8 AFFECTED ENVIRONMENT AND IMPACT ASSESSMENT FOR PROPOSED SOLAR ENERGY ZONES IN ARIZONA

8.1 BRENDA

8.1.1 Background and Summary of Impacts

8.1.1.1 General Information

The proposed Brenda Solar Energy Zone (SEZ) is located in La Paz County in west-central Arizona (Figure 8.1.1.1-1), 32 mi (52 km) east of the California border. The SEZ has a total area of 3,878 acres (16 km^2). In 2008, the county population was 20,005, while adjacent Riverside County to the west in California had a population of 2,087,917. The towns of Quartzsite and Salome in La Paz County are about 18 mi (29 km) west of, and 18 mi (29 km) east of, the SEZ respectively. The Phoenix metropolitan area is approximately 100 mi (161 km) to the east of the SEZ, and Los Angeles is approximately 230 mi (370 km) to the west.

The nearest major road access to the SEZ is via U.S. 60, which runs southwest to northeast, along the southeast border of the Brenda SEZ. The nearest railroad stop is 11 mi (18 km) away. The nearest airports serving the area are the Blythe and Parker (Avi Suquilla) Airports, both approximately 50 mi (80 km) from the SEZ, and neither of which have scheduled commercial passenger service. The Sky Harbor Airport in Phoenix is 125 mi (201 km) to the east, and Yuma International Airport in Yuma is 104 mi (167 km) to the south, of the SEZ.

A 161-kV transmission line passes 19 mi (31 km) west of the SEZ. It is assumed that a new transmission line would be needed to provide access from the SEZ to the transmission grid (see Section 8.1.1.1.2).

As of February 2010, there were no right-of-way (ROW) applications for solar projects within the SEZ; however, there were many ROW applications for solar projects that would be located within 50 mi (80 km) of the SEZ, including one categorized as a fast-track project. These applications are discussed in Section 8.1.22.2.1.

The proposed Brenda SEZ is undeveloped and rural, with few permanent residents in the area. The SEZ is located on the Ranegras Plain, bounded on the north by the Bouse Hills, on the west–southwest by the Plomosa Mountains and the Bear Hills, and on the east by the Granite Wash Mountains and Harquahala Mountains. Land within the SEZ is undeveloped scrubland characteristic of a semiarid basin.

The proposed Brenda SEZ and other relevant information are shown in Figure 8.1.1.1-1. The criteria used to identify the SEZ as an appropriate location for solar energy development included proximity to existing transmission or designated corridors, proximity to existing roads, and a slope of generally less than 2%. In addition, the area was identified as being relatively free

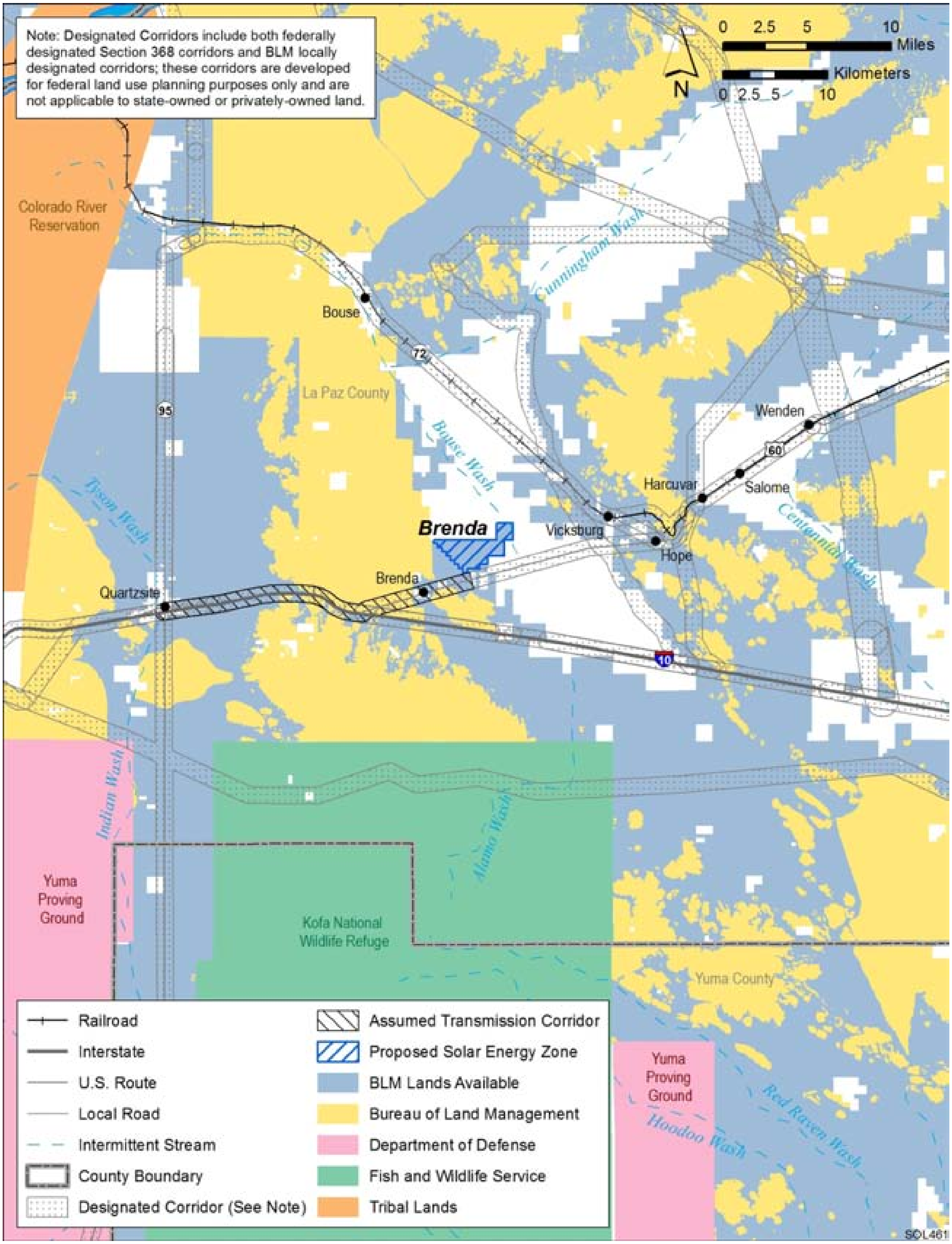

FIGURE 8.1.1.1-1 Proposed Brenda SEZ

of other types of conflicts, such as U.S. Fish and Wildlife Service (USFWS)-designated critical habitat for threatened and endangered species, Areas of Critical Environmental Concern (ACECs), Special Recreation Management Area (SRMAs), and National Landscape Conservation System (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 Brenda 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 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 Brenda SEZ encompassed 4,321 acres (17 km^2). Subsequent to the study area scoping period, the boundaries of the proposed Brenda SEZ were altered somewhat to facilitate the U.S. Department of the Interior (DOI) Bureau of Land Management's (BLM's) administration of the SEZ area. The revised SEZ is approximately 443 acres (1.8 km^2) smaller than the original SEZ as published in June 2009.

8.1.1.2 Development Assumptions for the Impact Analysis

Maximum solar development of the Brenda SEZ is assumed to be 80% of the SEZ area over a period of 20 years, a maximum of 3,102 acres (13 km^2). These values are shown in Table 8.1.1.2-1, along with other development assumptions. Full development of the Brenda SEZ would allow development of facilities with an estimated total of 345 MW of electrical power capacity if power tower, dish engine, or photovoltaic (PV) technologies were used, assuming 9 acres/MW (0.04 km^2/MW) of land required, and an estimated 620 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 a 161-kV line 19 mi (31 km) west of the SEZ. It is possible that a new transmission line could be constructed from the SEZ to this existing line, but the 161-kV capacity of that existing line would be inadequate for 345 to 620 MW of new capacity (note: a 500-kV line can accommodate approximately the load of one 700-MW facility). If the SEZ was at full build-out capacity, it is clear that new transmission and/or upgrades of existing transmission lines (in addition to or instead of construction of a connection to the nearest existing line) would be required to bring electricity from the proposed Brenda SEZ to load centers; however, at this time the location and size of such new transmission facilities is 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 purposes of as complete an analysis of impacts of development in the SEZ as possible, it was assumed that, at a minimum, a transmission line segment would be constructed from the proposed Brenda SEZ to the nearest existing transmission line to connect the SEZ to the transmission grid (the route of this transmission line was assumed to follow the route of the designated corridor that runs east-west along the SEZ's southern boundary; see Figure 8.1.1.1-1).

TABLE 8.1.1.2-1 Proposed Brenda 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 ROW and Road ROW	Distance to Nearest Designated Corridor[e]
3,878 acres and 3,102 acres[a]	345 MW[b] and 620 MW[c]	U.S. 60 adjacent	19 mi[d] and 161 kV	575 acres and 0 acres	Adjacent

[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.

This assumption was made without additional information on whether the nearest existing transmission line would actually be available for connection of future solar facilities, and without assumptions about upgrades of the line. Establishing a connection to the line closest to the SEZ would involve the construction of about 19 mi (31 km) of new transmission line outside of the SEZ. The ROW for this transmission line would occupy approximately 575 acres (2.3 km^2) of land, assuming a 250-ft (76-m) wide ROW. If a connecting transmission line were constructed to a different off-site grid location 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 are needed.

Existing road access to the proposed Brenda SEZ should be adequate to support construction and operation of solar facilities, because U.S. 60 runs along the southeast border of the SEZ. Thus, no additional road construction outside of the SEZ was assumed to be required to support solar development.

8.1.1.3 Summary of Major Impacts and SEZ-Specific Design Features

In this section, the impacts and SEZ-specific design features assessed in Sections 8.1.2 through 8.1.21 for the proposed Brenda SEZ are summarized in tabular form. Table 8.1.1.3-1 is a comprehensive list of impacts discussed in these sections; the reader may reference the

TABLE 8.1.1.3-1 Summary of Impacts of Solar Energy Development within the Proposed Brenda SEZ and SEZ-Specific Design Features[a]

Resource Area	Environmental Impacts—Proposed Brenda SEZ	SEZ-Specific Design Features
Lands and Realty	Full development of the SEZ could disturb up to 3,102 acres (13 km^2) and would establish a large industrial area that would exclude many existing and potential uses of the land, perhaps in perpetuity. Solar energy development would be a new and dominant land use in the area and may cause conflict with existing landowners of residential or commercial properties. Construction of new transmission facilities to connect solar facilities in the SEZ to the regional grid would disturb 575 acres (2.3 km^2) of land.	None.
Specially Designated Areas and Lands with Wilderness Characteristics	Seven specially designated areas within 25 mi (40 km) of the proposed Brenda SEZ could be affected by solar energy development within the SEZ. The New Water and Kofa WAs, Dripping Springs ACEC, and Plomosa SRMA are the most likely areas to be adversely affected. Overall impacts to specially designated areas are expected to be minimal to low.	To reduce potential impacts to the Plomosa SRMA consideration should be given to restricting solar energy development in the SEZ to areas east of the existing county road. Additionally, if the SEZ were restricted to the use of lower profile solar energy facilities, potential visual impacts would be reduced in the Plomosa SRMA, the Kofa and New Water WAs, and the Dripping Springs ACEC.
Rangeland Resources: Livestock Grazing	A maximum of 353 AUMs in the Crowder-Weisser allotment could be lost.	Development of range improvements and changes in grazing management should be considered to mitigate the loss of AUMs in the grazing allotment.
Rangeland Resources: Wild Horses and Burros	None.	None.

TABLE 8.1.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Brenda SEZ	SEZ-Specific Design Features
Recreation	Areas developed for solar energy production would be closed to recreational use. There is some potential for a loss of recreation use in portions of the Plomosa SRMA, the Kofa and New Water WAs, and the Dripping Springs ACEC.	To reduce potential impacts to recreation use in the Plomosa SRMA, consideration should be given to restricting solar energy development in the SEZ to areas east of the county road. Additionally, if the SEZ was restricted to the use of lower profile solar energy facilities, impacts to recreation use in the SRMA would likely be reduced.
Military and Civilian Aviation	The military has expressed concern that any development in the SEZ that exceeds 250 ft (76 m) in height would interfere with military operations in three MTRs. There would be no effect on civilian aviation facilities.	None.
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).	None.
Minerals (fluids, solids, and geothermal resources)	None.	None.

TABLE 8.1.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Brenda SEZ	SEZ-Specific Design Features
Water Resources	Ground-disturbance activities (affecting 77% of the total area in the peak construction year) could affect surface water quality due to surface runoff, sediment erosion, and contaminant spills. Construction activities may require up to 2,014 ac-ft (2.5 million m^3) of water during the peak construction year. Construction activities would generate as high as 74 ac-ft (91,000 m^3) of sanitary wastewater. Assuming full development of the SEZ, operations would use the following amounts of water: • For parabolic trough facilities (620-MW capacity), 443 to 940 ac-ft/yr (546,000 to 1.2 million m^3/yr) for dry-cooled systems; 3,111 to 9,316 ac-ft/yr (3.8 million to 11.5 million m^3/yr) for wet-cooled systems. • For power tower facilities (345-MW capacity), 245 to 521 ac-ft/yr (302,000 to 643,000 m^3/yr) for dry-cooled systems; 1,727 to 5,175 ac-ft/yr (2.1 million to 6.4 million m^3/yr) for wet-cooled systems. • For dish engine facilities (345-MW capacity), 176 ac-ft/yr (217,000 m^3/yr). • For PV facilities (345-MW capacity), 18 ac-ft/yr (22,000 m^3/yr). • Assuming full development of the SEZ, operations would generate up to 9 ac-ft/yr (11,000 m^3/yr) of sanitary wastewater.	Wet-cooling options would not be feasible. Other technologies should incorporate water conservation measures. During site characterization, hydrologic investigations would need to identify 100-year floodplains and potential jurisdictional water bodies subject to Clean Water Act Section 404 permitting. Siting of solar facilities and construction activities should avoid areas identified as within a 100-year floodplain. Before drilling a new well within the Ranegras Plain basin, a Notice of Intent to Drill must be filed with ADWR, and any groundwater rights policy of the ADWR must be followed (ADWR 2010c). Groundwater monitoring and production wells should be constructed in accordance with state standards. Stormwater management plans and best management practices (BMPs) should comply with standards developed by the Arizona Department of Environmental Quality. Water for potable uses would have to meet or be treated to meet drinking water quality standards. Land disturbance and operations activities should prevent erosion and sedimentation in the vicinity of the ephemeral washes present on the site.

TABLE 8.1.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Brenda SEZ	SEZ-Specific Design Features
Vegetation[b]	Up to 80% (3,102 acres [12.6 km^2]) of the SEZ would be cleared of vegetation; re-establishment of shrub communities in disturbed areas would likely be very difficult because of the arid conditions. Noxious weeds could become established in disturbed areas and colonize adjacent undisturbed habitats; thus, reducing restoration success and potentially resulting in widespread habitat degradation. 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. Grading could affect dry washes within the SEZ and transmission line corridor. Alteration of surface drainage patterns or hydrology could adversely affect downstream dry wash communities and intermittently flooded areas.	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 creosotebush–white bursage desert scrub communities and other affected habitats and to minimize the potential for the spread of noxious weeds or invasive species, such as those occurring in Le Paz County or the Lake Havasu Field Office Planning Area, that could be introduced as a result of solar energy project activities (see Section 8.1.10.2.2). To reduce the use of herbicides, invasive species control should focus on biological and mechanical methods where possible. All dry wash, dry wash woodland, chenopod scrub habitats, and saguaro cactus communities within the SEZ and all dry wash, dry wash woodland, mesquite bosque, chenopod scrub, and saguaro cactus communities within the assumed transmission line corridor should be avoided to the extent practicable, and any impacts minimized and mitigated. A buffer area should be maintained around dry washes, dry wash woodland, and mesquite bosque habitats to reduce the potential for impacts. Appropriate engineering controls should be used to minimize impacts on dry wash, dry wash woodland, mesquite bosque, and chenopod scrub, including downstream occurrences, resulting from surface water runoff, erosion, sedimentation, altered hydrology, accidental spills, or fugitive dust

TABLE 8.1.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Brenda SEZ	SEZ-Specific Design Features
Vegetation[b] *(Cont.)*		deposition to these habitats. Appropriate buffers and engineering controls would be determined through agency consultation. Transmission line towers should be sited and constructed to minimize impacts on dry washes, dry wash woodlands, and mesquite bosque communities; towers should span such areas whenever practicable. Groundwater withdrawals should be limited to reduce the potential for indirect impacts on groundwater-dependent communities, such as mesquite bosque communities.
Wildlife: Amphibians and Reptiles[b]	Direct impacts on amphibians and reptiles from development on the SEZ would be small (loss of ≤1.0% of potentially suitable habitats identified for the species in the SEZ region). With the implementation of proposed design features, indirect impacts would be expected to be negligible.	Bouse Wash should be avoided by solar energy development and Tyson Wash should be spanned by the transmission line.
Wildlife: Birds[b]	Direct impacts on bird species would be small (loss of ≤1.0% of potentially suitable habitats identified for the species in the SEZ region). 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. These indirect impacts are expected to be negligible with the implementation of design features.	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 Arizona Game and Fish Department. A permit may be required under the Bald and Golden Eagle Protection Act. Bouse Wash and Tyson Wash should be avoided by solar energy development or spanned by transmission line development, respectively.

TABLE 8.1.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Brenda SEZ	SEZ-Specific Design Features
Wildlife: Mammals[b]	Direct impacts on big game, small game, furbearers, and small mammals from habitat disturbance and long-term habitat reduction/ fragmentation would be small (loss of ≤1.0% of potentially suitable habitats identified for the species in the SEZ region). In addition to habitat loss, other direct impacts on mammals could result from collision with vehicles and infrastructure (e.g., fences). Indirect impacts on mammals could result from surface water and sediment runoff from disturbed areas, fugitive dust generated by project activities, accidental spills, and harassment. These indirect impacts are expected to be negligible with the implementation of design features.	The fencing around the solar energy facility should not block the free movement of mammals, particularly big game species. Bouse Wash and Tyson Wash should be avoided by solar energy development or spanned by transmission line development, respectively.
Aquatic Biota[b]	No perennial streams, water bodies, seeps, or springs are present in the areas of direct or indirect effects for the proposed Brenda SEZ or within the area of the presumed new transmission line corridor. Ephemeral streams may cross the SEZ, but these drainages only contain water following rainfall and typically do not support wetland or riparian habitats.	All aquatic habitats within the SEZ (e.g., Bouse Wash) should be avoided to the extent practicable.
Special Status Species[b]	Potentially suitable habitat for 20 special status species occurs in the affected area of the Brenda SEZ. For all of these special status species, less than 1% 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 to occupied habitats is not possible for some species, 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.

TABLE 8.1.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Brenda SEZ	SEZ-Specific Design Features
Special Status Species[b] *(Cont.)*		Avoiding or minimizing disturbance of sand dunes, sand transport systems, sand flats, agricultural and riparian habitats in the area of direct effects could reduce impacts on two special status species. Consultation with the USFWS and the AZGFD should be conducted to address the potential for impacts on the Sonoran population of bald eagle, a species listed as threatened under the ESA and CESA. Consultation would identify an appropriate survey protocol, avoidance measures, and, if appropriate, reasonable and prudent alternatives, reasonable and prudent measures, and terms and conditions for incidental take statements. Coordination with the USFWS and AZGFD should be conducted to address the potential for impacts on the Sonoran population of the desert tortoise—a species under review for listing under the ESA. Coordination would identify an appropriate survey protocol, and mitigation requirements, which may include avoidance, minimization, translocation, or compensation. 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 AZGFD.

TABLE 8.1.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Brenda SEZ	SEZ-Specific Design Features
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, which encompasses the nearby residences (trailers) at Pioneer (about 0.4 mi [0.6 km] south of the SEZ). 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 (Joshua Tree NP in California). In addition, construction emissions (primarily NO_x emissions) from the engine exhaust from heavy equipment and vehicles could cause some impacts on 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: 0.87 to 1.6% of total emissions of SO_2, NO_x, Hg, and CO_2 from electric power systems in the state of Arizona avoided (up to 837 tons/yr SO_2, 1,289 tons/yr NO_x, 0.012 ton/yr Hg, and 924,000 tons/yr CO_2).	None.
Visual Resources	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 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 residents nearest to the SEZ could be subjected to large visual impacts from solar energy development within the SEZ.	None.

TABLE 8.1.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Brenda SEZ	SEZ-Specific Design Features
Visual Resources *(Cont.)*	The SEZ is located 0.1 mi (0.2 km) from the Plomosa SRMA. Because of the open views of the SEZ and elevated viewpoints, weak to strong visual contrasts could be observed by SRMA visitors. The SEZ is located 2.3 mi (3.6 km) from the community of Brenda. Moderate to strong visual contrasts could be observed by residents of Brenda. The SEZ is located 2.5 mi (4.0 km) from the community of Hope, and 5.8 mi (9.3 km) from the community of Vicksburg. Weak to moderate visual contrasts could be observed by residents of Hope and Vicksburg. U.S. 60 passes within 0.4 mi (0.7 km) and is in the viewshed of the SEZ for about 20 mi (32 km). Because of the close proximity of U.S. 60 to the SEZ, strong visual contrasts could be observed by travelers on U.S. 60. I-10 passes within 3.3 mi (5.3 km) and is in the viewshed of the SEZ for about 19.7 mi (31.7 km). Moderate to strong visual contrasts could be observed by travelers on I-10.	

TABLE 8.1.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Brenda SEZ	SEZ-Specific Design Features
Acoustic Environment	*Construction*. Estimated noise levels at the nearest residences (0.3 mi [0.5 km] southeast of the SEZ boundary) would be about 55 dBA, which is well above the typical daytime mean rural background level of 40 dBA. However, this noise might be masked by road traffic on U.S. 60 to some extent. In addition, an estimated 51-dBA L_{dn} at these residences is below 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 southern SEZ boundary, the predicted noise level would be about 47 dBA at the nearest residences, which is higher than the typical daytime mean rural background level of 40 dBA. However, this noise might be masked by road traffic on U.S. 60 to some extent. If the operation were limited to daytime, 12 hours only, a noise level of about 45 dBA L_{dn} would be estimated for the nearest residences, which is well 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 residences would be 57 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 58 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 residences would be about 51 dBA, which is above the typical daytime mean rural background level of 40 dBA. On the basis of 12-hour daytime operation, the estimated 49 dBA L_{dn} at these residences would be below 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 nearby residences to the southern SEZ boundary along U.S. 60 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 Brenda 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 northern 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.
Paleontological Resources	The potential for impacts on significant paleontological resources in the proposed SEZ is unknown. A more detailed investigation of the alluvial deposits is needed prior to project approval. A paleontological survey will likely be needed.	The need for and the nature of any SEZ-specific design features would depend on the results of future paleontological investigations.

TABLE 8.1.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Brenda SEZ	SEZ-Specific Design Features
Cultural Resources	The proposed SEZ has the potential for containing prehistoric sites, especially in the eastern portion of the SEZ, and the potential also exists for historic resources. Direct impacts on significant cultural resources could occur in the proposed Brenda 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. Impacts on cultural resources also are possible in areas related to the transmission line ROW, as new areas of potential cultural significance could be directly affected by construction or opened to increased access from use.	SEZ-specific design features would be determined during consultations with the Arizona SHPO and affected Tribes and would depend on the findings of cultural surveys.
Native American Concerns	To date, no comments have been received from the Tribes specifically referencing the proposed Brenda SEZ. However, in a response letter, the Quechan Indian Tribe of Fort Yuma indicated that some of the SEZs proposed in this PEIS lie within their Tribal Traditional Use Area. They stressed the importance of evaluating impacts on landscapes as a whole. Commenting on past transmission line projects in the area, Native American groups have expressed a general mistrust of irreversible development projects because of the loss of natural habitat, particularly as it would affect eagle, deer, and bighorn sheep populations and wild plant resources. As consultation with the Tribes continues and project-specific analyses are undertaken, it is possible that Native Americans will express concerns over potential visual effects of solar energy development within the SEZ on the landscape.	The need for and nature of SEZ-specific design features would be determined during government-to-government consultation with the affected Tribes.

TABLE 8.1.1.3-1 (Cont.)

Resource Area	Environmental Impacts—Proposed Brenda SEZ	SEZ-Specific Design Features
Socioeconomics	*Construction:* 396 to 5,245 total jobs; $23.4 million to $309 million income in ROI for construction of solar facilities in the SEZ. *Operations:* 9 to 217 annual total jobs; $0.3 million to $8.1 million annual income in the ROI. *Construction of new transmission line:* 98 total jobs, $5.1 million income.	None.
Environmental Justice	There are minority and low-income 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 and low-income populations.	None.
Transportation	The primary transportation impacts are anticipated to be from commuting worker traffic. Single projects could involve up to 1,000 workers each day, with an additional 2,000 vehicle trips per day (maximum). This additional volume of traffic on U.S. 60 would represent an increase in traffic of about 130% in the area of the Brenda SEZ for a single project.	None.

Abbreviations: AAQS = ambient air quality standards; AQRV = air quality-related value; AZGFD = Arizona Game and Fish Department; BLM = Bureau of Land Management; BMP = best management practice; CEQ = Council on Environmental Quality; CO_2 = carbon dioxide; dBA = A-weighted decibel; DoD = U.S. Department of Defense; EPA = U.S. Environmental Protection Agency; ESA = Endangered Species Act; Hg = mercury; L_{dn} = day-night average sound level; MTR = military training route; NO_x = nitrogen oxides; NP = National Park; NRHP = *National Register of Historic Places*; PEIS = programmatic environmental impact statement; $PM_{2.5}$ = 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; ROW = right-of-way; SEZ = solar energy zone; SHPO = State Historic Preservation Office; SO_2 = sulfur dioxide; SRMA = Special Recreation Management Area; TES = thermal energy storage; USFWS = U.S. Fish and Wildlife Service.

[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 Brenda SEZ.

[b] The scientific names of all plants, wildlife, aquatic biota, and special status species are provided in Sections 8.1.10 through 8.1.12.

applicable sections for detailed support of the impact assessment. Section 8.1.22 discusses potential cumulative impacts from solar energy development in the proposed SEZ.

Only those design features specific to the proposed Brenda SEZ are included in Sections 8.1.2 through 8.1.21 and in the summary table. The detailed programmatic design features for each resource as 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.

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8.1.2 Lands and Realty

8.1.2.1 Affected Environment

The proposed Brenda SEZ is a small SEZ, and while it is located adjacent to a large block of public land, it is bordered on the north and east by a combination of state and private lands. The overall character of the land in the SEZ area is rural and undeveloped. The town of Brenda is located about 3 mi (5 km) southwest of the SEZ. A county road crosses through the western portion of the SEZ in a north–south orientation and about 320 acres (1.3 km^2) of the SEZ are separated from the rest of the area by the road. There is land disturbance on the south and west of the SEZ associated with road construction, power line construction, mining, and development of the town site. U.S. 60 parallels the southern side of the SEZ within 0.5 mi (0.8 km) and could provide good access to the site. There are scattered home sites and RV parks along U.S. 60.

In addition to the county road, there is a small portion of a ROW for a fiber optic line paralleling the highway that overlaps the SEZ. It is likely the actual line is not within the SEZ since the ROW was granted in 40-acre (0.2-km^2) aliquot parts.

As of February 2010, there were no ROW applications for solar energy facility development on the SEZ, but there are numerous applications on public lands near the area.

8.1.2.2 Impacts

8.1.2.2.1 Construction and Operations

Full development of the proposed Brenda SEZ could disturb up to 3,102 acres (13 km^2) (Table 8.1.1.2-1). 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. Since the SEZ is rural and undeveloped, utility-scale solar energy development would be a new and dominant land use in the area. If the SEZ were developed, there could be conflict with local residential and commercial landowners nearby because of the dramatic change in the appearance of the area. It also is possible that state and private lands located adjacent to the SEZ, with landowner agreement, would be developed in the same or complementary manner as the public lands.

Existing ROW authorizations in the SEZ are prior existing rights, and facilities within the ROWs would not be adversely affected by solar energy development. There is a technical issue about whether the existing ROW holders would agree to amend their existing ROWs to allow solar development to occur within portions of the existing ROWs, or if it would be necessary to make minor adjustments to the proposed SEZ boundary to avoid these ROWs. Either way, existing facilities within the ROWs would be protected. Should the proposed SEZ be identified as an SEZ in the Record of Decision (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. Because the area currently has so few ROWs present, and there is a large amount of potentially available BLM-administered land nearby, it is not anticipated that approval of solar energy development within the SEZ would have a significant impact on public land available for future ROWs in the area.

8.1.2.2.2 Transmission Facilities and Other Off-Site Infrastructure

Delivery of energy produced in the SEZ would require establishing connection to the regional grid. For analysis purposes, it is assumed that initial connection to the grid would be made to an existing 161-kV transmission line that is located 19 mi (31 km) west of the SEZ. Construction of a new line to connect to this line would result in the disturbance of about 575 acres (2.3 km^2).

U.S. 60 is adjacent to the SEZ, and it is assumed that no new roads would be required to access the site. Roads and transmission lines would be constructed within the SEZ as part of the development of the area.

8.1.2.3 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 lands and realty activities.

8.1.3 Specially Designated Areas and Lands with Wilderness Characteristics

8.1.3.1 Affected Environment

Eight specially designated areas occur within 25 mi (40 km) of the proposed Brenda SEZ that potentially could be affected by solar energy development within the SEZ. Most of these areas are more than 5 mi (8 km) from the SEZ. These include (see Figure 8.1.3.1-1) the following:

- Wilderness Areas (WAs)
  - East Cactus Plain
  - Kofa
  - New Water Mountains

- Wilderness Study Area (WSA)
  - Cactus Plain

- Areas of Critical Environmental Concern (ACECs)
  - Dripping Springs
  - Harquahala

- Special Recreation Management Area (SRMA)
  - Plomosa

- National Wildlife Refuge (NWR)
  - Kofa

There are no undesignated areas with wilderness characteristics near the SEZ. Viewshed analyses show that the Harquahala ACEC has such a small amount and percentage of the area within the viewshed that it is not considered further.

8.1.3.2 Impacts

8.1.3.2.1 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 wilderness areas and the WSA, 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

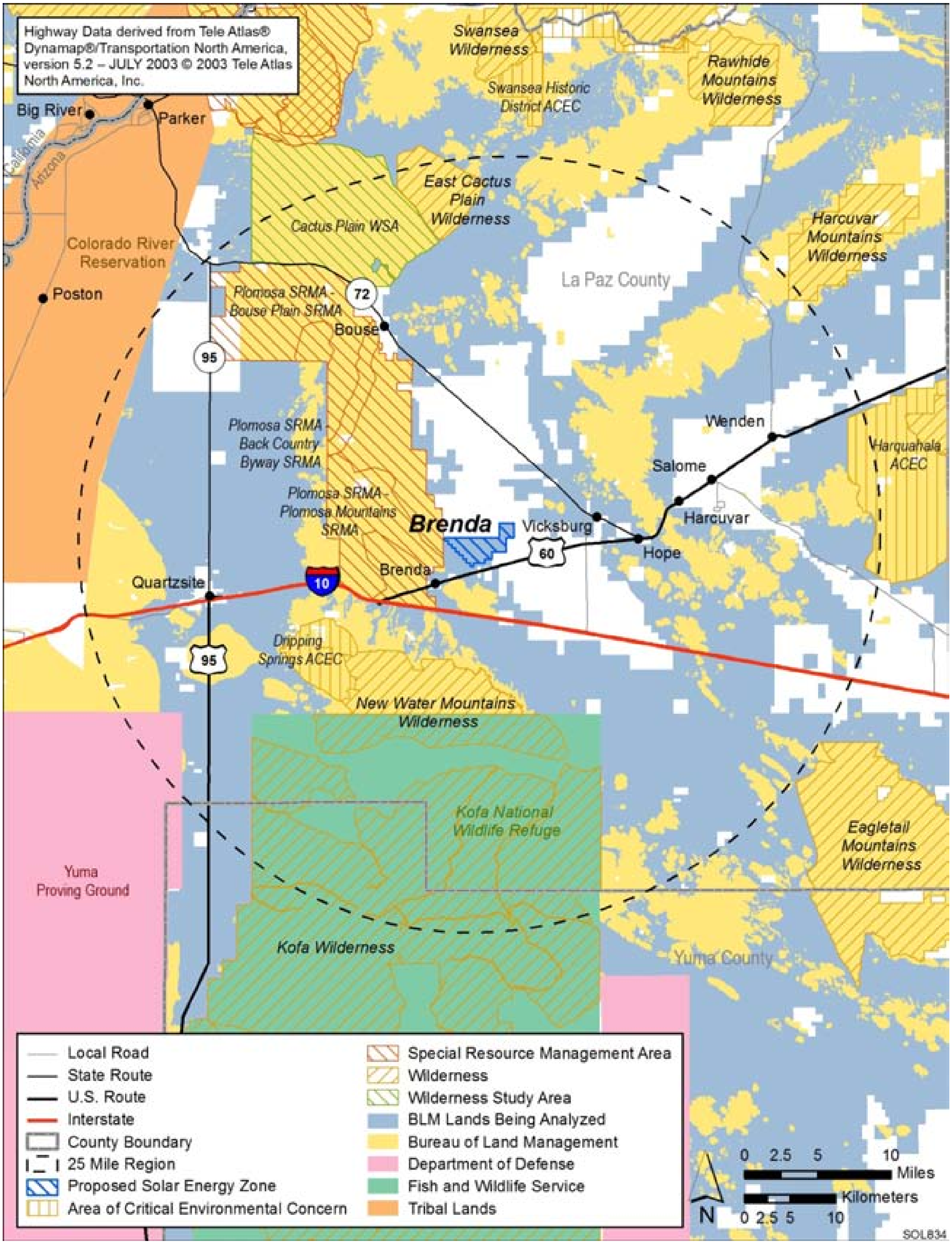

FIGURE 8.1.3.1-1 Specially Designated Areas in the Vicinity of the Proposed Brenda SEZ

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 developments 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 8.1.3.2-1. 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. Of the technologies being considered in the PEIS, these facilities (because of their potential height) could be visible from the largest amount of land. 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 8.3.14 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 farther, depending on other factors, such as 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 Brenda 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.

Wilderness Areas

East Cactus Plain. The area is located about 20 mi (32 km) north of the SEZ, and a large percentage of the area would have some view of the tops of any power tower facilities in the SEZ. Based on the visual analysis, visibility of lower-level facilities would be almost nonexistent. Because of the distance, intervening topography, and the extremely low viewing angle of solar facilities, even with power tower facilities, there would be no impact on wilderness characteristics within the WA.

TABLE 8.1.3.2-1 Potentially Affected Specially Designated Areas within a 25-mi (40-km) Viewshed of the Proposed Brenda SEZ[a]

		Feature Area or Linear Distance[b, c]		
			Visible between	
Feature Type	Feature Name (Total Acreage)	Visible within 5 mi	5 and 15 mi	15 and 25 mi
WAs	East Cactus Plain (14,318 acres)	0 acres	0 acres	9,888 acres (69%)
	Kofa (547,739 acres)	0 acres	1,553 acres (0.3%)	5,019 acres (0.9%)
	New Water Mountains (24,628 acres)	0 acres	4,124 acres (17%)	0 acres
WSA	Cactus Plain (58,893 acres)	0 acres	0 acres	27,908 acres (47%)
NWR	Kofa (665,435 acres)	0 acres	7,122 acres (1%)	5,756 acres (0.9%)
SRMAs	Plomosa Backcountry Byway (5,987 acres)	0 acres	5,219 acres (87%)	152 acres (3%)
	Plomosa Bouse Plain (75,085 acres)	14,094 acres (19%)	22,272 acres (30%)	1,862 acres (3%)
	Plomosa Mountains (28,112 acres)	5,050 acres (18%)	5,085 acres (18%)	444 acres (2%)
ACECs	Dripping Springs (11,081 acres)	0 acres	420 acres (4%)	0 acres
	Harquahala (77,201 acres)	0 acres	0 acres	139 acres (0.2%)

[a] Assuming power tower technology with a height of 650 ft (198.1 m).

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

[c] Percentage of total feature acreage viewable.

Kofa. The Kofa WA is located within the Kofa National Wildlife Refuge (NWR) and at its closest is about 14 mi (23 km) south of the SEZ. The primary areas of the WA with a view of the SEZ are the highest mountains in the central portion of the WA and the lower elevation northeastern corner of the WA. The total area with visibility of the SEZ extends to about 24 mi (39 km) south of the SEZ and includes 6,572 acres (27 km^2), or 1.2%, of the total acreage of the WA. Views from the high peaks would be restricted to the tops of power towers in the SEZ and would be at a very low angle. Even at 14 mi (23 km), because of the lower elevations, views of the SEZ would be at a low angle, and topographic screening from the Kofa, New Water, and Bear Mountains would further restrict the views of the SEZ to a small portion of the field of view. Because of these factors, the impact on wilderness characteristics is expected to be minimal.

New Water Mountains. The New Water Mountains WA is located about 6.5 mi (10.5 km) south of the SEZ, and portions of the area are substantially higher in elevation than the SEZ. The areas with visibility of the SEZ are between 6.5 and 8.5 mi (10.5 and 13.7 km) from the SEZ and would include about 4,124 acres (12 km^2), or 17%, of the WA. The clearest view of the SEZ is from portions of the WA in the northern end of the WA and from the areas of the highest elevation. Because of the moderate contrast with the background, viewers in these areas would be able to discern the structures in portions of the SEZ. The lower elevations of the WA would have a lower angle view of facilities in the SEZ, which would minimize the contrast between the structures and the surrounding landscape. Interstate 10 (I-10) and U.S. 60 are between the New Water WA and the SEZ, and where they are visible from the WA, the overall quality of the viewshed is already somewhat diminished. Because of the distances, the low contrast of solar facilities from many areas, the relatively restricted opportunities to view the SEZ, and the intervening highway development, the impact on wilderness characteristics from solar development in the SEZ is anticipated to be low.

Wilderness Study Area

Cactus Plain. The Cactus Plain WA is 18 mi (29 km) northwest of the SEZ and is located at a lower elevation than the SEZ. Viewshed analysis indicates that a maximum of 27,908 acres (113 km^2), or 47%, of the WSA would have a long distance view of solar facilities in the SEZ. However, because of the distance and the very low angle of the view, no impact on wilderness characteristics is anticipated.

National Wildlife Refuge

Kofa. The Kofa WA which is discussed above, makes up slightly more than 80% of the total acreage of the Kofa NWR. Additional areas within the NWR with a view of the SEZ, that are not designated as wilderness, include about 6,300 acres (25 km^2) that are located from 11 to 16 mi (18 to 26 km) from the SEZ. While the primary use of the refuge is for the management of bighorn sheep, recreational uses are also allowed; thus recreation users may utilize some of the areas that have visibility of the SEZ. Because most of these areas are located at lower elevations and are a long distance from the SEZ, they would have a very limited view of development within the SEZ and the potential impact on the recreational experience in these areas would be minimal. There would be no impact on wildlife resources within the refuge.

Special Recreation Management Area

Plomosa. The Plomosa SRMA is an area of about 110,000 acres (445 km^2) that comes within about one-eighth of a mile of the western boundary of the SEZ, at its nearest point. The BLM has identified three management zones within the SRMA, the northernmost of which is a BLM-designated Back Country Byway (BLM 2007a). The SRMA is located about 15 mi (24 km) east of Quartzite, AZ, an area that attracts a large number of winter visitors who stay in the area for up-to-six months. The SRMA is managed to provide a wide variety of outdoor activities for local residents and visitors, including backcountry driving, cultural/historical sightseeing, mountain biking, photography, hunting, hiking, camping, wildlife viewing, and rockhounding. As shown in Table 8.1.3.2-1, a large percentage of all three management zones are within 15 mi (24 km) and are within the viewshed of the SEZ. Impacts on visitors to the SRMA from development of the SEZ are difficult to predict, but since most activities do not require a pristine setting, impacts may be less than for visitors seeking a wilderness experience.

Solar development within the SEZ would be very visible from portions of the Bouse Plain and Plomosa Mountains management zones in the SRMA within 5 mi (8 km), and it is anticipated that there would be some adverse impact on the visual resources in those areas that likely would result in some reduction on recreation use. A large part of the Backcountry Byway management zone also is within the viewshed of the SEZ, but it is anticipated that because of the 9-mi (14.5-km) distance to the nearest boundary of the SEZ, there would be minimal impacts on that zone.

Areas of Critical Environmental Concern

Dripping Springs and Dripping Springs Core. The Dripping Springs area was designated to protect a perennial spring that has important cultural resource values and also is important to bighorn sheep. The area contains two separate ACECs, with the Dripping Springs Core ACEC completely included within the other. The area is 9 mi (14 km) from the SEZ at its nearest point to the SEZ. The visible area of the ACEC includes only the highest points within the ACEC and extends approximately 12 mi (19.3 km) from the southern boundary of the SEZ. About 420 acres (1.7 km^2) would have visibility of facilities in the SEZ. Because of the distance from the SEZ, the small amount of area with visibility of the SEZ, and the nature of the resources being protected in the ACECs, it is anticipated that there would be no impact on the ACECs from solar facilities in the SEZ.

8.1.3.2.2 Transmission Facilities and Other Off-Site Infrastructure

For analysis purposes, it is assumed that initial connection to the grid would be made to an existing 161-kV transmission line that is located 19 mi (31 km) west of the SEZ. Construction of a new line to connect to this line would result in the disturbance of about 575 acres (2.3 km^2) and would be visible from portions of the Plomosa SRMA, the New Water WA, and possibly the Dripping Springs ACEC. It is assumed that the transmission line would be constructed in the designated local and Section 368b (of the Energy Policy Act of 2005) corridors that follow U.S. 60 and I-10. Because of the existing disturbances along this anticipated transmission route and the distance from most of the specially designated areas, no additional impact caused by the construction of transmission facilities to these areas is anticipated.

8.1.3.3 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. The exceptions may be impacts on visual resources and recreation use in portions of the Plomosa SRMA.

Proposed design features specific to the proposed SEZ include:

- To reduce potential impacts on the Plomosa SRMA, consideration should be given to restricting solar energy development in the SEZ to areas east of the existing county road.

- If the SEZ were restricted to the use of lower profile solar energy facilities, potential visual impacts would be reduced in the Plomosa SRMA, the Kofa and New Water WAs, and the Dripping Springs ACEC.

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8.1.4 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 Brenda SEZ are discussed in Sections 8.1.4.1 and 8.1.4.2.

8.1.4.1 Livestock Grazing

8.1.4.1.1 Affected Environment

The proposed Brenda SEZ is located within the 234,645-acre (950-km^2) Crowder-Weisser grazing allotment, which supports 15,758 AUMs. The public lands in the SEZ constitute less than 2% of the total grazing allotment. One permittee operates in the allotment (BLM 2009).

8.1.4.1.2 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 permit 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 allotment may disrupt existing livestock improvements, such as wells, water pipelines, water developments, 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.

Using the simplified assumption that the percentage reduction in AUMs would be equal to the percentage loss of the acreage in the allotment, there would be a potential loss of 315 AUMs from the grazing permit. However, since the Weisser-Crowder allotment is so large, it is anticipated that it may be possible to absorb this potential loss elsewhere in the allotment through either installation of additional range improvements or changes in grazing management. Should it not be possible to mitigate the loss of AUMs, there would be a small impact to the permittee.

Transmission Facilities and Other Off-Site Infrastructure

For analysis purposes, it is assumed that initial connection to the grid would be made to an existing 161-kV transmission line that is located 19 mi (31 km) west of the SEZ. Construction of a new line to connect to this existing line would result in a maximum disturbance of about 575 acres (2.3 km^2) that would be completely within the Crowder-Weisser allotment. Using the assumption that it requires approximately 15 acres to support one AUM[1], there could be a maximum loss of an additional 38 AUMs associated with construction of the transmission line.

8.1.4.1.3 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 mitigation for some impacts on livestock grazing. The exceptions may be in the potential loss of 353 AUMs for the Weisser-Crowder grazing allotment.

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

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

8.1.4.2 Wild Horses and Burros

8.1.4.2.1 Affected Environment

Section 4.4.2 discusses wild horses (*Equus caballus*) and burros (*E. asinus*) that occur within the six-state study area. Seven wild horse and burro herd management areas (HMAs) occur within Arizona (BLM 2010a); portions of four of them (Alamo, Big Sandy, Cibola-Trigo, and Havasu) occur within the 50-mi (80-km) SEZ region for the proposed Brenda SEZ (Figure 8.1.4.2-1). A portion of the Chemehuevi HMA, an HMA in California, also occurs within the SEZ region. None of the HMAs occur within the SEZ or indirect impact area of the SEZ.

In addition to the HMAs managed by the BLM, the U.S. Forest Service (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). None of the territories occur within the SEZ region.

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[1] Based on a calculation comparing the total acreage of the allotment to the currently authorized AUMs.

