild Horses and Burros	A 50-mi (80-km) radius from the center of the Red Sands SEZ
Recreation	Otero, Dona Ana, Sierra, Socorro, Lincoln, and Chaves Counties in New Mexico; El Paso and Hudspeth Counties in Texas
Military and Civilian Aviation	Otero, Dona Ana, Sierra, Socorro, Lincoln, and Chaves Counties in New Mexico; El Paso and Hudspeth Counties in Texas
Soil Resources	Areas within and adjacent to the Red Sands SEZ
Minerals	Otero, Dona Ana, Sierra, Socorro, Lincoln, and Chaves Counties in New Mexico; El Paso and Hudspeth Counties in Texas
Water Resources	
Surface Water	Holloman (Raptor) Lake, Foster Lake (dry lake), Tularosa Creek, Salt Creek, Big Salt Lake, Lake Lucero, headwaters for the Sacramento River and the Rio Penasco
Groundwater	Tularosa groundwater basin
Air Quality and Climate	A 31-mi (50-km) radius from the center of the Red Sands SEZ
Vegetation, Wildlife and Aquatic Biota, Special Status Species	A 50-mi (80-km) radius from the center of the Red Sands SEZ, including portions of Otero, Dona Ana, Sierra, Socorro, Lincoln, and Chaves Counties in New Mexico and El Paso and Hudspeth Counties in Texas
Visual Resources	Viewshed within a 25-mi (40-km) radius of the Red Sands SEZ
Acoustic Environment (noise)	Areas adjacent to the Red Sands SEZ
Paleontological Resources	Areas within and adjacent to the Red Sands SEZ
Cultural Resources	Areas within and adjacent to the Red Sands SEZ for archaeological sites; viewshed within a 25-mi (40-km) radius of the Red Sands SEZ for other properties, such as traditional cultural properties
Native American Concerns	Areas within and adjacent to the Red Sands SEZ; viewshed within a 25-mi (40-km) radius of the Red Sands SEZ

TABLE 12.3.22.1-1 (Cont.)

Resource Area	Geographic Extent
Socioeconomics	A 50-mi (80-km) radius from the center of the Red Sands SEZ
Environmental Justice	A 50-mi (80-km) radius from the center of the Red Sands SEZ
Transportation	I-10 and I-25; U.S. 54, 70, and 82; State Highways 24, 130, and 521.

12.3.22.2 Overview of Ongoing and Reasonably Foreseeable Future Actions

The future actions described below are those that are "reasonably foreseeable"; that is, they have already occurred, are ongoing, are funded for future implementation, or are included in firm near-term plans. Types of proposals with firm near-term plans are as follows:

- Proposals for which NEPA documents are in preparation or finalized;
- Proposals in a detailed design phase;
- Proposals listed in formal NOIs published in the *Federal Register* or state publications;
- Proposals for which enabling legislations has been passed; and
- Proposals that have been submitted to federal, state, or county regulators to begin a permitting process.

Projects in the bidding or research phases or that have been put on hold were not included in the cumulative impact analysis.

The ongoing and reasonably foreseeable future actions described below are grouped into two categories: (1) actions that relate to energy production and distribution, including potential solar energy projects under the proposed action (Section 12.3.22.2.1); and (2) other ongoing and reasonably foreseeable actions, including those related to mining and mineral processing, grazing management, transportation, recreation, water management, and conservation (Section 12.3.22.2.2). Together, these actions and trends have the potential to affect human and environmental receptors within the geographic range of potential impacts over the next 20 years.

12.3.22.2.1 Energy Production and Distribution

In March 2007, New Mexico passed Senate Bill 418, which expands the state's Renewable Energy Standard to 20% by 2020, with interim standards of 10% by 2011 and 15% by 2015. The bill also establishes a standard for rural electric cooperatives of 10% by 2020.

Furthermore, utilities are to set a goal of at least 5% reduction in total retail sales to New Mexico customers, adjusted for load growth, by January 1, 2020 (DSIRE 2010).

Reasonably foreseeable future actions related to renewable energy production and energy distribution within 50 mi (80 km) of the proposed Red Sands SEZ are identified in Table 12.3.22.2-1 and are described in the following paragraphs. However, no foreseeable fast-track projects for solar, wind, or geothermal energy have been identified within this distance.

Renewable Energy Development

Renewable energy ROW applications are considered in two categories—fast-track and regular-track applications. Fast-track applications, which apply principally to solar energy facilities, are those applications on public lands for which the environmental review and public participation process is underway and the applications could be approved by December 2010. A fast-track project would be considered foreseeable because the permitting and environmental review processes would be under way. There are no solar fast-track project applications within the ROI of the proposed Red Sands SEZ. Regular-track proposals are considered potential future projects, but not necessarily foreseeable projects, since not all applications would be expected to be carried to completion.

TABLE 12.3.22.2-1 Reasonably Foreseeable Future Actions Related to Energy Development and Distribution near the Proposed Red Sands SEZ

Description	Status	Resources Affected	Primary Impact Location
Fast-Track Solar Energy Projects on BLM-Administered Land			
None			
Transmission and Distribution Systems			
SunZia Southwest Transmission Project (two 500-kV lines)	NOI May 29, 2009; Draft EIS is expected to be available for review and comment by late 2010	Land use, terrestrial habitats, visual	Project study area includes the proposed Red Sands SEZ, most of central New Mexico, and a corridor through southwest New Mexico that connects to Arizona
High Plains Express Transmission Project (two 500-kV lines)	Feasibility Study Report June 2008	Land use, terrestrial habitats, visual	Conceptual route from northeast to southwest New Mexico via Luna, New Mexico to Arizona

Pending Renewable Energy ROW Applications on BLM-Administered Lands. No solar or geothermal regular-track ROW applications have been submitted to the BLM that would be located within 50 mi (80 km) of the SEZ. However, there is one pending wind testing application within 50 mi (80 km) of the SEZ. Table 12.3.22.2-2 provides information on the wind project and Figure 12.3.22.2-1 shows the location of this application. The likelihood of the regular-track wind application project actually being developed is uncertain but is generally assumed to be less than that for fast-track applications.

Transmission and Distribution

SunZia Southwest Transmission Project. This proposed project would be for two 500-kV transmission lines with an estimated total capacity of 3,000 MW. The proposed 460-mi (736-km) long transmission line would originate at a new substation in either Socorro County or Lincoln County in the vicinity of Bingham or Ancho, New Mexico, and terminate at the Pinal Central Substation in Pinal County near Coolidge, Arizona. The route and alternatives would cross BLM lands for about 170 mi (272 km) in New Mexico and 45 mi (72 km) in Arizona, along with state and private lands (BLM 2010d). The project study area includes the Red Sands SEZ, most of central New Mexico, and a corridor through southwest New Mexico that connects to Arizona. The project would transmit electricity generated by power generation resources, including primarily renewable resources, to western power markets and load centers (BLM 2010d). A Draft EIS is expected to be available for public review and comment by late 2010. Other federal, state, and county permitting efforts are also underway. SunZia is anticipated to be in service and delivering renewable energy by early 2014 (SunZia 2010).