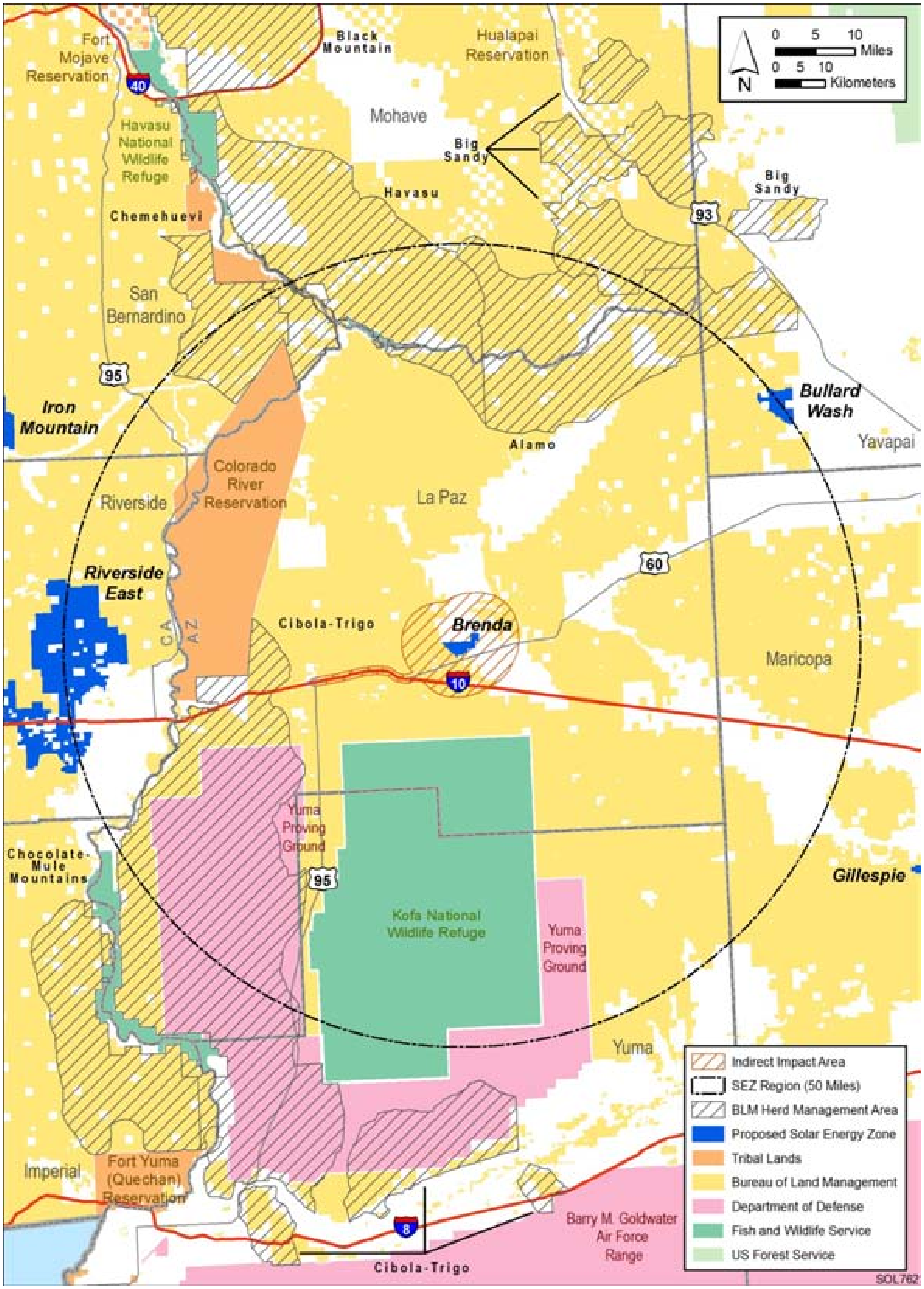

FIGURE 8.1.4.2-1 Wild Horse and Burro Herd Management Areas within the Analysis Area for the Proposed Brenda SEZ (Source: BLM 2010a)

8.1.4.2.2 Impacts

Because the proposed Brenda SEZ is about 19 mi (31 km) or more from any wild horse and burro HMAs managed by the BLM and more than 50 mi (80 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.

8.1.4.2.3 SEZ-Specific Design Features and Design Feature Effectiveness

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

8.1.5 Recreation

8.1.5.1 Affected Environment

The site of the proposed Brenda SEZ is located adjacent to U.S. 60 and is easily accessible from many locations. The area is located within 3 mi (5 km) of Brenda, Arizona, and is 15 mi (24 km) east of Quartzsite, Arizona, which is a hub of winter visitor activity in southwestern Arizona and southeastern California. The area within the SEZ is flat and generally unremarkable, with few passable roads and trails that provide access through the area. The area is located adjacent to the Plomosa SRMA, which is briefly described above in Section 8.1.3.2.1. A county road passes north–south through the western portion of the SEZ and provides a major access point into the Plomosa SRMA. There is an access road to the SRMA that departs the county road and passes through the portion of the proposed SEZ, west of the road. While there is no recreation use data for the area, a field investigation revealed few vehicle tracks in the area and no signs of camping or other recreational uses. The area is designated for off-highway vehicle (OHV) travel as "limited to designated roads and trails" (BLM 2007a). There are designated routes located in the Plomosa SRMA just west of the SEZ.

8.1.5.2 Impacts

8.1.5.2.1 Construction and Operations

Recreational users would lose the use of any portions of the SEZ developed for solar energy production, but it is anticipated this would be a minimal loss of recreational use. Access through areas developed for solar power production could be closed or rerouted, although the existing county road would continue to provide general north–south access. One access point to the SRMA through the western portion of the SEZ could be closed. The Plomosa SRMA could provide replacement recreation opportunities for anyone displaced from the SEZ.

Portions of the Plomosa SRMA are adjacent to the SEZ, and solar development within the SEZ would be very visible from areas within the SRMA. Whether the presence of solar development in the SEZ would affect recreational use of the SRMA is unknown, but large portions of the areas are located within the most sensitive visual zone surrounding the proposed SEZ. It is anticipated that some current and potential users of portions of the SRMA may choose to relocate their activities farther away from solar energy facilities. Some visitors may also find the solar facilities as an interesting attraction to their other activities.

Potential impacts to recreation use in portions of the New Water and Kofa WAs and the Dripping Springs ACEC are difficult to assess, but it is possible that visitors seeking a wilderness and/or scenic experience may avoid those areas with views of the SEZ.

Solar development within the SEZ would affect public access along OHV routes that are designated open and available for public use. If such routes 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.)

8.1.5.2.2 Transmission Facilities and Other Off-Site Infrastructure

For analysis purposes, it is assumed that initial connection to the grid would be made to an existing 161-kV transmission line that is located 19 mi (31 km) west of the SEZ. Construction of a new line to connect to this line would result in the disturbance of about 575 acres (2.3 km^2). It is anticipated that there would not be any additional impact on recreational use by the construction of transmission facilities.

8.1.5.3 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 mitigation for some impacts on recreation. The exceptions would be that recreational use within the SEZ would be lost, and some current and potential users of portions of the SRMA may choose to relocate their activities farther away from solar energy facilities.

Proposed design features specific to the proposed SEZ include:

- To reduce potential impacts to recreation use in the Plomosa SRMA, consideration should be given to restricting solar energy development in the SEZ to areas east of the county road.

- If the SEZ were restricted to the use of lower-profile solar energy facilities, impacts to recreation use in the SRMA would likely be reduced.

8.1.6 Military and Civilian Aviation

8.1.6.1 Affected Environment

The SEZ is located within an extensive web of military training routes (MTRs), and the entire SEZ is covered by a combination of three MTRs with 300-ft (91-m) above-ground-level (AGL) operating limits. Two of these routes are used as visual flight rule (VFR) corridors, and one is an instrument flight rule (IFR) corridor.

The closest civilian airports are located in Blythe, California, and Parker, Arizona. The Blythe Airport is located west of the SEZ about 48 mi (77 km), and the Parker Airport (Avi Suquilla Airport) is about 38 mi (61 km) northwest of the SEZ. Neither of these airports has regularly scheduled passenger or freight service.

8.1.6.2 Impacts

The military has indicated that the construction of solar or transmission facilities in excess of 250 ft (76 m) tall would adversely affect the use of the MTRs.

The Blythe and Parker airports are located far enough away from the proposed SEZ that there would be no effect on airport operations.

8.1.6.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features are required. 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.

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8.1.7 Geologic Setting and Soil Resources

8.1.7.1 Affected Environment

8.1.7.1.1 Geologic Setting

Regional Setting

The proposed Brenda SEZ is located in the northern part of the Ranegras Plain, a northwest-trending, broad, alluvial basin within the Basin and Range physiographic province in west-central Arizona. The plain is bounded on the north by the Bouse Hills, on the west by the Plomosa and New Water Mountains, on the east by the Granite Wash and Little Harquahala Mountains, and on the south by the Eagletail and Little Horn Mountains (Figure 8.1.7.1-1). Surrounded by low, block-faulted mountains, the Ranegras Plain is one of many structural basins (grabens) typical of the Basin and Range province.

Basin-fill beneath the Ranegras Plain consists of unconsolidated alluvial, eolian, and lacustrine deposits of Quaternary and Tertiary age estimated to be as thick as 1,000 ft (305 m) in the center of the basin (Figure 8.1.7.1-2). Groundwater occurs in these deposits, with the highest yields from the gravel and sand lenses within the upper (Quaternary) layers of fill at depths ranging from 28 to 455 ft (9 to 140 m) (ADWR 2010h,i; Metzger 1951). Unconsolidated sediments overlie bedrock units of Cretaceous and Tertiary fanglomerates and volcanic rocks with a maximum depth of about 2,000 ft (610 m). The basin is underlain by a basement complex of granite and undifferentiated metamorphic rocks (Fugro National, Inc 1979).

Exposed sediments on the Ranegras Plain are predominantly young (<10,000 years) alluvial deposits of gravel and sand (stream channels) and silt and clay (floodplains and playas) and eolian sands (Qy) (Figure 8.1.7.1-3). The surface of the Brenda SEZ is covered mainly by older (10,000 to 750,000 years) alluvial deposits (Qm). In the surrounding mountains, exposures are predominantly composed of Tertiary volcanics and Cretaceous and Jurassic sedimentary rocks. The oldest rocks in the region are the Early to Middle Proterozoic metamorphic and granitic rocks that occur in the Plomosa Mountains and Bouse Hills northwest of the SEZ and the Granite Wash Mountains to the northeast. These rocks have been intruded by Mesozoic (Late Cretaceous to Tertiary) granites and granodiorites. Small outcrops of Paleozoic limestone occur throughout the area.

Topography

The Ranegras Plain covers an area of about 538,700 acres (2,360 km^2) (ADWR 2010i). It slopes to the northwest, with elevations along its axis ranging from about 1,310 ft (400 m) at its southeastern end and along its sides to about 930 ft (280 m) near the town of Bouse at its northwestern end. Alluvial fan deposits occur along the mountain fronts on both sides of the

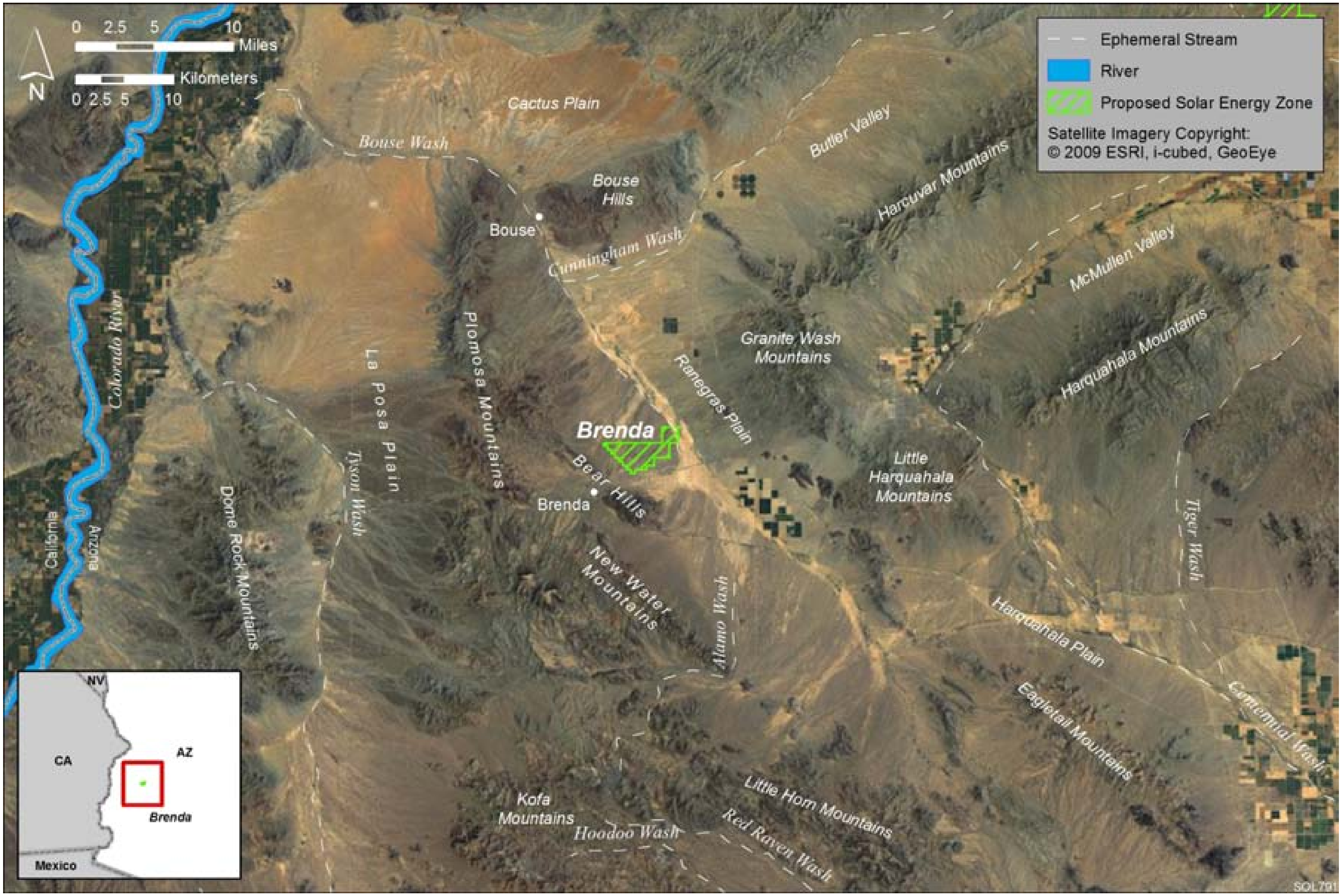

FIGURE 8.1.7.1-1 Physiographic Features of the Ranegras Plain

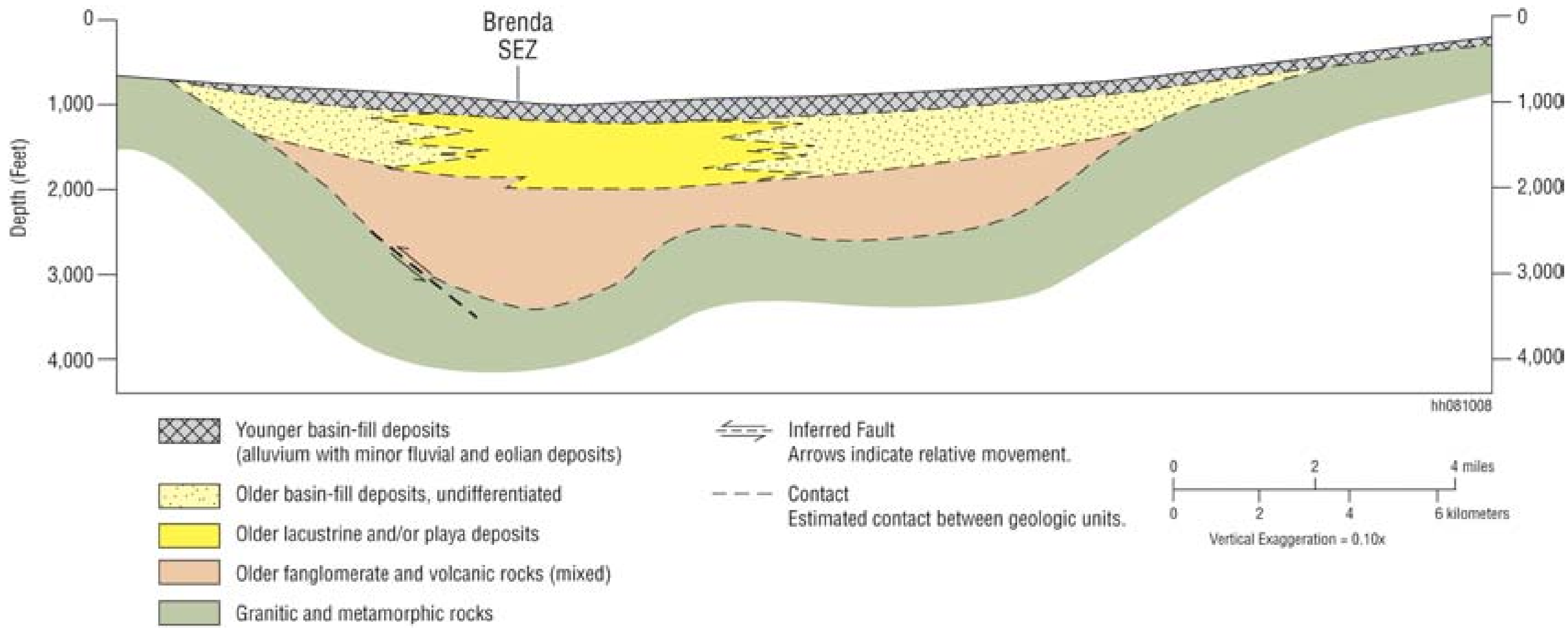

FIGURE 8.1.7.1-2 Generalized Geologic Cross Section (southwest to northeast) across the Northwestern Part of the Ranegras Plain (see Figure 8.1.7.1-5 for section location.) (Source: modified from Fugro National, Inc. 1979

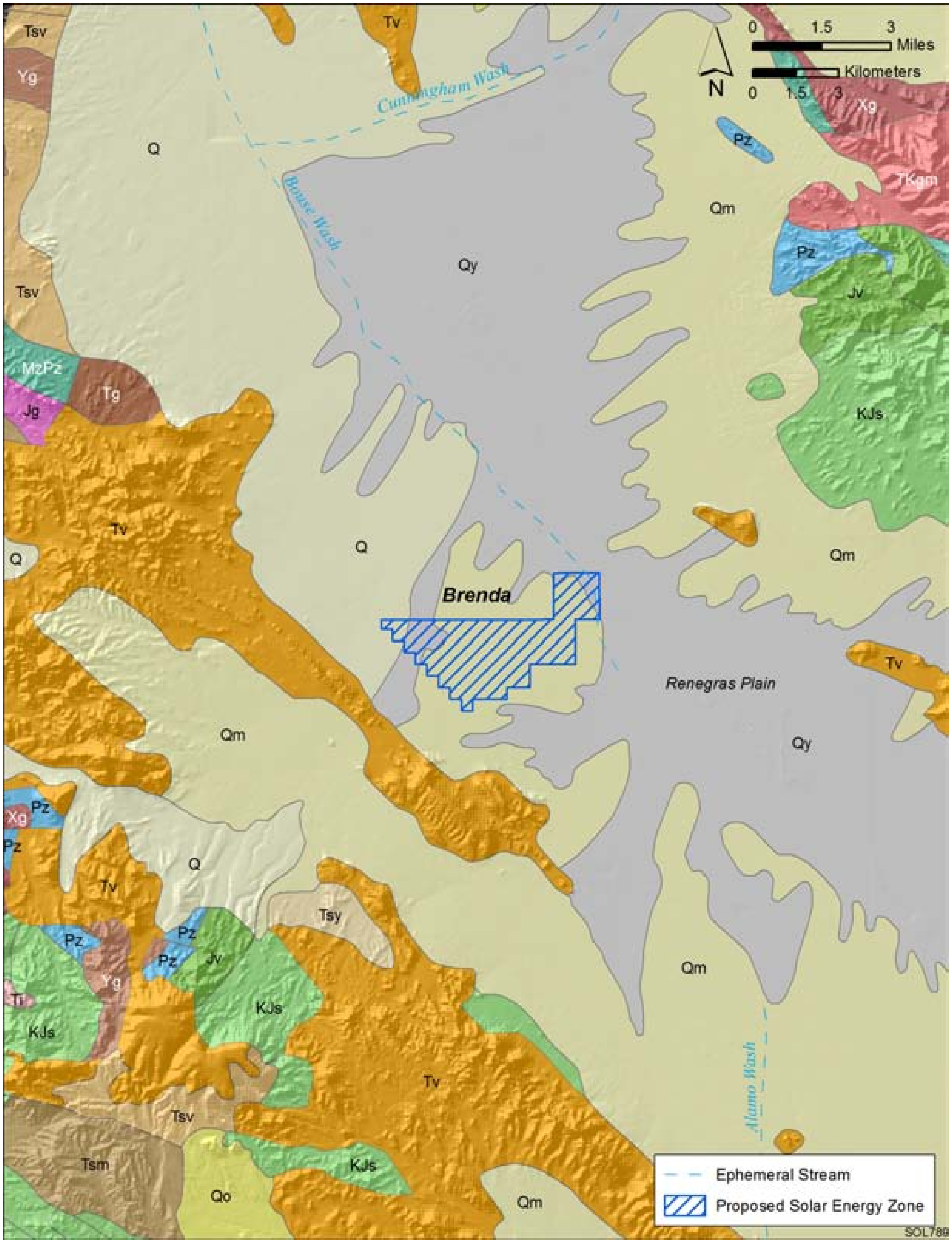

FIGURE 8.1.7.1-3 Geologic Map of the Ranegras Plain Region (adapted from Ludington et al. 2007; Richard et al. 2000)

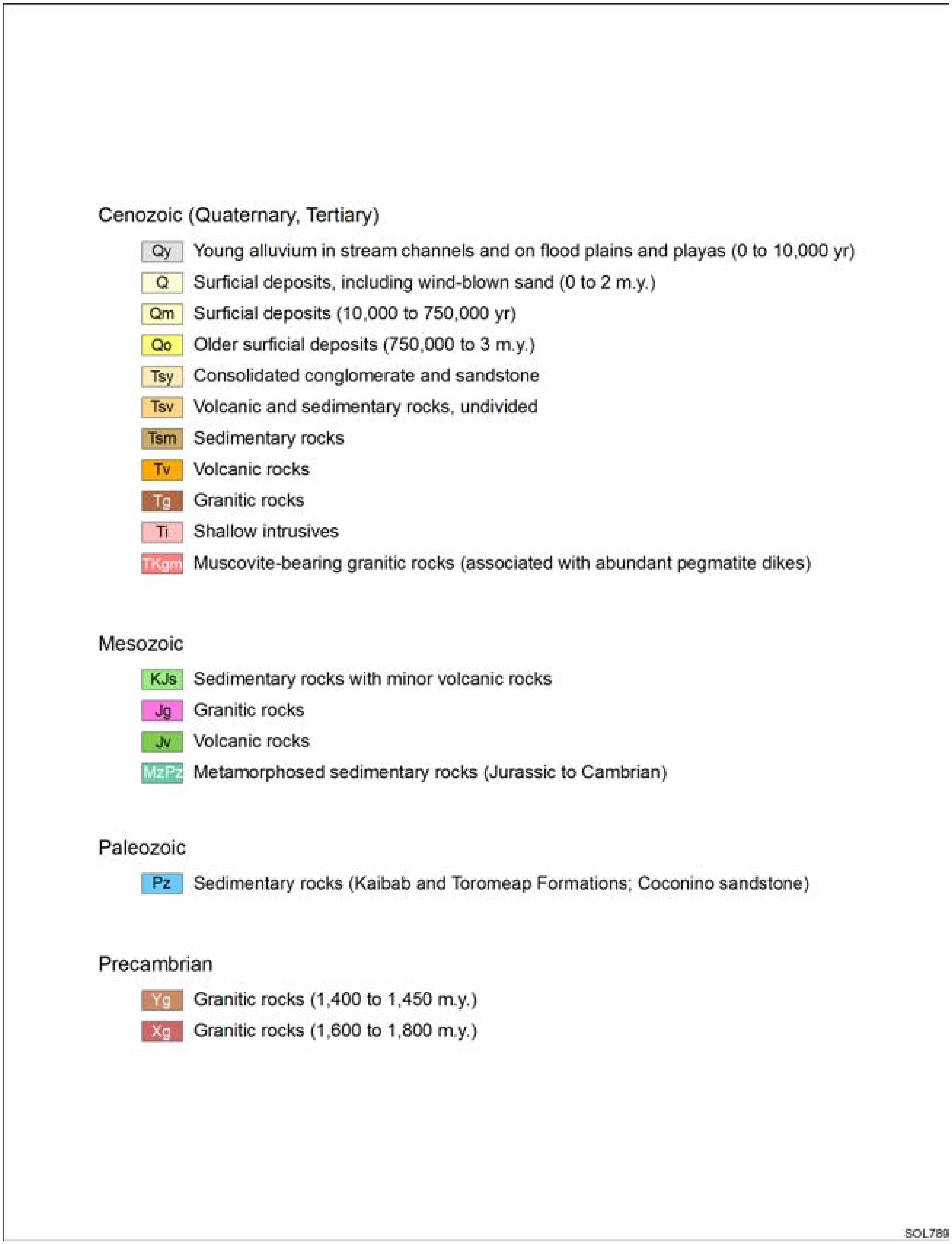

FIGURE 8.1.7.1-3 (Cont.)

valley. The valley is drained by Bouse Wash, an ephemeral stream that captures drainage from Butler and McMullen Valleys and exits the basin near the town of Bouse. Bouse Wash is a tributary to the Colorado River (to the west). Other topographic features include sand dunes, playas, and the many unnamed washes that drain the surrounding mountains and feed the central streams in the valley center.

The proposed Brenda SEZ is located in the northwestern end of the Ranegras Plain, in La Paz County, between the Bear Hills to the southwest and the Granite Wash Mountains to the northeast (Figure 8.1.7.1-1). Its terrain slopes gently to the northeast, with elevations ranging from about 1,240 ft (380 m) along its southwestern border to 1,110 ft (340 m) at the northeastern corner (Figure 8.1.7.1-4). Several drainages enter the SEZ from the southwest; Bouse Wash drains to the northwest, just beyond the northeast corner of the site.

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 Brenda 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. Most of the seismic activity in Arizona occurs along the northwest-trending boundary (transition zone) between the Basin and Range and Colorado Plateau physiographic provinces to the north of the three proposed Arizona SEZs (Figure 8.1.7.1-5). No Quaternary faults have been identified within the Ranegras Plain (USGS and AGS 2010); however, older faults of Cretaceous and Tertiary age, now covered by thick alluvium, have been inferred from topographic features (Metzger 1951).

From June 1, 2000, to May 31, 2010, there were no earthquakes recorded within a 61-mi (100-km) radius of the proposed Brenda SEZ (USGS 2010c). The most recent earthquakes have occurred in northern Arizona (north of Flagstaff) and in southeastern California (DuBois and Smith 1980). The largest earthquake in the region occurred on February 4, 1976, near Prescott, Arizona, about 100 mi (160 km) northeast of the Brenda SEZ (Figure 8.1.7.1-5). The earthquake registered a magnitude (ML[2]) of 5.2 (USGS 2010c).

[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).

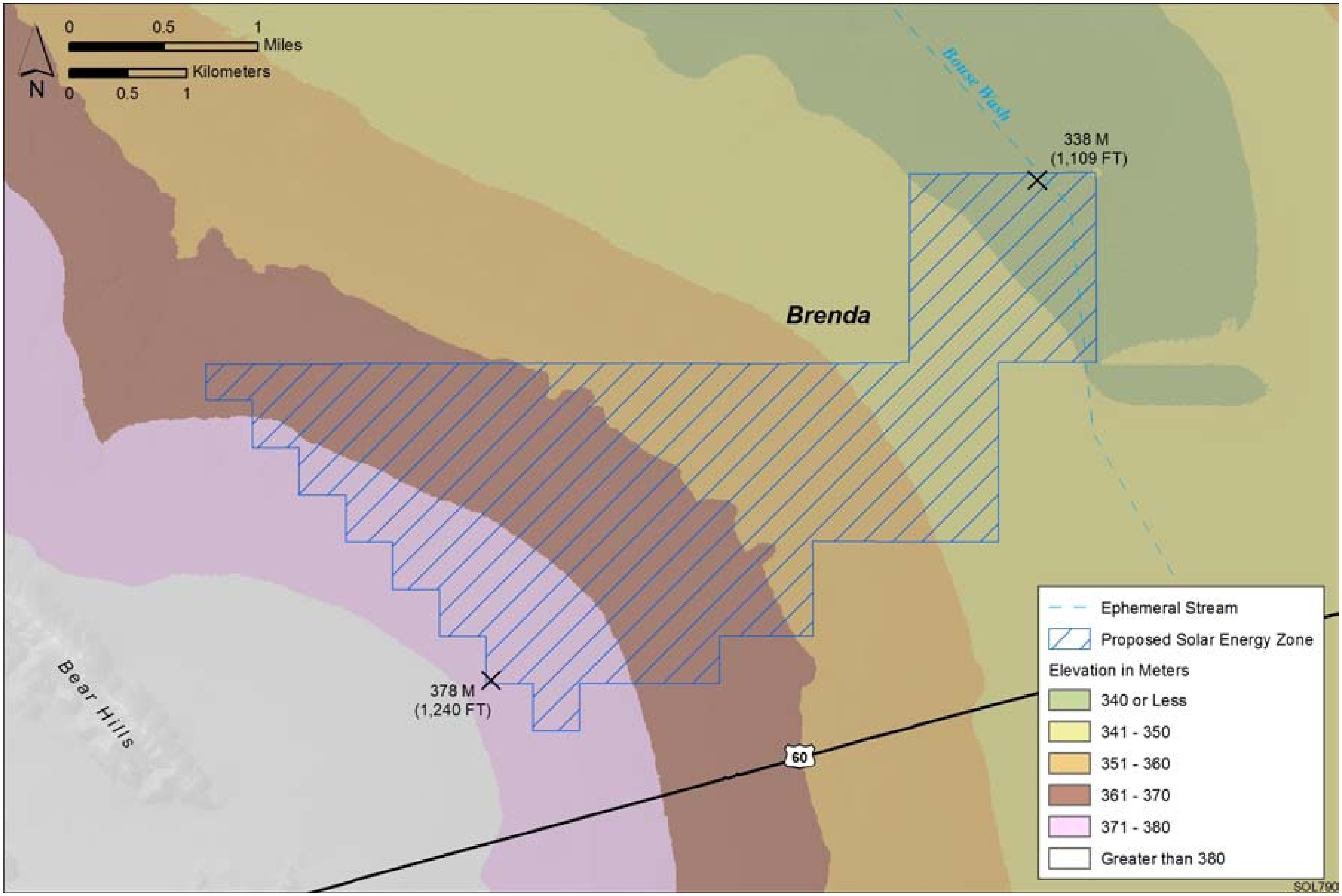

FIGURE 8.1.7.1-4 General Terrain of the Proposed Brenda SEZ

Liquefaction. The proposed Brenda SEZ lies within an area where the peak horizontal acceleration with a 10% probability of exceedance in 50 years is between 0.03 and 0.04 g. Shaking associated with this level of acceleration is generally perceived as light to moderate; the potential damage to structures is very light (USGS 2008). Given the absence of earthquakes within a 61-mi (100-km) radius of the Brenda SEZ and the very low intensity of ground shaking estimated for the area, the potential for liquefaction in valley sediments is also likely to be very low.

Volcanic Hazards. Extensive volcanic activity occurred in Arizona throughout the Tertiary period; the most recent activity occurred less than 4 million years ago, mainly along the edge of the Colorado Plateau in northeastern Arizona (Figure 8.1.7.1-5). Over the past 15 million years, eruptions were predominantly composed of basalt. The nearest volcanic center is the Sentinel volcanic field, about 70 mi (116 km) to the southeast of the proposed Brenda SEZ; basaltic lava flows erupted from volcanic vents in this area from about 3.3 million to 1.3 million years ago (Wood and Kienle 1992). Quaternary basalt outcrops have also been observed in Bouse Hills and the Plomosa Mountains (Metzger 1951). There is currently no evidence of volcanic activity in Arizona (Fellows 2000). Lynch (1982) suggests that the next eruption in Arizona would be most likely to occur in the San Francisco Mountain, Uinkaret, or Pinacate volcanic fields and, because it would likely be of the strombolian type (basaltic lava from a single vent with intermittent explosions), would cause little damage or disruption.

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 Ranegras Plain, if they are located at the base of steep slopes. The risk of rock falls and slope failures decreases toward the flat valley center.

The Arizona Geological Survey has reviewed aerial and satellite imagery and conducted on-the-ground investigations at 23 study areas to identify and map earth fissures with surface expression. The study areas are within four Arizona counties (Pinal, Maricopa, Cochise, and Pima) that are prone to fissuring (Shipman and Diaz 2008). To date, earth fissures and subsidence of about 0.6 ft (0.2 m) have been identified within the Harquahala Plain on the east side of the Eagletail Mountains (Maricopa County), about 40 mi (64 km) east-southeast of the proposed Brenda SEZ (AGS 2010; Galloway et al. 1999) (Figure 8.1.7.1-5). The fissures are the result of ground subsidence resulting from groundwater overdrafts in the basin that have caused differential compaction in the underlying aquifer. Land failure caused by subsidence and fissures in parts of Arizona has been significant enough to damage buildings, roads, railroads, and sewer lines, and to necessitate changes in the planned route of the Central Arizona Project (CAP) aqueduct (Galloway et al. 1999). Subsidence on the Ranegras Plain is also likely because of marked declines in groundwater levels since the 1950s (reported by the ADWR [2010i]) as a result of the high rates of irrigation pumpage in the basin.

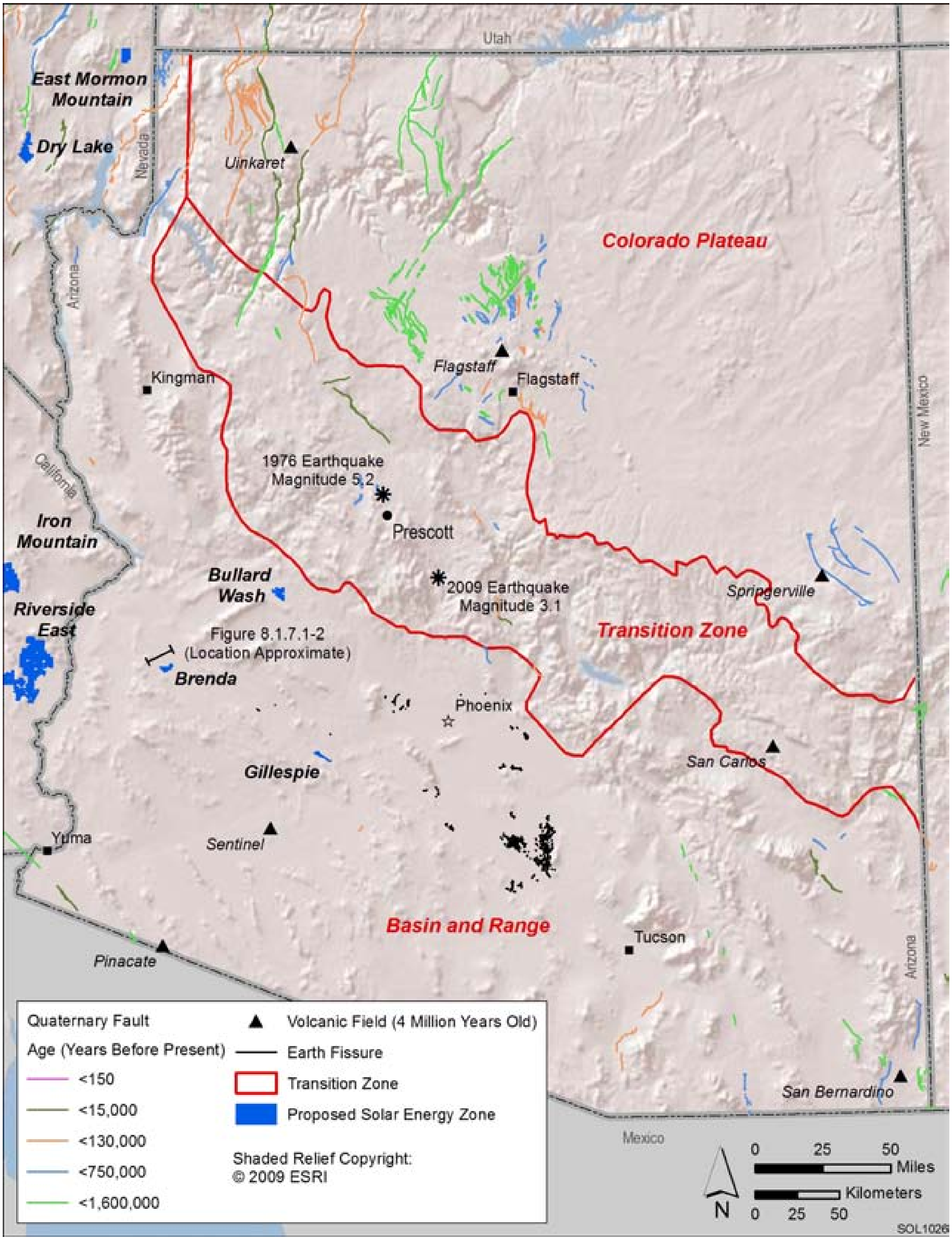

FIGURE 8.1.7.1-5 Quaternary Faults, Volcanic Fields, and Earth Fissures in Arizona (Sources: USGS and AGS 2010; USGS 2010c)

Other Hazards. Other potential hazards at the proposed Brenda 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 along the Ranegras Plain, 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 8.1.9.1.1 provides further discussion of flood risks within the Brenda SEZ.

8.1.7.1.2 Soil Resources

Most of the map unit composition within the proposed Brenda SEZ has not been delineated. Soils are predominantly the loams and sandy loams of soil series Pahaka-Estrella-Antho. The soils of these series are derived from mixed alluvium and are typical of alluvial fan terraces and relict basin floors. With slopes ranging from 0 to 5%, the soils are characterized as very deep and well to excessively well drained, with low to medium surface runoff (depending on slope and landform), and moderate to moderately rapid permeability (NRCS 2010a). Because of their fine-grained texture, they are moderately susceptible to wind erosion. Soils along the southwestern-facing site boundary occupy slopes at the base of the Bear Hills and belong to the Hyder-Coolidge-Ciprian-Cherioni soil series. These soils sit on bedrock and are shallower than soils in other parts of the SEZ; surface runoff rates are also higher for these soils.

Soil map units for mapped soils within the Brenda SEZ (covering about 32%) are described in Table 8.1.7.1-1. These are predominantly the sandy loams and gravelly sandy loams of the Denure-Pahaka-Growler and Gunsight family-Rillito complexes, which together make up about 18% of the soil coverage at the site (Figure 8.1.7.1-6). Parent material consists of fan alluvium from mixed sources. Soils are characterized as deep and well drained with a low runoff potential and moderate to moderately rapid permeability. The water erosion potential is slight to moderate for all soils. The susceptibility to wind erosion is moderate, with as much as 86 tons (78 metric tons) of soil eroded by wind per acre each year (NRCS 2010b).

Occasional flooding of the Gadsden-Glenbar complex soils occurs along the northeast corner of the SEZ (on the Bouse Wash floodplain), with a 5 to 50% chance in any given year. The flooding probability decreases away from Bouse Wash, with rare flooding (1 to 5% chance in any given year) occurring on most other soils. The Gunsight family complexes occur on higher ground, where the frequency of flooding is less than once in 500 years. Most of the soils are not suitable for cultivation unless irrigated; none are classified as prime farmland. The major crops in the region are alfalfa (hay and forage), cotton, and small grains (USDA 2010b; NRCS 2010b).

TABLE 8.1.7.1-1 Summary of Soil Map Units within the Proposed Brenda SEZ

Map Unit Symbol	Map Unit Name	Water Erosion Potential[a]	Wind Erosion Potential	Description	Area in Acres[b] (% of SEZ)
NOTCOM	Area not mapped	Not rated	Not rated	Map units not available. Soils belong to the following Soil Series: Pahaka-Estraella-Antho; Pahaka-Mohall-Laveen-Denure; and Hyder-Coolidge-Cipriano-Cherioni.	2,635 (68)
205	Denure-Pahaka-Growler complex (0 to 3% slopes)	Slight	Moderate (WEG 3)[c]	Consists of 30% Denure sandy loam, 30% Pahaka fine sandy loam, and 25% Growler fine sandy loam. Level to nearly level soils on alluvial fans. Parent material is fan alluvium from mixed sources. Soils are very deep and well drained, with low surface runoff potential (high infiltration rate) depending on slope and moderate to moderately rapid permeability. Available water capacity is low to moderate. Soil has features favorable to dust formation; high compaction potential. Used for rangeland, wildlife habitat, and irrigated cropland.	411 (11)
330	Gunsight family-Rillito complex (1 to 10% slopes)	Moderate	Moderate (WEG 5)	Consists of 55% Gunsight gravelly sandy loam and 35% Rillito gravelly sandy loam. Nearly level to gently sloping soils on alluvial fan terraces. Parent material is fan alluvium from mixed sources. Soils are very deep and somewhat excessively drained, with low surface runoff potential (high infiltration rate) and moderate permeability. Available water capacity is very low to low. Resists compaction. Used for rangeland, wildlife habitat, and irrigated cropland.	259 (7)

TABLE 8.1.7.1-1 (Cont.)

Map Unit Symbol	Map Unit Name	Water Erosion Potential[a]	Wind Erosion Potential	Description	Area in Acres[b] (% of SEZ)
200	Gunsight family-Pinamt complex (1 to 15% slopes)	Moderate	Moderate (WEG 6)[c]	Consists of 50% Gunsight very gravelly loam and 40% Pinamt extremely gravelly loam. Nearly level to gently sloping soils on alluvial fan terraces. Parent material is fan alluvium from mixed sources. Soils are very deep and well drained, with low surface runoff potential (high infiltration rate) and moderate to high permeability. Available water capacity is very low. High compaction potential. Used mainly for livestock grazing and wildlife habitat; unsuitable for cultivation.	159 (4)
312	Gadsden-Glenbar complex (0 to 2% slopes)	Moderate	Moderate (WEG 4)	Consists of 60% Gadsden silty clay loam and 35% Glenbar silty clay loam. Level to nearly level soils on flood plains. Parent material is mixed stream alluvium. Soils are very deep and well drained, with high surface runoff potential (very slow infiltration rate) and low permeability. Available water capacity is moderate. Soil has features favorable to dust formation; high compaction potential. Used for rangeland, wildlife habitat, and irrigated cropland.	149 (4)

[a] Water erosion potential rates the hazard of soil loss from off-road and off-trail areas after disturbance activities that expose the soil surface. The ratings are based on slope and soil erosion factor K (whole soil; doesn’t account for the presence of rock fragments) and represent soil loss caused by sheet or rill erosion where 50 to 75 percent of the surface has been exposed by ground disturbance. A rating of “slight” indicates that erosion is unlikely under ordinary climatic conditions. A rating of “severe” indicates that erosion is expected; loss of soil productivity and damage are likely and erosion control measures may be costly or impractical.

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

[c] 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: WEGs 3 and 4, 86 tons per acre per year; WEG 5, 56 tons per acre per year; and WEG 6, 48 tons per acre per year.

Source: NRCS (2010b).