High Plains Express Transmission Project. Two 500-kV transmission lines carrying up to 4,000 MW of bulk power are proposed. This project would traverse 1,300 mi (2,100 km) from east-central Wyoming, through eastern Colorado, across New Mexico, to Arizona. The conceptual route for one 500-kV line would connect to a substation about 90 mi (144 km) west of the Red Sands SEZ or interconnect with the proposed SunZia project for a portion of the route near the SEZ. The project would strengthen the eastern portion of the western grid, increase markets for renewable energy, increase system reliability, and allow economic transfers of energy. The project is projected to cost more than $5 billion (HPX 2008). Construction would begin in 2015, and operation would start in 2018. A project feasibility study was completed in 2008, and more detailed project studies are under way.

12.3.22.2.2 Other Actions

Other major ongoing and foreseeable actions identified within 50 mi (80 km) of the proposed Red Sands SEZ are listed in Table 12.3.22.2-3 and are described in the following subsections.

TABLE 12.3.22.2-2 Pending Renewable Energy Project ROW Applications on BLM-Administered Land within 50 mi (80 km) of the Red Sands SEZ

Serial No.	Project Name	Application Received	Size (acres[a])	MW	Technology	Status	Field Office
Wind Applications							
NMNM 115687	Guadalupe Mountains Wind, LLC	Feb. 16, 2006	46,547	–	Wind	Authorized for Wind Site Testing	Carlsbad

[a] To convert acres to km^2, multiply by 0.004047.

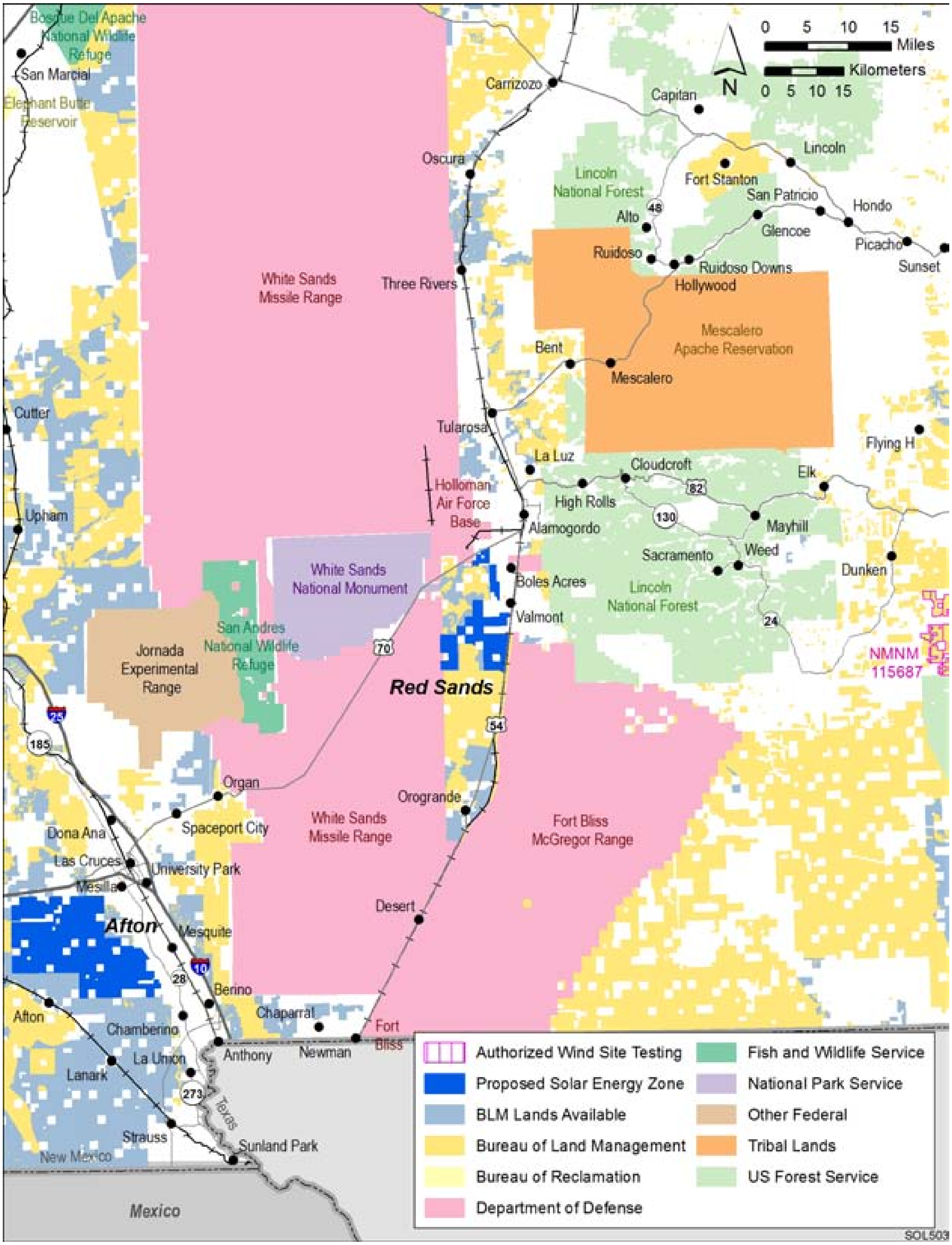

FIGURE 12.3.22.2-1 Locations of Renewable Energy Project ROW Applications within a 50-mi (80-km) Radius of the Proposed Red Sands SEZ

Other Ongoing Actions

Fort Bliss. The main cantonment area of Fort Bliss is located adjacent to El Paso, Texas, about 50 mi (80 km) south–southwest of the SEZ. The installation, which also includes the McGregor Range, the Dona Ana Range, the North Training Area in New Mexico, and the South Training Area in Texas, occupies a total of 1.12 million acres (4530 km^2). Fort Bliss comprises a complex of facilities and conducts training and test activities. The original Army post was established in 1854 (GlobalSecurity.org 2010a).

Fort Bliss McGregor Range. Fort Bliss McGregor Range, adjacent to the SEZ, encompasses 608,335 acres (2,461 km^2) of withdrawn public land, 71,083 acres (288 km^2) of Army fee-owned land, and 18,004 acres (73 km^2) of USFS land. Mission activities include training to maintain the operational readiness of active duty, reserve, and National Guard units through training, operations, and field exercises. Field exercises include field operations, communications, command and control, simulated enemy contact, smoke generation, and missile and weapons firing. Participation in joint training involves 10,000 to 20,000 personnel per year (GlobalSecurity.org 2010b).

Fort Bliss Dona Ana Range. Fort Bliss Dona Ana Range is 18 mi (28 km) south of the proposed Red Sands SEZ. The multi-purpose range complex consists of target lanes with armor stationary pits, moving and stationary targets, small arms ranges for mechanized infantry and aerial gunnery, and smoke generators for training to screen friendly actions against aggressor positions. Participation in joint training has involved more than 20,000 personnel per year (GlobalSecurity.org 2010c).

White Sands Missile Range (WSMR). The White Sands Missile Range, the Department of the Army's largest installation, covers about 2.2 million acres (8,900 km^2) and is located adjacent to the proposed Red Sands SEZ. The facility began operating in 1945 and employs about 2,700 military personnel and contractors. The primary mission is to support missile development and test programs for the U.S. Army, Navy, Air Force, and NASA. WSMR supports about 3,200 to 4,300 test events annually (GlobalSecurity.org 2010d; WSMR 2009).

Jornada Experimental Range. The Department of Agriculture's Jornada Experimental Range encompasses 193,000 acres (780 km^2). The closest boundary is 24 mi (39 km) west of the SEZ. The mission of the facility, which began operation in 1912, is to develop new knowledge of ecosystem processes as a basis for management and remediation of desert rangelands (USDA 2008).

TABLE 12.3.22.2-3 Other Major Actions near the Proposed Red Sands SEZ[a]

Description	Status	Resources Affected	Primary Impact Location
Fort Bliss	Established in 1854	Land use, terrestrial habitats, air quality, visual	50 mi (80 km) south southwest of the SEZ
Fort Bliss McGregor Range	Operating since the 1940s	Land use, terrestrial habitats, air quality, visual	Adjacent to the SEZ
Fort Bliss Dona Ana Range	Operating	Land use, terrestrial habitats, air quality, visual	18 mi (28 km) south of the SEZ
White Sands Missile Range	Operating since 1945	Land use, terrestrial habitats, air quality, visual	Adjacent to the SEZ
Jornada Experimental Range	Operating since 1912	Land use	Nearest boundary 24 mi (39 km) west of the SEZ
Opening of Hunting on the San Andres National Wildlife Refuge (NWR)	EA issued February 2007	Terrestrial habitat, wildlife	Boundary 20 mi (32 km) west of the SEZ
Mountain Lion Management on the San Andres NWR	EA issued September 2002	Terrestrial habitat, wildlife	Boundary 20 mi (32 km) west of the SEZ
Beddown of Training F-35A Aircraft at Holloman Air Force Base	NOI December 28, 2009	Land use	Adjacent to the SEZ
Lake Holloman Recreation Area Development	EA issued January 2009	Aquatic biota, surface water	Adjacent to the SEZ
Apache Pit Operating and Reclamation Plan	Scoping Letter April 2010	Terrestrial habitat, air quality	20 mi (32 km) northeast of the SEZ
Alamogordo Regional Water Supply Project	DEIS issued August 2010	Surface water, groundwater, geology, aquatic biota	Wells 30 mi (48 km) north of the SEZ; Desalination Facility 5 mi (8km) NE of SEZ
Tularosa Basin Desalination Research Facility	Final EA issued July 2003.	Terrestrial habitat, groundwater, cultural	5 mi (8 km) northeast of the SEZ

[a] Projects ongoing or in later stages of agency environmental review and project development.

Other Foreseeable Actions

Opening of Hunting on the San Andres National Wildlife Refuge (NWR). The USFWS intends to remove exotic antelope oryx on the San Andres NWR through a limited hunting program. The closest boundary of the NWR is 20 mi (32 km) west of the SEZ. The NWR encompasses 57,215 acres (232 km^2). The oryx, a large African antelope that was introduced in the early 1970s, has caused habitat damage and is a potential carrier of disease for desert mule deer and desert bighorn sheep (USFWS 2007).

Mountain Lion Management on the San Andres NWR. The USFWS intends to protect desert bighorn sheep from predation by mountain lions during restoration efforts for desert bighorn sheep in the San Andres Mountains. The closest boundary of the NWR is 20 mi (32 km) west of the SEZ. The NWR encompasses 57,215 acres (232 km^2). Control of mountain lions would be concentrated in a limited area around the desert bighorn sheep release sites. Any mature mountain lion perceived to be a threat would be killed (USFWS 2002).

Bed-down of Training F-35A Aircraft at Holloman Air Force Base. Holloman Air Force Base, located adjacent to the SEZ on the north, encompasses 59,639 acres (241 km^2). It is the home to the 49th Fighter Wing and the German Air Force training. The base supports a population of 21,000 active duty, Guard, and Reserve personnel; retirees; DoD civilians; and family members. F-22A, T-38, QF-4, and Tornado aircraft operate from the base. The base was opened in 1942 as Alamogordo Army Air Field, and renamed Holloman Air Force Base in 1948. Holloman Air Force Base is one of the sites being considered for the bed-down of training F-35A aircraft, and an EIS is being prepared for that action (Holloman Air Force Base 2010).

Lake Holloman Recreation Area Development. The 49th Fighter Wing proposes to construct camping, beach, and picnic areas; nature trails; restrooms; and recreational vehicle facilities at Lake Holloman and Lagoon G on Holloman Air Force Base. Currently, the areas surrounding Lake Holloman and Lagoon G do not support organized recreational activities. The lake, encompassing about 1,700 acres (6.9 km^2), is on the southernmost part of Holloman Air Force Base (Holloman Air Force Base 2009).

Apache Pit Operating and Reclamation Plan. The USFS has requested comments on the proposed Apache Pit Operating and Reclamation Plan. The existing Apache Pit gravel site is 2 mi (3 km) east of Cloudcroft, New Mexico, and about 20 mi (32 km) northeast of the SEZ. The existing pit covers 10 acres (0.04 km^2) and has operated for more than 16 years. The objective is to develop plan for an 18-acre (0.07-km^2) pit expansion to provide 1.5 million yd^3 (1.1 million m^3) of material to allow for future mining for an estimated 30 years (USFS 2010).

Alamogordo Regional Water Supply Project. The City of Alamogordo, New Mexico, plans to construct and operate 10 brackish groundwater wells, install water transmission lines to Alamogordo, construct a desalination plant, and construct a booster pump station to deliver the treated water into the municipal water system. The 10 wells would be drilled on about 20 acres (0.08 km^2) of BLM land 26 mi (42 km) north of Alamogordo and 30 mi (48 km) north of the SEZ. They would withdraw 4,000 ac-ft/yr (4.9 million m^3/yr) of brackish water. The reverse-osmosis desalination facility will be co-located on the 99-acre (0.40-km^2) site of the Tularosa Basin Desalination Research Facility in Alamogordo, about 5 mi (8km) northeast of the closest SEZ boundary. The water transmission line will run parallel to U.S. 54 (BLM 2010e).

Tularosa Basin Desalination Research Facility. The Bureau of Reclamation (BOR) has operated the Tularosa Basin Desalination Research Facility since 2007. The goal of the facility is to improve the existing desalination technologies. The 99-acre (0.40-km^2) site, located at the intersection of U.S. 70 and U.S. 54 in Alamogordo, New Mexico, is about 5 mi (8 km) northeast of the closest SEZ boundary. The site contains a 16,000-ft^2 (1,500-m^2) office and research building, a 4- to 5-acre (0.016- to 0.020-km^2) area for the evaluation of renewable energy desalination applications, a 4- to 5-acre (0.016- to 0.020-km^2) area for the concentrated disposal and minimization, and 4 to 5 acres (0.016 to 0.020 km^2) of concentrated reuse for agricultural applications (BOR 2003; Hightower 2004).

Grazing Allotments

Four grazing allotments overlap the Red Sands SEZ. Within 50 mi (80 km) of the SEZ, most of the grazing allotments are to the north and southeast.

Mining

Within 50 mi (80 km) of the Red Sands SEZ, the BLM GeoCommunicator database (BLM and USFS 2010b) shows several active mining claims on file with the BLM. The highest density (101 to 200 claims per township) is about 45 mi (75 km) north of the SEZ.

12.3.22.3 General Trends

12.3.22.3.1 Population Growth

Over the period 2000 to 2008, the counties in the ROI experienced growth in population. During that period, the population in Dona Ana County in New Mexico grew at an annual rate of 2.1%; Otero County in New Mexico grew by 0.6%; and El Paso County in Texas grew by 1.7%. The population of the three-county surrounding ROI for the proposed Red Sands SEZ in 2008 was 1,047,566, having grown at an average annual rate of 1.7% since 2000. The growth rate for the state of New Mexico as a whole was 1.7% (Section 12.3.10.1).