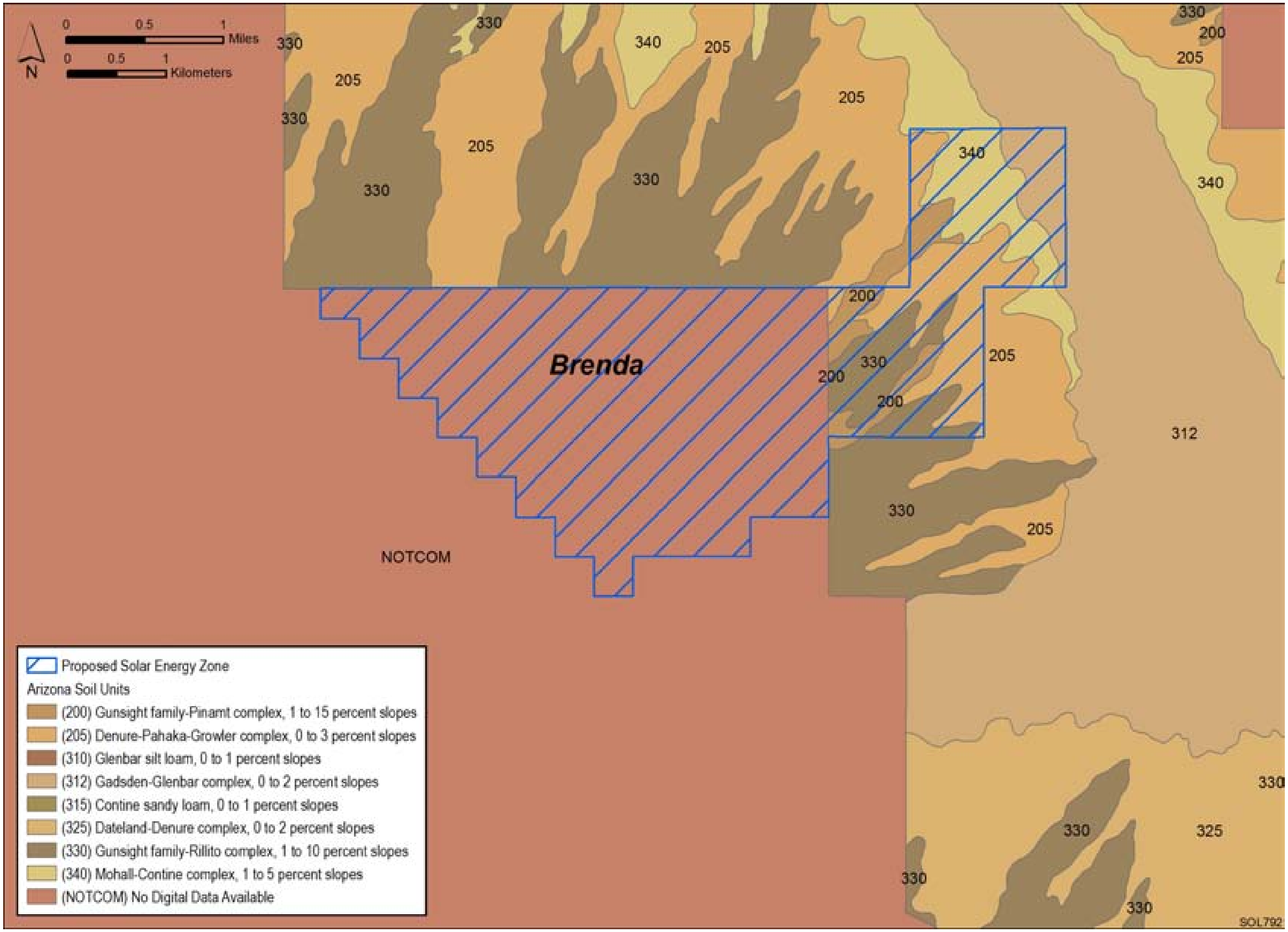

FIGURE 8.1.7.1-6 Soil Map for the Proposed Brenda SEZ (Source: NRCS 2008)

8.1.7.2 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 impacts 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 developments 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 since some components would involve greater disturbance and would take place over a longer timeframe.

8.1.7.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features were identified for soil resources at the proposed Brenda SEZ. Implementing the programmatic design features described under both Soils and Air Quality 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.

8.1.8 Minerals (Fluids, Solids, and Geothermal Resources)

8.1.8.1 Affected Environment

As of July 22, 2010, there were no locatable mining claims within the SEZ (BLM and USFS 2010a), and the public land within the SEZ was closed to mineral entry in June 2009, pending the outcome of this solar energy PEIS. There are no active oil and gas leases in the area, and the area within the SEZ has not been leased in the past. There are public land parcels near the SEZ that have been previously leased, but the leases have expired (BLM and USFS 2010b). The area remains open for discretionary mineral 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 2010b).

8.1.8.2 Impacts

If the area is identified as a solar energy zone, it would continue to be closed to all incompatible forms of mineral development. For the purpose of this analysis, it is assumed that future development of oil and gas resources, should any be found, would continue to be possible, since such development could occur with directional drilling from outside the SEZ. Since the SEZ does not contain existing mining claims, it was 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.

Neither the SEZ nor areas surrounding it have had a history of leasing or development of geothermal resources. For that reason, it is not anticipated that solar development would adversely affect development of geothermal resources.

8.1.8.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features were identified. 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 to mineral resources.

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8.1.9 Water Resources

8.1.9.1 Affected Environment

The proposed Brenda SEZ is located within the Colorado River Basin subregion of the Lower Colorado Hydrologic Region (USGS 2010a) and the Basin and Range physiographic province characterized by intermittent mountain ranges and desert valleys (Robson and Banta 1995). The proposed Brenda SEZ has surface elevations ranging between 1,110 and 1,235 ft (338 and 376 m). The Brenda SEZ is located on the Ranegras Plain in the valley between the Plomosa Mountains and the Bear Hills to the west–southwest and the Granite Wash Mountains and Little Harquahala Mountains to the east (Figure 8.1.9.1-1). Annual precipitation is between 4 and 8 in./yr (10 to 20 cm/yr) in the valley and between 8 and 14 in./yr (20 and 36 cm/yr) in the surrounding mountains (ADWR 2010a). Evaporation is estimated to be 115 in./yr (292 cm/yr) (Cowherd et al. 1988).

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

There are no perennial surface water features in or near the proposed Brenda SEZ. The Brenda SEZ is located within the Bouse Wash Basin, and Bouse Wash flows through the northeastern part of the SEZ (Figure 8.1.9.1-1). Bouse Wash is an ephemeral stream that flows from south to north along the centerline of the Ranegras Plain. Other named ephemeral washes are the Alamo Wash, which flows from the Plomosa Mountains west of the proposed Brenda SEZ to the Bouse Wash south of the Brenda SE, and the Cunningham Wash, which flows into the Bouse Wash north of the Brenda SEZ. Several unnamed ephemeral washes flow out of the Bear Hills to the southwest of the Brenda SEZ, creating an alluvial fan that covers the majority of the SEZ. The Colorado River is the nearest perennial stream, and it is located about 32 mi (51 km) west of the Brenda SEZ. The Bouse Wash flows toward the Colorado River, but the channel loses definition when it reaches the floodplain of the Colorado River in Parker Valley, which is used for agriculture and is the site of the Colorado River Indian Reservation.

Flood hazards have not been identified (Zone D) for the region surrounding the proposed Brenda SEZ (FEMA 2009). Intermittent flooding may occur with temporary ponding and erosion along the Bouse Wash and along the ephemeral washes that originate in the adjacent Bear Hills. No wetlands have been identified in the basin (USFWS 2009a).

8.1.9.1.2 Groundwater

The proposed Brenda SEZ is located within the Ranegras Plain groundwater basin. Groundwater in the Ranegras Plain Basin occurs primarily in basin-fill deposits. Groundwater flows through the basin from the southeast to the northwest and exits the basin near Bouse. Water levels are shallowest in the northwestern parts of the basin near Bouse and deepest in the eastern parts of the basin along the mountain fronts. Groundwater surface elevations range from 1,350 to 1,438 ft (411 to 438 m) in the southern portion of the basin and from 925 to 955 ft

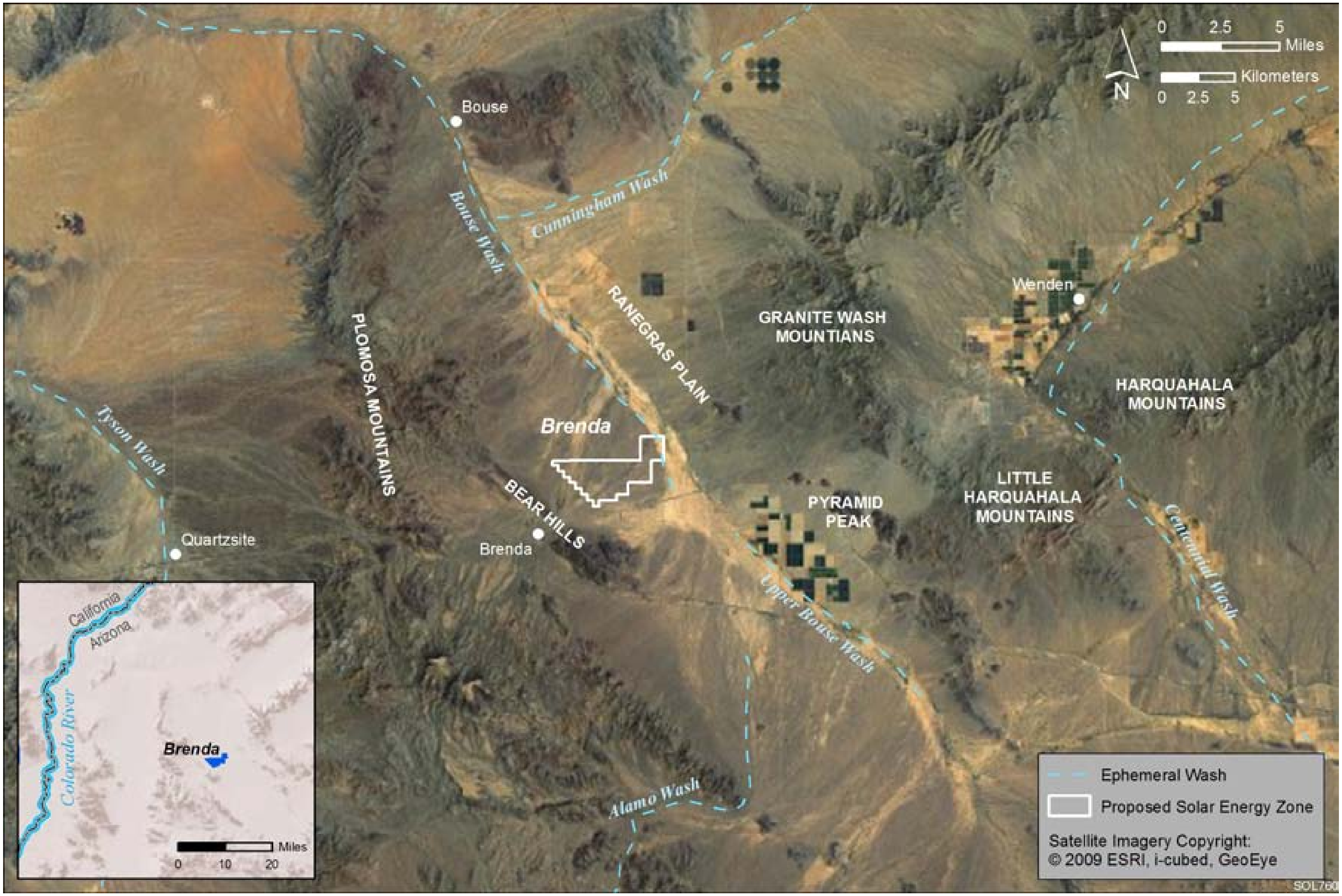

FIGURE 8.1.9.1-1 Surface Water Features near the Proposed Brenda SEZ

(282 to 291 m) in the northern portion of the basin (USGS 2010b; well numbers 335622114005601, 335555114000901, 333121113413001, and 332848113425101). Depth to water measurements ranged from 158 to 239 ft (48 to 73 m) below ground surface within the SEZ between 1993 and 2006 (USGS 2010b; well numbers 334422113524001, 334219113545001). In the Ranegras Plain Basin, water levels vary from 438 ft (134 m) below ground surface at the southern end of the basin to 75 ft (23 m) below ground surface in the northern part of the basin, near Bouse (ADWR 2010a). Water levels within the SEZ have declined at an average rate of 0.34 to 4.6 in./yr (0.85 to 11.5 cm/yr) between 1948 and 2006 (USGS 2010b; well numbers 334422113524001, 334219113545001, and 334144113510601).

The Arizona Department of Water Resources (ADWR) has estimated that there are 21.7 million ac-ft (26.8 billion m^3) of water available to a depth of 1,200 ft (366 m) below land surface (ADWR 2010b). There are five estimates of natural recharge to the basin that range from less than 1,000 ac-ft/yr (1.2 million m^3/yr) to more than 6,000 ac-ft/yr (7.4 million m^3/yr), with the most recent estimates at about 5,000 ac-ft/yr (6.2 million m^3/yr) (ADWR 2010a). Most water is recharged into the aquifer by infiltration of runoff in Bouse Wash and its tributaries and other runoff from the mountains at the basin margins. Recharge from precipitation is expected to be small because of low precipitation and high evaporation rates. Through seepage, an additional 2,000 to 3,000 ac-ft (2.5 million to 3.7 million m^3) of water could be recharged into the Ranegras Plain basin annually from the Central Arizona Project Canal (ADWR 2010b). Inflow on the order of less than 500 ac-ft/yr (620,000 m^3/yr) may also occur from each of two adjacent groundwater basins: Butler Valley and the Haquahala Basin. An estimated outflow of less than 1,000 ac-ft/yr (1.2 million m^3/yr) from the Parker Basin occurs near the town of Bouse (Freethy and Anderson 1986).

Specific capacity of wells in the basin has been estimated to range from 3 to 57 gallons per minute (11 to 216 L/min) per foot of aquifer drawdown, with lower values in the northern part of the basin and the highest values near the Pyramid Peak area (Johnson 1990).

In 1975, it was estimated that water levels had declined up to 40 ft (12 m) since irrigation began in 1949 in the basin; however, because of increased agricultural development in the Ranegras Plain Basin, water levels continued to decline (Johnson 1990). Data collected from 1945 to 2006 show a decline in water levels ranging from 25 to 146 ft (7.6 to 44 m) throughout the Ranegras Plain basin; however, a rebound of water levels ranging from 2.4 to 60 ft (0.7 to 18 m) has occurred in three of the four wells analyzed (USGS 2010b; wells 335622114005601, 334357113473201, 334121113450101, and 334839113514101). The withdrawals from the basin have caused a cone of depression to form in the eastern part of the basin, approximately 10 mi (16 km) from the Brenda SEZ, near Pyramid Peak (ADWR 2010b). Subsidence of the land surface has also occurred as a result of overdraft of the aquifer. Between 1992 and 1997 subsidence of up to 1.9 in. (5 cm) was measured to occur in the area of the basin where the highest drawdown has occurred (near Pyramid Peak) (ADWR 2010d). Between 2004 and 2010, an additional land subsidence of up to 1.9 in. (5 cm) was measured in the same area (ADWR 2010e).

Total dissolved solids (TDS) concentrations within the basin have been found to be generally high (ADWR 2010b). Of 48 wells sampled, 43 were found to have TDS levels above the secondary maximum contaminant level (MCL) of 500 mg/L (EPA 2009d) in samples taken between 1985 and 1989. Out of a total of 91 samples tested in the basin, 7 had TDS concentrations higher than 3,000 mg/L; at this level the water is considered "mineralized" (ADWR 2010a). The highest TDS concentrations are in the north-central part of the basin. The majority of the 48 samples also were found to have concentrations of fluoride that exceeded the secondary MCL (4.0 mg/L) (ADWR 2010b). Concentrations of hexavalent chromium in 13 out of 39 samples exceeded the 0.05 mg/L MCL, and concentrations of selenium in 4 of 39 samples exceeded the 0.01 mg/L MCL (ADWR 2010b). Of the total number of 91 samples reported to be taken between 1978 and 1990 that had concentrations exceeding water quality standards, 55 exceeded the MCL for arsenic and 18 exceeded the MCL for nitrate (ADWR 2010a). Concentrations of arsenic and fluoride have been found to exceed water quality standards in the groundwater in the vicinity of the proposed Brenda SEZ (ADWR 2010a).

8.1.9.1.3 Water Use and Water Rights Management

In 2005, water withdrawals from surface waters and groundwater in La Paz County were 704,009 ac-ft/yr (86 million m^3/yr), of which 87% came from surface waters and 13% came from groundwater. The largest water use category was irrigation, at 698,886 ac-ft/yr (86 million m^3/yr). Public supply/domestic water uses accounted for 4,697 ac-ft/yr (5.7 million m^3/yr), with mining water uses on the order of 303 ac-ft/yr (386,000 m^3/yr) (Kenny et al. 2009). Within the Ranegras Plain Basin, the annual groundwater withdrawals for agriculture were 29,500 ac-ft/yr (36 million m^3/yr) between 1991 and 1995, 32,000 ac-ft/yr (39 million m^3/yr) between 1996 and 2000, and 28,800 ac-ft/yr (35 million m^3/yr) between 2000 and 2005 (ADWR 2010a). Municipal water use from the Ranegras Plain Basin was estimated to be less than 300 ac-ft/yr (<370,000 m^3/yr) between 1991 and 1995, 300 ac-ft/yr (370,000 m^3/yr) between 1996 and 2000, and 400 ac-ft/yr (490,000 m^3) between 2001 and 2005 (ADWR 2010a).

Arizona water law is based on the doctrine of prior appropriation. However, water laws in Arizona are based on a bifurcated system in which surface water and groundwater rights are administered and assessed separately. The state of Arizona has four main sources of water: Colorado River water, surface water separate from the Colorado River, groundwater, and treated effluent. Rights for these four sources are assessed and administered separately; Colorado River water is regulated under the Law of the River, other surface water is based on prior appropriation, and groundwater rights are handled on a region-by-region basis (BLM 2001). Effluent is not available for use until it takes on the characteristics of surface water through treatment (ADWR 2010k). The ADWR is the agency responsible for the conservation and distribution of water in the state. It is also responsible for administering and assessment of novel and transfer of existing water rights and applications. The agency's broad goal is the security of long-term dependable water supplies for the state, which is the main factor in the assessment of water right applications (ADWR 2010j).

Upon completion of an application for water rights, the ADWR assesses it with three main criteria: whether the proposed water right will conflict with more senior water rights, whether the proposed right is a threat to public safety, and whether the proposed right will be detrimental to the interests and welfare of the general public (BLM 2001). Generally, surface water rights are assessed solely upon the criteria above, but they may also be subject to certain management plans in specific areas put into effect by the ADWR. Unlike the majority of groundwater rights that are bound to the land they occupy, users of surface water rights have the option to change location of the water right but not the beneficial use (a change of beneficial use application would need to be submitted). To change a surface water right's location, a "sever and transfer" permit needs to be approved by the ADWR and the governing body of the irrigation district or water users council of the proposed new location of the surface water right. Evaluations of "sever and transfer" permits follow the same general evaluation guidelines as new surface water rights, and the proposed new location of the right after the transfer is treated as a new surface water right. The new surface water right must not exceed the old one in annual water use (ADWR 2010k).

Arizona has rights to 2.8 million ac-ft of Colorado River water annually, which is further sub-divided into allocations for both general Colorado River water users and Central Arizona Project (CAP) users (ADWR 2010l). CAP is a system of water delivery canals, aqueducts, and pumping stations that deliver 1.5 million ac-ft/yr of Colorado River water from Lake Havasu to Pima, Pinal and Maricopa counties annually (CAP 2010). The flows of the Colorado River are variable; and thus, the water resource availability is variable from year to year.

The Ground Water Management Code (the Code) was put into effect in 1980 because of historic groundwater overdraft, where groundwater recharge is exceeded by discharge (in some places groundwater overdraft is in excess of 700,000 ac-ft/yr [864 million m^3/yr]) (ADWR 1999, 2010c). The Code describes three main goals for the state regarding the management of groundwater: the control of severe overdraft, the allocation of the limited water resources of the state, and the enhancement of the state's groundwater resources using water supply development (BLM 2001). Arizona's groundwater management laws are separated according to a three-tiered system based on The Code. Under that system, proposed applications are evaluated with an increasing level of scrutiny. The lowest level of management includes provisions that apply statewide, Irrigation Non-Expansion Areas (INAs) have an intermediate level of management, and Active Management Areas (AMAs) have the highest level of management with the most restrictions and provisions. Within an AMA or INA, a groundwater permit is required (BLM 2001). Currently the state has five AMAs and three INAs, each with its own specific rules and regulations regarding the appropriation of groundwater (ADWR 2010m). In locations outside of designated AMAs and INAs, a permit is not necessary to withdraw groundwater (BLM 2001). Use of this groundwater, however, requires the filing of a notice of intent to drill with the ADWR.

Recently, the ADWR (2010k) has created guidelines regarding the appropriation of water for solar generating facilities, specifically detailing what information needs to be submitted for permit evaluation. Information that is required includes the proposed method of power generation, the proposed amount of water to be consumed, the point of diversion, and to what or to whom the power is to be distributed. To secure water rights for a solar facility to be located within an AMA, the applicant must demonstrate that there is an "assured water supply" for the life of the project. The ADWR then makes a decision based on whether the proposed water right will be detrimental to public welfare and general conservation of water (ADWR 2010k).

Groundwater within the Brenda SEZ is located in the Ranegras Plain basin, which is part of the Lower Colorado River Planning Area, as defined by the ADWR (2010a). Within the Ranegras Plains Basin, there are no surface water rights available (e.g., from the Colorado River), and the primary source of water resources is groundwater (ADWR 2010a). Since the Ranegras Plains Basin is not included in either an AMA or INA, it is legal to pump groundwater without a permit; however, a Notice of Intent to Drill must be filed with ADWR (2010c). Groundwater level declines and associated land subsidence within the Ranegras Plain Basin have resulted from overdraft of the aquifer. Groundwater withdrawals far exceed the estimated recharge of the basin.

8.1.9.2 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, and 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).

8.1.9.2.1 Land Disturbance Impacts on Water Resources

Impacts related to land disturbance activities are common to all utility-scale solar energy projects and 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 Brenda SEZ could potentially affect natural drainage patterns and natural groundwater recharge and discharge properties. The alteration of natural drainage pathways during construction can lead to impacts related to flooding. Land-disturbance activities should be avoided to the extent possible in the vicinity of Bouse Wash and the unnamed ephemeral stream washes on the site. Alterations to these systems could enhance erosion processes, disrupt groundwater recharge, and negatively affect plant and animal habitats associated with the ephemeral channels. The Bouse Wash conveys flows during storm events, as is evident from channel incision and sedimentation patterns. In addition, water flowing in unnamed ephemeral washes off of the Bear Hills to the southwest during storm events has created sedimentation and erosion patterns. Land disturbance in the SEZ could potentially cause channel incision and sedimentation problems for these stream systems and downstream in Bouse Wash.

8.1.9.2.2 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 Brenda SEZ include the following:

- On the basis of a total area of 3,878 acres (15.7 km^2), it is assumed that one solar project would be constructed during the peak construction year;
- Water needed for making 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, result in the potential to disturb up to 77% 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 for providing 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 water supply. Because there are no significant surface water bodies on the proposed Brenda SEZ, the water requirements for construction activities could be met by either 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 8.1.9.2-1, could be as high as 2,014 ac-ft (2.5 million m^3). The assumptions underlying these estimates for each solar energy technology are described in Appendix M. Groundwater wells would have to yield up to an estimated 1,250 gal/min (4,720 L/min) to meet the estimated construction water requirements. This yield is within the range of producing wells within the

TABLE 8.1.9.2-1 Estimated Water Requirements during the Peak Construction Year for the Proposed Brenda SEZ

Activity	Parabolic Trough	Power Tower	Dish Engine	PV
Water use requirements[a]				
Fugitive dust control (ac-ft)[b,c]	1,313	1,969	1,969	1,969
Potable supply for workforce (ac-ft)	74	45	19	9
Total water use requirements (ac-ft)	1,387	2,014	1,988	1,979
Wastewater generated				
Sanitary wastewater (ac-ft)	74	45	19	9

[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 115 in./yr (292 cm/yr) (Cowherd et al. 1988).

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

Ranegras Plain Basin and is typical of well yields of small to medium-sized farms in Arizona (ADWR 2010a; USDA 2009c). 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. In addition, up to 74 ac-ft (91,000 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. Groundwater quality in the vicinity of the SEZ has concentrations of arsenic and fluoride that exceed drinking quality standards (ADWR 2010a). Water would need to be treated or imported to meet drinking water quality standards for potable water.

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 8.1.9.2-2). 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 the option was employed (30 to 60% range assumed) and the power of the system. The differences between the water requirements reported in Table 8.1.9.2-2 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.

Water use requirements among the solar energy technologies 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 8.1.9.2-2 lists the quantities of water needed for mirror/panel washing, potable water supply, and cooling activities for each solar energy technology. At full

TABLE 8.1.9.2-2 Estimated Water Requirements during Operations at the Proposed Brenda SEZ

Activity	Parabolic Trough	Power Tower	Dish Engine	PV
Full build-out capacity (MW)[a,b]	620	345	345	345
Water use requirements				
Mirror/panel washing (ac-ft/yr)[c,d]	310	172	172	17
Potable supply for workforce (ac-ft/yr)	9	4	4	0.4
Dry cooling (ac-ft/yr)[e]	124–620	69–345	NA[f]	NA
Wet cooling (ac-ft/yr)[e]	2,792–8,997	1,551–4,998	NA	NA
Total water use requirements				
Non-cooled technologies (ac-ft/yr)	NA	NA	176	18
Dry-cooled technologies (ac-ft/yr)	443–940	245–521	NA	NA
Wet-cooled technologies (ac-ft/yr)	3,111–9,316	1,727–5,175	NA	NA
Wastewater generated				
Blowdown (ac-ft/yr)[g]	176	98	NA	NA
Sanitary wastewater (ac-ft/yr)	9	4	4	0.4

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.

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 18 and 176 ac-ft/yr (22,000 to 220,000 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 245 ac-ft/yr (0.3 million m^3/yr) (power tower for an operating time of 30% using dry cooling) to 9,316 ac-ft/yr (11.5 million m^3/yr) (parabolic trough for an operating time of 60% using wet cooling). Operations would generate up to 9 ac-ft/yr (11,100 m^3/yr) of sanitary wastewater; in addition, for wet-cooled technologies, 98 to 176 ac-ft/yr (120,000 to 220,000 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 to prevent any groundwater contamination.

Water demands during operations would most likely be met by withdrawing groundwater from wells constructed on-site. Non-cooled technologies—PV system and dish engine—would require 11 gpm (42 L/min) and 110 gpm (410 L/min), respectively. Cooled technologies (parabolic trough and power tower) would require well yields between 150 and 580 gal/min (570 and 2,200 L/min) for dry cooling and between 1,100 and 5,800 gal/min (4,100 and 22,000 L/min) for wet cooling. The required well yields for dry cooling are within the range of well yields within the Ranegras Plain Basin; wet-cooling water demands would mostly exceed the average annual yield for a single well within the basin (ADWR 2010a). For wet cooling, multiple wells would be required. Water demands for non-cooled technologies are substantially less than those for cooled technologies.

Water demands for wet-cooling technologies are significant compared to the overall water balance in the Ranegras Plain Basin aquifer. The estimates of annual groundwater recharge for the Ranegras Plain Basin are from less than 1,000 to 6,000 ac-ft/yr (1.2 million to 7.4 million m^3/yr), and the higher end estimates of water required for wet cooling significantly exceed recharge estimates. For the Brenda SEZ, estimated water requirements for wet cooling are equivalent to 6 to 31% of the total average annual groundwater withdrawals in the basin between 1991 and 2005 (ADWR 2010a). However, the basin is already in a condition of overdraft. That is, withdrawal from wells (about 30,000 ac-ft/yr [37 million m^3]) exceeds the upper estimate for the basin's annual recharge (6,000 ac-ft [7.5 million m^3]) (ADWR 2010a). Additional water supply wells for a solar project would worsen the basin's overdraft condition. The estimated water requirements for wet cooling are equivalent to 34 to 190% of the annual recharge for the Ranegras Plain basin, most recently estimated to be 5,000 ac-ft/yr (6.2 million m^3/yr). Use of water for wet cooling could exacerbate existing conditions of groundwater overdraft in the Ranegras Plain basin. Based on the information presented here, wet cooling for the full build-out scenario is not deemed feasible for the Brenda SEZ. To the extent possible, facilities using dry cooling should implement water conservation practices to limit water needs.

The availability of water rights and the impacts associated with groundwater withdrawals would need to be assessed during the site characterization phase of a proposed solar project. Less water would be needed for any of the four solar technologies if the full build-out capacity were reduced. The analysis of water use for the various solar technologies assumed a single technology for full build-out. Water use requirements for development scenarios that assume a mixture of solar technologies can be estimated using water use factors described in Appendix M, Section M.9.

The effects of groundwater withdrawal rates on potential drawdown of groundwater elevations and flow directions would need to be assessed during the site characterization phase of a solar project and during the development of water supply wells. In the Ranegras Plain Groundwater Basin, water levels have declined by up to 85 ft (4.6 m), and surface elevations are subsiding at a maximum rate of about 0.3 in./yr (0.8 cm/yr) (ADWR 2010e) because of declining groundwater levels (ADWR 2010f). With these existing conditions, further groundwater withdrawals for solar energy development at the SEZ would potentially cause further drawdown of groundwater elevations and land subsidence in the vicinity of the SEZ. These indirect impacts could disturb regional groundwater flow patterns and recharge patterns, potentially affecting ecological habitats (see discussion in Section 8.1.10).

Concentrations of arsenic and fluoride have been found to exceed water quality standards in the groundwater in the vicinity of the proposed Brenda SEZ (ADWR 2010a), so groundwater would need to be treated or potable water would need to be imported into the area to support potable needs at solar energy facilities.

Decommissioning/Reclamation

During decommissioning/reclamation, all surface structures associated with the solar project would be dismantled, and the site 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 might 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.

8.1.9.2.3 Off-Site Impacts: Roads and Transmission Lines

U.S. 60 is adjacent to the southern border of the proposed Brenda SEZ, and as described in Section 8.1.1.2, the nearest transmission line is located approximately 19 mi (31 km) west of the SEZ. 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. Water needed for transmission line construction activities (e.g., for soil compaction, dust suppression, and potable supply for workers) could be trucked to the construction area from an off-site source. As a result, water use impacts would be negligible. Impacts on surface water and groundwater quality resulting from spills would be minimized by implementing the mitigation measures described in Section 5.9.3 (e.g., cleaning up spills as soon as they occur). Ground-disturbing activities that have the potential to increase sediment and dissolved solid loads in downstream waters would be conducted following the mitigation measures outlined in Section 5.9.3 to minimize impacts associated with alterations to natural drainage pathways and hydrologic processes.

8.1.9.2.4 Summary of Impacts on Water Resources

The impacts on water resources associated with solar energy development at the proposed Brenda SEZ are associated with land disturbance effects on the natural hydrology, water quality concerns, and water use requirements for the various solar energy technologies. Impacts relating to water use requirements vary depending on the type of solar technology built and, for technologies using cooling systems, the type of cooling (wet, dry, hybrid) employed. Water requirements would be greatest for wet-cooled parabolic trough and power tower facilities. Dry cooling reduces water use requirements by approximately a factor of 10, compared with wet cooling. PV requires the least amount of water among the solar energy technologies. The estimates of groundwater recharge, discharge, underflow from adjacent basins, and historical data on groundwater extractions and groundwater surface elevations suggest that there is not enough water available to support the water-intensive technologies, such as those using wet cooling for the full build-out scenario.

Because the Brenda SEZ is not located within a designated AMA or INA, no groundwater permit would be required for groundwater supply wells. However, an application to drill would have to be submitted to the state, and the groundwater extraction plans would have to be approved by the ADWR. The portion of the basin that contains the proposed SEZ (the Date Creek basin) was estimated to have a recharge of between 1,000 and 6,000 ac-ft/yr (1.2 million to 7.4 million m^3/yr). In addition, the sustainable yield has not been assessed for the basin; and thus, impacts of groundwater withdrawals on aquifer drawdown and potentially land subsidence would need to be investigated. Using water supply wells for the solar project in the basin (particularly for projects that use wet cooling) would worsen overdraft conditions and could increase land subsidence in the vicinity of the solar project. Land subsidence could impact the long-term storage capacity of the underlying aquifer by causing permanent damage due to compaction.

In addition, the water quality in many parts of the basin does not comply with drinking water quality standards, so groundwater would need to be treated or potable water would need to be imported into the area to support potable needs at solar energy facilities.

Land-disturbance activities can cause localized erosion and sedimentation issues, as well as alter groundwater recharge and discharge processes. Bouse Wash provides significant recharge to the Ranegras Plain Basin, and land disturbance activities in the vicinity of Bouse Wash and its tributaries could significantly affect groundwater recharge in the basin. Land disturbance within the SEZ could affect channel erosion and sedimentation patterns in Bouse Wash and also in the ephemeral washes that drain the Bear Hills to the southwest.

8.1.9.3 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 mitigate some impacts on water resources. Programmatic 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 on 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.

Proposed design features specific to the Brenda SEZ include the following:

- Wet-cooling options would not be feasible; other technologies should incorporate water conservation measures.

- During site characterization, hydrologic investigations would need to identify 100-year floodplains and potential jurisdictional water bodies subject to Clean Water Act Section 404 permitting. Siting of solar facilities and construction activities should avoid areas identified as within a 100-year floodplain.

- Before drilling a new well within the Ranegras Plain basin, a Notice of Intent to Drill must be filed with the ADWR, and any groundwater rights policy of the ADWR must be followed (ADWR 2010c).

- Groundwater monitoring and production wells should be constructed in accordance with state standards (ADWR 2010g).

- Stormwater management plans and best management practices (BMPs) should comply with standards developed by the Arizona Department of Environmental Quality (ADEQ 2010).

- Water for potable uses would have to meet or be treated to meet drinking water quality standards.

- Land disturbance and operations activities should prevent erosion and sedimentation in the vicinity of the ephemeral washes present on the site.

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8.1.10 Vegetation

This section addresses vegetation that could occur or is known to occur within the potentially affected area of the proposed Brenda 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 the SEZ and a 250-ft (76-m) wide portion of an assumed transmission line corridor. The area of indirect effects was defined as the area within 5 mi (8 km) of the SEZ boundary or within the 1-mi (1.6-km) wide assumed transmission line corridor 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.

8.1.10.1 Affected Environment

The proposed Brenda SEZ is located within the Sonoran Basin and Range Level III ecoregion (EPA 2007), which supports creosotebush- (*Larrea tridentata*) white bursage (*Ambrosia dumosa*) plant communities with large areas of palo verde- (*Parkinsonia microphylla*) cactus shrub and saguaro cactus (*Carnegiea gigantea*) communities (EPA 2002). The dominant species of the Lower Colorado River Valley subdivision of the Sonoran Desert are primarily creosotebush, white bursage, and all-scale (*Atriplex polycarpa*), with big galleta (*Pleuraphis rigida*), Palmer alkali heath (*Frankenia palmeri*), brittlebush (*Encelia farinosa*), and western honey mesquite (*Prosopis glandulosa* var. *torreyana*) dominant in some areas (Turner and Brown 1994). Larger drainageways and washes support species of small trees and shrubs that may also occur in adjacent areas, such as western honey mesquite, ironwood (*Olneya tesota*), and blue palo verde (*Parkinsonia florida*), as well as species such as smoketree (*Psorothamnus spinosa*) that are mostly restricted to drainageways. Shrub species found in minor drainages include cat-claw acacia (*Acacia greggii*), burrobrush (*Hymenoclea salsola* var. *pentalepis*), Anderson thornbush (*Lycium andersonii*), and desert broom (*Baccharis sarothroides*). Annual precipitation in the Sonoran Desert occurs in winter and summer (Turner and Brown 1994), and is very low in the area of the SEZ, averaging about 5.6 in. (14 cm) at Bouse, Arizona (see Section 8.1.13).

Land cover types described and mapped under the Southwest Regional Gap Analysis Project (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 Brenda SEZ are shown in Figure 8.1.10.1-1. Table 8.1.10.1-1 lists the surface area of each cover type within the potentially affected area.

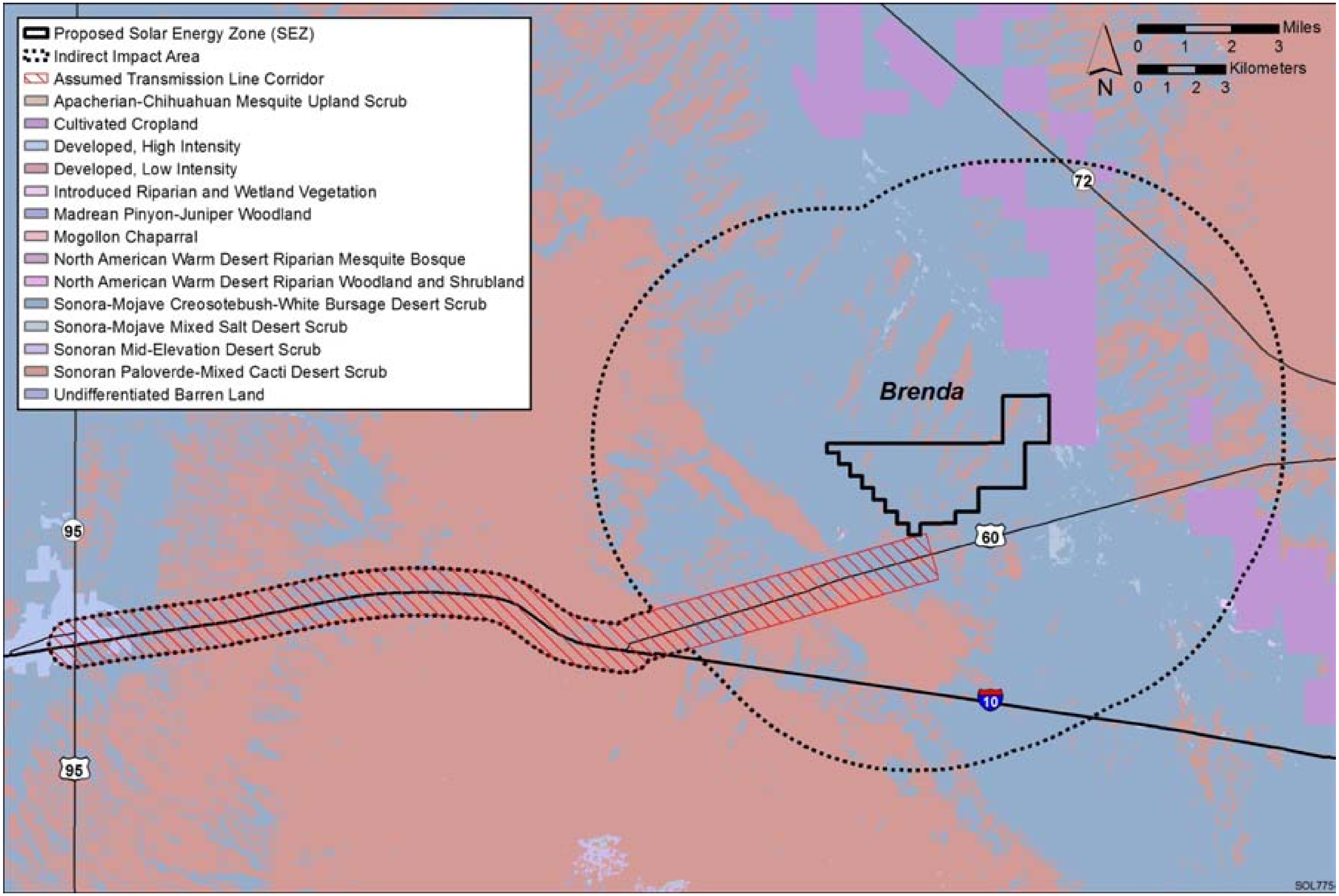

FIGURE 8.1.10.1-1 Land Cover Types within the Proposed Brenda SEZ (Source: USGS 2004)

1

TABLE 8.1.10.1-1 Land Cover Types within the Potentially Affected Area of the Proposed Brenda SEZ and Potential Impacts

	Area of Cover Type Affected (acres)[b]			
Land Cover Type[a]	Within SEZ (Direct Effects)[c]	Assumed Transmission Line (Direct Effects)[d]	Corridor and Outside SEZ (Indirect Effects)[e]	Overall Impact Magnitude[f]
Sonora–Mojave Creosotebush–White Bursage Desert Scrub: Occurs in broad valleys, lower bajadas, plains, and low hills in the Mojave and Sonoran deserts. Shrubs form a sparse to moderately dense cover (2 to 50%), although the ground surface may be mostly barren. The dominant species are typically creosotebush (*Larrea tridentata*) and white bursage (*Ambrosia dumosa*). Other shrubs, dwarf-shrubs, and cacti may also be dominant or form sparse understories. Herbaceous species are typically sparse, but may be seasonally abundant.	3,422 acres[g] (0.2%, 0.3%)	177 acres (<0.1%)	59,140 acres (2.6%)	Small
Sonoran Paloverde-Mixed Cacti Desert Scrub: Occurs on hillsides, mesas, and upper bajadas. The tall shrubs yellow palo verde (*Parkinsonia microphylla*) and creosotebush (*Larrea tridentata*), which are sparse to moderately dense, and/or sparse saguaro cactus (*Carnegia gigantea*) characterize the vegetation. Other shrubs and cacti are typically present. Perennial grasses and forbs are sparse. Annual species are seasonally present and may be abundant.	428 acres (<0.1%, <0.1%)	346 acres (<0.1%)	30,924 acres (1.5%)	Small
Agriculture: Areas where pasture/hay or cultivated crops account for more than 20% of total vegetation cover.	12 acres (<0.1%, 0.1%)	0 acres	7,077 acres (2.3%)	Small
Sonora-Mojave Mixed Salt Desert Scrub: Extensive open-canopied shrublands in the Mojave and Sonoran Deserts, usually occurring around playas and in valley bottoms or basins with saline soils. Vegetation is typically composed of one or more *Atriplex* species; other salt-tolerant plants are often present or even co-dominant. Grasses occur at varying densities.	9 acres (0.1%, 0.3%)	<1 acre (<0.1%)	533 acres (5.6%)	Small

TABLE 8.1.10.1-1 (Cont.)

	Area of Cover Type Affected (acres)[b]			
Land Cover Type[a]	Within SEZ (Direct Effects)[c]	Assumed Transmission Line (Direct Effects)[d]	Corridor and Outside SEZ (Indirect Effects)[e]	Overall Impact Magnitude[f]
Developed, Medium-High Intensity: Includes housing and commercial/industrial development. Impervious surfaces compose 50 to 100% of the total land cover.	0 acres	48 acres (0.4%)	1,291 acres (10.9%)	Small
Barren lands non-specific: Includes a variety of barren areas, generally with less than 15% cover of vegetation.	0 acres	2 acres (<0.1%)	111 acres (1.3%)	Small
North American Warm Desert Riparian Mesquite Bosque: Occurs along perennial and intermittent streams as relatively dense riparian corridors composed of trees and shrubs. Honey mesquite (*Prosopis glandulosa*) and velvet mesquite (*P. velutina*) are the dominant trees. Vegetation is supported by groundwater when surface water is absent.	0 acres	<1 acre (<0.1%)	8 acres (0.1%)	Small
Invasive Southwest Riparian Woodland and Shrubland: Dominated by non-native riparian trees and shrubs.	0 acres	0 acres	26 acres (0.3%)	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	0 acres	2 acres (<0.1%)	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).

Footnotes continued on next page.

TABLE 8.1.10.1-1 (Cont.)

[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 California and Arizona. However, the SEZ and affected area occur only in Arizona.

[d] For transmission development, direct effects were estimated within a 19-mi (31-km) long, 250-ft (76-m) wide assumed transmission ROW from the SEZ to the nearest existing line. Direct impacts within this area were determined from the proportion of the cover type within the 1-mi (1.6-km) wide transmission corridor. Impacts are for the area of the cover type within the assumed ROW, and the percentage that area represents of all occurrences of that cover type within the SEZ region.

[e] Area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary and the portions of the 1-mi (1.6-km) wide transmission corridor where ground-disturbing activities would not occur. Indirect effects include effects from surface runoff, dust, and other factors from project developments. The potential degree of indirect effects would decrease with increasing distance away from the SEZ. Includes the area of the cover type within the indirect effects area and the percentage that area represents of all occurrences of that cover type within the SEZ region.

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

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

Lands within the proposed Brenda SEZ are classified primarily as Sonora–Mojave Creosotebush–White Bursage Desert Scrub. Additional cover types within the SEZ are given in Table 8.1.10.1-1. During a September 2009 visit to the site, dominant species observed in the desertscrub communities present within the SEZ included creosotebush, saguaro cactus, palo verde, ironwood, and acacia. Characteristic Sonoran Desert species observed on the SEZ include these as well as ocotillo. Cacti species observed within the SEZ included saguaro cactus, cholla (*Opuntia* sp.), and barrel cactus (*Ferocactus cylindraceus*). Sensitive habitats on the SEZ include desert dry wash, dry wash woodlands, and desert chenopod scrub/mixed salt desert scrub. Cryptogrammic soil crusts occur in some areas of the SEZ. While portions of the SEZ support a sparse creosotebush community with few associated species, other areas of the SEZ support a high-quality, diverse, Sonoran desertscrub community.

The indirect impact area, including the area within 5 mi (8 km) around the SEZ and the transmission line corridor, includes nine cover types, which are listed in Table 8.1.10.1-1. The predominant cover types are Sonora–Mojave Creosotebush–White Bursage Desert Scrub and Sonoran Paloverde–Mixed Cacti Desert Scrub.

No National Wetland Inventory (NWI) data are available for the region that includes the proposed Brenda SEZ (USFWS 2009a). Numerous ephemeral desert dry washes occur within the SEZ, generally flowing to the northeast. These washes typically do not support wetland or riparian habitats. Bouse Wash, a large ephemeral wash, is located within the northeast portion of the SEZ and consists of a wide, shallow, braided channel. These dry washes typically contain water for short periods during or following precipitation events, and include temporarily flooded areas. Tyson Wash, located near the western end of the assumed transmission line corridor, supports dry wash woodland habitat south of Highway 10 (BLM 2007a). Small areas of North American Warm Desert Riparian Mesquite Bosque occur in scattered dry washes within the corridor.

The State of Arizona maintains an official list of weed species that are designated noxious species (AZDA 2010). Table 8.1.10.1-2 provides a summary of the noxious weed species regulated in Arizona that are known to occur in La Paz County (USDA 2010a), which includes the proposed Brenda SEZ. No species included in Table 8.1.10.1-2 was observed on the SEZ in August 2009.

The Arizona Department of Agriculture classifies noxious weeds into one of three categories (AZDA 2010):

- "Prohibited: Noxious weeds (includes plants, stolons, rhizomes, cuttings, and seed) that are prohibited from entry into the state."

- "Regulated: Noxious weeds that are regulated (includes plants, stolons, rhizomes, cuttings, and seed) and if found within the state may be controlled or quarantined to prevent further infestation or contamination."

TABLE 8.1.10.1-2 Designated Noxious Weeds of Arizona Occurring in Le Paz County

Common Name	Scientific Name	Category
Dodder	*Cuscuta* spp.	Restricted, prohibited
Field bindweed	*Convolvulus arvensis*	Regulated, prohibited
Morning glory	*Ipomoea* spp.	Prohibited
Puncture vine	*Tribulus terrestris*	Regulated, prohibited

Sources: AZDA (2010); USDA (2010a).

- "Restricted: Noxious weeds that are restricted (includes plants, stolons, rhizomes, cuttings, and seed) and if found within the state shall be quarantined to prevent further infestation or contamination."

Table 8.1.10.1-3 provides a summary of the federal regulated and restricted invasive plant species that are known to occur in the BLM Lake Havasu Field Office Planning Area (BLM 2007a), which includes the proposed Brenda SEZ. No species included in Table 8.1.10.1-3 was observed on the SEZ in August 2009.

8.1.10.2 Impacts

The construction of solar energy facilities within the proposed Brenda 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 (3,102 acres [12.6 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.

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. The proper implementation of programmatic design features, however, would reduce indirect effects to a minor or small level of impact.

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,

TABLE 8.1.10.1-3 Invasive Plant Species Occurring in the Lake Havasu Field Office Planning Area

Common Name	Scientific Name
Downy brome	*Bromus tectorum*
Musk thistle	*Carduus nutans*
Russian knapweed	*Acroptilon repens*
Saltcedar	*Tamarix* spp.
Scotch thistle	*Onopordium acanthium*
Spotted knapweed	*Centaurea maculosa*
Yellow star thistle	*Centaurea solstitialis*
Common reed	*Phragmites australis*
Eurasian water-milfoil	*Myriophyllum spicatum*
Giant reed	*Arundo donax*
Giant salvinia	*Salvinia molesta*

Source: BLM (2007b).

Section A.2.2, and any additional mitigation applied. Section 8.1.10.2.3, below, identifies design features of particular relevance to the proposed Brenda SEZ.

8.1.10.2.1 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 Brenda SEZ would primarily affect communities of the Sonora–Mojave Creosotebush–White Bursage Desert Scrub cover type. Additional cover types that would be affected within the SEZ include Sonoran Paloverde–Mixed Cacti Desert Scrub, Agriculture, and Sonora-Mojave Mixed Salt Desert Scrub. The Agriculture cover type would likely have relatively minor populations of native species. Table 8.1.10.1-1 summarizes the potential impacts on land cover types resulting from solar energy facilities in the proposed Brenda SEZ. Most of these cover types are relatively common in the SEZ region; however, Sonora-Mojave Mixed Salt Desert Scrub is relatively uncommon, representing 0.2% of the land area within the SEZ region. In addition, Barren Lands, Non-specific (0.2%); North American Warm Desert Riparian Mesquite Bosque (0.2%); and Sonora-Mojave Mixed Salt Desert Scrub (0.2%), would potentially be impacted by the transmission line ROW. Desert dry wash, dry wash woodlands, desert chenopod scrub/mixed salt desert scrub, and mesquite bosque are important sensitive habitats in the region.

The construction, operation, and decommissioning of solar projects within the proposed Brenda SEZ would result in small impacts on all cover types in the affected area.

Because of the arid conditions, re-establishment of desert scrub 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 portions of the SEZ and in many of the shrubland communities in the region. Damaging 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 indirect impact area identified in Table 8.1.10.1-1.

Grading could affect dry washes within the SEZ and transmission line corridor. Desert dry washes in the SEZ support woodlands that include ironwood and blue palo verde. Within the transmission line corridor, dry wash woodland occurs along Tyson Wash, and small areas of mesquite bosque occur in scattered dry washes. 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, such as chenopod scrub communities, downgradient from solar projects in the SEZ could be affected by ground-disturbing activities. Site clearing and grading could disrupt surface water, resulting in changes in the frequency, duration, depth, or extent of inundation or soil saturation, 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 8.1.9 for further discussion of impacts on washes. Direct impacts on desert washes that are Waters of the United States would require permitting from the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act.

Although the use of groundwater within the Brenda 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, such as mesquite bosque communities, could become degraded or lost as a result of lowered groundwater levels.

8.1.10.2.2 Impacts from Noxious Weeds and Invasive Plant Species

On February 8, 1999, President Bill Clinton 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. Despite required programmatic 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 Brenda SEZ, such that weeds could be transported into areas that were previously relatively weed-free, which could result in reduced restoration success and possible widespread habitat degradation.

Species designated as noxious weeds in Arizona and known to occur in La Paz County are listed in Table 8.1.10.1-2; species designated as federal regulated and restricted invasive species and known to occur in the Lake Havasu Field Office Planning Area are given in Table 8.1.10.1-3. Past or present land uses may affect the susceptibility of plant communities to the establishment of noxious weeds and invasive species. Small areas of Invasive Southwest Riparian Woodland and Shrubland totaling about 26 acres (0.1 km^2) occur in the indirect impact area; about 1,291 acres (5.2 km^2) of Developed, Medium-High Intensity occur within the indirect impact area, including the transmission line corridor. The developed areas likely support few native plant communities. Because disturbance may promote the establishment and spread of invasive species, developed areas may provide sources of such species. Existing roads and recreational OHV use within the SEZ area of potential impact also likely contribute to the susceptibility of plant communities to the establishment and spread of noxious weeds and invasive species.

8.1.10.3 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, the following measures can be identified at this time:

- 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 creosotebush–white bursage desert scrub communities and other affected habitats and to minimize the potential for the spread of noxious weeds or invasive species, such as those occurring in La Paz County or the Lake Havasu Field Office Planning Area, that could be introduced as a result of solar energy project activities (see Section 8.1.10.2.2). To reduce the use of herbicides, invasive species control should focus on biological and mechanical methods where possible.

- All dry wash, dry wash woodland, chenopod scrub habitats, and saguaro cactus communities within the SEZ and all dry wash, dry wash woodland, mesquite bosque, chenopod scrub, and saguaro cactus communities within the assumed transmission line corridor should be avoided to the extent practicable and any impacts minimized and mitigated. A buffer area should be maintained around dry washes, dry wash woodland, and mesquite bosque habitats to reduce the potential for impacts.

- Appropriate engineering controls should be used to minimize impacts on dry wash, dry wash woodland, mesquite bosque, and chenopod scrub, 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.

- Transmission line towers should be sited and constructed to minimize impacts on dry washes, dry wash woodlands, and mesquite bosque communities; towers should span such areas whenever practicable.

- Groundwater withdrawals should be limited to reduce the potential for indirect impacts on groundwater-dependent communities, such as mesquite bosque communities.

If these SEZ-specific design features are implemented in addition to programmatic design features, it is anticipated that a high potential for impacts from invasive species and potential impacts on dry wash, dry wash woodland, chenopod scrub, mesquite bosque, and saguaro cactus communities would be reduced to a minimal potential for impact.

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8.1.11 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 Brenda SEZ. Wildlife known to occur within 50 mi (80 km) of the SEZ (i.e., the SEZ region) were determined from Arizona Field Ornithologists (2010), Brennan (2008), Hoffmeister (1986), and SWReGAP (USGS 2007). Land cover types suitable for each species were determined from SWReGAP (USGS 2004, 2005a, 2007). The amount of aquatic habitat within the SEZ region was determined by estimating the length of linear perennial stream 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) and included the SEZ and a 250-ft (76-m) wide portion of an assumed 19-mi (31-km) long transmission line corridor. The maximum developed area within the SEZ would be 3,102 acres (12.6 km^2) and the maximum developed area within the transmission line would be 576 acres (2.3 km^2).

The area of indirect effects was defined as the area within 5 mi (8 km) of the SEZ boundary and within the 1.0-mi (1.6-km) wide assumed transmission line corridor where ground-disturbing activities would not occur, but that could be indirectly affected by activities in the area of direct effect (e.g., surface runoff, dust, noise, lighting, and accidental spills in the SEZ or road construction area). If a species' potentially suitable habitat within the SEZ was greater than the maximum of 3,102 acres (12.6 km^2) of direct effect, it was 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 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. These areas of direct and indirect effect are defined and the impact assessment approach is described in Appendix M.

The primary land cover habitat type within the affected area is Sonora-Mojave creosote desert scrub (see Section 8.1.10). Potentially unique habitats in the affected area include desert washes and associated riparian habitats. The only potential aquatic habitat known to occur in the SEZ is Bouse Wash, an intermittent streambed that exists along the easternmost boundary of the SEZ. The only other aquatic habitat within the affected area is Tyson Wash, west of the SEZ, in the assumed transmission line corridor. Other washes, Colorado River, Colorado River Aqueduct, Bill Williams River, Alamo Lake, Copper Basin Reservoir, and Gene Wash Reservoir occur within the SEZ region (Figure 8.1.9.1-1).

8.1.11.1 Amphibians and Reptiles

8.1.11.1.1 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 Brenda SEZ. The list of amphibian and reptile species potentially present in the SEZ area was determined from species lists available from Brennan (2008) and range maps and habitat information available from SWReGAP (USGS 2007). Land cover types suitable for each species were determined from SWReGAP (USGS 2004, 2005a, 2007). See Appendix M for additional information on the approach used.

Based on species distributions within the area of the SEZ and habitat preferences of the amphibian species, the Great Basin spadefoot (*Spea intermontana*) and red-spotted toad (*Bufo punctatus*) would be expected to occur within the SEZ (Brennan 2008; USGS 2007; Stebbins 2003). They would most likely occur in the portion of the SEZ that overlaps the Bouse Wash and within the portion of the assumed transmission line corridor that encompasses Tyson Wash.

More than 25 reptile species occur within the area that encompasses the proposed Brenda SEZ (Brennan 2008; USGS 2007; Stebbins 2003). The desert tortoise (*Gopherus agassizii*) is a federal and state listed threatened species and is discussed in Section 8.1.12. Lizard species expected to occur within the SEZ include the desert horned lizard (*Phrynosoma platyrhinos*), Great Basin collared lizard (*Crotaphytus bicinctores*), side-blotched lizard (*Uta stansburiana*), western whiptail (*Cnemidophorus tigris*), and zebra-tailed lizard (*Callisaurus draconoides*).

Snake species expected to occur within the SEZ include the coachwhip (*Masticophis flagellum*), common kingsnake (*Lampropeltis gentula*), glossy snake (*Arizona elegans*), gophersnake (*Pituophis catenifer*), groundsnake (*Sonora semiannulata*), and nightsnake (*Hypsiglena torquata*). The Mohave rattlesnake (*Crotalus scutulatus*), sidewinder (*C. cerastes*) and western diamond-backed rattlesnake (*C. atrox*) would be the most common poisonous snake species expected to occur on the SEZ.

Table 8.1.11.1-1 provides habitat information for representative amphibian and reptile species that could occur within the proposed Brenda SEZ.

8.1.11.1.2 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 additional mitigation applied. Section 8.1.11.1.3, below, identifies SEZ-specific design features of particular relevance to the proposed Brenda SEZ.

TABLE 8.1.11.1-1 Habitats, Potential Impacts, and Potential Mitigation for Representative Amphibian and Reptile Species That Could Occur on or in the Affected Area of the Proposed Brenda SEZ

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Amphibians					
Great Basin spadefoot (*Spea intermontana*)	Sagebrush flats, semi-desert shrublands, pinyon-juniper woodlands, and spruce-fir forests. Breeds in temporary and permanent waters including rain pools, pools in intermittent streams, and flooded areas along streams. About 2,091,500 acres[h] of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.2% of available potentially suitable habitat) during construction and operations	60,010 acres of potentially suitable habitat (2.9% of available potentially suitable habitat)	178 acres of potentially suitable habitat lost (<0.009% of available potentially suitable habitat) and 3,581 acres in area of indirect effect	Small overall impact. Avoid wash habitats.
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 4,251,700 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,353 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. Avoid wash habitats.
Lizards					
Desert horned lizard (*Phrynosoma platyrhinos*)	Deserts dominated by sagebrush, creosotebush, greasewood, or cactus. Occurs on sandy flats, alluvial fans, washes, and edges of dunes. Burrows in soil during periods of inactivity. About 4,261,700 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,363 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

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TABLE 8.1.11.1-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Lizards (Cont.)					
Great Basin collared lizard (*Crotaphytus bicinctores*)	Usually inhabits alluvia, lava flows, mountain slopes, canyons, buttes, rock outcrops, washes, and rocky plains. Limiting factors are the presence of large boulders and open/sparse vegetation. About 4,245,500 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,353 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. Avoid wash habitats. No other species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Side-blotched lizard (*Uta stansburiana*)	Low to moderate elevations in washes, arroyos, boulder-strewn ravines, rocky cliff bases, and flat shrubby areas in canyon bottoms. Often along sandy washes. Usually in areas with a lot of bare ground. About 4,185,400 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	90,812 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. Avoid wash habitats. No other species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Western whiptail (*Cnemidophorus tigris*)	Arid and semiarid habitats with sparse plant cover. About 4,269,000 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	90,822 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 8.1.11.1-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]			
		Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Lizards (Cont.)					
Zebra-tailed lizard (*Callisaurus draconoides*)	Open, warm-desert habitats, especially dry washes and canyons with fine gravel and sand. About 4,206,700 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,363 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. Avoid washes. No other species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Snakes					
Coachwhip (*Masticophis flagellum*)	Creosotebush desert, shortgrass prairie, shrub-covered flats and hills. Sandy to rocky substrates. Avoids dense vegetation. About 4,183,600 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	90,812 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
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 4,494,900 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	98,452 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 8.1.11.1-1 (Cont.)

		Maximum Area of Potential Habitat Affected[b]			
Common Name (Scientific Name)	Habitat[a]	Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
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 4,190,400 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	90,820 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Gophersnake (*Pituophis catenifer*)	Arid and semiarid regions with rocky to sandy soils. River bottoms, desert flats, sand hummocks, and rocky hillsides. About 4,508,100 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	99,743 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	5238 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Groundsnake (*Sonora semiannulata*)	Plains grasslands, sandhills, riparian areas, marshes, edges of ponds and lakes, rocky canyons, semi-desert and mountain shrublands, montane woodlands, rural and suburban areas, and agricultural areas. Likely inhabits pocket gopher burrows in winter. About 4,260,000 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	90,822 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 8.1.11.1-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Snakes (Cont.)					
Mohave rattlesnake (*Crotalus scutulatus*)	Upland desert and lower mountain slopes including barren desert, grassland, open juniper woodland, and scrubland. Especially common in areas of scattered scrubby growth such as creosote and mesquite. About 4,542,000 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	99,881 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	5238 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
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, it seeks refuge underground, in crevices, or under rocks. About 4,190,700 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	90,812 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Sidewinder (*Crotalus cerastes*)	Windblown sand habitats near rodent burrows. Most common in areas of sand hummocks topped with creosote, mesquite, or other desert plants. About 4,183,800 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	90,814 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 8.1.11.1-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Snakes (Cont.)					
Western diamond-backed rattlesnake (*Crotalus atrox*)	Dry and semi-dry lowland areas. Usually found in brush-covered plains, dry washes, rock outcrops, and desert foothills. About 4,498,200 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	98,452 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. Avoid wash habitats. No other species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

[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 3,102 acres of direct effect 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 3,102 acres of direct effect was also added to the area of indirect effect. 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.

[e] For transmission line development, direct effects were estimated within a 19-mi (31-km) long, 250-ft (76-m) wide transmission line ROW from the SEZ to the nearest existing transmission line. Indirect effects were estimated within a 1-mi (1.6-km) wide transmission line corridor to the existing transmission line, less the assumed area of direct effects.

Footnotes continued on next page.

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TABLE 8.1.11.1-1 (Cont.)

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[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 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.

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

Sources: Brennan (2008); CDFG (2008); NatureServe (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 8.1.11.1.1 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 8.1.11.1.3).

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 8.1.11.1-1, direct impacts on representative amphibian and reptile species would be small, ranging from a high of 0.2% for the Great Basin spadefoot to only 0.07% for all other species (Table 8.1.11.1-1). Larger areas of potentially suitable habitats for the amphibian and reptile species occur within the area of potential indirect effects (e.g., up to 2.9% of available habitat for the Great Basin spadefoot and 2.1 to 2.2% for all other species). Indirect 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 desert scrub, playa, and wash habitats.

8.1.11.1.3 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., washes). 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, two design features can be identified at this time:

- Bouse Wash should be avoided.

- Tyson Wash should be spanned by the transmission line.

If these SEZ-specific design features are implemented in addition to other programmatic design features, impacts on amphibian and reptile species could be reduced. However, as potentially suitable habitats for all of the representative 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.

8.1.11.2 Birds

8.1.11.2.1 Affected Environment

> **Desert Focal Bird Species**
>
> Bird species whose requirements define spatial attributes, habitat characteristics, and management regimes representative of a healthy desert system (Chase and Geupel 2005).

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 Brenda SEZ. The list of bird species potentially present in the SEZ area was determined from the Arizona Field Ornithologists (2010) and range maps and habitat information available from SWReGAP (USGS 2007). Land cover types suitable for each species were determined from SWReGAP (USGS 2004, 2005a, 2007). See Appendix M for additional information on the approach used.

Twelve of the bird species that could occur on or in the affected area of the SEZ are considered focal species in the *Desert Bird Conservation Plan* (CalPIF 2009): ash-throated flycatcher (*Myiarchus cinerascens*), black-tailed gnatcatcher (*Polioptila melanura*), black-throated sparrow (*Amphispiza bilineata*), burrowing owl (*Athene cunicularia*), common raven (*Corvus corax*), Costa's hummingbird (*Calypte costae*), Gila woodpecker (*Melanerpes uropygialis*), ladder-backed woodpecker (*Picoides scalaris*), Le Conte's thrasher (*Toxostoma lecontei*), Lucy's warbler (*Vermivora luciae*), phainopepla (*Phainopepla nitens*), and verdin (*Auriparus flaviceps*). Habitats for most of these species are described in Table 8.1.11.2-1. Because of its special species status, the burrowing owl is discussed in Section 8.1.12.1.

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 solar study area. However, within the proposed Brenda SEZ, waterfowl, wading birds, and shorebird species would be mostly absent to uncommon. Within the SEZ, Bouse Wash may attract shorebird species, but the Colorado River, Colorado River Aqueduct, Bill Williams River, Alamo Lake, Copper Basin Reservoir, and Gene Wash Reservoir, which occur within the 50-mi (80-km) SEZ region, 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.

TABLE 8.1.11.2-1 Habitats, Potential Impacts, and Potential Mitigation for Representative Bird Species That Could Occur on or in the Affected Area of the Proposed Brenda SEZ

		Maximum Area of Potential Habitat Affected[b]			
Common Name (Scientific Name)	Habitat[a]	Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Shorebirds					
Killdeer (*Charadrius vociferus*)	Open areas such as fields, meadows, lawns, mudflats, and shores. Nests on ground in open dry or gravelly locations. About 247,100 acres[h] of potentially suitable habitat occurs within the SEZ region.	12 acres of potentially suitable habitat lost (0.005% of available potentially suitable habitat) during construction and operations	8,368 acres of potentially suitable habitat (3.4% of available potentially suitable habitat)	48 acres of potentially suitable habitat lost (0.02% of available potentially suitable habitat) and 966 acres in area of indirect effect	Small overall impact. Avoid wash habitats. 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 4,276,900 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,363 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

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TABLE 8.1.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b] Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Neotropical Migrants (Cont.)					
Black-tailed gnatcatcher (*Polioptila melanura*)	Nests in bushes mainly in wooded desert washes with dense mesquite, palo verde, ironwood, and acacia. Also occurs in desert scrub habitat. About 4,200,100 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	90,846 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
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 4,198,600 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	90,820 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	43 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.1.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]			Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
		Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	
Neotropical Migrants (Cont.)					
Brewer's sparrow (*Spizella breweri*)	Common in Mojave and Colorado Deserts during winter. Occupies open desert scrub and cropland habitats. About 2,073,300 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.15% of available potentially suitable habitat) during construction and operations	59,462 acres of potentially suitable habitat (2.7% of available potentially suitable habitat)	177 acres of potentially suitable habitat lost (0.001% of available potentially suitable habitat) and 3,561 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Cactus wren (*Campylorhynchus brunneicapillus*)	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 roost. About 2,193,200 acres of potentially suitable habitat occurs within the SEZ region.	428 acres of potentially suitable habitat lost (0.02% of available potentially suitable habitat) during construction and operations	30,926 acres of potentially suitable habitat (1.4% of available potentially suitable habitat)	346 acres of potentially suitable habitat lost (0.02% of available potentially suitable habitat) and 6,961 acres in area of indirect effect	Small overall impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.1.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Neotropical Migrants (Cont.)					
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 4,203,500 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,355 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Common raven (*Corvus corax*)	Occurs in most habitats. Trees and cliffs provide cover. Roosts primarily in trees. Nests on cliffs, bluffs, tall trees, or man-made structures. Forages in sparse, open terrain. About 4,506,300 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	99,743 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	572 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 11,507 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.1.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Neotropical Migrants (Cont.)					
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, desert scrub, 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 4,269,800 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,363 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. Avoid wash habitats. No other mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Gila woodpecker (*Melanerpes uropygialis*)	Prefers sparsely covered desert habitats containing large saguaro cacti. About 2,215,000 acres of potentially suitable habitat occurs within the SEZ region.	428 acres of potentially suitable habitat lost (0.02% of available potentially suitable habitat) during construction and operations	32,251 acres of potentially suitable habitat (1.5% of available potentially suitable habitat)	394 acres of potentially suitable habitat lost (0.02% of available potentially suitable habitat) and 7,926 acres in area of indirect effect	Small overall impact. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.1.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b] Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Neotropical Migrants (Cont.)					
Greater roadrunner (*Geococcyx californianus*)	Desert scrub, chaparral, edges of cultivated lands, and arid open areas with scattered brush. 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 4,489,900 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	98,450 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. 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 2,294,000 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	67,202 acres of potentially suitable habitat (2.9% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.1.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b] Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Neotropical Migrants (Cont.)					
Ladder-backed woodpecker (*Picoides scalaris*)	Fairly common in Mojave and Colorado Deserts. 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 4,276,900 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,363 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Le Conte's thrasher (*Toxostoma leconteii*)	Open desert wash, alkali desert scrub, and desert succulent shrub habitats. Prefers to nest and forage in arroyos and washes lined with dense stands of creosotebush and salt bush. About 4,190,400 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	90,820 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. Avoid wash habitats. No other species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.1.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
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 4,265,700 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,361 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. 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, desert scrub, desert riparian, Joshua tree, and occasionally, open woodland habitats. Perches on poles, wires, or fence posts (suitable hunting perches are an important aspect of habitat). Nests in shrubs and small trees. About 4,507,900 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	98,478 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.1.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
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 2,151,500 acres of potentially suitable habitat occurs within the SEZ region.	428 acres of potentially suitable habitat lost (0.02% of available potentially suitable habitat) during construction and operations	30,960 acres of potentially suitable habitat (1.4% of available potentially suitable habitat)	346 acres of potentially suitable habitat lost (0.02% of available potentially suitable habitat) and 6,961 acres in area of indirect effect	Small overall impact. Avoid wash habitats. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Phainopepla (*Phainopepla nitens*)	Common in Mojave and Colorado deserts. Desert scrub, 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 2,376,700 acres of potentially suitable habitat occurs in the SEZ region.	440 acres of potentially suitable habitat lost (0.02% of available potentially suitable habitat) during construction and operations	38,037 acres of potentially suitable habitat (1.6% of available potentially suitable habitat)	346 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 6,961 acres in area of indirect effect	Small overall impact. Avoid wash habitats. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
Say's phoebe (*Sayornis saya*)	Arid open country, deserts, sagebrush plains, dry barren foothills, canyons, cliffs, ranches, and rural homes. Nests in cliff crevices, holes in banks, sheltered ledges, tree cavities, under bridges and roofs, and in mines. About 2,289,000 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	67,091 acres of potentially suitable habitat (2.9% of available potentially suitable habitat)	178 acres of potentially suitable habitat lost (0.0081% of available potentially suitable habitat) and 3,581 acres in area of indirect effect	Small overall impact. No mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.

TABLE 8.1.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b] Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Neotropical Migrants (Cont.)					
Verdin (*Auriparus flaviceps*)	Desert riparian, desert wash, desert scrub, and alkali desert scrub areas with large shrubs and small trees. Nests in shrubs, small trees, or cactus. About 4,419,600 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	97,911 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. Avoid wash habitats. No other mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect. Some measure of mitigation provided by the requirements of the Migratory Bird Treaty Act.
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 2,439,400 acres of potentially suitable habitat occurs in the SEZ region.	448 acres of potentially suitable habitat lost (0.02% of available potentially suitable habitat) during construction and operations	39,835 acres of potentially suitable habitat (1.6% of available potentially suitable habitat)	394 acres of potentially suitable habitat lost (0.016% of available potentially suitable habitat) and 7,926 acres in area of indirect effect	Small overall impact.

TABLE 8.1.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Birds of Prey (Cont.)					
Golden eagle (*Aquila chrysaetos*)	Grasslands, shrublands, pinyon-juniper woodlands, and ponderosa pine forests. Occasionally in most other habitats, especially during migration and in winter. Nests on cliffs and sometimes trees in rugged areas, with breeding birds ranging widely over surrounding areas. About 2,428,000 acres of potentially suitable habitat occurs in the SEZ region.	448 acres of potentially suitable habitat lost (0.02% of available potentially suitable habitat) during construction and operations	38,544 acres of potentially suitable habitat (1.6% of available potentially suitable habitat)	346 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 6,961 acres in area of indirect effect	Small overall impact. Some measure of mitigation provided by the requirements of the Bald and Golden Eagle Protection Act.
Prairie falcon (*Falco mexicanus*)	Open habitats adjacent to cliffs or bluffs. Occurs mainly in desert grassland, chaparral, and creosotebush-bursage habitats. About 4,542,000 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	99,881 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	574 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 11,548 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
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 2,410,400 acres of potentially suitable habitat occurs in the SEZ region.	448 acres of potentially suitable habitat lost (0.02% of available potentially suitable habitat) during construction and operations	38,534 acres of potentially suitable habitat (1.6% of available potentially suitable habitat)	346 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 6,961 acres in area of indirect effect	Small overall impact.

TABLE 8.1.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Birds of Prey (Cont.)					
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. Will roost communally in trees, exposed boulders, and occasionally on transmission line support towers. About 2,316,900 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	67,127 acres of potentially suitable habitat (2.9% of available potentially suitable habitat)	178 acres of potentially suitable habitat lost (0.008% of available potentially suitable habitat) and 3,581 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
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 4,286,600 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,389 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. Avoid wash habitats. No other species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
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 4,517,800 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,387 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 8.1.11.2-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Upland Game Birds (Cont.)					
White-winged dove (*Zenaida asiatica*)	Nests in low to medium height trees with dense foliage and fairly open ground cover. Feeds on wild seeds, grains, and fruit. About 4,268,300 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,387 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

[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 using SWReGAP habitat suitability and land cover models. This approach probably overestimates the amount of suitable habitat in the project area. A maximum of 13,242 acres of direct effect within the SEZ was assumed.

[c] Direct effects within the SEZ consist of the ground-disturbing activities associated with the construction and 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 3,102 acres of direct effect was also added to the area of indirect effect. 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.

[e] For transmission line development, direct effects were estimated within a 19-mi (31-km) long, 250-ft (76-m) wide access road ROW from the SEZ to the nearest existing transmission line. Indirect effects were estimated within a 1-mi (1.6-km) wide transmission line corridor to the existing transmission line, less the assumed area of direct effects.

Footnotes continued on next page.

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TABLE 8.1.11.2-1 (Cont.)

[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 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.

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

Sources: Arizona Field Ornithologists (2010); CalPIF (2009); CDFG (2008); NatureServe (2010); USGS (2004, 2005a, 2007).

Neotropical Migrants

As discussed in Section 4.10.2.2.3, neotropical migrants represent the most diverse category of birds within the six-state solar energy study area. Species expected to occur within the proposed Brenda SEZ include the ash-throated flycatcher, black-tailed gnatcatcher, black-throated sparrow, Brewer's sparrow (*Spizella breweri*), cactus wren (*Campylorhynchus brunneicapillus*), common poorwill (*Phalaenoptilus nuttallii*), common raven, Costa's hummingbird, Gila woodpecker, greater roadrunner (*Geococcyx californianus*), horned lark (*Eremophila alpestris*), ladder-backed woodpecker, Le Conte's thrasher, lesser nighthawk (*Chordeiles acutipennis*), loggerhead shrike (*Lanius ludovicianus*), Lucy's warbler, phainopepla, Say's phoebe (*Sayornis saya*), and verdin (Arizona Field Ornithologists 2010; CalPIF 2009; USGS 2007).

Birds of Prey

Section 4.10.2.2.4 provided an overview of the birds of prey (raptors, owls, and vultures) within the six-state solar study area. Raptor species that could occur within the proposed Brenda SEZ include the American kestrel (*Falco sparverius*), golden eagle (*Aquila chrysaetos*), prairie falcon (*Falco mexicanus*), red-tailed hawk (*Buteo jamaicensis*), and turkey vulture (*Cathartes aura*) (Arizona Field Ornithologists 2010; USGS 2007). Several other special status birds of prey are discussed in Section 8.1.12. These include the American peregrine falcon (*Falco peregrinus anatum*), bald eagle (Haliaeetus leucocephalus), ferruginous hawk (*Buteo regalis*), long-eared owl (*Asio otus*), and burrowing owl.

Upland Game Birds

Section 4.10.2.2.5 provided 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 Brenda SEZ include Gambel's quail (*Callipepla gambelii*), mourning dove (*Zenaida macroura*), and white-winged dove (*Zenaida asiatica*) (Arizona Field Ornithologists 2010; USGS 2007).

8.1.11.2.2 Impacts

The types of impacts 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 8.1.11.2.3, below, identifies design features of particular relevance to the proposed Brenda SEZ.

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 8.1.11.2.1 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 8.1.11.2.3).

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 8.1.11.2-1 summarizes the magnitude of potential impacts on representative bird species resulting from solar energy development in the proposed Brenda SEZ. On the basis of the impacts on birds summarized in Table 8.1.11.2-1, direct impacts on representative bird species would be small for all bird species (ranging from a high of 0.15% for Brewer's sparrow to a low of 0.005% for the killdeer [Table 8.1.11.2-1]). Larger areas of potentially suitable habitats for bird species occur within the area of potential indirect effects (e.g., up to 3.4% of available habitat for the killdeer). Indirect impacts on birds could result from surface water and sediment runoff from disturbed areas, fugitive dust generated by project activities, accidental spills, 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 bird species would be the restoration of original ground surface contours, soils, and native plant communities associated with desert scrub, playa, and wash habitats.

8.1.11.2.3 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., wash habitats). 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 that are important for reducing impacts on birds are best established when considering specific project details, some design features can be identified at this time:

- For solar energy developments 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 Arizona Game and Fish Department. A permit may be required under the Bald and Golden Eagle Protection Act.

- Bouse Wash and Tyson Wash, which could provide occasional watering and feeding sites for some bird species, should be avoided by solar energy development or spanned by transmission line development.

If the SEZ-specific design features are implemented in addition to programmatic design features, impacts on bird species could be reduced. However, as potentially suitable habitats for most 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.

8.1.11.3 Mammals

8.1.11.3.1 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 Brenda SEZ. The list of mammal species potentially present in the SEZ area was determined from Hoffmeister (1986) and range maps and habitat information available from SWReGAP (USGS 2007). Land cover types suitable for each species were determined from SWReGAP (USGS 2004, 2005a, 2007). See Appendix M for additional information on the approach used. About 45 species of mammals have ranges that encompass the area of the proposed Brenda SEZ (Hoffmeister 1986; USGS 2007); however, suitable habitats for a number of these species are limited or nonexistent within the SEZ (USGS 2007). Similar to the overview of mammals provided for the six-state solar energy 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 important habitats.

Big Game

The big game species that could occur within the affected area of the proposed Brenda SEZ include cougar (*Puma concolor*), mule deer (*Odocoileus hemionus*), and Nelson's bighorn sheep (*Ovis canadensis nelsoni*) (Hoffmeister 1986; USGS 2007). Due to its special species status, the Nelson's bighorn sheep is addressed in Section 8.1.12.

Other Mammals

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

Nongame mammal (small) species generally include smaller mammals such as rodents, bats, and shrews. Species for which potentially suitable habitat occurs within the SEZ include the Arizona pocket mouse (*Perognathus amplus*), Botta's pocket gopher (*Thomomys bottae*), cactus mouse (*Peromyscus eremicus*), canyon mouse (*P. crinitis*), deer mouse (*P. maniculatus*), desert pocket mouse (*Chaetodipus penicillatus*), desert shrew (*Notiosorex crawfordi*), desert woodrat (*Neotoma lepida*), Merriam's pocket mouse (*Dipodomys merriami*), round-tailed ground squirrel (*Spermophilus tereticaudus*), southern grasshopper mouse (*Onychomys torridus*), and white-tailed antelope squirrel (*Ammospermophilus leucurus*) (Hoffmeister 1986; 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 (*Pipistrellus hesperus*) (Hoffmeister 1986; USGS 2007). However, roost sites for the bat species (e.g., caves, hollow trees, rock crevices, or buildings) would be limited, to absent, within the SEZ. Several other special status bat species that could occur within the SEZ area are addressed in Section 8.1.12.1.

Table 8.1.11.3-1 provides habitat information for representative mammal species that could occur within the proposed Brenda SEZ.

8.1.11.3.2 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 8.1.11.3.3, below, identifies design features of particular relevance to mammals for the proposed Brenda SEZ.

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 8.1.11.3.1 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 8.1.11.3.3).

Table 8.1.11.3-1 summarizes the magnitude of potential impacts on select mammal species resulting from solar energy development (with the inclusion of programmatic design features) in the proposed Brenda SEZ.

TABLE 8.1.11.3-1 Habitats, Potential Impacts, and Potential Mitigation for Representative Mammal Species That Could Occur on or in the Affected Area of the Proposed Brenda SEZ

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
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 4,275,100 acres[h] of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,363 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
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 4,500,000 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	97,937 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
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 4,199,800 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	90,822 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

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TABLE 8.1.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Small Game and Furbearers (Cont.)					
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 2,322,600 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	66,670 acres of potentially suitable habitat (2.9% of available potentially suitable habitat)	179 acres of potentially suitable habitat lost (0.008% of available potentially suitable habitat) and 3,601 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Bobcat (*Lynx rufus*)	Most habitats, other than subalpine coniferous forest and montane meadow grasslands. Most common in rocky country from deserts through ponderosa forests. About 2,096,300 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	59,470 acres of potentially suitable habitat (2.8% of available potentially suitable habitat)	178 acres of potentially suitable habitat lost (0.008% of available potentially suitable habitat) and 3,581 acres in area of indirect effect	Small overall impact. Avoid wash habitats. No other species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
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 4,517,700 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	99,879 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	574 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 11,548 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 8.1.11.3-1 (Cont.)

		Maximum Area of Potential Habitat Affected[b]			
Common Name (Scientific Name)	Habitat[a]	Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Small Game and Furbearers (Cont.)					
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 are also used as cover. About 4,430,000 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	98,020 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	525 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,562 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Gray fox (*Urocyon cinereoargenteus*)	Deserts, open forests, and brush. Prefers wooded areas, broken country, brushlands, and rocky areas. Tolerant of low levels of residential development. About 4,418,400 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	97,909 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
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 4,276,900 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,363 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. Avoid wash habitats. No other species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 8.1.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]			Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
		Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	
Small Game and Furbearers (Cont.)					
Kit fox (*Vulpes macrotis*)	Desert and semidesert areas with relatively open vegetative cover and soft soils. Seeks shelter in underground burrows. About 4,257,800 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,353 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Ringtail (*Bassariscus astutus*)	Usually in rocky areas with cliffs or crevices for daytime shelter, desert scrub, chaparral, pine-oak and conifer woodlands. About 4,438,100 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	99,202 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	572 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 11,507 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Striped skunk (*Mephitis mephitis*)	Prefers semi-open country with woodland and meadows interspersed, brushy areas, bottomland woods. Frequently found in suburban areas. Dens often under rocks, logs, or buildings. About 4,426,800 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	97,903 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 8.1.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Nongame (small) Mammals					
Arizona pocket mouse (*Perognathus amplus*)	Various desert scrub habitats. Sleeps and rears young in underground burrows. About 4,242,800 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	90,812 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Big brown bat (*Eptesicus fuscus*)	Most habitats from lowland deserts to timberline meadows. Roosts in hollow trees, rock crevices, mines, tunnels, and buildings. About 4,437,800 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	99,192 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	571 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 11,487 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
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 4,192,500 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	90,812 acres of potentially suitable habitat (2,2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 8.1.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
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 4,440,300 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	99,305 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	573 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 11,528 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Cactus mouse (*Peromyscus eremicus*)	Variety of areas, including desert scrub, semidesert chaparral, desert wash, semidesert grassland, and cliff and canyon habitats. About 4,279,500 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	90,882 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. Avoid wash habitats. No other species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
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 4,208,700 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	90,822 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 8.1.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Nongame (small) Mammals (Cont.)					
Canyon mouse (*Peromyscus crinitus*)	Associated with rocky substrates in a variety of habitats, including desert scrub, sagebrush shrublands, woodlands, cliffs and canyons, and volcanic rock and cinder lands. Source of free water not required. About 4,259,100 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,355 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Deer mouse (*Peromyscus maniculatus*)	Tundra; alpine and subalpine grasslands; plains grasslands; open, sparsely vegetated deserts; warm temperate swamps and riparian forests; and Sonoran desert scrub habitats. About 4,417,000 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	97,903 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
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 4,268,700 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	90,848 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 8.1.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Nongame (small) Mammals (Cont.)					
Desert shrew (*Notiosorex crawfordi*)	Usually in arid areas with adequate cover such as semiarid grasslands, shortgrass plains, desert scrub, chaparral slopes, shortgrass plains, oak savannas and woodlands, and alluvial fans. About 4,497,500 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	98,478 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Desert woodrat (*Neotoma lepida*)	Sagebrush scrub; chaparral; deserts and rocky slopes with scattered cactus, yucca, pine-juniper, or other low vegetation; creosotebush desert; Joshua tree woodlands; scrub oak woodlands, pinyon-juniper woodlands; and riparian zones. Most abundant in rocky areas with Joshua trees. Dens built of debris on ground, among cacti or yucca, along cliffs, among rocks, or occasionally in trees. About 4,268,800 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,363 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 8.1.11.3-1 (Cont.)

Common Name (Scientific Name)	Habitat[a]	Maximum Area of Potential Habitat Affected[b]: Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Nongame (small) Mammals (Cont.)					
Merriam's kangaroo rat (*Dipodomys merriami*)	Plains grasslands, scrub-grasslands, desertscrub, shortgrass plains, oak and juniper savannahs, mesquite dunes, and creosote flats. About 4,265,700 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,361 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Round-tailed ground squirrel (*Spermophilus tereticaudus*)	Low flat areas with desert shrubs and usually with sandy soils. Also in areas with coarse hard-packed sand and gravel, alkali sinks, and creosotebush communities. Burrows usually at base of shrubs. Avoids rocky hills. About 4,265,100 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,363 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Silver-haired bat (*Lasionycteris noctivagans*)	Urban areas, chaparral, alpine and subalpine grasslands, forests, scrub-grassland, oak savannah, and desertscrub habitats. Roosts under bark, and in hollow trees, caves, and mines. Forages over clearings and open water. About 2,107,100 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	60,754 acres of potentially suitable habitat (2.9% of available potentially suitable habitat)	226 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 4,567 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 8.1.11.3-1 (Cont.)

		Maximum Area of Potential Habitat Affected[b]			
Common Name (Scientific Name)	Habitat[a]	Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Nongame (small) Mammals (Cont.)					
Southern grasshopper mouse (*Onychomys torridus*)	Low, arid, shrub and semiscrub vegetation of deserts. About 4,268,700 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	91,381 acres of potentially suitable habitat (2.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
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 2,150,600 acres of potentially suitable habitat occurs within the SEZ region	3,102 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat) during construction and operations	59,496 acres of potentially suitable habitat (2.6% of available potentially suitable habitat)	178 acres of potentially suitable habitat lost (0.008% of available potentially suitable habitat) and 3,581 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.
Western pipistrelle (*Parastrellus hesperus*)	Deserts and lowlands, desert mountain ranges, desert scrub 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 4,206,900 acres of potentially suitable habitat occurs in the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	92,214 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	573 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 11,568 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

TABLE 8.1.11.3-1 (Cont.)

		Maximum Area of Potential Habitat Affected[b]			
Common Name (Scientific Name)	Habitat[a]	Within SEZ (Direct Effects)[c]	Outside SEZ (Indirect Effects)[d]	Within Transmission Line Corridor (Indirect and Direct Effects)[e]	Overall Impact Magnitude[f] and Species-Specific Mitigation[g]
Nongame (small) Mammals (Cont.)					
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 its nights and other periods of inactivity in underground burrows. About 4,184,400 acres of potentially suitable habitat occurs within the SEZ region.	3,102 acres of potentially suitable habitat lost (0.07% of available potentially suitable habitat) during construction and operations	90,812 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (0.01% of available potentially suitable habitat) and 10,522 acres in area of indirect effect	Small overall impact. No species-specific mitigation of direct effects is feasible because suitable habitat is widespread in the area of direct effect.

[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 using SWReGAP habitat suitability and land cover models. This approach probably overestimates the amount of suitable habitat in the project area. A maximum of 3,102 acres of direct effect 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 3,102 acres of direct effect was also added to the area of indirect effect. 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.

[e] For transmission line development, direct effects were estimated within a 19-mi (31-km) long, 250-ft (76-m) wide access road ROW from the SEZ to the nearest existing transmission line. Indirect effects were estimated within a 1-mi (1.6-km) wide transmission line corridor to the existing transmission line, less the assumed area of direct effects.

Footnotes continued on next page.

TABLE 8.1.11.3-1 (Cont.)

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[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 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.

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

Sources: CDFG (2008); Hoffmeister (1986); NatureServe (2010); USGS (2004, 2005a, 2007).

Cougar

Up to 3,102 acres (12.6 km^2) of potentially suitable cougar habitat could be lost through solar energy development within the proposed Brenda SEZ. An additional 523 acres (2.1 km^2) could be lost by transmission line development. Together, these represent about 0.08% of potentially suitable cougar habitat within the SEZ region. Over 91,000 acres (368 km^2) of potentially suitable cougar habitat occurs within the area of indirect effect for the SEZ and transmission line. This is about 2.1% of potentially suitable cougar habitat within the SEZ region. Overall, impacts on cougar from solar energy development in the SEZ would be small.

Mule Deer

Up to 3,102 acres (12.6 km^2) of potentially suitable mule deer habitat could be lost through solar energy development within the proposed Brenda SEZ. An additional 523 acres (2.1 km^2) could be lost by transmission line development. Together, these represent about 0.08% of potentially suitable mule deer habitat within the SEZ region. Over 97,900 acres (396 km^2) of potentially suitable mule deer habitat occurs within the area of indirect effect for the SEZ and access road. This is about 2.2% of potentially suitable mule deer habitat within the SEZ region. Overall, impacts on mule deer from solar energy development in the SEZ would be small.

Other Mammals

Direct impacts on all other representative mammal species from solar energy development within the proposed Brenda SEZ would be small (Table 8.1.11.3-1). For all of these species, up to 3,102 acres (12.6 km^2) (0.07 to 0.1%) of potentially suitable habitat would be lost. Direct impacts from transmission line development for these species would range from 178 to 574 acres (0.7 to 2.3 km^2) (Table 8.1.11.3-1). Loss of potential habitat to transmission line development would be no more than 0.01% of potentially suitable habitat within the SEZ region for any of these species. Larger areas of potentially suitable habitats for these mammal species occur within the area of potential indirect effects (i.e., from 2.1 to 2.9% of available habitat [Table 8.1.11.3-1]).