12.3.22.3.2 Energy Demand

The growth in energy demand is related to population growth through increases in housing, commercial floorspace, transportation, manufacturing, and services. Given that population growth is expected in Dona Ana, Otero, and El Paso Counties between 2006 and 2016, an increase in energy demand is also expected. However, the Energy Information Administration (EIA) projects a decline in per-capita energy use through 2030, mainly because of the high cost of oil and improvements in energy efficiency throughout the projection period. Primary energy consumption in the United States between 2007 and 2030 is expected to grow by about 0.5% each year; the fastest growth is projected for the commercial sector (at 1.1% each year). Transportation, residential, and industrial energy consumption are expected to grow by about 0.5%, 0.4%, and 0.1% each year, respectively (EIA 2009).

12.3.22.3.3 Water Availability

As described in Section 12.3.9, depth to groundwater in the vicinity of the Red Sand SEZ is about 75 feet (23 m). Groundwater pumping in the Tularosa Basin underlying the SEZ has led to drawdown of the water table elevation. Water levels have dropped between 15 and 35 ft (5 and 11 m) between 1954 and 1996 east of the proposed SEZ near well fields serving the Holloman Air Force Base. Annual recharge to the basin is estimated range from 14,500 to 29,920 ac-ft (18 million to 37 million m^3).

In 2005, water withdrawals from surface waters and groundwater in Otero County were 40,711 ac-ft/yr (50.2 million m^3/yr), of which 27% came from surface waters and 73% from groundwater. The largest water use category was agricultural irrigation, at 36,743 ac-ft/yr (45.3 million m^3/yr). Public supply water use accounted for 3,408 ac-ft/yr (4.2 million m^3/yr), which was provided by groundwater only.

The Tularosa Basin is recognized by the New Mexico Office of the State Engineer as a mined basin, in which groundwater withdrawals exceed recharge, and use is administered to a specified amount of dewatering during a 40-year planning period. The estimated maximum groundwater use, if mined, is 63,250 ac-ft/yr (78 million m^3/yr).

12.3.22.3.4 Climate Change

A report on global climate change in the United States prepared by the U.S. Global Change Research Program (GCRP 2009) documents current temperature and precipitation conditions and historic trends. Excerpts of the conclusions from this report indicate the following for the southwestern region of the United States, which includes western and central New Mexico:

- Decreased precipitation, with a greater percentage of that precipitation coming from rain, will result in a greater likelihood of winter and spring flooding and decreased stream flow in the summer.

- Increased frequency and altered timing of flooding will increase risks to people, ecosystems, and infrastructure.

- The average temperature in the Southwest has already increased by about 1.5ºF (0.8ºC) compared to a 1960 to 1979 baseline, and by the end of the century, the average annual temperature is projected to rise 4ºF to 10ºF (2ºC to 6ºC).

- A warming climate and the related reduction in spring snowpack and soil moisture have increased the length of the wildfire season and the intensity of forest fires.

- Later snow and less snow coverage in ski resort areas could force ski areas to shut down before the season would otherwise end.

- Much of the Southwest has experienced drought conditions since 1999. This represents the most severe drought in the last 110 years. Projections indicate an increasing probability of drought in the region.

- As temperatures rise, the landscape will be altered as species shift their ranges northward and upward to cooler climates.

- Temperature increases, when combined with urban heat island effects for major cities such as Albuquerque, present significant stress to health and electricity and water supplies.

- Increased minimum temperatures and warmer springs extend the range and lifetime of many pests that stress trees and crops, and lead to northward migration of weed species.

12.3.22.4 Cumulative Impacts on Resources

This section addresses potential cumulative impacts in the proposed Red Sands SEZ on the basis of the following assumptions: (1) because of the moderate size of the proposed SEZ (>10,000 and <30,000 acres [>40.5 and <121 km^2]), up to two projects could be constructed at a time, and (2) maximum total disturbance over 20 years would be about 18,016 acres (73 km^2) (80% of the entire proposed SEZ). For purposes of analysis, it is also assumed that no more than 3,000 acres (12.1 km^2) would be disturbed per project annually and up to 250 acres (1.01 km^2) monthly on the basis of construction schedules planned in current applications. Since a 115-kV line runs through the SEZ, no analysis of impacts has been conducted for the construction of a new transmission line outside of the SEZ that might be needed to connect solar facilities to the regional grid (see Section 12.3.1.2). Regarding site access, the nearest major roads are U.S. 70, which runs by the northernmost boundary of the SEZ, and U.S. 54, which runs along a portion of the eastern boundary. It is assumed that no new access roads would need to be constructed to reach either road and to support solar development in the SEZ.

Cumulative impacts that would result from the construction, operation, and decommissioning of solar energy development projects within the proposed SEZ when added to other past, present, and reasonably foreseeable future actions described in the previous section in each resource area are discussed below. At this stage of development, because of the uncertain nature of future projects in terms of size, number, and location within the proposed SEZ and the types of technology that would be employed, the impacts are discussed qualitatively or semiquantitatively, with ranges given as appropriate. More detailed analyses of cumulative impacts would be performed in the environmental reviews for the specific projects in relation to all other existing and proposed projects in the geographic area.

12.3.22.4.1 Lands and Realty

The area covered by the proposed Red Sands SEZ is largely rural and undeveloped. The area surrounding the SEZ is mostly rural, with some industrial/commercial and residential development near the northern and eastern borders. The SEZ also borders three different U.S. military installations, including Holloman Air Force Base to the north, while the White Sands National Monument lies 4 mi (6.4 km) to the west. U.S. 70 and U.S. 54 would provide access to the SEZ, while the interior of the SEZ is accessible via several dirt/gravel roads (Section 12.3.2.1).

Development of the SEZ for utility-scale solar energy production would establish a new industrial area that would exclude many existing and potential uses of the land, perhaps in perpetuity. There is little development within the SEZ, while several industrial facilities lie along U.S. 70 to the north. Thus, utility-scale solar energy development within the SEZ would not be a new land use in the area but would convert additional rural land to such use. Access to portions of the SEZ holding solar facilities by both the general public and much wildlife, for current uses, would be eliminated. Roads and trails that provide public access to the area, especially from the east, would be blocked or rerouted by solar energy development.

As shown in Table 12.3.22.2-2 and Figure 12.3.22.2-1, there are currently no solar applications on the SEZ or on public land within a 50-mi (80-km) radius of the proposed SEZ. There is one wind testing application and no geothermal applications within this distance. Other ongoing and currently foreseeable projects identified in Section 12.3.22.2.2 are mainly military training bases and related activities (Section 12.3.22.2), which dominate land use near the SEZ. The proposed Afton and Mason Draw SEZs are located about 50 mi (80 km) to the southwest.

The development of utility-scale solar projects in the proposed Red Sands SEZ in combination with other ongoing and foreseeable actions within the 50-mi (80-km) geographic extent of effects could have small-to-moderate cumulative effects on land use through impacts on land access and use for other purposes, due to the large amounts of surrounding lands already committed to military and other uses. It is not anticipated that approval of solar energy development within the SEZ would have a significant impact on the amount of public lands available for future ROWs outside the SEZ, however (Section 12.3.2.2.1).