Summary

Overall, impacts on mammal species would be small (Table 8.1.11.3-1). In addition to habitat loss, other direct impacts on mammals could result from collision with vehicles and infrastructure (e.g., fences). Indirect impacts on mammals could result from surface water and sediment runoff from disturbed areas, fugitive dust generated by project activities, accidental spills, 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 mammal species would be the restoration of original ground surface contours, soils, and native plant communities associated with desert scrub, playa, and wash habitats.

8.1.11.3.3 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. While SEZ-specific design features are best established when considering specific project details, design features that can be identified at this time are:

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

- Bouse Wash and Tyson Wash, which could provide occasional watering and feeding sites for some bird species, should be avoided by solar energy development or spanned by transmission line development, respectively.

If these SEZ-specific design features are implemented in addition to the 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.

8.1.11.4 Aquatic Biota

8.1.11.4.1 Affected Environment

The proposed Brenda SEZ is located in a semiarid desert valley where surface waters are typically limited to intermittent washes that only contain water for short periods during or following precipitation. No perennial streams, water bodies, seeps, or springs are present on the proposed Brenda SEZ or within the area of the presumed new transmission line corridor. Ephemeral streams may cross the SEZ, but these drainages only contain water following rainfall and typically do not support wetland or riparian habitats. One mi (2 km) of Bouse Wash runs through the eastern edge of the proposed Brenda SEZ. Bouse Wash is a typically dry intermittent stream that is not expected to contain aquatic habitat. Although not considered aquatic habitat, intermittent and ephemeral streams may contain seasonal populations of crustaceans and terrestrial and aquatic insect larvae adapted to desiccation. These organisms may exist in a dormant form even during dry conditions (Levick et al. 2008). More detailed site survey data are needed to characterize the aquatic biota, if present.

No perennial streams, water bodies, seeps, or springs are present within the area of indirect effects associated with the SEZ or the presumed new transmission line corridor, but 7 mi (11 km) of Bouse Wash and 0.6 mi (1 km) of Tyson Wash are located within the area of indirect effects associated with the SEZ and new transmission line corridor, respectively. Both streams are intermittent and are not likely to contain aquatic habitat, but more detailed site survey data are needed to characterize the aquatic biota, if present. Bouse Wash does not flow into any perennial surface water, but Tyson Wash drains into the Colorado River.

Outside of the indirect effects area, but within 50 mi (80 km) of the proposed Brenda SEZ, there are approximately 37 mi (59 km) of perennial streams, 494 mi (795 km) of intermittent streams, and 23 mi (37 km) of man-made stream and aqueduct. Also present within 50 mi (80 km) of the SEZ is an additional 15,738 acres (64 km^2) of lake-habitat, 809 acres (3 km^2) of reservoirs, and 44,606 acres (180 km^2) of the Colorado River. However, these water bodies are all more than 30 mi (48 km) from the proposed Brenda SEZ. Intermittent streams are the only surface water feature in the area of direct and indirect effects, and their area represents approximately 2% of the total amount of intermittent stream present in the 50-mi (80-km) SEZ region.

8.1.11.4.2 Impacts

Because surface water habitats are a unique feature in the arid landscape in the vicinity of the proposed Brenda SEZ, the maintenance and protection of such habitats may be important to the survival of aquatic and terrestrial organisms. The types of impacts that aquatic habitats and biota could incur from the development of utility-scale solar energy facilities are described in detail in Section 5.10.3. Aquatic habitats present on or near the locations selected for construction of solar energy facilities could be affected in a number of ways, including (1) direct disturbance, (2) deposition of sediments, (3) changes in water quantity, and (4) degradation of water quality.

There are no permanent water bodies, streams, or wetlands present within the boundaries of either the proposed Brenda SEZ or the presumed new transmission line corridor, and consequently there would be no direct impacts on aquatic habitats from solar energy development. Intermittent streams are present in the area of direct and indirect effects, and disturbance of land areas within the SEZ for solar energy facilities and the construction of a new transmission line corridor could increase the transport of soil into these intermittent streams via water- and airborne pathways. Although intermittent and ephemeral streams may contain aquatic biota, these streams are typically dry and are not likely to support aquatic habitat or communities. 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 to aquatic biota. The introduction of waterborne sediments to Bouse Wash and Tyson Wash could be minimized using common mitigation measures such as settling basins, silt fences, or directing water draining from the developed areas away from streams. Bouse Wash does not connect to any permanent surface water features, but Tyson Wash flows into the Colorado River. However, it is unlikely any of the sediment from surface runoff or airborne dust associated with ground disturbance would reach aquatic habitat, given the large distance from the SEZ and transmission line to the nearest perennial stream (30 mi [48 km]).

In arid environments, reductions in the quantity of water in aquatic habitats are of particular concern. Water quantity in aquatic habitats could also be affected if significant amounts of surface water or groundwater are utilized for power plant cooling water, for washing mirrors, or for other needs. The greatest need for water would occur if technologies employing wet cooling, such as parabolic trough or power tower, were developed at the site; the associated impacts would ultimately depend on the water source used (including groundwater from aquifers at various depths). There are no surface water habitats on the proposed Brenda SEZ that could be used to supply water needs. Water demands during normal operations would most likely be met by withdrawing groundwater from wells constructed on-site, potentially affecting water levels in surface water features outside of the proposed SEZ and the area of indirect effects, and, as a consequence, potentially reduce habitat size, connectivity, and create more adverse environmental conditions for aquatic organisms in those habitats (Section 8.1.9). 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 impacts from water withdrawals.

As described in Section 5.10.2.4, 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/reclamation of a solar energy facility. There is the potential for runoff containing contaminants to enter Bouse Wash, especially if construction occurs nearby. Bouse Wash is located within the SEZ; typically it is dry and is not expected to contain aquatic habitat. However, aquatic biota may be present seasonally, and they could be affected by contaminants. Because of the relatively large distance from any permanent surface water features to solar development activities and transmission line corridors, the potential for introducing contaminants into such water bodies would be small, especially if the appropriate mitigation measures were used.

8.1.11.4.3 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, a design feature that can be identified at this time is the following:

- All aquatic habitats within the SEZ (e.g., Bouse Wash) should be avoided to the extent practicable.

If this SEZ-specific design feature is 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 in the proposed Brenda SEZ would be negligible.

8.1.12 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, on or within the potentially affected area of the proposed Brenda SEZ. Special status species include the following types of species[3]:

- Species listed as threatened or endangered under the Endangered Species Act (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 Arizona[4]; and
- Species that have been ranked by the state of Nevada as S1 or S2, or species of concern by the USFWS; hereafter referred to as "rare" species.

Special status species known to occur within 50 mi (80 km) of the Brenda SEZ center (i.e., the SEZ region) were determined from natural heritage records available through NatureServe Explorer (NatureServe 2010) and information provided by the Arizona Natural Heritage Program (ANHP) (Schwartz 2009; ANHP 2010), California Regional Gap Analysis Project (CAReGAP) (USGS 2010d), Southwest Regional Gap Analysis Project (SWReGAP) (USGS 2004, 2005a, 2007), and USFWS Environmental Conservation Online System (ECOS) (USFWS 2010a). Information reviewed consisted of county-level occurrences as determined from NatureServe, quad-level occurrences provided by the ANHP, and 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 La Paz, Maricopa, Mohave, Yavapai, and Yuma Counties in Arizona, as well as Imperial, Riverside, and San Bernardino Counties in California. However, the SEZ (and affected area) occurs only in La Paz County, Arizona. See Appendix M for additional information on the approach used to identify species that could be affected by development within the SEZ.

8.1.12.1 Affected Environment

The affected area considered in our 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

[3] 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 2008c). These species are included here to ensure broad consideration of species that may be most vulnerable to impacts.

[4] State listed species for the state of Arizona are those plants protected under the Arizona Native Plant Law or wildlife listed by the Arizona Game and Fish Department as Wildlife of Special Concern (WSC).

Brenda SEZ, the area of direct effect included the SEZ and the portion of the assumed transmission corridor where ground-disturbing activities are assumed to occur. No new road developments are expected to be needed to serve development on the SEZ because of the proximity of existing infrastructure (refer to Section 8.1.1.2 for development assumptions). The area of indirect effects was defined as the area within 5 mi (8 km) of the SEZ boundary and the portion of the assumed transmission corridor 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 included effects from surface runoff, dust, noise, lighting, and accidental spills from the SEZ, but did not include ground-disturbing activities. The potential magnitude of indirect effects would decrease with increasing distance away 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 includes both the direct and indirect effects areas.

The primary land cover habitat type within the affected area is Sonora-Mojave creosote desert scrub (see Section 8.1.10). Potentially unique habitats in the affected area in which special status species may reside include desert washes and associated riparian habitats. The only potential aquatic habitat known to occur on the SEZ is Bouse Wash, an intermittent streambed that exists along the easternmost boundary of the SEZ. The only other aquatic habitat within the affected area is Tyson Wash, which occurs west of the SEZ in the transmission corridor (Figure 8.1.12.1-1).

All special status species that are known to occur within the Brenda 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. Of these species, there are 20 that could be affected by solar energy development on the SEZ, on the basis of recorded occurrences or the presence of potentially suitable habitat in the area. These species, their status, and their habitats are presented in Table 8.1.12.1-1. 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 SWReGAP 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 over 20 mi (32 m) away from the SEZ.

Based on ANHP records, quad-level occurrences for two special status species intersect the affected area of the Brenda SEZ: desert tortoise (Sonoran population) and California leaf-nosed bat. The Sonoran population of the desert tortoise, occurring south and east of the Colorado River, is currently under review for ESA listing as a threatened or endangered species. This species is also a BLM-designated sensitive species and is listed by the state of Arizona (Wildlife of Special Concern). The California leaf-nosed bat is a BLM-designated sensitive species, listed by the state of Arizona (Wildlife of Special Concern); this species is also listed as a species of concern by the USFWS. There are no groundwater-dependent species in the vicinity of the SEZ based upon ANHP records, information provided by the USFWS (Stout 2009), and the evaluation of groundwater resources in the Brenda SEZ region (Section 8.1.9).

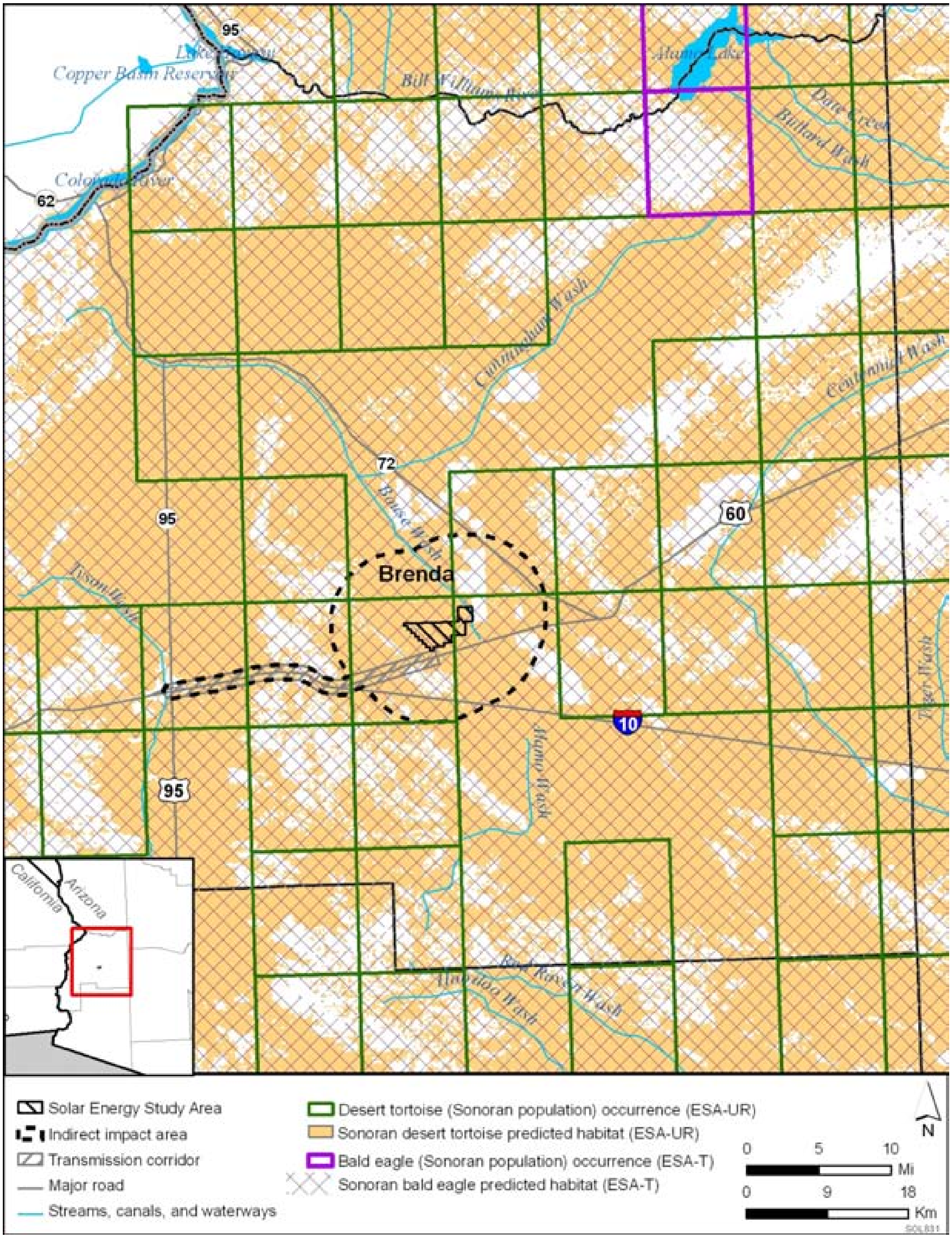

FIGURE 8.1.12.1-1 Known or Potential Occurrences of Species Listed as Endangered or Threatened under the ESA, Candidate for Listing under the ESA, or Species under Review for ESA Listing in the Affected Area of the Proposed Brenda SEZ (Sources: Schwartz 2009; USFWS 2010b; USGS 2007)

1

TABLE 8.1.12.1-1 Habitats, Potential Impacts, and Potential Mitigation for Special Status Species That Could Be Affected by Solar Energy Development on the Proposed Brenda SEZ

				Maximum Area of Potential Habitat Affected[c]			
Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Within SEZ (Direct Effects)[d]	Transmission Line (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants							
Arid tansy-aster	*Machaeranthera arida*	AZ-S1	Low sand dunes, alkaline flats, riverbanks, and sandy roadsides. Nearest recorded quad-level occurrence is approximately 13 mi[i] north of the SEZ. About 154,000 acres[j] of potentially suitable habitat occurs within the SEZ region.	0 acres	50 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	1,438 acres of potentially suitable habitat (0.9% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of sand dunes, sand transport systems, and flats in the transmission corridor could reduce impacts. In addition, pre-disturbance surveys and avoiding or minimizing disturbance of 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 8.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Plants (Cont.)							
California fan palm	*Washingtonia filifera*	AZ-SR; AZ-S1	Desert riparian or oasis habitats in isolated areas of the Sonoran and Mojave deserts at elevations between 500 and 1,000 ft.[k] Nearest recorded quad-level occurrence is approximately 25 mi south of the SEZ. About 117,000 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	36 acres of potentially suitable riparian habitat (<0.1% of available potentially suitable habitat)	Small overall impact; no direct effect. No species-specific mitigation is warranted.
Mohave thistle	*Cirsium mohavense*	AZ-S1	Wetland habitats, perennial springs, moist canyons, streambanks, and poorly drained alkaline flats, seeps, and springs. Elevation ranges between 1,400 and 1,480 ft. Nearest recorded quad-level occurrence is from the Santa Maria River, approximately 45 mi northeast of the SEZ. About 138,500 acres of potentially suitable habitat occurs within the SEZ region.	0 acres.	0 acres	36 acres of potentially suitable habitat (<0.1% of available potentially suitable habitat)	Small overall impact; no direct effect. No species-specific mitigation is warranted.
Straw-top cholla	*Opuntia echinocarpa*	AZ-SR	Sandy or gravelly soil of benches, slopes, mesas, flats, and washes at elevations between 1,000 and 6,700 ft. Nearest recorded quad-level occurrence is approximately 15 mi northeast of the SEZ. About 123,500 acres of potentially suitable habitat occurs within the SEZ region.	0 acres	0 acres	36 acres of potentially suitable habitat (<0.1% of available potentially suitable habitat)	Small overall impact; no direct effect. No species-specific mitigation is warranted.

TABLE 8.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Utah swallowwort	*Cynanchum utahense*	AZ-S2	Mojave and Sonoran Desert scrub communities at elevations between 600 and 5,000 ft. Nearest recorded quad-level occurrence is approximately 13 mi west of the SEZ. About 4,458,000 acres of potentially suitable habitat occurs within the SEZ region.	3,100 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	91,350 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance of 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. Note that these same potential mitigations apply to all special status plants.
Woolly heads	*Nemacaulis denudata*	AZ-S2	Desert dunes in Mojave and Sonoran Desert scrub communities at elevations below 1,600 ft. Nearest recorded quad-level occurrence is approximately 13 mi north of the SEZ. About 4,458,000 acres of potentially suitable habitat occurs within the SEZ region.	3,100 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	523 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	91,350 acres of potentially suitable habitat (2.0% of available potentially suitable habitat)	Small overall impact. See Utah swallowwort for a list of potential mitigations applicable to all special status plant species.

TABLE 8.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Amphibians							
Lowland leopard frog	*Lithobates yavapaiensis*	BLM-S; AZ-WSC; FWS-SC	Aquatic systems in desert grasslands, pinyon-juniper woodlands, and agricultural areas including rivers, streams, beaver ponds, springs, earthen cattle tanks, livestock guzzlers, canals, and irrigation sloughs. Nearest recorded quad-level occurrence is approximately 22 mi east of the SEZ. About 189,500 acres of potentially suitable habitat occurs within the SEZ region.	128 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	30 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	5,325 acres of potentially suitable habitat (2.8% of available potentially suitable habitat)	Small overall impact. Avoiding or minimizing disturbance of agricultural and riparian habitats within the area of direct effects could reduce impacts on this species to negligible levels. In addition, pre-disturbance surveys and avoiding or minimizing disturbance of 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 8.1.12.1-1 (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]: Transmission Line (Direct Effects)[e]	Maximum Area of Potential Habitat Affected[c]: Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Reptiles							
Desert rosy boa	*Charina trivirgata gracia*	BLM-S; FWS-SC	Scrublands, rocky deserts, and canyons with permanent or intermittent streams. Nearest recorded quad-level occurrence is approximately 7 mi east of the SEZ. About 3,583,000 acres of potentially suitable habitat occurs within the SEZ region.	1,392 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	531 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	53,800 acres of potentially suitable habitat (1.5% 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.
Desert tortoise (Sonoran population)[l]	***Gopherus agassizii***	ESA-UR; BLM-S; AZ-WSC	Desert creosotebush communities on firm soils for digging burrows; often along riverbanks, washes, canyon bottoms, creosote flats, and desert oases. Quad-level occurrences for this species intersect the SEZ. About 3,381,000 acres of potentially suitable habitat occurs within the SEZ region.	3,848 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	487 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	84,500 acres of potentially suitable habitat (2.5% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance of occupied habitats in the area of direct effect, translocation of individuals from areas of direct effect, or compensatory mitigation of direct

TABLE 8.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Desert tortoise (Sonoran population)[l] (*Cont.)*							effects on occupied habitats could reduce impacts. The potential for impact and need for mitigation should be determined in coordination with the USFWS and AZGFD.
Gila monster	*Heloderma suspectum*	FWS-SC	Rocky, deeply incised topography in desert scrub, desert riparian, oak woodland, and semi-desert grassland. Occurs in lower mountain slopes, rocky bajadas, canyon bottoms, and arroyos at elevations below 3,950 ft. Nearest recorded quad-level occurrence is approximately 7 mi east of the SEZ. About 3,611,000 acres of potentially suitable habitat occurs within the SEZ region.	3,834 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	530 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	90,000 acres of potentially suitable habitat (2.5% of available potentially suitable habitat)	Small overall impact. Pre-disturbance surveys and avoiding or minimizing disturbance of 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 8.1.12.1-1 (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]: Transmission Line (Direct Effects)[e]	Maximum Area of Potential Habitat Affected[c]: Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Birds							
American peregrine falcon	*Falco peregrinus anatum*	BLM-S; AZ-WSC; FWS-SC	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. Nearest recorded quad-level occurrence is from the vicinity of Alamo Lake, approximately 40 mi northeast of the SEZ. About 4,315,000 acres of potentially suitable habitat occurs within the SEZ region.	3,878 acres of potentially suitable foraging habitat lost (0.1% of available potentially suitable habitat)	573 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	98,800 acres of potentially suitable habitat (2.3% of available potentially suitable habitat)	Small overall impact. No direct effect on nesting habitat. Avoidance of direct impacts on foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effect.
Bald eagle (Sonoran population)	*Haliaeetus leucocephalus*	ESA-T; BLM-S; AZ-WSC; AZ-S2	Winter resident in the SEZ region, most commonly along large bodies of water where fish and waterfowl prey are available. May occasionally forage in arid shrubland habitats. Nearest recorded quad-level occurrence is from the vicinity of Alamo Lake, approximately 35 mi northeast of the SEZ. About 4,437,500 acres of potentially suitable habitat occurs within the SEZ region.	3,878 acres of potentially suitable foraging habitat lost (0.1% of available potentially suitable habitat)	531 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	97,700 acres of potentially suitable foraging habitat (2.2% 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.

TABLE 8.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Ferruginous hawk	*Buteo regalis*	BLM-S; AZ-WSC; FWS-SC; AZ-S2	Winter resident in the SEZ region. Grasslands, sagebrush, and saltbrush habitats, as well as the periphery of pinyon-juniper woodlands throughout the project area. Populations are known to occur in La Paz County, Arizona. About 216,500 acres of potentially suitable foraging habitat occurs within the SEZ region.	0 acres	0 acres	7,000 acres of potentially suitable habitat (3.3% of available potentially suitable habitat)	Small overall impact on foraging habitat only; no direct effect. No species-specific mitigation is warranted.
Great egret	*Ardea alba*	BLM-S; AZ-WSC; AZ-S1	Year-round resident in the lower Colorado River Valley. Transient in the SEZ affected area. Primarily associated with open water areas such as marshes, estuaries, lagoons, lakes, ponds, rivers and flooded fields. Nearest recorded quad-level occurrence is from the Colorado River, approximately 35 mi west of the SEZ. About 27,700 acres of potentially suitable year-round foraging and nesting habitat occurs within the SEZ region.	0 acres	0 acres	170 acres of potentially suitable habitat (0.6% of available potentially suitable habitat)	Small overall impact; no direct effect. No species-specific mitigation is warranted.
Long-eared owl	*Asio otus*	FWS-SC; AZ-S2	Winter resident in the SEZ affected area. Deciduous and evergreen forests, orchards, wooded parks, farm woodlots, riparian areas, and desert oases. Nearest recorded quad-level occurrence is approximately 30 mi southeast of the SEZ. About 4,476,500 acres of potentially suitable habitat occurs within the SEZ region.	3,878 acres of potentially suitable foraging habitat lost (0.1% of available potentially suitable habitat)	530 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	97,100 acres of potentially suitable habitat (2.2% 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.

TABLE 8.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Western burrowing owl	*Athene cunicularia hypugaea*	BLM-S; FWS-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 dogs, badgers, etc.). Nearest recorded quad-level occurrence is approximately 50 mi southwest of the SEZ. About 4,124,000 acres of potentially suitable habitat occurs within the SEZ region.	3,878 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	531 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	97,700 acres of potentially suitable habitat (2.4% of available potentially suitable habitat)	Small overall impact on foraging and nesting habitat. Pre-disturbance surveys and avoiding or minimizing disturbance occupied burrows in the area of direct effect or compensatory mitigation of direct effects on occupied habitats could reduce impacts.
Mammals							
California leaf-nosed bat	***Macrotus californicus***	BLM-S; AZ-WSC; FWS-SC	Year-round resident in southern California and southwestern Arizona. May be locally common in some areas. Occurs in desert riparian, desert wash, desert scrub, and palm oasis habitats at elevations below 2,000 ft. Roosts in mines, caves, and buildings. Quad-level occurrences for this species intersect the SEZ. About 3,576,500 acres of potentially suitable habitat occurs within the SEZ region.	1,392 acres of potentially suitable foraging habitat lost (0.1% of available potentially suitable habitat)	531 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	53,850 acres of potentially suitable habitat (1.5% 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..

TABLE 8.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Mammals (Cont.)							
Cave myotis	*Myotis velifer*	FWS-SC	Desert scrub, shrublands, washes, and riparian habitats. Roosts in colonies in caves. Nearest recorded quad-level occurrence is approximately 7 mi east of the SEZ. About 4,160,500 acres of potentially suitable habitat occurs within the SEZ region.	3,834 acres of potentially suitable foraging habitat lost (0.1% of available potentially suitable habitat)	530 acres of potentially suitable foraging habitat lost (<0.1% of available potentially suitable habitat)	90,000 acres of potentially suitable habitat (2.2% 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.
Townsend's big-eared bat	*Corynorhinus townsendii*	BLM-S; FWS-SC	Near forests and shrubland habitats below 9,000 ft elevation throughout the SEZ region. The species may use caves, mines, and buildings for day roosting and winter hibernation. May be a summer or year-round resident throughout the SEZ region. Nearest recorded quad-level occurrence is approximately 20 mi south of the SEZ. About 4,434,500 acres of potentially suitable habitat occurs within the SEZ region.	3,878 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	575 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	99,000 acres of potentially suitable habitat (2.2% 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.

TABLE 8.1.12.1-1 (Cont.)

Common Name	Scientific Name	Listing Status[a]	Habitat[b]	Maximum Area of Potential Habitat Affected[c]: Within SEZ (Direct Effects)[d]	Transmission Line (Direct Effects)[e]	Indirect Effects (Outside SEZ)[f]	Overall Impact Magnitude[g] and Species-Specific Mitigation[h]
Mammals (Cont.)							
Western yellow bat	*Lasiurus xanthinus*	BLM-S; AZ-WSC; AZ-S2	Year-round resident in desert riparian, desert wash, and palm oasis habitats at elevations below 2,000 ft. Roosts in trees. Nearest recorded quad-level occurrence is approximately 20 mi south of the SEZ. About 4,068,000 acres of potentially suitable habitat occurs within the SEZ region.	3,848 acres of potentially suitable habitat lost (0.1% of available potentially suitable habitat)	573 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	91,750 acres of potentially suitable habitat (2.3% 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.

[a] AZ-S1 = ranked as S1 in the state of Arizona; AZ-S2 = ranked as S2 in the state of Arizona; AZ-SR = salvage restricted plant species under the Arizona Native Plant Law; AZ-WSC = listed as a wildlife species of concern in the state of Arizona; BLM-S = listed as a sensitive species by the BLM; ESA-T = listed as threatened under the ESA; ESA-UR = under review for listing under the ESA; FWS-SC = USFWS species of concern.

[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.

[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. No new access roads are assumed to be needed due to the proximity of existing roads 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] For transmission ROW development, direct effects were estimated within a 19-mi (30-km) long, 250-ft (76-m) wide ROW from the SEZ to the nearest existing transmission line. Direct impacts within this area were determined from the proportion of potentially suitable habitat within the 1-mi (1.6-km) wide transmission corridor.

Footnotes continued on next page.

TABLE 8.1.12.1-1 (Cont.)

[f] Area of indirect effects was assumed to be the area adjacent to the SEZ within 5 mi (8 km) of the SEZ boundary and the portion of the transmission corridor where ground-disturbing activities would not occur. Indirect effects include effects from surface runoff, dust, noise, lighting, and so on from project developments. The potential degree of indirect effects would decrease with increasing distance away from the SEZ. Indirect effects on groundwater-dependent species were considered outside these defined areas.

[g] 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.

[h] 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.

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

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

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

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

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

In scoping comments on the proposed Brenda SEZ (Stout 2009), the USFWS did not express concern for impacts of project development within the SEZ on any species listed as threatened or endangered under the ESA. However, according to SWReGAP information, the Sonoran population of the bald eagle is currently listed under the ESA and has the potential to occur within the affected area of the Brenda SEZ. This species is discussed below and information on its habitat is presented in Table 8.1.12.1-1; additional basic information on life history, habitat needs, and threats to populations of the desert tortoise is provided in Appendix J.

The Sonoran population of the bald eagle is currently listed as threatened under the ESA, although recent findings by the USFWS have indicated that listing for this species is not warranted (USFWS 2010b). According to ANHP records, the species is known to occur in the vicinity of Alamo Lake, approximately 35 mi (56 km) northeast of the SEZ. This species is primarily known to occur in riparian habitats associated with larger permanent water bodies such as lakes, rivers, and reservoirs. However, it may occasionally forage in arid shrubland habitats. According to the SWReGAP habitat suitability model, approximately 102,000 acres (413 km^2) of potentially suitable winter foraging habitat for the Sonoran population of the bald eagle may occur in the affected area of the Brenda SEZ. Because there are no permanent surface water features and little riparian habitat (36 acres [0.1 km^2]) in the affected area, most of this potentially suitable foraging habitat is represented by shrubland. Critical habitat has not been designated for this species.

8.1.12.1.2 Species That Are Candidates for Listing under the ESA

In scoping comments on the proposed Brenda SEZ (Stout 2009), the USFWS did not express concern for impacts of project development within the SEZ on any species that are candidates for listing under the ESA. There are no ANHP records or potentially suitable habitats for any ESA candidate species within the affected area.

8.1.12.1.3 Species That Are under Review for Listing under the ESA

In scoping comments on the proposed Brenda SEZ (Stout 2009), the USFWS identified one species under ESA review that may be directly or indirectly affected by solar energy development on the SEZ—the Sonoran population of the desert tortoise. This distinct population segment of desert tortoise, which occurs south and east of the Colorado River, is currently under review by the USFWS for listing under the ESA (Mojave populations north and west of the Colorado River are currently listed as threatened under the ESA, but are outside of the affected area of the Brenda SEZ). The Sonoran population of the desert tortoise was petitioned for listing under the ESA on October 9, 2008 (WildEarth Guardians and Western Watersheds Project 2008). Quad-level occurrences for this species intersect the Brenda SEZ and other portions of the affected area (Figure 8.1.12.1-1). According to the SWReGAP land cover model, approximately 3,848 acres (16 km^2) of potentially suitable for this species occurs on the

SEZ; approximately 84,500 acres (342 km^2) of potentially suitable habitat occurs in the area of indirect effects (Table 8.1.12.1-1). Furthermore, the USGS desert tortoise model (Nussear et al. 2009) identifies the SEZ affected area as potentially suitable habitat, where the average modeled suitability value is greater than 0.6 (out of 1.0). There are no BLM-developed suitable habitat categories for the desert tortoise within the proposed Brenda SEZ. However, Category II desert tortoise habitat occurs in the transmission corridor; Category II and III suitable habitats also occur in the area of indirect effects. These BLM habitat categories are used for BLM planning and land management (as reviewed in WildEarth Guardians and Western Watersheds Project 2008). Category I habitats are the most essential for the maintenance of large, long-term populations; Category II habitats are intermediate in the maintenance of large, long-term populations; Category III habitats are not essential to the maintenance of viable long-term populations and are identified to limit further declines in the population size to the extent practical. Additional basic information on life history, habitat needs, and threats to populations of these species is provided in Appendix J.

8.1.12.1.4 BLM-Designated Sensitive Species

Twelve BLM-designated sensitive species may occur in the affected area of the Brenda SEZ (Table 8.1.12.1-1). These BLM-designated sensitive species include the following (1) amphibian: lowland leopard frog; (2) reptile: Sonoran desert tortoise and desert rosy boa; (3) birds: American peregrine falcon, bald eagle, ferruginous hawk, great egret, long-eared owl, and western burrowing owl; and (4) mammals: California leaf-nosed bat, Townsend's big-eared bat, and western yellow bat. Of these BLM-designated sensitive species with potentially suitable habitat in the affected area, only quad-level occurrences of the California leaf-nosed bat intersect the affected area of the Brenda SEZ. 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 8.1.12.1-1. Two of these species—the desert tortoise and bald eagle—have previously been discussed because of their current or pending status under the ESA (Sections 8.1.12.1.1 and 8.1.12.1.3). All other BLM-designated sensitive species as related to the SEZ are described in the remainder of this section. Additional life history information for these species is provided in Appendix J.

Lowland Leopard Frog

The lowland leopard frog is primarily known from central and southern Arizona, although the species is also known to occur in western New Mexico and northern Mexico. It inhabits aquatic to mesic systems such as grasslands, pinyon-juniper forests, agricultural areas, lakes, streams, and reservoirs. The nearest quad-level occurrences of this species are approximately 22 mi (35 km) east of the SEZ. According to the SWReGAP habitat suitability model, potentially suitable habitat for this species occurs in the SEZ and throughout portions of the affected area (Table 8.1.12.1-1).

Desert Rosy Boa

The desert rosy boa is known from Arizona and southeastern California. This species inhabits arid scrublands, rocky deserts, and canyons near washes or streams. The nearest quad-level occurrences of this species are approximately 7 mi (11 km) east of the SEZ. According to the SWReGAP habitat suitability model, potentially suitable habitat for this species occurs in the SEZ and throughout portions of the affected area (Table 8.1.12.1-1).

American Peregrine Falcon

The American peregrine falcon is known throughout the western United States from 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. The nearest recorded quad-level occurrences of this species are from the vicinity of Alamo Lake, approximately 40 mi (64 km) northeast of the SEZ (Table 8.1.12.1-1). 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 Brenda SEZ. However, on the basis of an evaluation of the SWReGAP land cover types, there is no suitable nesting habitat (cliffs or outcrops) within the affected area.

Ferruginous Hawk

The ferruginous hawk is known to occur throughout the western United States. According to the SWReGAP habitat suitability model, only potentially suitable winter foraging habitat for this species may occur within the affected area of the Brenda SEZ. This species inhabits open grasslands, sagebrush flats, desert scrub, and the edges of pinyon-juniper woodlands. It is known to occur in La Paz County, Arizona. Suitable habitat for this species does not occur on the Brenda SEZ or within the transmission corridor; however, potentially suitable foraging habitat occurs in portions of the area of indirect effects outside of the SEZ (Table 8.1.12.1-1).

Great Egret

The great egret is considered to be a year-round resident in the lower Colorado River Valley in southwestern Arizona and southeastern California. This species is primarily associated with open water areas such as marshes, lakes, ponds, and reservoirs. The nearest recorded quad-level occurrences of this species are from the Colorado River, approximately 35 mi (56 km) west of the SEZ (Table 8.1.12.1-1). According to the SWReGAP habitat suitability model, potentially suitable year-round habitat may occur outside of the SEZ within the area of indirect effects east of Bouse Wash. There are no permanent surface water features in the affected area that may provide suitable habitat; therefore, this species may only occur in the affected area as a transient.

Western Burrowing Owl

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 Brenda SEZ. The species forages in grasslands, shrublands, and open disturbed areas, and nests in burrows usually constructed by mammals. The species is known to occur in La Paz County, Arizona; the nearest quad-level occurrences are approximately 50 mi (80 km) southwest of the SEZ. Potentially suitable foraging and breeding habitat is expected to occur in the SEZ and in other portions of the affected area (Table 8.1.12.1-1). 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.

California Leaf-Nosed Bat

The California leaf-nosed bat is a large-eared bat with a leaf-like flap of protective skin on the tip of its nose. It primarily occurs along the Colorado River, from southern Nevada through Arizona and California to Baja, California, and Sinaloa, Mexico. The species forages in a variety of desert habitats including desert riparian, desert wash, desert scrub, and palm oasis. It roosts in caves, crevices, and mines. Quad-level occurrences of this species intersect the Brenda SEZ and other portions of the affected area. According to the SWReGAP habitat suitability model, potentially suitable year-round foraging habitat for this species may occur on the SEZ and throughout the affected area (Table 8.1.12.1-1). On the basis of an evaluation of SWReGAP land cover types, however, there is no suitable roosting habitat (rocky cliffs and outcrops) within the affected area.

Townsend's Big-Eared Bat

The Townsend's big-eared bat is a year-round resident in the Brenda 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. The nearest recorded occurrences of this species are approximately 20 mi (32 km) south of the SEZ. According to the SWReGAP habitat suitability model, potentially suitable year-round foraging habitat for this species may occur on the SEZ and throughout the affected area (Table 8.1.12.1-1). On the basis of an evaluation of SWReGAP land cover types, however, there is no suitable roosting habitat (rocky cliffs and outcrops) within the affected area.

Western Yellow Bat

The western yellow bat is an uncommon year-round resident in the Brenda SEZ region, where it forages in desert riparian and desert oasis habitats and roosts in trees. The nearest recorded occurrences of this species are approximately 20 mi (32 km) south of the SEZ. According to the SWReGAP habitat suitability model, potentially suitable year-round foraging habitat for this species may occur on the SEZ and throughout the affected area

(Table 8.1.12.1-1). On the basis of an evaluation of SWReGAP land cover types, however, there is no suitable roosting habitat (woodlands) within the affected area.

8.1.12.1.5 State-Listed Species

There are 10 species listed by the state of Arizona that may occur in the Brenda SEZ affected area (Table 8.1.12.1-1). These state-listed species include the following (1) plants: California fan palm and straw-top cholla; (2) amphibian: lowland leopard frog; (3) reptile: desert tortoise; (4) birds: American peregrine falcon, bald eagle, ferruginous hawk, and great egret; and (5) mammals: California leaf-nosed bat and western yellow bat. All of these species are protected in the state of Arizona under the Arizona Native Plant Law or by the Arizona Game and Fish Department (AZGFD) as Wildlife of Special Concern (WSC). Of these species, the California fan palm and straw-top cholla have not been previously described as ESA-listed (Section 8.1.12.1.1), under review for ESA listing (Section 8.1.12.1.3), or BLM-designated sensitive (Section 8.1.12.1.4). These species as related to the SEZ are described in this section and Table 8.1.12.1-1. Additional life history information for these species is provided in Appendix J.

California Fan Palm

The California fan palm is a perennial tree known from California and western Arizona. This species inhabits desert riparian and oasis areas in the Mojave and Sonoran Deserts. The nearest quad-level occurrences are approximately 25 mi (40 km) south of the Brenda SEZ (Table 8.1.12.1-1). According to the SWReGAP land cover model, potentially suitable habitat does not occur on the SEZ or within the transmission corridor; however, approximately 36 acres (0.1 km^2) of potentially suitable desert riparian habitat exists in the area of indirect effects outside of the SEZ.

Straw-Top Cholla

The straw-top cholla is a perennial shrub-like cactus that is known from the southwestern United States. This species inhabits sandy or gravelly soils on desert flats, mesas, and washes. The nearest quad-level occurrences are approximately 15 mi (24 km) northeast of the Brenda SEZ (Table 8.1.12.1-1). According to the SWReGAP land cover model, potentially suitable habitat does not occur on the SEZ or within the transmission corridor; however, approximately 36 acres (0.1 km^2) of potentially suitable desert riparian habitat exists in the area of indirect effects outside of the SEZ.

8.1.12.1.6 Rare Species

There are 18 rare species (i.e., state rank of S1 or S2 in Arizona or a species of concern by the USFWS) that may be affected by solar energy development on the Brenda SEZ (Table 8.1.12.1-1). Of these species, there are eight rare species that have not been discussed previously. These include the following (1) plants: arid tansy-aster, Mohave thistle, Utah swallowwort, woolly heads; (2) reptile: Gila monster; (3) bird: long-eared owl; and (4) mammal: cave myotis. These species as related to the SEZ are described in Table 8.1.12.1-1.

8.1.12.2 Impacts

The potential for impacts on special status species from utility-scale solar energy development within the proposed Brenda SEZ is presented 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 8.1.12.1 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 8.1.12.3).

Solar energy development within the Brenda SEZ could affect a variety of habitats (see Sections 8.1.9 and 8.1.10). These impacts on habitats could in turn affect special status species that are dependent on those habitats. Based on ANHP records, quad-level occurrences of the following two special status species intersect the Brenda SEZ: desert tortoise and California leaf-nosed bat. These species are listed in bold in Table 8.1.12.1-1. 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 8.1.12.1, this approach to identifying the species that could occur in the affected area probably overestimates the number of species that actually occur in the affected area, and may therefore overestimate impacts on some special status species.

Potential direct and indirect impacts on special status species within the SEZ and in the area of indirect effect outside the SEZ are presented in Table 8.1.12.1-1. In addition, the overall potential magnitude of impacts on each species (assuming programmatic design features are in place) is presented along with any potential species-specific mitigation measures that could further reduce impacts.

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 are sited in areas where special status species are known to occur or could occur. As presented in Section 8.1.1.2, it is assumed that a new 19-mi (30-km) long transmission ROW would be created within a locally designated corridor from the western boundary of the SEZ to the nearest existing transmission line. No new access roads would be needed to serve solar energy developments within this SEZ due to the proximity of an existing U.S. highway (U.S. 60).

Direct impacts would result from habitat destruction or modification. It is assumed that direct impacts would occur only within the SEZ and transmission corridor where ground-disturbing activities are expected to occur. Indirect impacts could result from depletions of groundwater resources, 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 developments 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., rock outcrops and playa habitats). Indirect impacts on special status species could be reduced to negligible levels by implementing programmatic design features, especially those engineering controls that would reduce groundwater consumption, runoff, sedimentation, spills, and fugitive dust.

8.1.12.2.1 Impacts on Species Listed under the ESA

In scoping comments on the proposed Brenda SEZ (Stout 2009), the USFWS did not express concern for impacts of project development within the SEZ on any species listed as threatened or endangered under the ESA. However, the Sonoran population of the bald eagle is currently listed under the ESA and has the potential to occur within the affected area of the Brenda SEZ on the basis of SWReGAP information.

The Sonoran population of the bald eagle is currently listed as threatened under the ESA[5] and is known to occur in the vicinity of Alamo Lake, approximately 35 mi (56 km) northeast of the SEZ (Figure 8.1.12.1-1). According to the SWReGAP habitat suitability model, only winter foraging habitat is expected to occur in the affected area of the Brenda SEZ. Approximately 3,878 acres (16 km^2) of potentially suitable foraging habitat within the SEZ and 531 acres (2 km^2) of potentially suitable foraging habitat within the transmission corridor could be directly affected by construction and operations of solar energy development on the SEZ. This direct effects area represents about 0.1% of available suitable habitat in the region. About 97,700 acres

[5] A recent finding by the USFWS has indicated that listing of this species under the ESA is no longer warranted (USFWS 2010b).

(395 km^2) of suitable foraging habitat occurs in the area of potential indirect effects; this area represents about 2.2% of the available suitable habitat in the region (Table 8.1.12.1-1). On the basis of SWReGAP land cover data, there are no permanent surface water features and little riparian habitat (36 acres [0.1 km^2]) in the affected area. Therefore, most of this potentially suitable foraging habitat is desert shrubland.

The overall impact on the bald eagle from construction, operation, and decommissioning of utility-scale solar energy facilities within the Brenda 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; however, avoidance of all potentially suitable foraging habitat is not a feasible way to mitigate impacts to this species because potentially suitable foraging habitat (shrubland) is widespread in the area of direct effect and readily available in other portions of the affected area.

Development of actions to reduce impacts (e.g., reasonable and prudent alternatives, reasonable and prudent measures, and terms and conditions) on the Sonoran population of the bald eagle, including development of a survey protocol, avoidance measures, minimization measures, and, potentially, compensatory mitigation, would require consultation with the USFWS per Section 7 of the ESA. These consultations may also be used to develop incidental take statements in accordance with Section 10 of the ESA (if necessary). Consultation with AZGFD should also occur to determine any state mitigation requirements.

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

In scoping comments on the proposed Brenda SEZ (Stout 2009), the USFWS did not express concern for impacts of project development within the SEZ on any species that are candidates for listing under the ESA. There are no ANHP records or potentially suitable habitats for any ESA candidate species within the affected area.