12.3.22.4.2 Specially Designated Areas and Lands with Wilderness Characteristics

Six specially designated areas are within 25 mi (40 km) of the proposed Red Sands SEZ in New Mexico and potentially could be affected by solar energy development within the SEZ from impacts on scenic and wilderness characteristics (Section 12.3.3.1). The potential exists for cumulative visual impacts on these areas from the construction of utility-scale solar energy facilities within the SEZ and other development outside the SEZ within the geographic extent of effects. The magnitude of cumulative effects from currently foreseeable development, however, would be low due to the small number of projects identified. Existing military, commercial, and residential development to the north and east of the SEZ would contribute to cumulative visual impacts on sensitive areas.

12.3.22.4.3 Rangeland Resources

The proposed Red Sands SEZ covers from 13 to 51% of five existing grazing allotments, while additional grazing lands on private or state lands within the outer boundary of the SEZ may also be affected (Section 12.3.4.1.1). If utility-scale solar facilities were constructed on the SEZ, those areas occupied by the solar projects would be excluded from grazing. However, there would be a minimal impact on livestock use within the Las Cruces District of no more than about 0.6% of total AUMs. Other foreseeable projects within 50 mi (80 km) of the SEZ are not expected to significantly affect grazing because of the nature and small number of the proposed projects. Thus, cumulative impacts on grazing would be small.

The proposed Red Sands SEZ is about 90 mi (145 km) or more from the nearest wild horse and burro HMA managed by the BLM and 200 mi (322 km) from any wild horse and burro territories administered by the USFS; thus solar energy development within the SEZ would not directly or indirectly affect wild horses and burros (Section 12.3.4.2.2). The SEZ would not, therefore, contribute to cumulative effects on wild horses and burros.

12.3.22.4.4 Recreation

There is little current recreational use within the area of the proposed SEZ, mainly hiking, biking, backcountry driving, and hunting (Section 12.3.5.1). Construction of utility-scale solar projects on the SEZ would preclude recreational use of the affected lands for the duration of the projects, while access restrictions within the SEZ could affect access to recreational areas within and outside the SEZ. Such effects are expected to be small due to low current use. However, much of the surrounding land is also closed to recreation and alternate recreational areas may require additional travel by users. Effects on wilderness characteristics in surrounding specially designated areas from visual impacts of solar facilities are more difficult to assess, but small cumulative impacts on these areas from solar development in the proposed SEZ could accrue. Other foreseeable actions within the geographic extent of effects are limited and would not contribute significantly to cumulative impacts on recreation.

12.3.22.4.5 Military and Civilian Aviation

The proposed Red Sands SEZ is located in the center of a concentration of MTRs and SUAs that support activities at surrounding military installations. The military has expressed concerns over potential impacts from solar facilities on flight operations, especially with regard to Holloman Air Force Base to the north of the SEZ. In addition, the Alamogordo-White Sands Regional Airport is within the 3 mi (4.8 km) of the SEZ (Section 12.3.6.1). FAA regulations, including height restrictions on solar facilities and transmission lines to prevent conflicts with civilian airport operations, would come into effect to protect civilian flight operations there. Foreseeable development within 50 mi (80 km) of the SEZ would not affect military or civilian aviation; thus, there would be no cumulative impacts.

12.3.22.4.6 Soil Resources

Ground-disturbing activities (e.g., grading, excavating, and drilling) during the construction phase of a solar project, including the construction of any associated transmission line connections and new roads, would contribute to soil loss due to wind erosion. Road use during construction, operations, and decommissioning of the solar facilities would further contribute to soil loss. Programmatic design features would be employed to minimize erosion and loss. Residual soil losses with mitigations in place would be in addition to losses from ongoing activities outside of the proposed SEZ, including military training operations and OHV use. Cumulative impacts on soil resources from other ongoing and foreseeable projects within the region are unlikely, because these projects are few in number and generally do not produce significant soil disturbance (Section 12.3.22.2). Cumulative impacts from solar facilities in the proposed Red Sands SEZ would depend on the number and size of facilities ultimately built, but are expected to remain small with mitigations in place.

Landscaping of solar energy facility areas in the SEZ could alter drainage patterns and lead to increased siltation of surface water streambeds, in addition to that from other activities outside the SEZ. However, with the expected programmatic design features in place, cumulative impacts would likewise be small.

12.3.22.4.7 Minerals (Fluids, Solids, and Geothermal Resources)

As discussed in Section 12.3.8, there are currently no active oil and gas leases or mining claims within the proposed Red Sands SEZ, and there are no pending proposals for geothermal energy development. Because of the generally low level of mineral production in the proposed SEZ and surrounding area, and the expected low impact on mineral accessibility of other foreseeable actions within the geographic extent of effects, no cumulative impacts on mineral resources are expected.

12.3.22.4.8 Water Resources

Section 12.3.9.2 describes the water requirements for various technologies if they were to be employed on the proposed SEZ to develop utility-scale solar energy facilities. The amount of water needed during the peak construction year for evaluated solar technologies would be up to about 3,200 ac-ft/yr (3.9 million m^3/yr). During operations, with full development of the SEZ on more than 80% of its available land area, the amount of water needed for evaluated solar technologies would range from 102 to 54,098 ac-ft/yr (126,000 to 67 million m^3/yr). The amount of water needed during decommissioning would be similar to or less than the amount used during construction. In 2005, water withdrawals from surface waters and groundwater in Otero County were 40,711 ac-ft/yr (50.2 million m^3/yr), of which 27% came from surface waters and 73% came from groundwater. The largest water use category was agricultural irrigation, at 36,743 ac-ft/yr (45.3 million m^3/yr). Public supply water use accounted for 3,408 ac-ft/yr (4.2 million m^3/yr), which was provided for by groundwater only (Section 12.3.9.1.3). Therefore, cumulatively, the additional water resources needed for solar facilities in the SEZ during operations would constitute from a small (0.25%) to a very large (133%) increment (the ratio of the annual water requirement for operations to the annual amount withdrawn in Otero County), depending on the solar technology used (PV technology at the low end and the wet-cooled parabolic trough technology at the high end). As discussed in Section 12.3.9.1.2, the proposed Red Sands SEZ is located on the Tularosa Groundwater Basin. Estimated groundwater recharge in the vicinity of the Alamogordo-Tularosa Management Area is 11,890 ac-ft/yr (14.7 million m^3/yr) in a normal year. Thus, using wet cooling for a full build-out of the Red Sands SEZ would consume up to 450% of the entire estimated recharge in a normal year, while dry-cooling technologies, which would use up to 5,455 ac-ft (6.7 million m^3), could use up to 46% of the recharge in a normal year (Section 12.3.9.2.2).