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

In scoping comments on the proposed Brenda SEZ (Stout 2009), the USFWS identified one species under ESA review that may be directly or indirectly affected by solar energy development on the SEZ—the Sonoran population of the desert tortoise. This distinct population segment of desert tortoise, which occurs south and east of the Colorado River, is currently under review by the USFWS for listing under the ESA (Mojave populations north and west of the Colorado River are currently listed as threatened under the ESA, but are outside of the affected area of the Brenda SEZ). Quad-level occurrences for this species intersect the Brenda SEZ and other portions of the affected area (Figure 8.1.12.1-1). There are no BLM-developed suitable habitat categories for the desert tortoise within the Brenda SEZ. However, Category II habitat occurs in the transmission corridor; Category II and III suitable habitats also occur in the area of indirect effects. These BLM habitat categories are used for BLM planning and land management (as reviewed in WildEarth Guardians and Western Watersheds Project 2008). According to the SWReGAP habitat suitability model, approximately 3,848 acres (16 km^2) of potentially suitable habitat on the SEZ and 487 acres (2 km^2) of potentially suitable habitat within the transmission corridor could be directly affected by construction and operations of solar energy development on the SEZ (Table 8.1.12.1-1). This direct effects area represents about 0.1% of available suitable habitat of the desert tortoise in the region. About 84,500 acres (342 km^2) of suitable habitat occurs in the area of potential indirect effects; this area represents about 2.5% of the available suitable habitat in the region (Table 8.1.12.1-1).

The overall impact on the Sonoran population of the desert tortoise from construction, operation, and decommissioning of utility-scale solar energy facilities within the Brenda 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 region. The implementation of programmatic design features alone is unlikely to reduce these impacts to negligible levels. Avoidance of potentially suitable habitats for this species is not a feasible means of mitigating impacts because these habitats (desert scrub) are widespread throughout the area of direct effect. Pre-construction surveys to determine the abundance of desert tortoises on the SEZ, avoiding or minimizing disturbance to occupied habitats, and the implementation of a desert tortoise translocation plan and compensation plan could further reduce direct impacts.

Development of actions to reduce impacts (e.g., reasonable and prudent alternatives, reasonable and prudent measures, and terms and conditions) for the desert tortoise, including a survey protocol, avoidance measures, minimization measures, and, potentially, translocation actions, and compensatory mitigation, should be conducted in coordination with the USFWS and AZDFG. There are inherent dangers to tortoises associated with their capture, handling, and translocation from the SEZ. These actions, if done improperly, can result in injury or death. To minimize these risks, the desert tortoise translocation plan should be developed in consultation with the USFWS, and follow the *Guidelines for Handling Desert Tortoises During Construction Projects* (Desert Tortoise Council 1994) and other current translocation guidance provided by the USFWS or other state agencies. Consultation will identify potentially suitable recipient locations, density thresholds for tortoise populations in recipient locations, procedures for pre-disturbance clearance surveys and tortoise handling, as well as disease testing and post-translocation monitoring and reporting requirements. Despite some risk of mortality or decreased fitness, translocation is widely accepted as a useful strategy for the conservation of the desert tortoise (Field et al. 2007).

To offset impacts of solar development on the SEZ, compensatory mitigation may be needed to balance the acreage of habitat lost with acquisition of lands that would be improved and protected for desert tortoise populations (USFWS 1994). Compensation can be accomplished by improving the carrying capacity for the desert tortoise on the acquired lands. Other mitigation actions may include funding for the enhancement of desert tortoise habitat on existing federal lands. Coordination with the USFWS and AZGFD would be necessary to determine the appropriate mitigation ratio to acquire, enhance, and preserve desert tortoise compensation lands.

8.1.12.2.4 Impacts on BLM-Designated Sensitive Species

BLM-designated sensitive species that may be affected by solar energy development on the Brenda SEZ and that are not previously discussed are discussed below.

Lowland Leopard Frog

The lowland leopard frog is not known to occur in the affected area of the Brenda SEZ; however, approximately 128 acres (0.5 km^2) of potentially suitable habitat on the SEZ and 30 acres (0.1 km^2) of potentially suitable habitat in the transmission corridor could be directly affected by construction and operations (Table 8.1.12.1-1). Some of this potentially suitable habitat occurs along Bouse Wash in the eastern portion of the SEZ and along Tyson Wash outside of the SEZ in the transmission corridor. This direct impact area represents about 0.1% of potentially suitable habitat in the SEZ region. About 5,323 acres (22 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents about 2.8% of the potentially suitable habitat in the SEZ region (Table 8.1.12.1-1).

The overall impact on the lowland leopard frog from construction, operation, and decommissioning of utility-scale solar energy facilities within the Brenda 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.

Avoiding or minimizing disturbance to agricultural, aquatic, and riparian (e.g. desert wash) habitats within the area of direct effects could reduce impacts on this species 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, 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.

Desert Rosy Boa

The desert rosy boa is known to occur within the SEZ region and potentially suitable habitat is expected to occur in the affected area. Approximately 1,392 acres (6 km^2) of potentially suitable habitat on the SEZ and 531 acres (2 km^2) of potentially suitable habitat in the transmission corridor could be directly affected by construction and operations (Table 8.1.12.1-1). This direct impact area represents 0.1% of potentially suitable habitat in the SEZ region. About 53,800 acres (218 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents about 1.5% of the potentially suitable habitat in the SEZ region (Table 8.1.12.1-1).

The overall impact on the desert rosy boa from construction, operation, and decommissioning of utility-scale solar energy facilities within the Brenda 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 desert rosy boa is not feasible because potentially suitable desert scrub and wash habitats are 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 Brenda SEZ region and potentially suitable foraging habitat is expected to occur in the affected area. Approximately 3,878 acres (16 km^2) of potentially suitable habitat on the SEZ and 573 acres (2 km^2) of potentially suitable habitat in the transmission corridor could be directly affected by construction and operations (Table 8.1.12.1-1). This direct impact area represents 0.1% of potentially suitable habitat in the SEZ region. About 98,800 acres (400 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents about 2.3% of the potentially suitable habitat in the SEZ region (Table 8.1.12.1-1). Most of this area could serve as foraging habitat (open shrublands). On the basis of SWReGAP land cover data, there is no suitable nesting habitat (cliffs or outcrops) within the affected area.

The overall impact on the American peregrine falcon from construction, operation, and decommissioning of utility-scale solar energy facilities within the Brenda 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 to mitigate impacts on the American peregrine falcon is not feasible because potentially suitable foraging habitats are widespread throughout the area of direct effect and readily available in other portions of the affected area.

Ferruginous Hawk

The ferruginous hawk is a winter resident in the Brenda 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 on the SEZ or within the transmission corridor. However, about 7,000 acres (28 km^2) of potentially suitable foraging habitat occurs in the area of indirect effects; this area represents about 3.3% of the potentially suitable habitat in the SEZ region (Table 8.1.12.1-1).

The overall impact on the ferruginous hawk from construction, operation, and decommissioning of utility-scale solar energy facilities within the Brenda 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.

Great Egret

The great egret is a year-round resident in the Brenda SEZ region and potentially suitable habitat is expected to occur in the affected area. According to the SWReGAP habitat suitability model, suitable habitat does not occur on the SEZ or within the transmission corridor. However, approximately 170 acres (0.7 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents about 0.6% of the potentially suitable habitat in the SEZ region (Table 8.1.12.1-1). Because there are no permanent surface water features in the affected area that may provide suitable foraging or nesting habitat, this species may occur in the affected area only as a transient.

The overall impact on the great egret from construction, operation, and decommissioning of utility-scale solar energy facilities within the Brenda 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.

Western Burrowing Owl

The western burrowing owl is a year-round resident in the Brenda SEZ region and potentially suitable foraging and nesting habitat is expected to occur in the affected area. Approximately 3,878 acres (16 km^2) of potentially suitable habitat on the SEZ and 531 acres (2 km^2) of potentially suitable habitat in the transmission corridor could be directly affected by construction and operations (Table 8.1.12.1-1). This direct impact area represents 0.1% of potentially suitable habitat in the SEZ region. About 97,700 acres (395 km^2) of potentially suitable habitat occurs in the area of indirect effects; this area represents about 2.4% of the potentially suitable habitat in the SEZ region (Table 8.1.12.1-1). Most of this area could serve as foraging and nesting habitat (shrublands). The abundance of burrows suitable for nesting on the SEZ and in the area of indirect effects 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 Brenda 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 scrub habitats are widespread throughout the area of direct effect and 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 burrows 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-construction surveys for the species and its habitat in the area of direct effects.

California Leaf-Nosed Bat

The California leaf-nosed bat is a year-round resident within the Brenda SEZ region. On the basis of SWReGAP land cover data, suitable roosting habitats (caves and mines) do not occur in the affected area. However, approximately 1,392 acres (6 km^2) of potentially suitable foraging habitat on the SEZ and 531 acres (2 km^2) of potentially suitable foraging habitat in the transmission corridor could be directly affected by construction and operations (Table 8.1.12.1-1). This direct impact area represents about 0.1% of potentially suitable foraging habitat in the region. About 53,850 acres (218 km^2) of potentially suitable foraging habitat occurs in the area of indirect effect; this area represents about 1.5% of the available suitable foraging habitat in the region (Table 8.1.12.1-1). The potentially suitable habitat in the affected area is primarily foraging habitat represented by desert shrubland. On the basis of an evaluation of SWReGAP landcover types, there are no potentially suitable roosting habitats (rocky cliffs and outcrops) in the affected area.

The overall impact on the California leaf-nosed bat from construction, operation, and decommissioning of utility-scale solar energy facilities within the Brenda 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 region. The implementation of programmatic design features may 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.

Townsend's Big-Eared Bat

The Townsend's big-eared bat is a year-round resident within the Brenda SEZ region. On the basis of SWReGAP land cover data, suitable roosting habitats (caves and mines) do not occur in the affected area. However, approximately 3,878 acres (16 km^2) of potentially suitable foraging habitat on the SEZ and 575 acres (2 km^2) of potentially suitable foraging habitat in the transmission corridor could be directly affected by construction and operations (Table 8.1.12.1-1). This direct impact area represents about 0.1% of potentially suitable foraging habitat in the region. About 99,000 acres (401 km^2) of potentially suitable foraging habitat occurs in the area of indirect effect; this area represents about 2.2% of the available suitable foraging habitat in the region (Table 8.1.12.1-1). The potentially suitable habitat in the affected area is primarily foraging habitat represented by desert shrubland. On the basis of an evaluation of SWReGAP landcover types, there are no potentially suitable roosting habitats (rocky cliffs and outcrops) in the affected area.

The overall impact on the California leaf-nosed bat from construction, operation, and decommissioning of utility-scale solar energy facilities within the Brenda 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 region. The implementation of programmatic design features may be sufficient to reduce indirect impacts on this species to negligible levels. Avoidance of all potentially suitable foraging habitats is not a feasible way of mitigating impacts because potentially suitable habitat is widespread throughout the area of direct effect and readily available in other portions of the SEZ region.

Western Yellow Bat

The western yellow bat is an uncommon year-round resident within the Brenda SEZ region. On the basis of SWReGAP land cover data, suitable roosting habitats (trees) do not occur in the affected area. However, approximately 3,848 acres (16 km^2) of potentially suitable foraging habitat on the SEZ and 573 acres (2 km^2) of potentially suitable foraging habitat in the transmission corridor could be directly affected by construction and operations (Table 8.1.12.1-1). This direct impact area represents about 0.1% of potentially suitable foraging habitat in the region. About 91,750 acres (371 km^2) of potentially suitable foraging habitat occurs in the area of indirect effect; this area represents about 2.2% of the available suitable foraging habitat in the region (Table 8.1.12.1-1). The potentially suitable habitat in the affected area is primarily foraging habitat represented by desert shrubland. On the basis of an evaluation of SWReGAP landcover types, there are no potentially suitable roosting habitats (woodlands) in the affected area.

The overall impact on the western yellow bat from construction, operation, and decommissioning of utility-scale solar energy facilities within the Brenda 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 foraging habitat in the region. The implementation of programmatic design features may 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 is readily available in other portions of the SEZ region.

8.1.12.2.5 Impacts on State-Listed Species

There are 10 species listed by the state of Arizona that may occur in the Brenda SEZ affected area (Table 8.1.12.1-1). Of these species, only the California fan palm and straw-top cholla have not been previously discussed as listed under the ESA, under review for ESA listing, or BLM-designated sensitive. Impacts on each of these species are discussed below.

California Fan Palm

The California fan palm is not known to occur in the affected area of the Brenda SEZ and, according to the SWReGAP land cover model, suitable desert riparian or oasis habitat does not occur on the site or within the transmission corridor. However, approximately 36 acres (0.1 km^2) of potentially suitable desert riparian habitat occurs in the area of indirect effects; this area represents less than 0.1% of the potentially suitable habitat in the SEZ region (Table 8.1.12.1-1).

The overall impact on the California fan palm from construction, operation, and decommissioning of utility-scale solar energy facilities within the proposed Brenda 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.

Straw-Top Cholla

The straw-top cholla is not known to occur in the affected area of the Brenda SEZ and, according to the SWReGAP land cover model, suitable desert riparian, wash, or mesa habitat does not occur on the site or within the transmission corridor. However, approximately 36 acres (0.1 km^2) of potentially suitable desert riparian habitat occurs in the area of indirect effects; this area represents less than 0.1% of the potentially suitable habitat in the SEZ region (Table 8.1.12.1-1).

The overall impact on the straw-top cholla from construction, operation, and decommissioning of utility-scale solar energy facilities within the Brenda 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.

8.1.12.2.6 Impacts on Rare Species

There are 18 rare species (i.e., state rank of S1 or S2 in Arizona or a species of concern by the USFWS) that may be affected by solar energy development on the Brenda SEZ (Table 8.1.12.1-1). Impacts on eight rare species have not been discussed previously. These include the following (1) plants: arid tansy-aster, Mohave thistle, Utah swallowwort, and woolly heads; (2) reptile: Gila monster; (3) bird: long-eared owl; and (4) mammal: cave myotis. Impacts on these species are described in Table 8.1.12.1-1.

8.1.12.3 SEZ-Specific Design Features and Design Feature Effectiveness

The implementation of 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 mitigation measures 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 area of direct effects to determine the presence and abundance of special status species, including those identified in Table 8.1.12.1-1. Disturbance to occupied habitats for these species should be avoided or minimized to the extent practicable. If avoiding or minimizing impacts to 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.

- Avoiding or minimizing disturbance of dunes and sand flats in the area of direct effects could reduce impacts on the arid tansy-aster.

- Avoiding or minimizing disturbance of agricultural and riparian habitats in the area of direct effects could reduce impacts on the lowland leopard frog.

- Consultation with the USFWS and the AZGFD should be conducted to address the potential for impacts on the Sonoran population of bald eagle, a species listed as threatened under the ESA and CESA. Consultation would identify an appropriate survey protocol, avoidance measures, and, if appropriate, reasonable and prudent alternatives, reasonable and prudent measures, and terms and conditions for incidental take statements.

- Coordination with the USFWS and AZGFD should be conducted to address the potential for impacts on the Sonoran population of the desert tortoise, a species under review for listing under the ESA. Coordination would identify an appropriate survey protocol and mitigation requirements, which may include avoidance, minimization, translocation, or compensation.

- 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 AZGFD.

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.

8.1.13 Air Quality and Climate

8.1.13.1 Affected Environment

8.1.13.1.1 Climate

The proposed Brenda SEZ is in the south-central portion of La Paz County in western Arizona. The SEZ is located on the middle of the valley floor at an average elevation of 1,180 ft (360 m). Nearby mountain ranges are oriented northwest–southeast. The SEZ is located in the northern portion of the Sonoran Desert, which covers the southwestern Arizona, southern California, and northwestern Mexican states. The area experiences a desert-like arid climate, characterized by hot summers, mild winters, light precipitation, a high rate of evaporation, low relative humidity, abundant sunshine, and large temperature ranges (NCDC 2010a). Meteorological data collected at the Blythe Airport in Blythe, California, about 45 mi (72 km) west of the Brenda SEZ boundary, and at Bouse, about 16 mi (26 km) north–northwest, are summarized below.

A wind rose from the Blythe Airport, based on data collected 33 ft (10 m) above the ground over the 5-year period 2005 to 2009, is presented in Figure 8.1.13.1-1 (NCDC 2010b).[6] During this period, the annual average wind speed at the airport was about 7.6 mph (3.4 m/s); the prevailing wind direction was from the south (about 12.6% of the time) and secondarily from the north–northwest (about 9.0% of the time). Wind directions alternated between north–northwest (March, May, August, and October) and south (the rest of the months) throughout the year. In California, general wind flow is from the west or northwest throughout the year, but prevailing wind direction for a given site is influenced by local terrain. Wind speeds categorized as calm (less than 1.1 mph [0.5 m/s]) occurred frequently (about one-fifth 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 summer and fall at 7.8 mph (3.5 m/s); lower in winter at 7.4 mph (3.3 m/s); and lowest in spring at 7.2 mph (3.2 m/s).

Topography plays a large role in determining the temperature of any specific location in Arizona. For the period 1932 to 2010, the annual average temperature at Bouse was 70.2°F (21.2°C) (WRCC 2010). December was the coldest month, with an average minimum of 34.4°F (1.3°C), and July was the warmest, with an average maximum of 108.1°F (42.3°C). In summer, daytime maximum temperatures over 100°F (37.8°C) are common, and minimums are in the 70s. The minimum temperatures recorded were below freezing (≤32°F [0°C]) during the colder months (more than 12 days in December and January), but subzero temperatures were never recorded. During the same period, the highest temperature, 123°F (50.6°C), was reached in

[6] No meteorological stations to provide representative data are located near the SEZ. The Blythe Airport, the closest meteorological station from the Brenda SEZ was chosen to be representative of the SEZ, in part because the northwest–southeast orientation of valley and mountain ranges at the SEZ match closely with prevailing wind direction at the Blythe Airport.

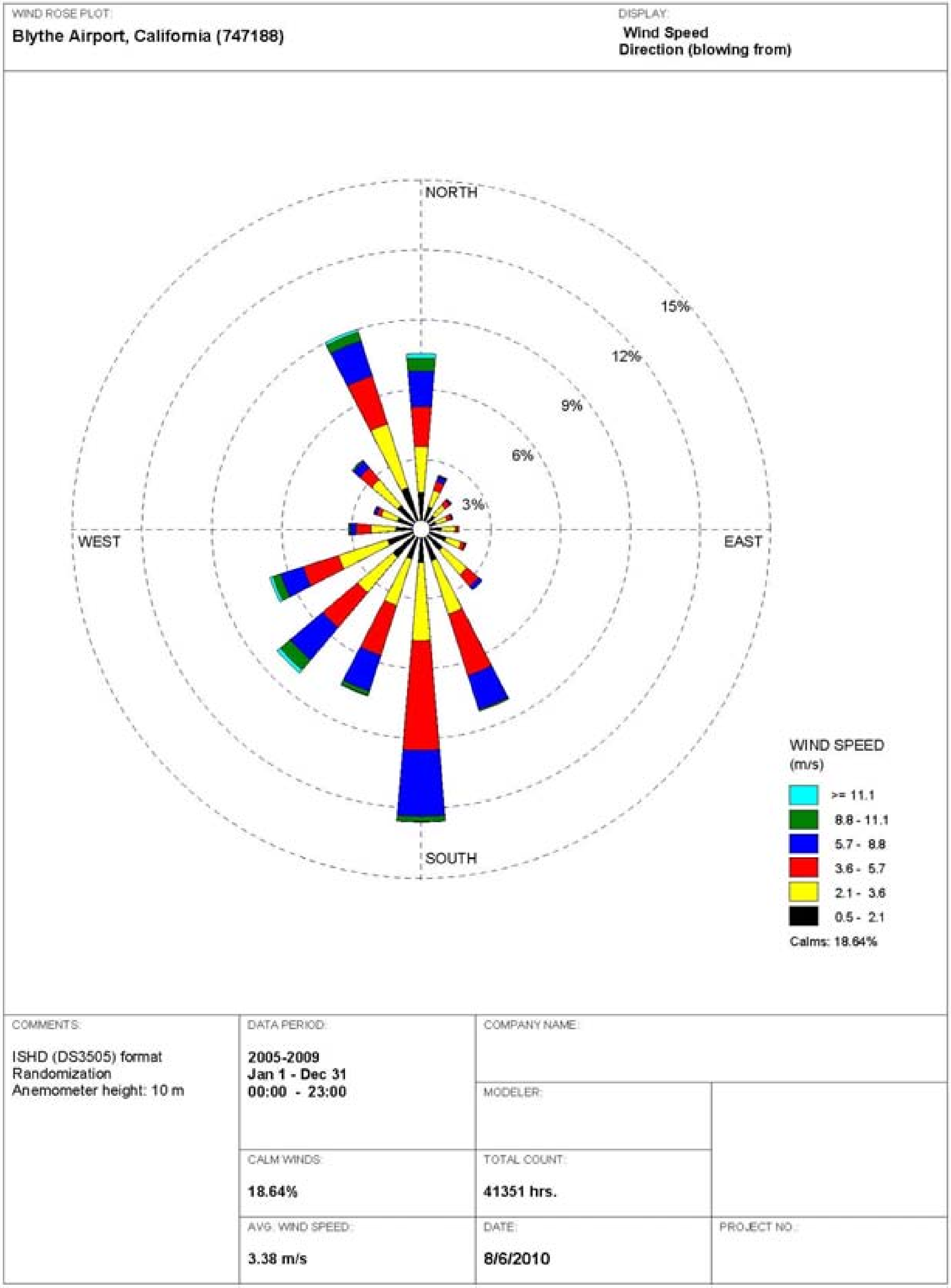

FIGURE 8.1.13.1-1 Wind Rose at 33 ft (10 m) at the Blythe Airport in Blythe, California, 2005 to 2009 (Source: NCDC 2010b)

July 1958, and the lowest, 11°F (−11.7°C), in January 1974. In a typical year, about 173 days had a maximum temperature of at least 90°F (32.2°C), while about 37 days had minimum temperatures at or below freezing.

Throughout Arizona, precipitation patterns depend largely on elevation and the season of the year. Rain occurs primarily in two distinct seasons—winter and summer monsoon season (NCDC 2010a). For the 1932 to 2010 period, annual precipitation at Bouse averaged about 5.55 in. (14.1 cm) (WRCC 2010). On average, 26 days a year have measurable precipitation (0.01 in. [0.025 cm] or higher). Seasonally, precipitation is the highest in winter followed by summer, and the lowest in spring. Snowfall at Bouse is uncommon and limited to December. The annual average snowfall at Bouse was about 0.1 in. (0.3 cm), and the highest monthly snowfall recorded was 4 in. (10.2 cm) in December 1932.

The proposed Brenda SEZ is far from major water bodies (more than 140 mi [225 km]) to the Gulf of California). Severe weather events, such as floods, hail, and thunderstorm winds, have been reported in La Paz County, which encompasses the Brenda SEZ (NCDC 2010c).

Flood conditions occur infrequently in Arizona, but occasional heavy storms during summer thunderstorm season at times cause floods that do considerable local damage. Since 1994, 24 floods (mostly flash floods) have been reported in La Paz County, half of which occurred in the nearby towns such as Vicksburg, Bouse, and Quartzsite. These floods caused two deaths and considerable property and crop damages.

In La Paz County, eight hail events in total have been reported since 1997, but only one of those caused minor crop damage. Hail measuring 1.75 in. (4.4 cm) in diameter was reported in two incidents. In La Paz County, 51 thunderstorm wind events have been reported since 1983, and those up to a maximum wind speed of 81 mph (36 m/s) occur primarily during the summer and cause some property damage (NCDC 2010c).

No dust storm events were reported in La Paz County (NCDC 2010c). However, the ground surface of the SEZ is covered primarily with loams to sandy loams (with gravelly loams along the west side, about 30% of the site), which have moderate dust storm potential. On occasion, high winds accompanied by thunderstorms and dry soil conditions could result in blowing dust in La Paz County. Dust storms can deteriorate air quality and visibility and have adverse effects on health, particularly for people with asthma or other respiratory problems.

Hurricanes and tropical storms formed off the coast of Central America and Mexico weaken over the cold waters off the California coast. Accordingly, hurricanes rarely hit Arizona through California. Historically, two tropical storms/depressions from the Gulf of California passed within 100 mi (160 km) of the proposed Brenda SEZ (CSC 2010). No tornadoes were reported in La Paz County (NCDC 2010c).

8.1.13.1.2 Existing Air Emissions

La Paz County has a few industrial emission sources over the county, but their emissions are relatively small. No emission sources are located around the proposed Brenda SEZ. Several major roads exist in La Paz County, such as I-10, U.S. 60, U.S. 95, and State Routes 72 and 95. Thus, onroad mobile source emissions are substantial compared with other sources in La Paz County. Data on annual emissions of criteria pollutants and VOCs in La Paz County are presented in Table 8.1.13.1-1 for 2002 (WRAP 2009). Emission data are classified into six source categories: point, area (including fugitive dust), onroad mobile, nonroad mobile, biogenic, and fire (wildfires, prescribed fires, agricultural fires, structural fires). In 2002, nonroad sources were major contributors to total sulfur dioxide (SO_2) emissions (about 51%). Onroad sources were major contributors to nitrogen oxides (NO_x) and carbon monoxide (CO) emissions (about 73% and 45%, respectively,) and secondary contributors to SO_2 emissions (about 34%). Biogenic sources (i.e., vegetation—including trees, plants, and crops—and soils) that release naturally occurring emissions contributed secondarily to CO emissions (about 40%), and accounted for most of the volatile organic compounds (VOC) emissions (about 96%). Area sources accounted for about 91% of PM_{10} and 70% of $PM_{2.5}$. In La Paz County, point and fire emissions sources were minor contributors to criteria pollutants and VOCs.

TABLE 8.1.13.1-1 Annual Emissions of Criteria Pollutants and VOCs in La Paz County, Arizona, Encompassing the Proposed Brenda SEZ, 2002[a]

Pollutant[b]	Emissions (tons/yr)[c]
SO_2	152
NO_x	4,911
CO	68,025
VOCs	178,905
PM_{10}	3,196
$PM_{2.5}$	886

[a] Includes point, area (including fugitive dust), 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 VOC = volatile organic compound.

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

Source: WRAP (2009).

In 2010, Arizona is projected to produce about 116.6 MMt of *gross*[7] carbon dioxide equivalent (CO_2e)[8] emissions, which is about 1.6% of total U.S. greenhouse gas (GHG) emissions in 2007 (Bailie et al. 2005). Gross GHG emissions in Arizona increased by about 77% from 1990 to 2010 because of Arizona's rapid population growth and attendant economic growth, compared to 16% growth in U.S. GHG emissions during the 1990 to 2005 period. In 2005, electric use (about 40.0%) and transportation (about 38.9%) were the primary contributors to gross GHG emission sources in Arizona. Fuel use in the residential, commercial, and industrial (RCI) sectors combined accounted for about 15.4% of total state emissions. Arizona's *net* emissions were about 109.9 MMt CO_2e, considering carbon sinks from forestry activities and agricultural soils throughout the state. The

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

[8] 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.

U.S. Environmental Protection Agency (EPA) (2009a) also estimated 2005 emissions in Arizona. Its estimate of CO_2 emissions from fossil fuel combustion was 97.2 MMt, which was comparable to the state's estimate. Electric power generation and transportation accounted for about 51.8% and 38.8% of the CO_2 emissions total, respectively, while the residential, commercial, and industrial (RCI) sectors accounted for the remainder (about 9.4%).

8.1.13.1.3 Air Quality

The State of Arizona has adopted the National Ambient Air Quality Standards (NAAQS) for six criteria pollutants: sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone (O_3), particulate matter (PM; PM_{10} and $PM_{2.5}$), and lead (Pb) (ADEQ 2009; EPA 2010a). The NAAQS for criteria pollutants are presented in Table 8.1.13.1-2.

La Paz County is located administratively within the Mohave-Yuma Intrastate Air Quality Control Region (AQCR), along with Mohave and Yuma Counties. Currently, the area surrounding the proposed SEZ is designated by the U.S. EPA as being in unclassifiable/attainment of NAAQS for all criteria pollutants (Title 40, Part 81, Section 303 of the *Code of Federal Regulations* [40 CFR 81.303]).

Because of La Paz County's low population density, it has no significant emission sources of its own, only mobile emissions along major highways. Accordingly, ambient air quality in La Paz County is relatively good, except for O_3 and possibly PM levels. The only ambient air-monitoring station in La Paz County is at Alamo Lake State Park, which is about 37 mi (60 km) north–northeast of the SEZ. That station has collected only NO_2 and O_3 data. To characterize ambient air quality around the SEZ, data from the three closest monitoring stations, all in Maricopa County, were chosen. For CO and PM_{10}, concentration data from Buckeye, which is located about 75 mi (121 km) east–southeast of the SEZ, are presented in Table 8.1.13.1-2. For SO_2 and $PM_{2.5}$, highest concentrations at two monitoring stations in the Phoenix area, which are located over 100 mi (161 km) east of the SEZ, are presented. No Pb measurements have been made in the state of Arizona because of low Pb concentration levels after the phaseout of leaded gasoline. The background concentrations of criteria pollutants at these stations for the period 2004 to 2008 are presented in Table 8.1.13.1-2 (EPA 2010b). Monitored concentration levels were lower than their respective standards (up to 10%), except O_3, PM_{10}, and $PM_{2.5}$, which exceed their respective NAAQS. These criteria pollutants are of regional concern in the area, because of high temperatures, abundant sunshine, and windblown dust from occasional high winds and dry soil conditions,

The Prevention of Significant Deterioration (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 Arizona and California, but none is within 62 mi (100 km) of the proposed SEZ. The nearest is Joshua Tree National Park (NP) in California (40 CFR 81.405), about 76 mi (122 km) west of the Brenda SEZ. This

TABLE 8.1.13.1-2 NAAQS and Background Concentration Levels Representative of the Proposed Brenda SEZ in La Paz County, Arizona, 2004 to 2008

			Background Concentration Level	
Pollutant[a]	Averaging Time	NAAQS	Concentration[b,c]	Measurement Location, Year
SO_2	1-hour	75 ppb[d]	–[e]	–
	3-hour	0.5 ppm	0.013 ppm (2.6%)	Phoenix, Maricopa County, 2007
	24-hour	0.14 ppm	0.008 ppm (5.7%)	Phoenix, Maricopa County, 2004
	Annual	0.030 ppm	0.003 ppm (10%)	Phoenix, Maricopa County, 2004
NO_2	1-hour	100 ppb[f]	–	–
	Annual	0.053 ppm	0.003 ppm (5.7%)	Alamo Lake State Park, La Paz County, 2006
CO	1-hour	35 ppm	1.6 ppm (4.6%)	Buckeye, Maricopa County, 2007
	8-hour	9 ppm	0.9 ppm (10%)	Buckeye, Maricopa County, 2005
O_3	1-hour	0.12 ppm[g]	0.083 ppm (69%)	Alamo Lake State Park, La Paz County, 2007
	8-hour	0.075 ppm	0.076 ppm (101%)	Alamo Lake State Park, La Paz County, 2008
PM_{10}	24-hour	150 $\mu g/m^3$	204 $\mu g/m^3$ (136%)	Buckeye, Maricopa County, 2008
	Annual	50 $\mu g/m^3$ [h]	53 $\mu g/m^3$ (106%)	Buckeye, Maricopa County, 2007
$PM_{2.5}$	24-hour	35 $\mu g/m^3$	42.3 $\mu g/m^3$ (121%)	Phoenix, Maricopa County, 2005
	Annual	15.0 $\mu g/m^3$	13.5 $\mu g/m^3$ (90%)	Phoenix, Maricopa County, 2006
Pb	Calendar quarter	1.5 $\mu g/m^3$	–	–
	Rolling 3-month	0.15 $\mu g/m^3$ [i]	–	–

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; SO_2 = sulfur dioxide.

b Monitored concentrations are the 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 Values in parentheses are background concentration levels as a percentage of NAAQS. Calculation of 1-hour SO_2 and NO_2 to NAAQS was not made, because no measurement data based on new NAAQS are available.

d Effective August 23, 2010.

e A dash indicates not applicable or not available.

f Effective April 12, 2010.

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

h Effective December 18, 2006, the EPA revoked the annual PM_{10} standard of 50 $\mu g/m^3$ but annual PM_{10} concentrations are presented for comparison purposes.

i Effective January 12, 2009.

Sources: ADEQ (2009); EPA (2010a,b).

Class I area is not located downwind of prevailing winds at the Brenda SEZ (Figure 8.1.13.1-1). The next nearest Class I areas are beyond 124 mi (200 km) from the SEZ.

8.1.13.2 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 heat transfer fluids [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–fired 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 Brenda 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 8.1.13.3 below identifies SEZ-specific design features of particular relevance to the proposed Brenda SEZ.

8.1.13.2.1 Construction

The Brenda 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 Prevention of Significant Deterioration (PSD) increment levels at nearby Class I areas.[9] However, no receptors were modeled for PSD analysis at the nearest Class I area, Joshua Tree NP, because it is about 76 mi (122 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 Joshua Tree NP were selected as surrogates for the PSD analysis. For the Brenda SEZ, the modeling was conducted based on the following assumptions and input:

- Uniformly distributed emissions of 3,000 acres (12.1 km^2) over the Brenda SEZ of 3,878 acres (15.7 km^2),

- Surface hourly meteorological data from the Blythe Airport in California and upper air sounding data from Tucson for the 2005-2009 period, and

- A regularly spaced receptor grid over a modeling domain of 62 × 62 mi (100 × 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 8.1.13.2-1. Maximum 24-hour PM_{10} concentration increments modeled to occur at the site boundaries would be an estimated 440 $\mu g/m^3$, which far exceeds the relevant standard level of 150 $\mu g/m^3$. Total 24-hour PM_{10} concentrations of 644 $\mu g/m^3$ would also exceed the standard level at the SEZ boundary. In particular, highest PM_{10} concentrations among nearby residences are predicted to be about 175 $\mu g/m^3$ at Pioneer, located about 0.4 mi (0.6 km) south of the SEZ. 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 20 $\mu g/m^3$ at Brenda, about 15 $\mu g/m^3$ at Vicksburg, about 10 $\mu g/m^3$ at Bouse, and about 5 $\mu g/m^3$ at Quartzsite. Annual average modeled concentration increments and total concentrations (increment plus background) for PM_{10} at the SEZ boundary would be about 70.7 $\mu g/m^3$ and 124 $\mu g/m^3$, respectively, which are higher than the NAAQS level of 50 $\mu g/m^3$, which was revoked by EPA in December 2006. Annual PM_{10} increments would be much lower, about 15 $\mu g/m^3$ at Pioneer, about 0.7 $\mu g/m^3$ at Brenda, and 0.5 $\mu g/m^3$ or lower at all other nearby towns.

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9 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.

TABLE 8.1.13.2-1 Maximum Air Quality Impacts from Emissions Associated with Construction Activities for the Proposed Brenda 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	440	204	644	150	293	429
	Annual	–[d]	70.7	53.0	124	50	141	247
$PM_{2.5}$	24 hours	H8H	27.2	42.3	69.5	35	78	199
	Annual	–	7.1	13.5	20.6	15.0	47	137

[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 8.1.13.1-2.

[d] A dash indicates not applicable.

Total 24-hour $PM_{2.5}$ concentrations would be 69.5 μg/m³ at the SEZ boundary, which is higher than the NAAQS level of 35 μg/m³; modeled increments contribute about two-thirds of background concentration to this total. The total annual average $PM_{2.5}$ concentration would be 20.6 μg/m³, which is above the NAAQS level of 15.0 μg/m³. At Pioneer, predicted maximum 24-hour and annual $PM_{2.5}$ concentration increments would be about of about 15 and 1.5 μg/m³, respectively.

Predicted 24-hour and annual PM_{10} concentration increments at the surrogate receptors for the nearest Class I Area—Joshua Tree NP in California—would be about 5.3 and 0.08 μg/m³, or 67% and 2.0% of the PSD increments for the Class I area, respectively. These surrogate receptors are more than 45 mi (72 km) from the Joshua Tree NP, and thus predicted concentrations in Joshua Tree NP would be much lower than the above values (about 27% 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 NAAQS 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 (Joshua Tree NP in California). 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 could affect air-quality values (AQRVs) (e.g., visibility and acid deposition) at the nearby federal Class I area. However, SO_X emissions from engine exhaust would be very low, because programmatic design features would require 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. Construction-related emissions are temporary in nature and thus would cause some unavoidable but short-term impacts.

Transmission lines within a designated ROW would be constructed to connect to the nearest regional grid. A regional 161-kV transmission line is located about 19 mi (31 km) from the proposed Brenda SEZ; thus construction of a transmission line over this relatively long distance would likely be needed. Construction activities would result in fugitive dust emissions from soil disturbance and engine exhaust emissions from heavy equipment and vehicles. Construction time for the transmission line could be about two years. However, the site of construction along the transmission line ROW would move continuously, thus no particular area would be exposed to air emissions for a prolonged period. Therefore, potential air quality impacts on nearby residences along the transmission line ROW, if any, would be minor and temporary in nature.

8.1.13.2.2 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). Some of these sources may need to comply with emissions standards, including, but not limited to, the New Source Performance Standards (NSPS) for boilers (40 CFR Part 60), the NSPS for stationary diesels (40 CFR 60 Subpart IIII), federal requirements for nonroad diesels (40 CFR Part 89), and the National Emission Standards for Hazardous Air Pollutants (NESHAP) for stationary reciprocating engines (40 CFR 63 Subpart ZZZZ). In addition, given the typically small emissions, it is unlikely that PSD requirements would apply to typical solar energy facilities.

The type of emission sources caused by and offset by operation of a solar facility are discussed in Section M.13.4 of Appendix M.

Estimates of potential air emissions displaced by solar project development at the Brenda SEZ are presented in Table 8.1.13.2-2. Total power generation capacity ranging from 345 to 620 MW is estimated for the Brenda SEZ for various solar technologies (see Section 8.1.2). 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

TABLE 8.1.13.2-2 Annual Emissions from Combustion-Related Power Generation Avoided by Full Solar Development of the Proposed Brenda 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
3,878	345–620	604–1,087	465–837	716–1,289	0.007–0.012	513–924
Percentage of total emissions from electric power systems in Arizona[d]			0.87–1.6%	0.87–1.6%	0.87–1.6%	0.87–1.6%
Percentage of total emissions from all source categories in Arizona[e]			0.42–0.76%	0.20–0.35%	–[f]	0.48–0.86%
Percentage of total emissions from electric power systems in the six-state study area[d]			0.19–0.33%	0.19–0.35%	0.22–0.40%	0.20–0.35%
Percentage of total emissions from all source categories in the six-state study area[e]			0.10–0.18%	0.03–0.05%	–	0.06–0.11%

[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 1.54, 2.37, 2.2×10^{-5}, and 1,700 lb/MWh, respectively, were used for the state of Arizona.

[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).

factor per megawatt-hour of power by conventional technologies is assumed (EPA 2009c). It is estimated that if the Brenda SEZ was fully developed, emissions avoided would range from 0.87 to 1.6% of total emissions of SO_2, NO_x, Hg, and CO_2 from electric power systems in the state of Arizona (EPA 2009c). Avoided emissions would be up to 0.40% 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 0.76% of SO_2, 0.35% of NO_x, and 0.86% of CO_2 emissions in the state of Arizona (EPA 2009a; WRAP 2009). These emissions would be up to 0.18% of total emissions from all source categories in the six-state study area. Power generation from fossil fuel–fired power plants accounts for about 68% of the total electric power generated in Arizona. The contribution of coal combustion is about 40%, followed by natural gas combustion of about 28%, and nuclear generation of about 25%. Thus, solar facilities to be built in the Brenda SEZ could reduce fuel-combustion-related emissions in

Arizona to some extent, but relatively less so than those built in other states with higher fossil use rates.

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 Brenda 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.

8.1.13.2.3 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).

8.1.13.3 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 Brenda SEZ (such as 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.

8.1.14 Visual Resources

8.1.14.1 Affected Environment

The proposed Brenda SEZ is located in La Paz County in southwestern Arizona. The western border of the SEZ is 32 mi (52 km) east of the California border. The SEZ occupies 3,878 acres (15.7 km^2) and extends nearly 5 mi (8 km) east to west and approximately 3 mi (5 km) north to south. The SEZ ranges in elevation from 1,110 ft (338 m) in the eastern portion to 1,230 ft (375 m) in the western portion.

The SEZ is within the Sonoran basin and range physiographic province. The physiographic province is typified by scattered low mountains and contains large tracts of federally owned land, most of which is used for military training. The Sonoran basin and range is slightly hotter than the Mojave basin and range and has large areas of palo verde-cactus shrub and giant saguaro cactus.

The SEZ lies within the Ranegras Plain, bounded by mountain ranges to the east, northeast, south, and west. The Bear Hills are located about 1.3 mi (2 km) southwest of the SEZ. Granite Wash Mountains rise about 7.3 mi (12 km) northeast of the SEZ. These mountains include peaks generally between 1,945 ft and 2,670 ft (593 and 814 m) in elevation. From the northwest to the southeast, the broad Ranegras Plain extends more than 40 mi (64 km) and is about 10 mi (16 km) wide. The location of the SEZ and surrounding mountain ranges are shown in Figure 8.1.14.1-1.

The SEZ is located within a broad plain, with the strong horizon line and surrounding mountain ranges being the dominant visual features. The surrounding mountains are generally various shades of brown, from tan to dark brown. In contrast, gray gravels and tan sands dominate the desert floor, which is dotted with the olive green of creosotebush and the deeper greens of saguaro, ocotillo, barrel, and other cacti.

Vegetation within the SEZ is predominantly scrubland, with creosotebush and other low shrubs dominating the Ranegras Plain within the SEZ. Vegetation is generally sparse in much of the SEZ, with widely spaced shrubs growing on more or less barren gravel flats. The southwest portion of the SEZ is more densely vegetated with various trees and shrubs in addition to cacti, and in some areas, the vegetation is tall enough to partially screen views across the plain. The saguaro and ocotillo add interesting vertical line and color contrasts where they occur, and the rounded forms of trees add form and color contrast in some areas. During a September 2009 site visit, the vegetation presented a range of greens (mostly olive green of creosotebushes, but with deeper green trees and cacti in some locations) and some grays and tans (from lower shrubs). Vegetation texture was medium to coarse, with generally low visual interest in areas dominated by creosotebush and higher visual interest levels in areas containing cacti and trees.

No permanent surface water is present within the SEZ; however, the intermittent Bouse Wash runs through the eastern portion of the SEZ, extending from northwest to southeast.

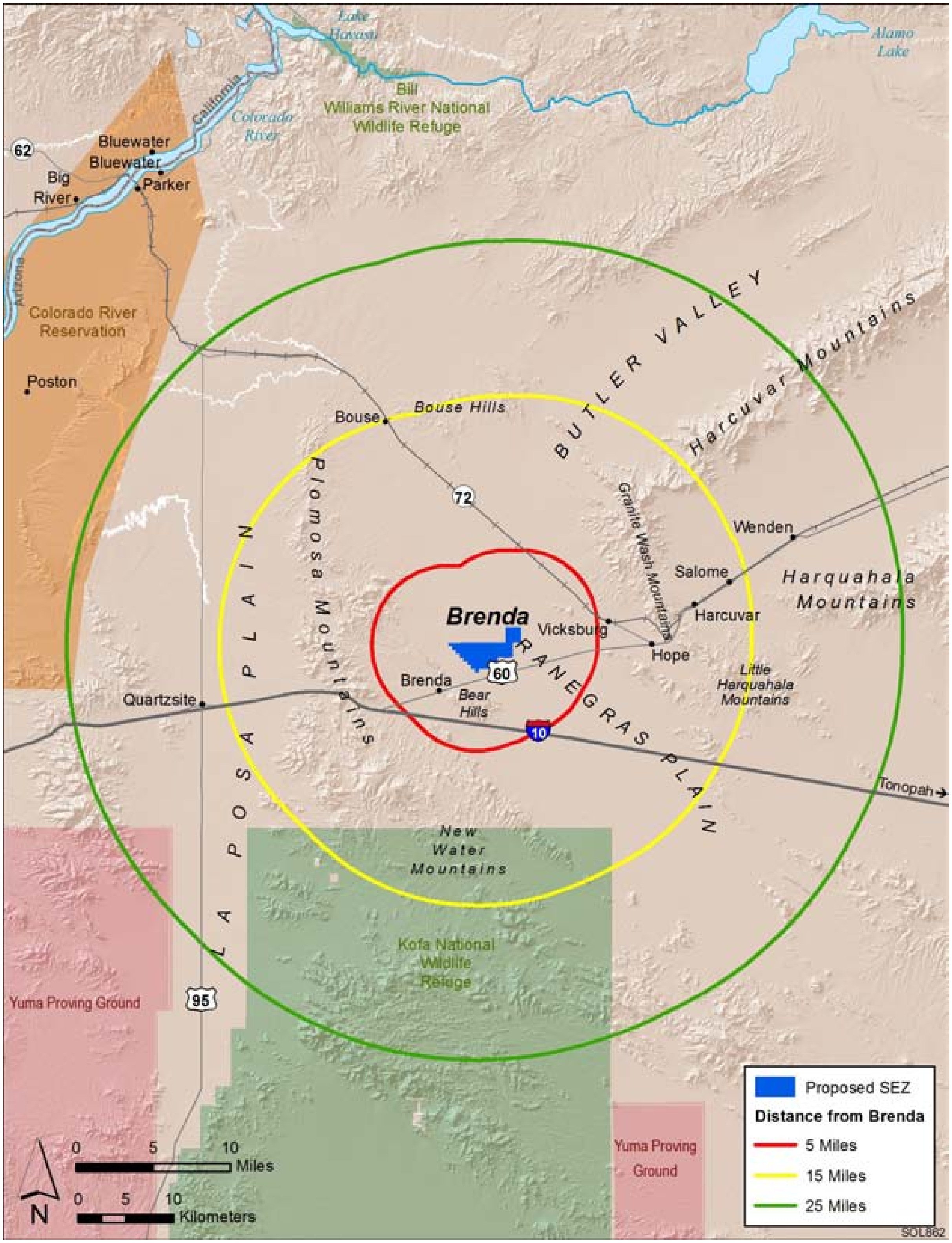

FIGURE 8.1.14.1-1 Proposed Brenda SEZ and Surrounding Lands

Cultural disturbances visible within the SEZ include dirt roads and a corral and well on the western edge of the SEZ. The SEZ is currently grazed. These cultural modifications generally detract somewhat from the scenic quality of the SEZ; however, the SEZ is large enough that from many locations within it, these features either are not visible or are so distant that they have minimal effect on views. From most locations within the SEZ, the landscape is generally natural in appearance, with little disturbance visible.