While solar development of the proposed SEZ with water-intensive technologies that would use groundwater would likely be judged infeasible because of concerns for groundwater supplies, if employed, intensive groundwater withdrawals could cause drawdown of groundwater, disturbance of regional groundwater flow and recharge pattern, and potentially affect ecological habitats. Cumulative impacts on groundwater could occur when combined with other current and future projects in the region, including potential effects of the planned Alamogordo Regional Water Supply Project, which would draw 4,000 ac-ft/yr (4.9 million m^3/yr) from wells located about 30 mi (48 km) north of the SEZ to support a growing population. Groundwater pumping in the Tularosa Basin has already led to drawdown of the water table, as observed in the Tularosa irrigation district, the City of Alamogordo, Boles Acres, White Sands, and elsewhere (Section 12.3.9.1.2). Drawdown of groundwater surface elevations in the vicinity of White Sands National Monument is a particular concern because of the importance of the groundwater table for preserving the gypsum sand dunes. Water use by solar energy facilities in the proposed Red Sands SEZ could thus contribute to impacts on groundwater in the Tularosa Basin. Cumulative impacts on groundwater resources might be offset to some degree by conversion of existing water rights for use by solar facilities or by use of reclaimed municipal or industrial wastewater for such use.

Small quantities of sanitary wastewater would be generated during the construction and operation of the potential utility-scale solar energy facilities. The amount generated from solar facilities would be in the range of 19 to 148 ac-ft/yr (23,000 to 183,000 m^3/yr) during the peak construction year and 2 to 50 ac-ft/yr (up to 62,000 m^3/yr) during operations. Because of the small quantity, the sanitary wastewater generated by the solar energy facilities would not be expected to put undue strain on available sanitary wastewater treatment facilities in the general area of the SEZ. For technologies that rely on conventional wet-cooling systems, there would also be 569 to 1,024 ac-ft/yr (0.70 million to 1.3 million m^3/yr) of blowdown water from cooling towers. Blowdown water would need to be either treated on-site or sent to an off-site facility. Any on-site treatment of wastewater would have to ensure that treatment ponds are effectively lined in order to prevent any groundwater contamination. Thus, blowdown water would not contribute to cumulative effects on treatment systems or on groundwater.

12.3.22.4.9 Vegetation

The proposed Red Sands SEZ is located primarily within the Chihuahuan Basins and Playas ecoregion, which support communities of desert shrubs and grasses. The predominant cover types within the proposed SEZ are Apacherian–Chihuahuan Piedmont Semi-Desert Grassland and Steppe, Chihuahuan Stabilized Coppice Dune and Sand Flat Scrub, and Chihuahuan Mixed Salt Desert Scrub. Dominant species are burrograss, Alkali sacaton, mesa dropseed, soaptree yucca, creosotebush, honey mesquite, and fourwing saltbush. Sensitive habitats on the SEZ include wetlands, riparian areas, desert dry washes, playas, and sand dunes. Dry washes generally do not support wetland habitats. In addition, several palustrine wetlands, with varying levels and types of vegetation and covering about 17 acres (0.07 km^2), and two riverine wetlands of about 0.3 mi (0.4 km) in total length, occur on the SEZ. In the 5-mi (8-km) area of indirect effects, the predominant cover types are Chihuahuan Stabilized Coppice Dune and Sand Flat Scrub, Chihuahuan Mixed Salt Desert Scrub, and Apacherian–Chihuahuan Piedmont Semi-Desert Grassland and Steppe. This area holds numerous wetlands, including lacustrine open water and flats, palustrine scrub-shrub and open water, and riverine wetlands (Section 12.3.10.1).

If utility-scale solar energy projects were to be constructed within the SEZ, all vegetation within the footprints of the facilities would likely be removed during land-clearing and land-grading operations. Full development of the SEZ over 80% of its area would result in large impacts on the North American Warm Desert Pavement cover type, moderate impacts on the Chihuahuan Mixed Salt Desert Scrub and North American Warm Desert Playa cover types, and small impacts on all other cover types in the affected area (Section 12.3.10.2.1).

Intermittently flooded areas downgradient from solar projects could be affected by ground-disturbing activities. Alteration of surface drainage patterns or hydrology, sedimentation, and siltation could adversely affect on-site and downstream wetland communities, particularly the playa areas to the west of the SEZ. Plant communities supported by groundwater, such as some mesquite communities, could also be affected by lower groundwater levels if solar projects were to draw heavily on this resource. Groundwater drawdown has already been observed in the underlying Tularosa Basin.

The fugitive dust generated during the construction of the solar facilities could increase the dust loading in habitats outside a solar project area, in combination with that from other construction, agriculture, recreation, transportation activities, and military training activities in the region. The cumulative dust loading could result in reduced productivity or changes in plant community composition. Programmatic design features would be used to reduce the impacts from solar energy projects and thus reduce the overall cumulative impacts on plant communities and habitats.

While most of the cover types within the SEZ are relatively common in the SEZ region, a number of cover types are relatively uncommon, representing less than 1% of the land area within the region. In addition, sensitive areas are present within the SEZ, including desert dry washes, riparian areas, playas, sand dunes, and areas with cryptogamic soil crusts. Thus, future solar facilities and other ongoing and reasonably foreseeable future actions could have a cumulative effect on sensitive and rare cover types and habitat types, as well as on those that are more abundant. Such effects would likely be small for foreseeable development due to the abundance of most of the cover types and habitats and the small number of foreseeable actions within the geographic extent of effects.

12.3.22.4.10 Wildlife and Aquatic Biota

Wildlife species that could potentially be affected by the development of utility-scale solar energy facilities in the proposed Red Sands SEZ include amphibians, reptiles, birds, and mammals. The construction of utility-scale solar energy projects in the SEZ and any associated transmission lines and roads in or near the SEZ would affect wildlife through habitat disturbance (i.e., habitat reduction, fragmentation, and alteration), wildlife disturbance, loss of connectivity between natural areas, and wildlife injury or mortality. In general, species with broad distributions and a variety of habitats would be less affected than species with narrowly defined habitats within a restricted area. The use of programmatic design features would reduce the severity of impacts on wildlife. These programmatic design features may include pre-disturbance biological surveys to identify key habitat areas used by wildlife, followed by avoidance or minimization of disturbance to those habitats.

Impacts from full build-out over 80% of the proposed SEZ would result in small impacts on amphibian, reptile, bird, and mammal species (Section 12.3.11). Impacts from ongoing and foreseeable development within the 50-mi (80-km) geographic extent of effects would add to those of the SEZ. Because few foreseeable projects have been identified (Section 12.3.22.2), cumulative effects in the region would be small for most species. Two future actions have been identified that would benefit wildlife in the region: (1) removing introduced exotic antelope oryx on the San Andres NWR and (2) protecting desert bighorn sheep from predation by mountain lions in the San Andres Mountains.

There are no perennial water bodies or streams within the proposed Red Sands SEZ or within a 5-mi (8-km) radius of indirect effects. There are 0.3 mi (0.4 km) of intermittent stream wetlands as well as small ephemeral washes and unnamed dry lakes within the SEZ, however, that support minimal aquatic or riparian habitats and species adapted to such conditions.

Wetlands occur in some abundance, however, within the 50-mi (80-km) geographic extent of effects, especially to the west of the SEZ and near Holloman Lake, a permanent water body (Section 12.3.11.4.1). Holloman Lake and the associated surface waters provide habitat to aquatic biota. Disturbance of land areas within the SEZ for solar energy facilities could result in transport of soil into ephemeral washes on-site and to aquatic habitats in the area of indirect effects. Such impacts would be mitigated, however, and no contributions to cumulative impacts on aquatic biota and habitats are expected in combination with the limited other foreseeable actions in the region. Groundwater drawdown from solar facilities might contribute to small cumulative impacts on supported aquatic habitats, including in Holloman Lake.

12.3.22.4.11 Special Status Species (Threatened, Endangered, Sensitive, and Rare Species)

On the basis of recorded occurrences or suitable habitat, as many as 43 special status species could occur within the proposed Red Sands SEZ. Of these species, 17 are known or are likely to occur within the affected area of the SEZ (including the SEZ and the 5-mi [8-km] area of indirect effects). Alamo beardtongue, golden columbine, grama grass cactus, Sacramento Mountains prickly-poppy, Scheer's pincushion cactus, Villard pincushion cactus, White Sands pupfish, Texas horned lizard, American peregrine falcon, Baird's sparrow, black tern, gray vireo, interior least tern, northern aplomado falcon, western burrowing owl, white-faced ibis, and spotted bat. Four ESA-listed species may occur in the affected area, including two species already mentioned: northern aplomado falcon, Kuenzler's hedgehog cactus, Sacramento Mountains prickly-poppy, and interior least tern. Section 12.3.12.1 discusses the nature of the special status listing of these species within state and federal agencies. Numerous additional species that may occur on or in the vicinity of the SEZ are listed as threatened or endangered by the State of New Mexico or listed as a sensitive species by the BLM. Design features to be used to reduce or eliminate the potential for effects on these species from the construction and operation of utility-scale solar energy facilities in the SEZ include avoidance of habitat and minimization of erosion, sedimentation, and dust deposition. Ongoing effects on special status species within the 50-mi (80-km) geographic extent of effects include those from roads, transmission lines, agriculture, military training operations, and urban development in the area, particularly to the north and east of the SEZ. Special status species are also likely present in areas outside the SEZ within the 50-mi (80-km) geographic extent of effects that would be affected by future development. However, cumulative impacts on protected species are expected to be low for foreseeable development, because few projects have been identified (Section 12.3.22.2). Projects would employ mitigation measures to limit effects.

12.3.22.4.12 Air Quality and Climate

While solar energy generates minimal emissions compared with fossil fuels, the site preparation and construction activities associated with solar energy facilities would be responsible for some amount of air pollutants. Most of the emissions would be particulate matter (fugitive dust) and emissions from vehicles and construction equipment. When these emissions are combined with those from other nearby activities outside the proposed Red Sands SEZ, or when they are added to natural dust generation from winds and windstorms, the air quality in the general vicinity of the projects could be temporarily degraded. For example, during construction of solar facilities the maximum 24-hour PM_{10} concentration at or near the SEZ boundaries could at times exceed the applicable standard of 150 $\mu g/m^3$. Dust generation from construction activities can be controlled by implementing aggressive dust control measures, such as increased watering frequency or road paving or treatment.

Ozone, PM_{10}, and $PM_{2.5}$ are of regional concern in the area because of high temperatures, abundant sunshine, and windblown dust from occasional high winds and dry soil conditions. Construction of solar facilities in the SEZ in addition to ongoing and potential future sources in the geographic extent of effects could contribute cumulatively to short-term ozone and PM increases. Cumulative air quality effects due to dust emissions are expected to be small and short term.

Over the long term and across the region, the development of solar energy may have beneficial cumulative impacts on the air quality and atmospheric values by offsetting the need for energy production that results in higher levels of emissions, such as coal, oil, and natural gas. As discussed in Section 12.3.13.2.2, air emissions from operating solar energy facilities are relatively minor, while the displacement of criteria air pollutants, VOCs, TAPs, and GHG emissions currently produced from fossil fuels could be significant. For example, if the Red Sands SEZ were fully developed (80% of its acreage) with solar facilities, the quantity of pollutants avoided could be as large as 18% of all emissions from the current electric power systems in New Mexico.

12.3.22.4.13 Visual Resources

The proposed Red Sands SEZ, located in Otero County in southern New Mexico, lies within the Tularosa Valley, a flat, generally treeless valley, with the strong horizon line and surrounding buttes and the Sacramento Escarpment being the dominant visual features (Section 12.3.14.1). The area is rural in character, with Holloman Air Force Base and commercial and residential areas nearby. Cultural modifications in the SEZ include dirt and gravel roads, existing transmission towers, a gravel pit, and grazing facilities. In addition, U.S. 70 runs along the northern SEZ boundary and U.S. 54 along the eastern boundary. The VRI values for the SEZ and immediate surroundings are mostly VRI Class III, but with three very small areas of Class II values, indicating moderate, and high visual values, respectively. The inventory indicates moderate scenic quality for the SEZ and its immediate surroundings; however, the inventory indicates high sensitivity for the Lone Butte area. Locations with high scenic value lie in the surrounding areas and highlands.

Construction of utility-scale solar facilities on the SEZ would alter the natural scenic quality of the immediate area, while the broader area, which is already affected by urban, industrial, and agricultural development, would be further altered. Because of the large size of utility-scale solar energy facilities and the generally flat, open nature of the proposed SEZ, some lands outside the SEZ would also be subjected to visual impacts related to the construction, operation, and decommissioning of utility-scale solar energy facilities. Visual impacts resulting from solar energy development within the SEZ would be in addition to impacts caused by other potential projects in the area, such as other solar facilities on private lands, transmission lines, and other renewable energy facilities (e.g., wind mills). The presence of new facilities would normally be accompanied by increased numbers of workers in the area, traffic on local roadways, and support facilities, all of which would add to cumulative visual impacts.

There are currently no pending solar applications on the SEZ or on public lands within 50 mi (80 km) of the SEZ. There is one wind site testing application and no geothermal applications within this distance (Figure 12.3.22.2-1). Little other foreseeable development has been identified (Section 12.3.22.2.2). While the number of foreseeable and potential projects within the geographic extent of visual effects is low, it may be concluded that the general visual character of the landscape on and within the immediate vicinity of the SEZ could be cumulatively affected by the presence of solar facilities on the SEZ and any other new and existing infrastructure within the viewshed. The degree of cumulative visual impacts would depend in large part on the number and location of solar facilities built on the proposed SEZ. Because of the topography of the region, solar facilities would be visible at great distances. In addition, facilities would be located near major roads and thus would be viewable by motorists, who would also be viewing transmission lines, towns, and other infrastructure, as well as the road system itself.

As additional facilities are added, several projects might become visible from one location, or in succession, as viewers move through the landscape, as by driving on local roads. In general, the new facilities would be expected to vary in appearance, and depending on the number and type of facilities, the resulting visual disharmony could exceed the visual absorption capability of the landscape and add significantly to the cumulative visual impact. Considering the low level of currently foreseeable development in the region, however, small cumulative visual impacts would occur within the geographic extent of effects from future solar and other existing and future development.

12.3.22.4.14 Acoustic Environment

The areas around the proposed Red Sands SEZ range from rural to industrial. Existing noise sources around the SEZ include road traffic, railroad traffic, commercial/military aircraft flyover, livestock grazing, and the surrounding military ranges and communities.
The construction of solar energy facilities could increase the noise levels periodically for up to 3 years per facility, but there would be little or minor noise impacts during the operation of solar facilities, except from solar dish engine facilities and from parabolic trough or power tower facilities using TES, which could affect nearby residences.

Other ongoing and reasonably foreseeable and potential future activities in the general vicinity of the SEZ are described in Section 12.3.22.2. Because few proposed projects lie nearby outside the SEZ and noise from facilities built within the SEZ would be short range, cumulative noise effects during the construction or operation of solar facilities are unlikely.