Off-site cultural disturbances visible from the SEZ include traffic on U.S. 60 and I-10, 0.5 mi (0.7 km) and 3.4 mi (5.4 km) south of the SEZ at the points of closest approach, respectively; unpaved roads; residential and other structures along U.S. 60; agricultural lands and associated structures; livestock corrals; and fences. In general, these cultural disturbances detract from scenic values of the SEZ, primarily in the southern and eastern portions of the SEZ.

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 and the breadth of the Ranegras Plain, the SEZ presents a vast panoramic landscape with sweeping views of the surrounding mountains that add to the scenic values within the SEZ viewshed. In general, the mountains appear to be devoid of vegetation, and their varied and irregular forms and various shades of brown provide visual contrasts to the strong horizontal line, green vegetation, and gray gravels and tan sands of the valley floor. In particular, the Bear Hills and the Plomosa Mountains add significantly to scenic values when viewed from the nearby western portions of the SEZ. The mountains surrounding the SEZ generally are visually pristine. Panoramic views of the SEZ and the surrounding mountains are shown in Figures 8.1.14.1-2, 8.1.14.1-3, and 8.1.14.1-4.

The BLM conducted a visual resource inventory (VRI) for the SEZ and surrounding lands in 2010; however, the VRI was not completed in time for the new data to be included in the draft PEIS. The new VRI data will be incorporated into the analyses presented in the final PEIS. 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 key observation points (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).

FIGURE 8.1.14.1-2 Approximately 180° Panoramic View of the Proposed Brenda SEZ from West Central Portion of SEZ, Facing West toward Bear Hills (Left of Center) and Plomosa Mountains (Center and Right)

FIGURE 8.1.14.1-3 Approximately 120° Panoramic View of the Proposed Brenda SEZ from Far Eastern Portion of SEZ Facing West toward Granite Wash Mountains

FIGURE 8.1.14.1-4 Approximately 120° Panoramic View of the Proposed Brenda SEZ from Far Western Boundary of SEZ Facing East–Northeast with Plomosa Mountains at Left

The *Record of Decision and Lake Havasu Field Office Approved Resource Management Plan* (BLM 2007a) indicates that the SEZ is managed as visual resource management (VRM) Class IV. VRM Class IV permits major modification of the existing character of the landscape. More information about the BLM VRM program is available in Section 5.12 and in *Visual Resource Management,* BLM Manual Handbook 8400 (BLM 1984).

8.1.14.2 Impacts

The potential for impacts from utility-scale solar energy development on visual resources within the proposed Brenda SEZ and surrounding lands, as well as the impacts of related developments (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 assess precisely 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 is 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 thus 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 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.

8.1.14.2.1 Impacts on the Proposed Brenda 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 night sky pollution impacts, such as increased skyglow, light spillage, and glare, 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 8.1.22.4.13 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. VRM Class IV is the current VRM Class designation for the proposed Brenda SEZ. 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.

8.1.14.2.2 Impacts on Lands Surrounding the Proposed Brenda 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 are visible from 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 8.1.14.2-1 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, and dark purple, and at least the upper portions of power tower receivers could 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 the figures and discussed in the text. These heights represent the maximum and minimum landscape visibility for solar energy technologies analyzed in this PEIS. Viewsheds for solar dish and CSP technology power blocks (38 ft [11.6 m]) and for 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.

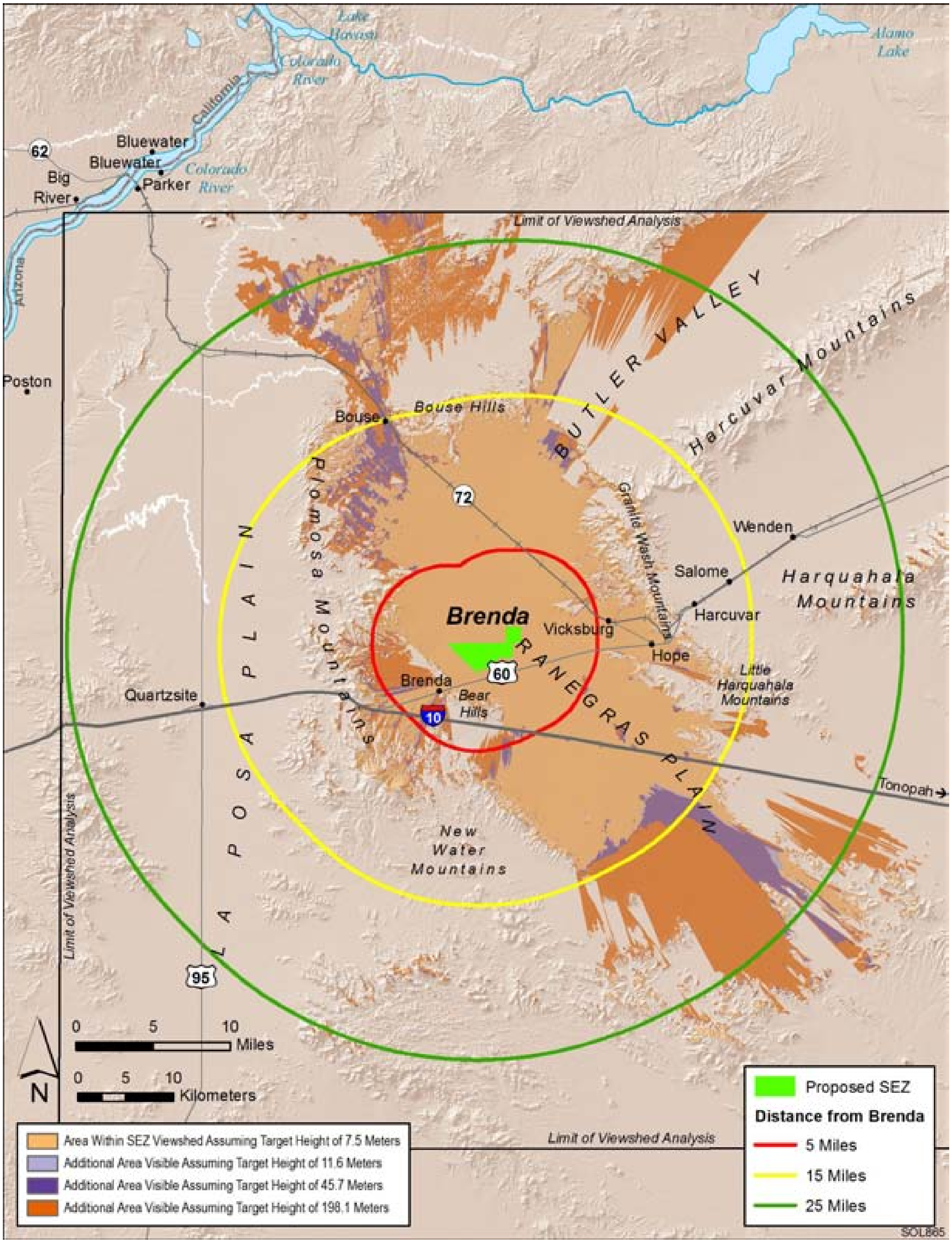

FIGURE 8.1.14.2-1 Viewshed Analyses for the Proposed Brenda SEZ and Surrounding Lands, Assuming Solar Technology Heights of 24.6 ft (7.5 m), 38 ft (11.6 m), 150 ft (45.7 m), and 650 ft (198.1 m) (shaded areas indicate lands from which solar development within the SEZ could be visible)

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

Figure 8.1.14.2-2 shows the results of a geographical information system (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 could 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.

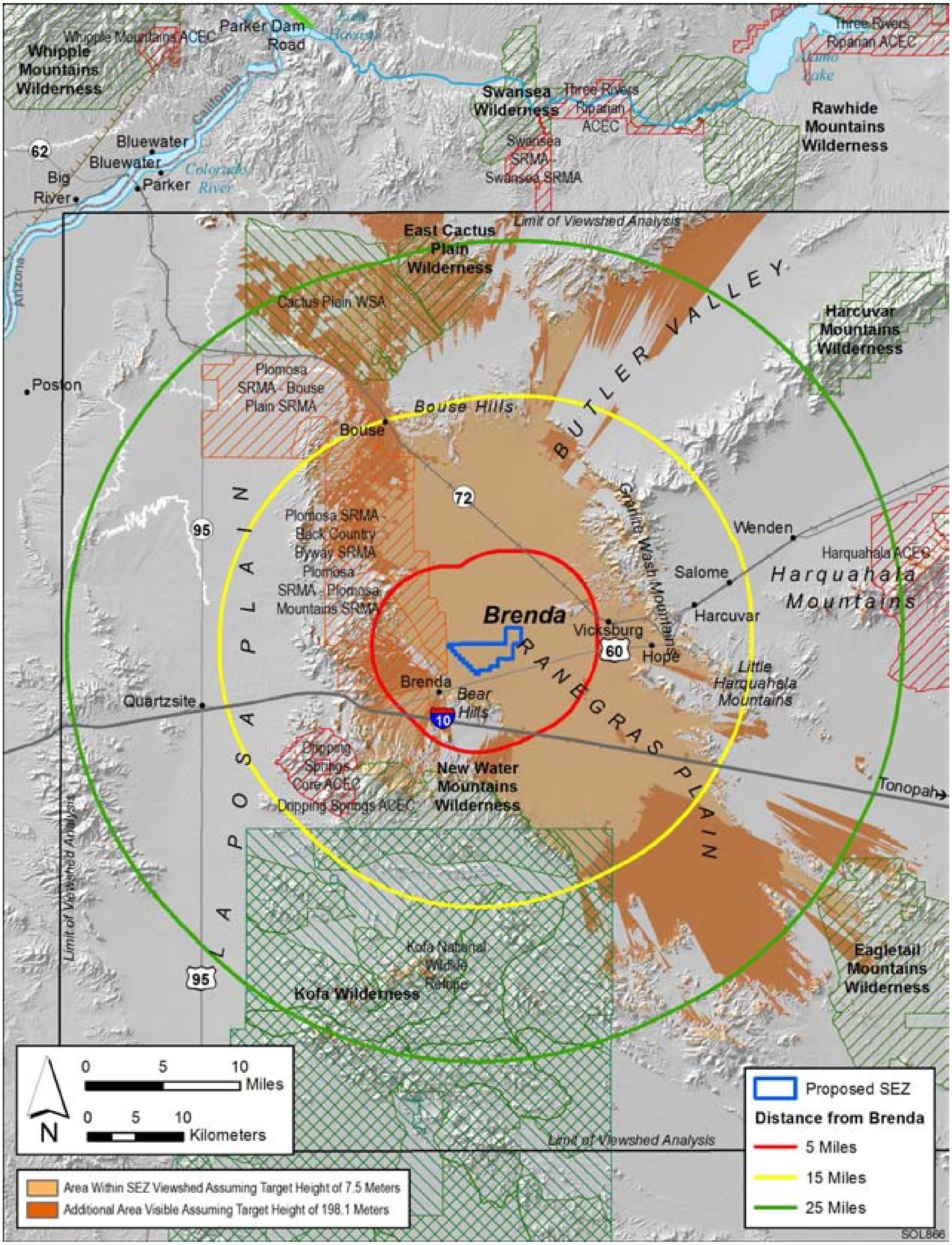

FIGURE 8.1.14.2-2 Overlay of Selected Sensitive Visual Resource Areas onto Combined 650-ft (198.1-m) and 24.6-ft (7.5-m) Viewsheds for the Proposed Brenda SEZ

Potential impacts on specific sensitive resource areas visible from and within 25 mi (40 km) of the proposed Brenda SEZ are discussed below. The results of this analysis are also summarized in Table 8.1.14.2-1. Further discussion of impacts on these areas is available in Section 8.1.3 (Specially Designated Areas and Lands with Wilderness Characteristics) and Section 8.1.17 (Cultural Resources) of this 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 changes in the forms, lines, colors, and textures of objects seen. 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 this 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.

TABLE 8.1.14.2-1 Selected Potentially Affected Sensitive Visual Resources within 25-mi (40-km) Viewshed of the Proposed Brenda SEZ, Assuming a Target Height of 650 ft (198.1 m)

		Feature Area or Linear Distance[a]		
			Visible between	
Feature Type	Feature Name (Total Acreage)	Visible within 5 mi	5 and 15 mi	15 and 25 mi
WAs	East Cactus Plain (14,318 acres)	0 acres	0 acres	9,888 acres (69%)[b]
	Kofa (547,739 acres)	0 acres	1,553 acres (0.3%)	5,019 acres (0.9%)
	New Water Mountains (24,628 acres)	0 acres	4,124 acres (17%)	0 acres
WSA	Cactus Plain (58,893 acres)	0 acres	0 acres	27,908 acres (47%)
Wildlife Refuge	Kofa (665,435 acres)	0 acres	7,122 acres (1%)	5,756 acres (0.9%)
SRMAs	Plomosa Backcountry Byway (5,987 acres)	0 acres	5,219 acres (87%)	152 acres (3%)
	Plomosa Bouse Plain (75,085 acres)	14,094 acres (19%)	22,272 acres (30%)	1,862 acres (3%)
	Plomosa Mountains (28,112 acres)	5,050 acres (18%)	5,085 acres (18%)	444 acres (2%)
ACECs designated for outstanding scenic values	Dripping Springs (11,081 acres)	0 acres	420 acres (4%)	0 acres
	Harquahala (77,201 acres)	0 acres	0 acres	139 acres (0.2%)

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

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

Wilderness Areas

- *East Cactus Plain*—East Cactus Plain is a 14,318-acre (58-km^2) congressionally designated wilderness area (WA) located 20 mi (32 km) north of the SEZ. Recreation such as backpacking, day hiking, sightseeing, horseback riding, and botanical and wildlife study are enhanced by varying dune topography, colors, and vegetation of the WA. Wilderness visitation is estimated at less than 200 visits annually.

Within the WA, visibility of solar facilities within the SEZ would be limited almost entirely to the upper portions of tall power towers. This area includes about 9,888 acres (40 km^2) in the 650-ft (198.1-m) viewshed, or 69% of the total WA acreage, and 6 acres (0.02 km^2) in the 24.6-ft (7.5-m) viewshed, or 0.04% of the total WA acreage. The visible area of the WA extends beyond 25 mi (40 km) from the northern boundary of the SEZ.

Most of the WA is about 100 to 200 ft (30 to 60 m) higher in elevation than the SEZ, with a much smaller area 300 to 400 ft (90 to 120 m) higher than the SEZ. At a distance of 20 to 25 mi (32 to 40 km), the vertical angle of view is very low, and only the upper portions of sufficiently tall power towers would be visible from most of the WA. Power tower receivers would appear as points of light just above the southern horizon, against a backdrop of the Bear Hills. At night, if sufficiently tall, power towers could have red or white flashing hazard navigation lighting that could potentially be visible from the WA. A very small area at the highest elevation within the WA could see lower height facilities in favorable viewing conditions, but from the long distance and very low viewing angle, the SEZ would occupy a very small portion of the horizontal field of view. Solar energy development within the SEZ would not be visible at all from large portions of the WA, and from the areas where it could be seen, the expected visual contrast levels would be minimal.

- *Kofa*—Kofa is a 547,739-acre (2,217-km^2) congressionally designated WA located 14 mi (22 km) south of the SEZ. Wildlife management is the primary function of the Kofa WA, and all other uses are secondary. At Kofa, hunting, camping, rock climbing and repelling, hiking, wildlife observation, photography, sightseeing, and environmental education activities are allowed and considered compatible.

  Within 25 mi (40 km) of the SEZ, solar energy facilities within the SEZ could be visible from the northeastern portions of the WA (about 6,572 acres [26.60 km^2] in the 650-ft [198.1-m] viewshed, or 1% of the total WA acreage, and 1,749 acres [7.078 km^2] in the 25-ft [7.5-m] viewshed, or 0.3% of the total WA acreage). The area of the WA with potential visibility of solar facilities within the SEZ extends to 24 mi (38 km) from the southern boundary of the SEZ.

  Within the WA, visibility of the SEZ would be limited to the highest peaks in the central portion of the WA and to the far northeastern corner and far eastern side of the WA. Within the central portion of the WA, views of the SEZ would be nearly completely screened by the intervening peaks of the Kofa Mountains, the New Water Mountains, and the Bear Hills north of the Kofa Mountains. Although the viewpoints are significantly elevated with respect to the SEZ, the angle of view would be low and the topographic screening of the SEZ would reduce its visibility to such an extent that it would occupy a very small portion of the horizontal field of view. Where a clear line of sight to power towers within the SEZ existed, the receivers of operating power towers would appear as points of light just above the northern horizon. At night, if sufficiently tall, power towers could have red or white flashing hazard navigation lighting that could potentially be visible from the WA. As seen from these viewpoints, expected visual contrasts from solar energy development within the SEZ would be minimal.

In the far northeastern corner and eastern side of the WA, there would be more open views of the SEZ, although the eastern end of the Bear Hills would provide partial screening of the SEZ from most locations. Elevated viewpoints within the WA could be as much as 800 ft (240 m) higher than the SEZ, but at distances of 16 to 25 mi (26 to 40 km), the vertical angle of view would be very low, and the partial topographic screening would reduce the visible portion of the SEZ so that it would occupy a very small portion of the horizontal field of view. Where solar facilities were visible within the SEZ, they would be seen edge-on, which would minimize their apparent size, and they would appear as short, thin lines just above the horizon and would replicate the strong horizon line, which would tend to reduce visual contrast. As seen from these viewpoints, expected visual contrasts from solar energy development within the SEZ would be weak.

In general, as seen from viewpoints in the WA, visual contrasts associated with solar facilities within the SEZ would depend on viewer location within the WA, the numbers, types, sizes and locations of solar facilities in the SEZ, and other project- and site-specific factors. Under the 80% development scenario analyzed in the PEIS, where there were unobstructed views, contrasts would be expected to be minimal to weak.

- *New Water Mountains*—New Water Mountains is a 24,628-acre (100-km^2) congressionally designated WA located 6.5 mi (10.5 km) at the point of closest approach south of the SEZ. The *Yuma Field Office Record of Decision and Approved Resource Management Plan* (BLM 2010c) states that recreation within the New Water Mountains Wilderness is to include sustainable opportunities for hiking, camping, hunting, and rock hounding.

  Within 25 mi (40 km), solar energy facilities within the SEZ could be visible from the northern portions of the mountains within the WA. Areas of the WA with potential visibility of solar facilities within the SEZ within the 25-mi (40-km) radius of analysis total about 4,124 acres (16.69 km^2) in the 650-ft (198.1-m) viewshed, or 17% of the total WA acreage, and 3,016 acres (12.21 km^2) in the 24.6-ft (7.5-m) viewshed, or 12% of the total WA acreage. The visible area of the WA extends to about 8.5 mi (13.7 km) from the southern boundary of the SEZ.

Figure 8.1.14.2-3 is a Google Earth visualization of the SEZ as seen from the western portion of Black Mesa, at nearly the highest elevation within the WA, and with the clearest view of the SEZ of any area in the WA. The visualization includes a simplified wireframe model of a hypothetical solar power tower facility. The model was placed within the SEZ as a visual aid for assessing the approximate size and viewing angle of utility-scale solar facilities. The receiver tower depicted in the visualization is a properly scaled model of a 459-ft (140-m) power tower with an 867-acre (3.5-km^2) field of 12-ft (3.7-m) heliostats, representing about 100 MW of electric generating capacity. One model was placed in the SEZ for this and other visualizations shown in this section of this PEIS. In the visualization, the SEZ area is depicted in orange, the heliostat field in blue.

The viewpoint in the visualization is about 1,300 ft (400 m) higher in elevation than the SEZ, and about 9.2 mi (14.8 km) from the SEZ. The SEZ is visible just above a large gap in the Bear Hills southwest of the SEZ, with some screening of the eastern portion of the SEZ by intervening mountains. The SEZ is far enough from the viewpoint that it would occupy a moderate amount of the horizontal field of view. From this elevated location, the tops of solar collector/reflector arrays within the SEZ would be visible: this would make their large areal extent apparent and would tend to reveal their strong regular geometry. Taller solar facility components, such as transmission towers, could be visible projecting above the collector/reflector arrays. Power towers within the SEZ might appear as bright points of light against the backdrop of the plain, and the supporting tower structures would likely be visible. At night, if sufficiently tall, power towers could have red or white flashing hazard navigation lights that would likely be visible from this location. Depending on project location within the SEZ, the types of solar facilities and their designs, and other visibility factors, under the 80% development scenario analyzed in this PEIS, weak to moderate visual contrasts from solar energy facilities within the SEZ could be expected at this location.

Most other locations within the WA would be at lower elevations, which would be expected to decrease the vertical angle of view and increase the likelihood and extent of screening of the SEZ, so that minimal to weak visual contrast would be expected from solar energy development within the SEZ.

Visual contrasts associated with solar energy development within the SEZ would depend on viewer location within the WA; solar facility type, size, and location within the SEZ; and other visibility factors. Under the 80% development scenario analyzed in this PEIS, minimal to weak levels of visual contrast would be expected, with potentially moderate levels of contrast expected for the highest elevations within the WA that have clear lines of sight to the SEZ. The highest contrast levels would be expected for peaks in

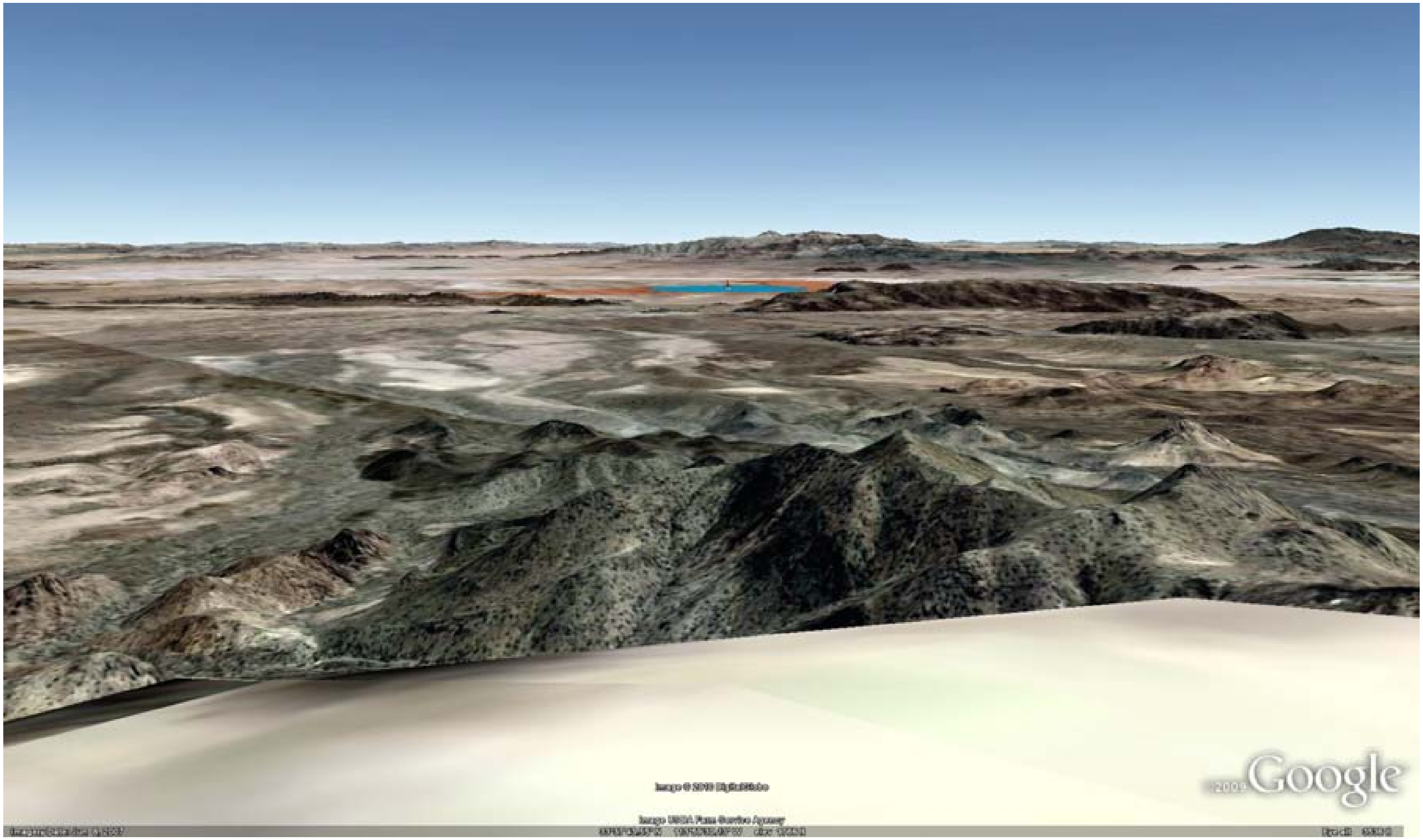

FIGURE 8.1.14.2-3 Google Earth Visualization of the Proposed Brenda SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from Viewpoint on Black Mesa in the New Water Mountains WA

the northern part of the WA, with lower contrasts expected for lower elevations and viewpoints in the southern part of the WA.

Wilderness Study Area

- *Cactus Plain*—The 58,893-acre (238-km^2) Cactus Plain WSA is 18 mi (29 km) northwest of the SEZ at the closest point of approach. According to the *Record of Decision and Lake Havasu Field Office Approved Resource Management Plan* (BLM 2007a), the WSA will be managed in a manner that does not impair the suitability of the area for the future designation as wilderness by Congress. About 27,908 acres (112.94 km^2), or 47% of the WSA, is within the 650-ft (198.1-m) viewshed of the SEZ, and 6,483 acres (26.24 km^2), or 11% of the WSA, is within the 24.6-ft (7.5-m) viewshed. The portions of the WSA within the viewshed extend from the point of closest approach to beyond 25 mi (40 km) from the SEZ.

  The SEZ is visible from the Cactus Plain WSA through a gap between the Plomosa Mountains and the Bouse Hills; however, most of the WSA is at a slightly lower elevation than the SEZ, and at more than 18 mi (29 km) from the SEZ, the angle of view to the SEZ would be very low. In addition, the far western portion of the Bouse Hills provides partial screening of the SEZ from portions of the WSA, so that the SEZ occupies a very small portion of the horizontal field of view. Where solar facilities were visible within the SEZ, they would be seen edge-on, and the collector/reflector arrays would be seen as extremely thin and short lines just at the southern horizon. The receivers of operating power tower within the SEZ would be seen as distant points of light just above the southern horizon, against a sky backdrop. At night, if sufficiently tall, power towers could have red or white flashing hazard navigation lights that could be visible from the WSA. Under the 80% development scenario analyzed in this PEIS, minimal visual contrast would be expected for viewpoints in the Cactus Plain WSA.

National Wildlife Refuge

- *Kofa*—The 665,435-acre (2,692.92-km^2) Kofa NWR is 10 mi (16 km) south of the SEZ at the closest point of approach. The refuge encompasses pristine desert. About 12,878 acres (52.115 km^2), or 2% of the NWR, is within the 650-ft (198.1-m) viewshed of the SEZ, and 5,573 acres (22.55 km^2), or 0.8% of the NWR, is 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 23 mi (37 km) from the SEZ.

  Within the NWR, visibility of the SEZ is limited to the highest peaks in the north central portion of the NWR and to the far northeastern corner of the NWR, with a few very small areas scattered along the peaks of the New Water

Mountains along the northern boundary of the NWR. Within the north central portion of the NWR, views of the SEZ are nearly completely screened by the intervening peaks of the Kofa Mountains, the New Water Mountains, and the Bear Hills north of the Kofa Mountains. Although the viewpoints are significantly elevated with respect to the SEZ, the angle of view is low and the topographic screening of the SEZ reduces its visibility such that it would occupy a very small portion of the horizontal field of view. Where a clear line of sight to power towers within the SEZ existed, the upper portions of the towers would appear as points of light just above the northern horizon. At night, if sufficiently tall, power towers could have red or white flashing hazard navigation lights that could be visible from the NWR. As seen from these viewpoints, expected visual contrasts from solar energy development within the SEZ would be minimal.

In the far northeastern corner of the NWR, there are more open views of the SEZ, although the eastern end of the Bear Hills provides partial screening of the SEZ from most locations. Elevated viewpoints within the NWR could be more than 1,000 ft (300 m) higher than the SEZ, and at distances of 11 to 15 mi (18 to 24 km), the vertical angle of view is high enough that the tops of solar collector/reflector arrays could be visible, making the large size and the strong regular geometry of the arrays apparent. The partial topographic screening of views of the SEZ by the Bear Hills would reduce the visible portion of the SEZ, so that it would occupy a small portion of the horizontal field of view.

In general, as seen from viewpoints in the Kofa NWR, visual contrasts associated with solar facilities within the SEZ would depend on viewer location within the NWR; the numbers, types, sizes and locations of solar facilities in the SEZ; and other project- and site-specific factors. Under the 80% development scenario analyzed in the PEIS, where there were unobstructed views, contrasts would be expected to be minimal to weak.

Special Recreation Management Area

The Plomosa Mountains SRMA consists of three adjacent units. Information about the units is presented separately below, but the impact analysis treats them as one SRMA.

- *Plomosa Backcountry Byway*—The Plomosa Backcountry Byway SRMA is a BLM-designated SRMA located 9.2 mi (14.8 km) northwest of the SEZ at the point of closest approach. It is a 5,987-acre (24.23-km^2) scenic route providing cultural/historical sightseeing, vistas, and photography.

  The area of the SRMA within the 650-ft (198.1-m) viewshed of the SEZ includes 5,371 acres (21.73 km^2), or 90% of the total SRMA acreage. The area of the SRMA within the 24.6-ft (7.5-m) viewshed of the SEZ includes 763 acres (3.09 km^2), or 13% of the total SRMA acreage. The visible area extends from the point of closest approach to almost 16 mi (26 km) into the SRMA.

- *The Plomosa Bouse Plain*—The Plomosa Bouse Plain SRMA is a BLM-designated SRMA located 0.2 mi (0.3 km) west of the western boundary of the SEZ. It contains 75,085 acres (303.86 km^2).

  Approximately 38,228 acres (154.70 km^2), or 51% of the SRMA, is within the 650-ft (198.1-m) viewshed of the SEZ, and 20,723 acres (83.863 km^2) is in the 24.6-ft (7.5-m) viewshed, or 28% of the total SRMA acreage. The visible area of the SRMA extends approximately 18 mi (29 km) from the northwestern boundary of the SEZ.

- *The Plomosa Mountains*—The Plomosa Mountains SRMA is a BLM-designated SRMA located approximately 1 mi (1.6 km) west of the SEZ. It encompasses 28,112 acres (113.77 km^2).

  Approximately 10,579 acres (42.812 km^2), or 38% of the SRMA, is within the 650-ft (198.1-m) viewshed of the SEZ, and 7,029 acres (28.44 km^2) is in the 24.6-ft (7.5-m) viewshed, or 25% of the total SRMA acreage. The visible area of the SRMA extends approximately 6.5 mi (10.5 km) from the western boundary of the SEZ.

  Much of the area encompassed by the SRMA units is within the viewshed of the SEZ. SRMA areas within the viewshed include portions of SRMA units on the Ranegras Plain east of the Plomosa Mountains, and the eastern slopes of the Plomosa Mountains. The southwestern and northwestern portions of the collective SRMA are generally screened by the peaks within the eastern portion of the Plomosa Mountains.

  From those portions of the SRMA on the Ranegras Plain, although viewpoints are closer to the SEZ, the angle of view is very low because the elevation of the SRMA is similar to that of the SEZ. In the Plomosa Mountains, viewpoints on mountain peaks can be more than 1,000 ft (300 m) higher in elevation than the SEZ, so vertical angles of view are higher, though the distances may be greater. Farther west in the SRMA, intervening mountains tend to provide partial screening of views of the SEZ. Distances from viewpoints in this portion of the SRMA are long enough that the angle of view is low; this would cause solar facilities visible within the SEZ to appear edge-on, reducing associated visual contrast levels.

  Figure 8.1.14.2-4 is a Google Earth visualization of the SEZ as seen from a nearby point on an unpaved road within the Plomosa Mountains unit of the SRMA. The road is a major access road to the SRMA from the community of Brenda, and the viewpoint is at the base of the Bear Hills, about 1.1 mi (1.8 km) from the nearest point on the northwest corner of the SEZ, and at

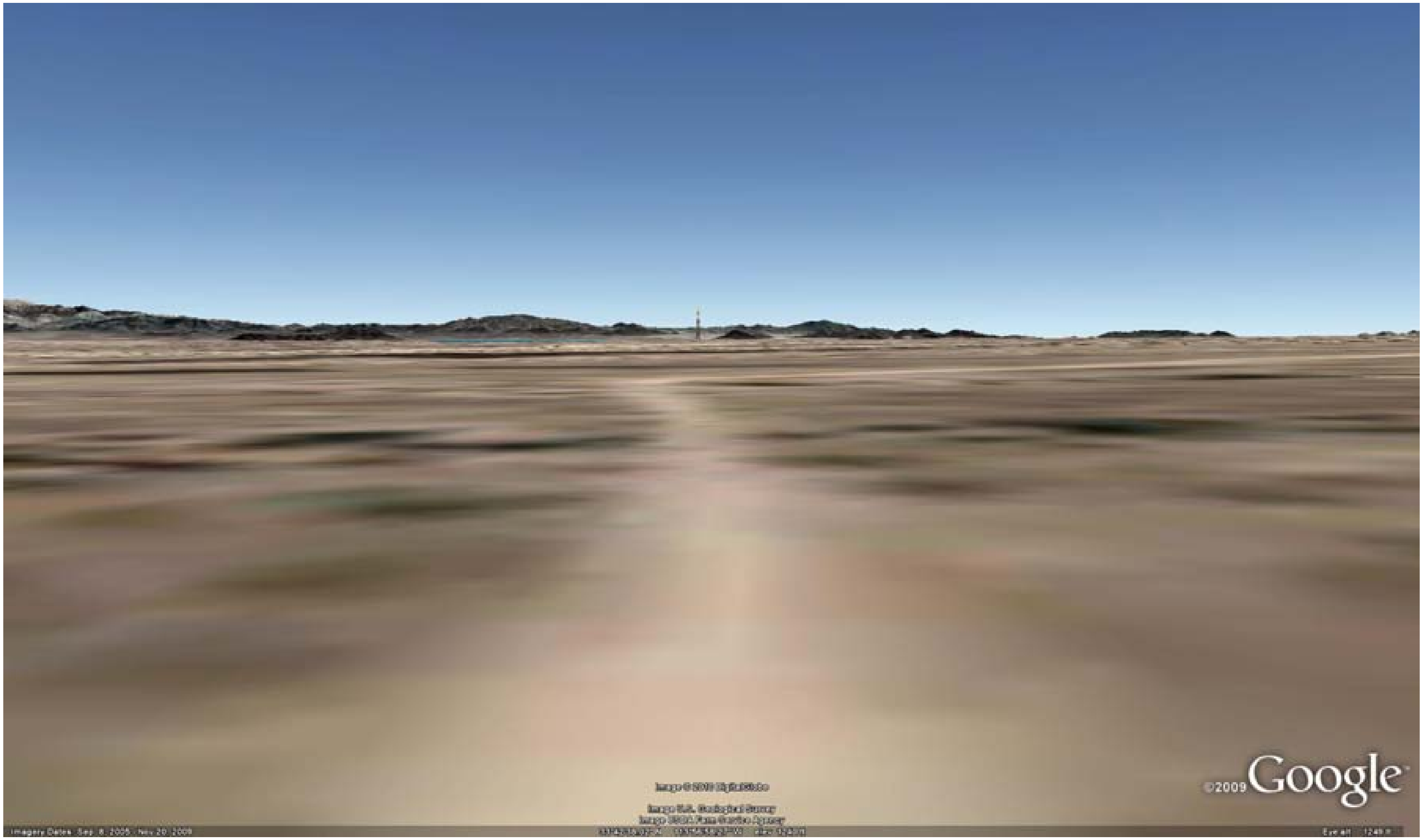

FIGURE 8.1.14.2-4 Google Earth Visualization of the Proposed Brenda SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from Viewpoint on Access Road from Brenda in Plomosa Mountains SRMA

nearly the same elevation as the SEZ. The visualization suggests that from this viewpoint, some of the ground surface of the SEZ would be screened by a slight rise between the viewpoint and the SEZ, but the SEZ would still occupy most of the horizontal field of view. At the short viewing distance, taller solar facility components, such as power towers, buildings, cooling towers, and plumes could project noticeably above solar collector/reflector arrays and provide strong form, line, and color contrasts to the strongly horizontal collector/reflector arrays as well as the surrounding mostly natural appearing landscape. Details of project components could be discernable, likely increasing texture contrasts. Receivers on operating power towers within the SEZ could appear as brilliant nonpoint (i.e., having a cylindrical or rectangular visible surface area) light sources during the day and, if more than 200 ft (61 m) tall, would have navigation warning lights at night that could be very conspicuous from this location. Under the 80% development scenario analyzed in this PEIS, strong visual contrast levels from solar energy development within the SEZ would be expected at this viewpoint.

Figure 8.1.14.2-5 is a Google Earth visualization of the SEZ as seen from a point on an unpaved road within the Bouse Plain unit of the SRMA, about 1.9 mi (3.0 km) north–northwest of the northwest corner of the SEZ. The viewpoint elevation is about 35 ft (11 m) lower than the elevation of the nearest point on the SEZ, so the angle of view is very low, and the collector/ reflector arrays of solar facilities within the SEZ would be viewed edge-on, which would make their large areal extent and strong regular geometry less apparent. The low angle of view would also cause them to appear as lines on the horizon that would replicate the strong horizon line, tending to reduce visual contrasts levels.

Depending on the technology type, ancillary facilities such as STGs, transmission components, cooling towers, and buildings might project above the collector/reflector arrays, and could contrast in form, line, and color with the strongly horizontal arrays, as well as the surrounding mostly natural appearing landscape. Plumes (if present) could add further contrasts. The SEZ would occupy most of the horizontal field of view, and solar facilities within the SEZ would likely strongly attract visual attention. Receivers on operating power towers within the SEZ could appear as brilliant nonpoint light sources during the day and, if more than 200 ft (61 m) tall, could have navigation warning lights at night that could be very conspicuous from this location. Under the 80% development scenario analyzed in this PEIS, strong visual contrast levels from solar energy development within the SEZ would be expected at this viewpoint.

FIGURE 8.1.14.2-5 Google Earth Visualization of the Proposed Brenda SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from Viewpoint on Access Road from Brenda in Bouse Plain Unit of the Plomosa Mountains SRMA

Figure 8.1.14.2-6 is a Google Earth visualization of the SEZ as seen from a high peak within the Plomosa Mountains unit of the SRMA, about 5.1 mi (8.2 km) northwest of the northwest corner of the SEZ. The viewpoint elevation is about 1,200 ft higher than the elevation of the nearest point on the SEZ, so the angle of view is relatively high and the tops of solar collector/reflector arrays within the SEZ would be visible, which would tend to reveal their strong regular geometry and make their large size more apparent. The SEZ is far enough from the viewpoint that it would occupy a moderate amount of the horizontal field of view.

Taller ancillary facilities, such as buildings, transmission structures, and cooling towers; and plumes (if present) would likely be visible projecting above the collector/reflector arrays. 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.

Power towers within the SEZ might appear as very bright point light sources against the backdrop of the plain, and the supporting tower structures would be visible. If more than 200 ft (61 m) tall, power towers could have navigation warning lights at night that could be conspicuous from this location. Depending on project location within the SEZ, the types of solar facilities and their designs, and other visibility factors, under the 80% development scenario analyzed in this PEIS, strong visual contrasts from solar energy development within the SEZ could be expected at this location.

The paved roadway through the Plomosa Backcountry Byway unit is largely outside the lower height viewsheds of the SEZ, and from most points along the roadway, only the upper portions of sufficiently tall power towers at particular locations within the SEZ could be seen through narrow gaps in the intervening Plomosa Mountains. The receivers on these power towers would generally appear as bright lights just above the peaks and ridges of the Plomosa Mountains, but for road travelers, the glimpses would be fleeting, and associated impacts would be expected to be minimal. Where the roadway left the Plomosa Mountains east of the mountains, the lower elevation and longer distance to the SEZ would keep visibility of the SEZ and associated impacts minimal.

In summary, for those portions of the SRMA east of the Plomosa Mountains and within a few miles of the SEZ, strong visual contrasts associated with solar energy development within the SEZ would be expected, while viewpoints farther north in the unit would experience lower levels of contrast as the distance to the SEZ increased. The high peaks in the eastern part of the Plomosa Mountains with clear lines of sight to the SEZ could be subject to moderate to strong impacts depending on distance to the SEZ. Other areas in

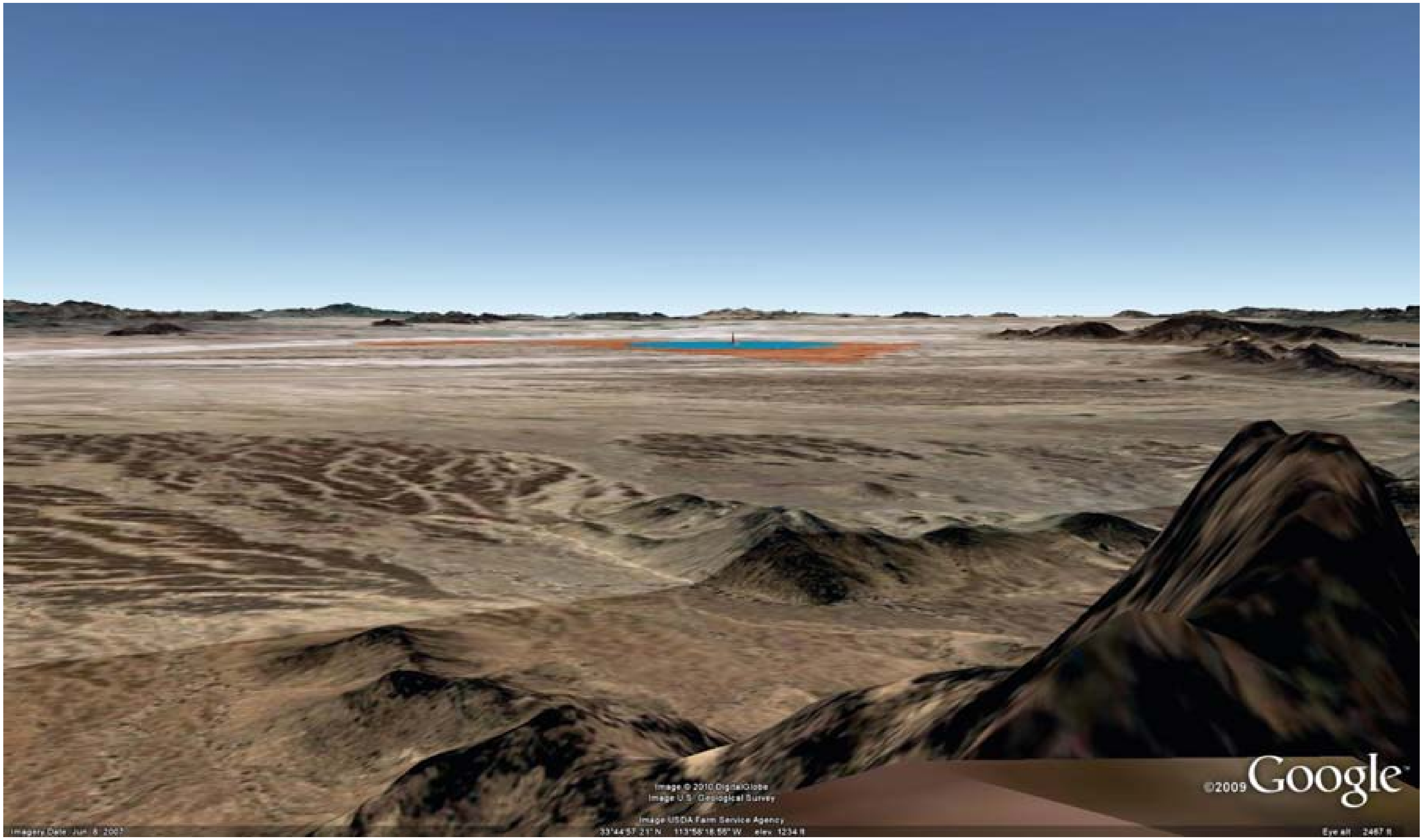

FIGURE 8.1.14.2-6 Google Earth Visualization of the Proposed Brenda SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Model, as Seen from Viewpoint on a Peak in the Plomosa Mountains Unit of the Plomosa Mountains SRMA

the SRMA would be subject to lower levels of contrast, and expected contrast levels for the Plomosa Backcountry Byway unit would be minimal, due primarily to very limited visibility of the SEZ.