12.3.22.4.15 Paleontological Resources

The proposed Red Sands SEZ has a low potential for containing significant paleontological resources; there are no known localities of paleontological resources within the SEZ or within 5 mi (8 km) of its boundaries (Section 12.3.16.1). Prior to solar development, the preliminary PFYC classifications of Classes 1 and 2 for the SEZ would require confirmation, but paleontological surveys would not likely be needed (Section 12.3.16.2). Any resources unexpectedly encountered during solar facility construction would be mitigated to the extent possible. Cumulative impacts on paleontological resources within the geographic extent of effects are not expected.

12.3.22.4.16 Cultural Resources

The proposed Red Sands SEZ is rich in cultural history, with settlements dating as far back as 12,000 years, and has the potential to contain significant cultural resources. About 7% of the area of the SEZ has been surveyed for cultural resources. Surveys have recorded 18 cultural resource sites within the SEZ. About 11% of the area within 5 mi (8 km) of the SEZ has been surveyed, resulting in the recording of 849 sites within this range (Section 12.3.17.1.5). Areas with potential for significant sites within the proposed SEZ include dune and playa areas in the eastern portion of the SEZ (Section 12.3.17.2). It is possible that the development of utility-scale solar energy projects in the SEZ, when added to other potential projects likely to occur in the area would contribute cumulatively to cultural resource impacts occurring in the region. Little foreseeable development has been identified within the 25-mi (40-km) geographic extent of effects (Section 12.3.22.2). While any future solar projects would disturb large areas, the specific sites selected for future projects would be surveyed; historic properties encountered would be avoided or mitigated to the extent possible. Through ongoing consultation with the New Mexico SHPO and appropriate Native American governments, it is likely that most adverse effects on significant resources in the region could be mitigated to some degree. While mitigation of all impacts may not be possible, particularly visual impacts outside the SEZ, it is unlikely that any sites recorded in the SEZ would be of such individual significance that development would cumulatively cause an irretrievable loss of information about a significant resource type, but this would depend on the results of future surveys and evaluations.

12.3.22.4.17 Native American Concerns

Government-to-government consultation is under way with federally recognized Native American Tribes with possible traditional ties to the Red Sands area. All such Tribes have been contacted and provided an opportunity to comment or consult regarding this PEIS. To date, no specific concerns have been raised to the BLM regarding the proposed Red Sands SEZ. However, the Pueblo of Ysleta del Sur has requested that they be consulted if human remains or other NAGPRA materials are encountered during development, implying concern for human burials and objects of cultural patrimony. Impacts of solar development on water resources in the SEZ and in the surrounding area are likely to be of major concern to affected Tribes, as are intrusions on the landscape and impacts on plants and game and on traditional resources at specific locations (Section 12.3.18). The development of solar energy facilities in combination with the development of other foreseeable projects in the area could reduce the traditionally important plant and animal resources available to the Tribes. Such effects would be small for foreseeable development due to the abundance of the most culturally important plant species and the small number and minor effects of foreseeable actions within the geographic extent of effects. Continued discussions with area Tribes through government-to-government consultation is necessary to effectively consider and address the Tribes' concerns tied to solar energy development in the Red Sands SEZ.

12.3.22.4.18 Socioeconomics

Solar energy development projects in the proposed Red Sands SEZ could cumulatively contribute to socioeconomic effects in the immediate vicinity of the SEZ and in the surrounding ROI. The effects could be positive (e.g., creation of jobs and generation of extra income, increased revenues to local governmental organizations through additional taxes paid by the developers and workers) or negative (e.g., added strain on social institutions such as schools, police protection, and health-care facilities). Impacts from solar development would be most intense during facility construction, but of greatest duration during operations. Construction would temporarily increase the number of workers in the area needing housing and services in combination with temporary workers involved in any other new development in the area, including other renewable energy projects. The number of workers involved in the construction of solar projects in the peak construction year could range from about 260 to 3,500, depending on the technology being employed, with solar PV facilities at the low end and solar trough facilities at the high end. The total number of jobs created in the area could range from approximately 800 (solar PV) to as high as 10,700 (solar trough). Cumulative socioeconomic effects in the ROI from the construction of solar facilities would occur to the extent that multiple construction projects of any type were ongoing at the same time. It is a reasonable expectation that this condition would occur within a 50-mi (80-km) radius of the SEZ occasionally over the 20-year or more solar development period.

Annual impacts during the operation of solar facilities would be less, but of 20- to 30-year duration, and could combine with those from other new projects in the area. Additional employment could occur at other new, but not yet foreseen, facilities within 50 mi (80 km) of the proposed SEZ. On the basis of the assumption of full build-out of the SEZ (Section 12.3.19.2.2), the number of workers needed at the solar facilities in the SEZ would range from 39 to 785, with approximately 56 to 1,300 total jobs created in the region. Population increases would contribute to general upward trends in the region in recent years. The socioeconomic impacts overall would be positive, through the creation of additional jobs and income. The negative impacts, including some short-term disruption of rural community quality of life, would not likely be considered large enough to require specific mitigation measures.

12.3.22.4.19 Environmental Justice

Any impacts from solar development could have cumulative impacts on minority or low-income populations within 50 mi (80 km) of the proposed SEZ in combination with other development in the area. Such impacts could be both positive, such as from increased economic activity, and negative, such as from visual impacts, noise, and exposure to fugitive dust (Section 12.3.20.2). Actual impacts would depend on where minority or low-income populations are located relative to solar and other proposed facilities, and on the geographic range and duration of effects. Overall, effects from facilities within the SEZ are expected to be small, while those from other foreseeable actions would be minor and would not likely combine with negative effects from the SEZ on minority or low-income populations. It is not expected that the proposed Red Sands SEZ would contribute to cumulative impacts on minority or low-income populations.

12.3.22.4.20 Transportation

U.S. 70 lies adjacent to the northernmost border, and U.S. 54 lies along part of the eastern border of the proposed Red Sands SEZ. The nearest public airport is Alamogordo–White Sands Regional Airport located 2 mi (3 km) to the northeast of the SEZ on U.S. 70. The nearest rail stops are at Alamogordo and Omlee directly to the east of the SEZ. During construction of utility-scale solar energy facilities, up to 1,000 workers could be commuting to the construction site at the SEZ at a given time for a single project, which could increase the AADT on these roads by 2,000 vehicle trips for each facility under construction. Light to moderate congestion impacts could occur on either U.S. 70 or U.S. 54 near SEZ access points (Section 12.3.21.2). This increase in highway traffic from construction workers could likewise represent small to moderate cumulative impacts in combination with existing traffic levels and increases from any additional future development in the area. Impacts would be greatest if two solar facility projects were constructed on the SEZ at the same time. Local road improvements might be necessary on affected portions of U.S. 70 or U.S. 54 and on any other affected roads. Any impacts during construction activities would be temporary. The impacts can also be mitigated, to some degree, by staggered work schedules and ride-sharing programs. Traffic increases during operation would be relatively small because of the low number of workers needed to operate the solar facilities and it would have little contribution to cumulative impacts.

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12.3.23 References

Note to Reader: This list of references identifies Web pages and associated URLs where reference data were obtained for the analyses presented in this PEIS. It is likely that at the time of publication of this PEIS, some of these Web pages may no longer be available or their URL addresses may have changed. The original information has been retained and is available through the Public Information Docket for this PEIS.

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