ACECs Designated for Outstandingly Remarkable Scenic Values

- *Dripping Springs and Dripping Springs Core ACEC*—The 11,081-acre ($45-km^2$) Dripping Springs ACEC is located 9 mi (14.5 km) southwest of the SEZ at the closest point of approach. The Dripping Springs ACEC contains a combination of archaeological and historic features that are frequently visited by the public. An oasis with rock outcroppings, sheer cliffs along the backdrop of the area, exposed bedrock, and significant cholla stands add to the scenic value of the ACEC. The Dripping Springs Core ACEC is located 11 mi (17.7 km) southwest of the SEZ, entirely within the Dripping Springs ACEC.

  Approximately 420 acres ($1.7 km^2$), or 4% of the ACEC, is within the 650-ft (198.1-m) viewshed of the SEZ, and 127 acres ($0.5 km^2$) is in the 24.6-ft (7.5-m) viewshed, or 1% of the total ACEC acreage. The visible area of the ACEC extends approximately 12 mi (19.3 km) from the southern boundary of the SEZ.

  Visibility of the SEZ from the ACECs is limited to the highest elevations within the ACECs. From these locations, views of the SEZ are partially screened by peaks in the Plomosa Mountains relatively close to the ACECs and/or by the Bear Hills close to the SEZ. At a distance of approximately 11 mi (18 km), the angle of view is low enough that solar facilities within the SEZ would be seen nearly edge-on, which would decrease their apparent size and tend to conceal the strong regular geometry of the collector/reflector arrays. The solar arrays would appear as lines just over the Bear Hills and would be partially screened by the Bear Hills. Where visible, the facilities edge-on appearance would tend to replicate the line of the plain in which the SEZ is located, reducing visual contrast. Receivers on power towers within the SEZ could appear as bright points of light just above the Bear Hills during the day, and if more than 200 ft (61 m) tall, could have navigation warning lights at night that would likely be visible from the ACECs.

  Viewpoints at lower elevations within the ACECs would have slightly lower viewing angles, and would also be subject to greater screening by intervening terrain, and thus lower levels of visual contrast from solar energy development within the SEZ would be expected. Overall, under the 80% development scenario analyzed in this PEIS, minimal to weak levels of visual contrast for viewpoints within the Dripping Springs and Dripping Springs Core ACEC would be expected.

- *Harquahala*—The 77,201-acre (312.42-km^2) Harquahala ACEC is located 23 mi (37 km) east of the SEZ at the closest point of approach. The 5,691-ft (1,735-m) high Harquahala Peak, the highest point in southwest Arizona, provides a vast panorama of surrounding desert and distant mountain ranges and is accessible via the Harquahala Mountain Summit Road in the ACEC, although the summit itself is not within the SEZ 25-mi (40-km) viewshed.

  Approximately 139 acres (0.563 km^2), or 0.2% of the ACEC, is within the 650-ft (198.1-m) viewshed of the SEZ, and 74 acres (0.30 km^2) is in the 24.6-ft (7.5-m) viewshed, or 0.1% of the total ACEC acreage. The visible area of the ACEC extends approximately 12 mi (19 km) from the southern boundary of the SEZ.

  Visibility of solar facilities within the SEZ would be limited to the crest of a ridge running southwest to northeast across the ACEC. From the northwest side of this ridgeline, much of the SEZ is screened either by mountains in the Harquahala or Little Harquahala mountain ranges relatively close to the viewpoint, or by the Granite Wash Mountains close to the SEZ. At a distance between 23 and 25 mi (37 and 40 km) from the SEZ, the vertical angle of view is very low, and with the topographic screening, the SEZ occupies a very small portion of the horizontal field of view. If a clear line of sight to power towers within the SEZ existed, they would appear as distant points of light just above the peaks of the Little Harquahala Mountains during the day, and if more than 200 ft (61 m) tall, could have navigation warning lights at night that would likely be visible from the ACECs. Under the 80% development scenario analyzed in this PEIS, visual contrasts from solar energy development within the SEZ would be expected to 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, no suitable transmission line is within the proposed SEZ, so construction and operation of a transmission line outside the proposed SEZ would be required, and construction of transmission lines within the SEZ to connect facilities to the existing line would also be required. Note that depending on project- and site-specific conditions, visual impacts associated with access roads, and particularly with 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

U.S. 60. U.S. 60 runs parallel to the southern boundary of the Brenda SEZ, at a distance of about 0.4 mi (0.7 km) at the point of closest visible approach. The AADT value for U.S. 60 in the vicinity of the SEZ is about 1,500 vehicles (ADOT 2010), although traffic would increase slightly as a result of solar energy development within the SEZ. About 20 mi (32 km) of U.S. 60 is within the SEZ viewshed. About 13.4 mi (21.6 km) of U.S. 60 is within the 5-mi (8-km) viewshed of the SEZ; 5 mi (8 km) is the limit of the BLM VRM program's foreground-middleground distance.

Solar facilities within the SEZ would be in full view for westbound U.S. 60 travelers. The SEZ would come into view about 1.2 mi (1.9 km) east of Hope and about 9.6 mi (15.5 km) from the SEZ, after turning west while descending a pass in the Harquahala Mountains. At highway speeds, the SEZ would be in view for about 9 minutes before travelers would pass directly south of the SEZ on U.S. 60.

Because of the distance to the SEZ and low viewing angle, solar facilities within the SEZ would create weak levels of visual contrast after first coming into view, but contrast levels would reach moderate levels after just a few minutes. The SEZ would be in view directly in front of westbound vehicles. At 4.6 mi (7.4 km) from the SEZ, the road would turn slightly south so that it would point slightly south of the SEZ, and the SEZ would appear to move slightly to the right as vehicles rounded the curve. Visual contrast from solar facilities within the SEZ would quickly reach strong levels as vehicles approached the point of closest approach of U.S. 60 to the SEZ.

Figure 8.1.14.2-7 is a Google Earth visualization of the SEZ (highlighted in orange) as seen from U.S. 60 approximately 0.5 mi (0.8 km) from the southern boundary of the SEZ, near the point of closest approach. From this location, solar facilities within the SEZ would be seen edge-on, and they would repeat the strong line of the horizon; this would tend to reduce visual contrast. However, the SEZ is close enough that it would occupy more than the full horizontal field of view, and viewers would have to turn their heads to encompass the entire SEZ. Solar facilities within the SEZ would likely strongly command visual attention and would be expected to dominate views from U.S. 60 at this location.

Because the road is less than 0.5 mi (0.8 km) from the SEZ at this viewpoint, strong visual contrasts would be expected, depending on solar project characteristics and location within the SEZ. Details of collector array and other structures could be visible, and there would be strong contrasts of light and shadows falling between the collectors. Ancillary facilities taller than the solar collector/reflector arrays for a given facility could add strong form, line, color, and texture contrasts with the strongly horizontal arrays, and any visible plumes could be prominent, depending on lighting conditions. Views to the north of the SEZ could be completely or partially

FIGURE 8.1.14.2-7 Google Earth Visualization of the Proposed Brenda SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from Viewpoint on U.S. 60

screened by solar facilities, depending on the layout of those facilities within the SEZ. At night, facility lighting could be obvious and a potential source of light spill and glare.

Depending on lighting conditions, the solar technologies present, facility layout, and mitigation measures employed, the presence of large numbers of reflective surfaces very close to the roadway could potentially distract drivers and/or impair views toward the facilities. These potential impacts could be reduced by siting reflective components away from the byway, employing various screening mechanisms, and adjusting the mirror operations to reduce potential impacts. However, because of their height, power tower receivers located close to the roadway could be difficult to screen.

If power tower facilities in the SEZ were located close to the road, the receivers could appear as brilliant non-point light sources atop clearly discernable tower structures as viewed from the road and, if sufficiently close to the road, would likely strongly attract views, although they might be difficult for some people to look at for extended periods. Also, during certain times of the day from certain angles, sunlight on dust particles in the air might result in the appearance of light streaming down from the tower.

Eastbound travelers on U.S. 60 would have a much briefer and very different visual experience than those just described for westbound travelers. The western terminus of U.S. 60 is the I-10 interchange just west of Brenda and approximately 6.3 mi (10.1 km) west–southwest of the SEZ. The SEZ would be partially visible at that point, but weak levels of visual contrast would be expected because of partial screening of the SEZ by the Bear Hills. The SEZ would be partially visible through a narrow gap in the Bear Hills directly northeast of Brenda. At the interchange, the width of the gap is insufficient to permit a view of the entire SEZ from U.S. 60, but because U.S. 60 passes directly through the gap, the apparent width of the gap would increase as travelers approached Brenda. As travelers passed through Brenda and the Bear Hills gap just east of Brenda, the view of the Ranegras Plain and the SEZ would open up, and because the distance to the SEZ from the gap is about 2 mi (3.2 km), solar facilities within the SEZ would be in full view and likely to cause strong visual contrasts for travelers on U.S. 60.

Figure 8.1.14.2-8 is a Google Earth visualization of the SEZ (highlighted in orange) as seen from U.S. 60 just east of Brenda. Visual contrasts from solar energy development within the SEZ as seen from this viewpoint would depend on solar facility type, size, and location within the SEZ, but contrasts would likely peak at strong levels as eastbound travelers closely approached and passed the south side of the SEZ.

In summary, visual contrasts associated with solar energy development within the SEZ would be highly dependent on viewer location on U.S. 60; solar facility type, size, and location within the SEZ; and other visibility factors. Under the 80% development scenario analyzed in this PEIS, weak to strong visual contrast levels would be expected.

Interstate 10. I-10 passes within 3.3 mi (5.3 km) and is in the viewshed of the SEZ for about 20 mi (32 km). The AADT value for I-10 in the vicinity of the SEZ is about 18,000 vehicles (ADOT 2010). About 5 mi (8 km) of I-10 is within the 5-mi (8-km) viewshed

FIGURE 8.1.14.2-8 Google Earth Visualization of the Proposed Brenda SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from Viewpoint on U.S. 60 East of Brenda

of the SEZ; 5 mi (8 km) is the limit of the BLM VRM program's foreground-middleground distance.

For westbound travelers on I-10, the SEZ would come into view just west of a pass at the far southern end of the Little Harquahala Mountains, about 15 mi (24 km) from the SEZ. Because of the long distance to the SEZ and low viewing angle, solar facilities within the SEZ would create weak levels of visual contrast after first coming into view. At highway speeds, the SEZ would be in view for about 13 to 14 minutes before views of the SEZ would be cut off by screening from the Bear Hills directly south of the SEZ, at about 4.1 mi (6.7 km) from the SEZ. Facilities located within the SEZ, especially near the road, would attract the eye as travelers approached the SEZ, but would not be expected to dominate views because the forms of the Bear Hills, Plomosa Mountains, New Water Mountains, and Kofa Mountains would strongly attract views and would be directly in front of the vehicle. During the approach, the SEZ and associated solar facilities would gradually increase in apparent size and appear to move farther and farther to the right (north) as travelers approached the SEZ.

Figure 8.1.14.2-9 is a Google Earth visualization of the SEZ (highlighted in orange) as seen from I-10 approximately 5.4 mi (8.7 km) from the southeast corner of the SEZ. The viewpoint is about 20 ft (7 m) higher in elevation than the SEZ. From this location, collector/reflector arrays of solar facilities within the SEZ would be seen edge-on, and they would repeat the strong line of the horizon, which would tend to reduce visual contrast. However, the SEZ is close enough that it would occupy a moderate amount of the horizontal field of view. Visual contrasts from solar energy development within the SEZ as seen from this viewpoint would depend on solar facility type, size, and location within the SEZ, but would be expected to be moderate. Shortly after reaching this location, the Bear Hills would begin to screen the SEZ from view as travelers passed the SEZ to the south, so visual contrasts for westbound viewers on I-10 would not be expected to reach strong levels.

Eastbound travelers on I-10 would have a very different visual experience than westbound travelers. For eastbound travelers, the SEZ would first come into view as they approached the U.S. 60 interchange west of Brenda. The SEZ would be partially visible through a narrow gap in the Bear Hills directly northeast of Brenda. Because of the distance between the gap and I-10, the width of the gap is insufficient to permit a view of the entire SEZ from I-10, so travelers would get a brief partial "sweeping" view of solar facilities through the gap as they approached Brenda. The view duration would be about 3 to 4 minutes and would be cut off by screening from the Bear Hills just south of Brenda.

At the point of closest approach with maximum visibility through the gap (about 4.7 mi [7.5 km]), because there would be only a partial view of the SEZ through the gap, the SEZ would occupy only a small portion of the horizontal field of view, and the angle of view is low, because I-10 is about only about 200 ft (60 m) higher in elevation than the SEZ. In an open setting, this would be expected to create weak levels of visual contrast; however, eastbound travelers' views tend to focus on the conspicuous gap in the Bear Hills. This would focus visual attention on facilities visible through the gap, particularly if there were glinting or glare from reflective surfaces within the facilities, and especially if there were one or more power tower receivers

FIGURE 8.1.14.2-9 Google Earth Visualization of the Proposed Brenda SEZ (shown in orange tint) and Surrounding Lands, with Power Tower Wireframe Models, as Seen from Viewpoint on I-10

visible through the gap, as at this short distance, they could be very bright non-point light sources.

About 5.5 minutes after passing Brenda, the view of the SEZ for eastbound travelers would open up as they passed the eastern end of the Bear Hills, but by this point, their vehicles would be nearly past the SEZ. Only by turning their heads sharply left would they see solar development within the SEZ before very quickly passing to the east of the SEZ so that it would be behind them. At this point, for viewers looking at the SEZ, moderate levels of visual contrast form solar facilities within the SEZ would be expected.

In summary, visual contrasts associated with solar energy development within the SEZ would be highly dependent on viewer location on I-10; solar facility type, size, and location within the SEZ; and other visibility factors. Under the 80% development scenario analyzed in this PEIS, weak to moderate visual contrast levels would be expected.

Communities of Vicksburg, Brenda, and Hope. The viewshed analyses indicate visibility of the SEZ from the community of Vicksburg (approximately 5.8 mi [9.3 km]) east of the SEZ, the community of Brenda (approximately 2.5 mi [4 km] southwest of the SEZ), and the community of Hope (approximately 8.5 mi [14 km] east of the SEZ).

- Vicksburg is only slightly elevated with respect to the SEZ, so the angle of view to the SEZ from Vicksburg is low. Solar facilities within the SEZ would be seen nearly edge-on, and their collector/reflector arrays would appear as thin horizontal lines that would tend to repeat the strong line of the horizon, reducing visual contrast. Taller ancillary facilities, such as buildings, transmission structures, and cooling towers; and plumes (if present) would likely be visible projecting above the collector/reflector arrays. 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. If power towers were present in the SEZ, when operating they would likely appear as bright points of light atop discernable tower structures. If more than 200 ft (61 m) tall, power towers could have navigation warning lights at night that would likely be visible from Vicksburg. Weak to moderate levels of visual contrast would be expected.

- Hope is somewhat farther from the SEZ than Vicksburg, but 400 to 500 ft higher in elevation than the SEZ; however, solar facilities within the SEZ would still be seen nearly edge-on, with weak levels of visual contrast expected.

- The far northeastern end of Brenda is 2.3 mi (3.6 km) southwest of the SEZ, and the far southwestern end is about 3.1 mi (5.0 km) southwest of the SEZ. As noted above, the SEZ is visible from Brenda through a gap in the Bear

Hills (see Figure 8.1.14.2-8). Because the gap is just east of Brenda, the gap affords relatively open views of the SEZ. Brenda is roughly 100 ft (30 m) higher in elevation than the SEZ, so the angle of view is low; however, because of the short distance to the SEZ and despite partial screening of the SEZ by the Bear Hills and smaller hills between Brenda and the SEZ, moderate to strong visual contrast levels would be expected, depending on viewers' locations within Brenda. The walls of the gap would tend to "frame" views of solar facilities, which would tend to focus views on them, particularly if there were glinting or glare from reflective surfaces within the facilities and especially if there were one or more power tower receivers visible through the gap. If power towers were located within the portion of the SEZ closest to Brenda, they could appear as brilliant nonpoint light sources in the gap, seen against the backdrop of the Granite Wash Mountains northeast of the SEZ. Structures and trees within Brenda might screen some views of the SEZ, but there is little vegetation within Brenda, and the structures are generally low in height and widely spaced, so that screening opportunities would be minimal.

At night, if power towers more than 200 ft (61 m) tall were located within the SEZ, they could have flashing red or white hazard navigation lights that could be very conspicuous as viewed from Brenda. Other lighting associated with solar facilities within the SEZ could be visible from Brenda as well.

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, particularly U.S. 60 and I-10. 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.

8.1.14.2.3 Summary of Visual Resource Impacts for the Proposed Brenda SEZ

Because under the 80% development scenario analyzed in this PEIS there could be numerous solar facilities within the SEZ, a variety of technologies employed, and a range of supporting facilities that would contribute to visual impacts, a visually complex, man-made appearing industrial landscape could result. This essentially industrial-appearing landscape would contrast greatly with the surrounding generally natural-appearing lands. Large visual impacts on the SEZ and surrounding lands within the SEZ viewshed would be associated with solar energy development within the Brenda 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 and outside the SEZ.

The SEZ is in an area of low scenic quality. Visitors to the area, workers, and residents of Brenda, Vicksburg, Hope, and nearby areas 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. Residents of Brenda may experience moderate to strong visual contrasts from solar energy development within the SEZ as viewed from the community, and residents nearest to the SEZ along U.S. 60 could be subjected to strong visual contrasts from solar energy development within the SEZ.

Utility-scale solar energy development within the proposed Brenda SEZ is likely to result in weak to strong visual contrasts for some viewpoints within Plomosa SRMA, which is within 0.1 mi (0.2 km) of the SEZ at the point of closest approach. Minimal to weak visual contrasts would be expected for some viewpoints within other sensitive visual resource areas within the SEZ 25-mi (40 km) viewshed.

U.S. 60 passes very close to the SEZ, and travelers on that road could be subjected to strong visual contrasts from solar development within the SEZ, but typically their exposure would be brief. I-10 is farther from the SEZ but still close enough that travelers on that road could be subjected to moderate to strong visual contrasts from solar development within the SEZ at the closest points, but typically their exposure also would be brief.

8.1.14.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features have been identified to protect visual resources for the proposed Brenda SEZ. As noted in Section 5.12, the presence and operation of large-scale solar energy facilities and equipment would introduce major visual changes into non-industrialized landscapes and could create strong visual contrasts in line, form, color, and texture that could not easily be mitigated substantially. Implementation of the programmatic design features that are presented in Appendix A, Section A.2.2, would be expected to reduce the magnitude of visual impacts experienced; however, the degree of effectiveness of these design features could be assessed only at the site- and project-specific level. Because of the large-scale, reflective surfaces, and strong regular geometry of utility-scale solar energy facilities and the typical 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.

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8.1.15 Acoustic Environment

8.1.15.1 Affected Environment

The proposed Brenda SEZ is located in the south central portion of La Paz County in western Arizona. Neither the State of Arizona nor La Paz County has established quantitative noise-limit regulations applicable to solar energy development.

U.S. 60 runs east–west as close as about 0.4 mi (0.6 km) to the south, while I-10 runs east–west as close as about 3 mi (5 km) to the south of the proposed Brenda SEZ. State Route 72 runs northwest–southeast as close as 4 mi (6 km) to the northeast of the SEZ. A paved county road passes through the western portion of the SEZ. There are good access roads to the site from the south and west of the SEZ but minimal internal roads. The nearest railroad runs about 4 mi (6 km) northeast of the SEZ, parallel to State Route 72. Nearby airports include those in Salome and Quartzsite, about 14 mi (22 km) east and 17 mi (27 km) west of the SEZ, respectively. No industrial activities except grazing are located around the SEZ, and water development (wells) and corrals are developed on the western edge of the SEZ. Large-scale irrigated agricultural lands are situated around the SEZ, about 5 mi (8 km) to the southeast and 6 mi (10 km) to the north–northeast. No sensitive receptors (e.g., hospitals, schools, or nursing homes) exist very close to the proposed Brenda SEZ. The nearest residences from the SEZ boundary are about 0.3 mi (0.5 km) to the southeast. Several RV/trailer parks have developed along U.S. 60, from Pioneer, 0.4 mi (0.6 km) to the south of the SEZ to Brenda, 2 mi (3.2 km) to the southwest of the SEZ. The nearby population centers with schools include Salome, about 14 mi (22 km) east–northeast of the SEZ; Bouse, about 15 mi (24 km) north–northwest; and Quartzsite, about 16 mi (26 km) west. Accordingly, noise sources around the SEZ include road traffic, railroad traffic, infrequent aircraft flyover, animal grazing, and occasional community activities and events. Other noise sources are associated with current land use around the SEZ, including probable outdoor recreation and OHV use. The proposed Brenda SEZ is mostly undeveloped, the overall character of which is considered rural. To date, no environmental noise survey has been conducted around the proposed Brenda SEZ. On the basis of the population density, the day-night average noise level (L_{dn} or DNL) is estimated to be 28 dBA L_{dn} for La Paz County, below the range of 33 to 47 dBA L_{dn} typical of a rural area (Eldred 1982; Miller 2002).[10]

8.1.15.2 Impacts

Potential noise impacts associated with solar projects in the Brenda SEZ would occur during all phases of the projects. During the construction phase, potential noise impacts associated with operation of heavy equipment and vehicular traffic on the nearest residences (about 0.3 mi [0.5 km] to the southeast of the SEZ boundary) would be anticipated, albeit of short duration. During the operations phase, potential impacts on nearby residences would be

[10] 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.

anticipated, depending 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 Brenda 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 8.1.15.3 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.

8.1.15.2.1 Construction

The proposed Brenda 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 are 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; thus 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 residences closest to the southeastern SEZ boundary, estimated noise levels at the nearest residences would be about 55 dBA, which is well above the typical daytime mean rural background level of 40 dBA. However, this noise might be masked by road traffic on U.S. 60 to some extent. In addition, an estimated 51-dBA L_{dn}[11] at these residences is below the EPA guidance of 55 dBA L_{dn} for residential areas.

In addition, noise levels were estimated at specially designated areas within 5 mi (8 km) of the proposed Brenda SEZ, which is the farthest distance that noise (except extremely loud noise) would be discernable. There is only one specially designated area within this area:

[11] For this analysis, background levels of 40 and 30 dBA for daytime and nighttime hours, respectively, were assumed, which resulted in a day-night average noise level (L_{dn}) of 40 dBA.

Plomosa SRMA, which is located as close as 700 ft (210 m) west of the SEZ. Noise levels of 60 dBA and 50 dBA are estimated at about 0.2 mi (0.3 km) and 0.5 mi (0.8 km) from the construction site, respectively. Thus, if construction would occur near the western SEZ boundary, areas within Plomosa SRMA (within 0.5 mi [0.8 km] from the SRMA boundary) could be disturbed by construction noise from the SEZ. As discussed in Section 5.10.2, sound levels above 90 dB are likely to adversely affect wildlife (Manci et al. 1988). Thus, construction noise is not likely to adversely affect wildlife except in areas directly adjacent to the construction site.

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 residences would be anticipated to be negligible, considering the distance (about 0.3 mi [0.5 km] from the SEZ boundary).

It is assumed that most construction activities would occur during the day, when noise is better tolerated, because of the masking effects of background noise than at night. In addition, construction activities for a utility-scale facility are temporary in nature (typically a few years). Construction within the proposed Brenda SEZ would cause some unavoidable but localized short-term noise impacts on neighboring communities, particularly for activities occurring near the southern proposed SEZ boundary, close to the nearby residences along U.S. 60.

Construction activities could result in various degrees of ground vibration, depending on the equipment used and construction methods employed. 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 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, including pile driving for dish engines.

It is assumed that a transmission line would be constructed to connect to the nearest regional power grid. A 161-kV transmission line is located about 19 mi (31 km) from the proposed Brenda SEZ; thus, construction of a transmission line over this relatively long distance would be needed to connect to the regional grid. For construction of transmission lines, noise sources and their noise levels might be similar to construction noise sources at an industrial facility of a comparable size. Transmission line construction for the Brenda SEZ could be performed in about two years. However, the area under construction along the transmission line ROW would move continuously, so no particular area would be exposed to noise for a prolonged period. Therefore, potential noise impacts on nearby residences along the transmission line ROW, if any, would be minor and temporary in nature.

8.1.15.2.2 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 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 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, including 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. On the basis of a 250-MW parabolic trough facility with a cooling tower (Beacon Solar, LLC 2008), simple noise modeling indicates that noise levels around the power block would be more than 85 dBA, 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 southeastern SEZ boundary, the predicted noise level would be about 47 dBA at the nearest residences, about 0.3 mi (0.5 km) from the SEZ boundary, which is higher than the typical daytime mean rural background level of 40 dBA. However, this noise might be masked by road traffic on U.S. 60 to some extent. If TES were not used (i.e., if the operation were limited to daytime, 12 hours only[12]), 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 residences, about 45 dBA L_{dn} would be estimated, which is well below the EPA guideline of 55 dBA L_{dn} for residential areas. 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 Brenda 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[13] 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 sound level (L_{dn}), 6-hour nighttime generation with TES is assumed after 12-hour daytime generation. For nighttime hours under

[12] Maximum possible operating hours at the summer solstice, but limited to 7 to 8 hours at the winter solstice.

[13] A shadow zone is defined as the region in which direct sound does not penetrate because of upward diffraction.

temperature inversion, 10 dB is added to sound levels estimated from the uniform atmosphere (see Section 4.13.1). On the basis of these assumptions, the estimated nighttime noise level at the nearest residences (about 0.3 mi [0.5 km] from the SEZ boundary) would be about 57 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 58 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 sound levels would be lower than 58 dBA L_{dn} at the nearest residences, even if TES were used at a solar facility. Consequently, operating parabolic trough or power tower facilities using TES and located near the SEZ boundary could result in adverse noise impacts at the nearest residences, depending on background noise levels and meteorological conditions.

Associated with operation of a solar facility using TES, estimated noise levels would be about 51 dBA at the SEZ boundary and 41 dBA at about 1 mi (1.6 km) outside from the SEZ boundary. Thus, for a solar facility located near the western SEZ boundary, areas within Plomosa SRMA (within 1 mi [1.6 km] from the SRMA boundary) could be disturbed by the operational noise from the SEZ but this is not anticipated to adversely affect wildlife (Manci et al. 1988).

In the permitting process, refined noise propagation modeling would be warranted along with measurement of 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 Brenda SEZ, on the basis of the assumption of dish engine facilities of up to 345-MW total capacity (covering 80% of the total area, or 3,102 acres [12.55 km^2]), up to 13,788 25-kW dish engines could be employed. For a large dish engine facility, several hundred 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 (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 48 dBA at 1.0 mi (1.6 km) and 43 dBA at 2 mi (3.2 km) from the boundary of the square-shaped dish engine solar field; both 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 dish engines were placed all over the Brenda SEZ at intervals of 98 ft (30 m). Under these assumptions, the estimated noise level at the nearest residences, about 0.3 mi (0.5 km) from the SEZ boundary, would be about 51 dBA, which is above the typical daytime mean rural background level of 40 dBA. On the basis of

12-hr daytime operation, the estimated 49 dBA L_{dn} at these residences is below the EPA guideline of 55 dBA L_{dn} for residential areas. On the basis of other noise attenuation mechanisms, noise levels at the nearest residences would be lower than the values estimated above. However, noise from dish engines could cause adverse impacts on the nearest residences, depending on background noise levels and meteorological conditions.

For dish engines placed all over the SEZ, estimated noise levels would be about 51 dBA at the boundary of Plomosa SRMA, which is about 700 ft (210 m) from the SEZ boundary. Areas within the Plomosa SRMA (within 0.5 mi [0.8 km] of the SRMA boundary) could be disturbed by the dish engine noise from the SEZ, but this is not anticipated to adversely affect wildlife (Manci et al. 1988).

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 Brenda 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 residences, assuming a 0.8-mi (1.3-km) distance (at least 0.5 mi [0.8 km] to the facility boundary and 0.3 mi [0.5 km] to the nearest residences). Accordingly, potential impacts of these noise sources on the nearest residences would be negligible.

For impacts from transmission line corona discharge noise during rainfall events (discussed in Section 5.13.1.5), the noise level 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 respectively (Lee et al. 1996), 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 close to it (e.g., within 500 ft [152 m] of a 230-kV transmission line). The proposed Brenda 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.

8.1.15.2.3 Decommissioning/Reclamation

Decommissioning/reclamation requires many of the same procedures and equipment used in traditional construction. Decommissioning/reclamation 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 moderate 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.

8.1.15.3 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 residences near the southern SEZ boundary along U.S. 60 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 Brenda SEZ should be located more than 1 to 2 mi (1.6 to 3 km) from the nearest residences (i.e., the facilities should be located in the northern 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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8.1.16 Paleontological Resources

8.1.16.1 Affected Environment

The surface geology of the proposed Brenda SEZ is composed entirely of thick alluvial deposits (more than 100 ft [30 m] thick), ranging in age from the Pliocene to Holocene. The total acreage of the alluvial deposits within the SEZ is 3,878 acres (15.7 km^2). In the absence of a PFYC map for Arizona, a preliminary classification of potential fossil yield classification (PFYC) Class 3b is assumed for the young Quaternary alluvial deposits (see Section 4.8 for a discussion of the PFYC system). Class 3b indicates that the potential for the occurrence of significant fossil materials is unknown and needs to be investigated further. Late Pleistocene (Rancholabrean) vertebrate fauna of *Mammuthus columbi, Equui large* sp., *Equui small* sp., and *Nothrotherium* have been identified in a lens of lag gravel within fine-grained alluvial sediments in Maricopa County, Arizona, at a depth of less than 20 ft (6 m) from the natural topographic surface (Lunden and Royse 1973). In addition to Pleistocene fauna, there also is a potential for Miocene faunas from these basin fill deposits. Rhinoceros and camel have been documented at Anderson Mine in southwestern Yavapai County (Morgan and White 2005). These finds indicate the potential for other similar finds in the region.

8.1.16.2 Impacts

The potential for impacts on significant paleontological resources in the proposed SEZ is unknown. A more detailed investigation of the alluvial deposits is needed prior to project approval. A paleontological survey will likely be needed following consultation with the BLM. The appropriate course of action would be determined as established in BLM IM2008-9 and IM2009-011 (BLM 2007b, 2008a). Section 5.14 discusses the types of impacts that could occur on any significant paleontological resources found to be present within the proposed Brenda 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.

Approximately 19 mi (31 km) of transmission line is anticipated to be needed to connect to an existing line west of the SEZ, resulting in approximately 575 acres (2.3 km^2) of disturbance in areas predominantly composed of alluvial sediments (preliminarily classified as PFYC Class 3b). Direct impacts during construction are possible in PFYC Class 3b areas, but since the assumed route of the line follows existing road corridors (U.S. 60 and I-10), the potential for impacts is reduced because of the prior ground disturbance. No needs for new access roads have currently been identified, assuming an existing road would be used; therefore, no additional areas of paleontological concern would be made accessible as a result of development within the proposed Brenda SEZ. 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 were to occur.

Programmatic design features requiring a stop work order in the event of an inadvertent discovery of paleontological resources would reduce impacts by preserving some information and allowing possible excavation of the resource, if warranted. Depending on the significance of the find, it could also result in some modification to the project footprint. Since the SEZ is located in an area classified as PFYC Class 3b, a stipulation would be included in permitting documents to alert solar energy developers of the possibility of a delay if paleontological resources are uncovered during surface-disturbing activities.

8.1.16.3 SEZ-Specific Design Features and Design Feature Effectiveness

Impacts would be minimized through the implementation of required programmatic design features, including a stop-work stipulation in the event that paleontological resources are encountered during construction, 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 findings of future paleontological surveys.

8.1.17 Cultural Resources

8.1.17.1 Affected Environment

8.1.17.1.1 Prehistory

The proposed Brenda SEZ is located in the northern Sonoran Desert within the basin and range province in western Arizona. The earliest known use of the area was likely during the Paleoindian Period, sometime between 12,000 and 10,000 B.P. Surface finds of Paleoindian fluted projectile points, the hallmark of the Clovis culture, have not been found in the area; most of the sites from this time period are located in the southeastern part of the state. The closest known Paleoindian finds to the proposed Brenda SEZ are at Painted Rocks Reservoir, 68 mi (110 km) to the southeast, and Ventana Cave, about 150 mi (241 km) to the southeast. In addition to these projectile points, Clovis people are characterized by a hunting and gathering subsistence economy in which they followed migrating herds of Pleistocene mega fauna. Paleoindian sites in Arizona are typically characterized by either fluted or unfluted points, extinct mega fauna, chipped stone tools, and bone and horn implements. Tools were fashioned either from chert or from obsidian; the closest known source of obsidian to the proposed Brenda SEZ is located at Vulture Mountain, 50 mi (80 km) to the east. The majority of Paleoindian sites occur in the transition zone between mountain and desert environments, and those that have been found in the desert are located close enough to the transition zone that it can be assumed they were likely located there during Paleoindian times. Paleoindian sites that are found generally are either kill sites, where large numbers of animals were slaughtered, or other sites, thought to be base camps (Martin and Plog 1973; NROSL 2009; Reid and Whittlesey 1997).

The Archaic Period began at the end of the Pleistocene, about 10,000 to 8,000 B.P., and continued until the advent of ceramics, about 2,000 B.P. Also referred to as the Cochise Culture, the Archaic lifeways were similar to those of their Paleoindian predecessors, hunting and gathering wild animals and plants. However, plants took on a greater role as there were no longer the mega fauna to hunt, and smaller animals such as deer, antelope and rabbits were hunted instead. Consequently, plant processing tools, such as manos and metates, are more prevalent in the archaeological record. Archaic peoples likely followed a seasonal round of movement, harvesting and hunting what was available at that place and time; therefore, these ephemeral sites are difficult to distinguish. Ventana Cave contained not only Paleoindian material but also significant amounts of Archaic artifacts. Caves provide especially good preservation, and normally perishable artifacts are sometimes well preserved in cave environments. Artifacts such as cordage, netting, hides, skins, and sandals have been found, providing valuable information about Archaic lifeways in the desert Southwest. Because Archaic people were so mobile, they maintained light and portable equipment—baskets, milling stones, and spear points being the hallmarks of the Archaic culture. It is assumed that Archaic Period groups would have lived and traveled with groups of related families when local resources were abundant, but during hard times groups likely dispersed, separated from other families by environmental features such as deserts or mountain ranges. Groups may have isolated themselves in resource-rich regions for a sustained period of time, resulting in vast tracts of land that would have been unpopulated for long spans of time. Other artifacts associated with southern Arizonan Archaic Period lifeways are sleeping circles or camp clearings, trails, shrines, rock alignments, and zoomorphic intaglios, sites of which have been identified within 5 mi (8 km) of the proposed Brenda SEZ (Reid and Whittlesey 1997).

The Late Archaic Period saw the beginnings of agriculture in Arizona. The Sonoran Desert is believed to have been the heartland from which corn agriculture spread to the rest of Arizona. In the middle of the twentieth century it was proposed that corn agriculture spread to Arizona from Mexico via the Sierra Madre corridor to the Mogollon highlands, into the Colorado Plateau, and then into the Sonoran Desert prior to being adopted by the rest of the region. More recent research has suggested the opposite, that the Sonoran Desert's warm growing conditions and the planting of corn at low elevations using well-watered floodplains was more conducive to corn agriculture, and the technology spread widely from the Sonoran Desert into the rest of Arizona. While these Late Archaic farmers were growing corn, it was not their only means of subsistence, and therefore they continued to maintain a seasonal round of hunting and gathering, while retaining a residence for a period of time near their fields to plant and harvest their crops. Their base camps were located in the lowlands, usually occupied in the summer; these clusters of houses usually formed a generally circular arrangement with pits located in the floors of houses or in the areas between houses for the storage of tools and food. Often the floors of houses were completely taken up by the storage pits and there were no hearths, leading some archaeologists to believe that the primary function of the houses was for storage. Some Late Archaic sites have been found to have large, domed-shaped structures, believed to be ceremonial in nature. The artifacts that have been found in them tend to be religious in nature; a baton made of phyllite, pigments, figurines, bone tubes, and worked shell pieces. It is believed that these structures were the predecessor to the subsurface kivas constructed by later Southwestern groups. Late Archaic groups also were known to have created ceramics, although they were fashioned not into containers but into figurines and beads (Reid and Whittlesey 1997; Matson 1991).

With the end of the Archaic Period, two distinct groups occupied the area in the vicinity of the proposed Brenda SEZ: the Hohokam people, who were largely centered near the Gila River and its tributaries, and the Patayan culture, which was focused on the Colorado River and its tributaries. The proposed Brenda SEZ is between these two rivers, so both cultural groups are discussed.

There are two branches of the Hohokam culture, the River Hohokam and the Desert Hohokam, the tradition beginning around A.D. 300 and extending until A.D. 1450. The River Hohokam lived in large villages, sometimes occupied for hundreds of years, and utilized the river to irrigate their crops through the construction of canals. This ability to establish long-term occupations because of the river as a reliable water source, allowed extensive public architectural projects to be undertaken and craft specialization to occur. At some River Hohokam sites platform mounds and ball courts have been excavated. It has been suggested that the construction of large-scale irrigation projects, platform mounds, and ball courts reflects a complex social and political relationship among the Hohokam. The Desert Hohokam relied on floodwater and rainwater for farming. They lived in the valleys and bajadas that were not near the river zones and planted their fields on alluvial fans and at the mouths of washes. Because the Desert Hohokam relied on more ephemeral sources of water, they did not develop the long-term occupation of sites and social complexity that the River Hohokam did. Both the River and Desert Hohokam groups supplemented their diets through the collection of wild plants and hunting, helping to provide some subsistence reliability during difficult agricultural times. During the course of the Hohokam culture, settlements became more and more densely populated, and shifts in material culture and changes in ceremonial and agricultural practices occurred. The archaeological assemblage associated with the Hohokam cultural tradition consists of ceramics (vessels and figurines); bedrock mortars; carved, ground, and flaked stone artifacts; shell jewelry; and stone bowls with effigies. Evidence of Hohokam occupation in the archaeological record becomes very sparse during the late fourteenth and fifteenth centuries, suggesting that either the culture changed its lifeways significantly enough to affect interpretation of cultural materials related to the Hohokam or the Hohokam left the area, possibly due to excessive flooding, oversalinization of agricultural fields, or conflicts with competing groups (BLM 2010b; McGuire and Schiffer 1982; Reid and Whittlesey 1997).

The Patayan culture also occupied different regions of the Colorado River Valley; some groups were concentrated in the upland environments, others in the lowlands. Similar to the Desert Hohokam, the Patayan culture also used floodwater to irrigate their crops, with the first evidence of the Patayan culture seen around A.D. 700. Most Patayan sites are ephemeral, generally indicating temporary habitation or activity camps, although there are a few large Patayan sites on the southwest portion of the Gila River representing more permanent village settlements. It is believed that the Patayan and Hohokam maintained a friendly relationship and the interaction between the groups increased through time. The Patayan moved seasonally, occupying the river valleys in the summer while maintaining their horticultural endeavors and moving to the uplands to exploit piñon nuts and other upland resources. Trade was likely important for the Patayan people, and they created a vast network of trails, not only for trade but also for travel and connecting ceremonial territories. Along the trails, cairns and shrines can be found, as well as campsites, intaglios, cleared circles, and petroglyphs. It is believed that the Patayan culture was the antecedent culture to the contemporary Native American groups that were in the area (the Maricopa, Mohave, Quechan, and Yavapai), but some suggest Hohokam derivation instead. Pima groups are thought to have been descended from the Hohokam culture (BLM 2010b; McGuire and Schiffer 1982; Neusius and Gross 2007; Reid and Whittlesey 1997).

8.1.17.1.2 Ethnohistory

The proposed Brenda SEZ is situated in the western part of traditional Yavapai territory, the portion inhabited by the Tolkapaya or Western Yavapai. Tolkapaya territory ranged from the mountains east of the Colorado, eastward to the western slopes of Kirkland Valley. Many Tolkapayas traveled periodically to the banks of the Colorado River and planted crops near the Quechan, with whom they were on friendly terms. The Quechan in turn would from time to time travel to the mountainous regions of Tolkapaya territory to access upland resources not available in their own lands (Khera and Mariella 1983). Their allies, the Mohave, hunted in Yavapai lands (BLM 2008b). Members of both groups may have been familiar with the area of the proposed SEZ. The Western Yavapai may also have interacted with the neighboring Halchidoma.

Yavapai

Traditionally the Yavapai were inhabitants of west central Arizona who spoke a common language and thought of themselves as one people originating in the Sedona Red Rock country. They were and are speakers of an Upland Yuman dialect of the Hokan language family. Their northern boundary ranged from the San Francisco Peaks to north of the Santa Maria and Bill Williams Rivers. Westward they extended to the mountains and lowlands along the Colorado River. On the south they extended as far as the mountains north of the Gila River, the northern bank of the Salt River, through the lower Verde Valley to the Superstition and Pinal Mountains. Their eastern extent included the Tonto Basin and the Mogollon Rim. Traditionally they were divided into four subtribes. The range of the Tolkapaya, the southwestern portion of Yavapai territory, was the most extensive of the four (Khera and Mariella 1983).

The Yavapai developed from the Northeastern Pai, who appear to have emerged from the prehistoric Patayan tradition. The Yavapai may have diverged from the Hualapai and Havasupai as late as the eighteenth Century (Bean et al. 1978). Like many of their neighbors, the Yavapai depended on a mixture of agriculture and a seasonal round of hunting and gathering for their subsistence. Gardens including maize, beans, and squash were planted both on floodplains and in irrigated plots. Settlement size and duration were dictated by the abundance and availability of nearby resources. In the western desert, the presence of water—rivers, streams, springs, or natural tanks—was essential. Yavapai traditional territory included the Sonoran Desert, mountain, and transitional environments, providing a wide range of seasonal resources. Yavapai groups were highly mobile and flexible in size. Deer, pronghorn antelope, and bighorn sheep were among the large game animals they hunted, along with a wide range of smaller species. Mescal, available year-round, was a dietary stable of the Yavapai (Gifford 1932). However, their greatest food supply was in the fall when nuts (acorns, piñon, and walnuts), seeds (sunflower, goldeneye, and wild grasses), and berries (manzanita, juniper, cedar, mulberry, hackberry, and lemon berries) were ripening (Khera and Mariella 1983).

As with other highly mobile groups in the West, the Yavapai were skilled creators of light strong basketry, used for a variety of purposes. Pottery was also known. They used stone manos and metates to process the seed and nuts. Other tools and hunting implements were made of wood, chipped stone, and cane, as appropriate. Winter dwellings were in caves, rock shelters, or pole-dome huts roofed with thatch and covered with dirt. Summer residences were open ramada structures (Gifford 1932; Khera and Mariella 1983).

The Yavapai were often at odds with their northern and southern neighbors, the Walapai, Havasupai, Papago, Pima, and Maricopa, but got along well with their western and eastern neighbors, the Mojave, Quechan, Cocopah, and Apache. Until the discovery of gold in central Arizona during the 1860s, the Yavapai had little contact with Euro-Americans. When Euro-Americans began to arrive, they and their livestock began to diminish the water, plant, game, and farmland resources upon which the Yavapai depended. Although the Yavapai were for the most part peaceful, lacking firearms early on, Euro-Americans tended to view them as Apache and dealt with them violently and the Yavapai responded in kind (Bean et al. 1978). In 1865, about 2,000 Tolkapayas agreed to settle with other Tribes on the Colorado River Reservation. However, the reservation lacked sufficient agricultural lands to support its inhabitants, and the

Yavapai were forced to return to their mountains to hunt and gather for part of the year. In 1873, a relatively successful reservation was established at Rio Verde, but in 1875 its inhabitants were forced to march to the San Carlos Apache reservation, with much loss of life. Resources at San Carlos proved insufficient to support the newcomers, many of whom were eventually allowed to leave during the 1880s and 1890s, while some intermarried with the Apaches and remained. Subsequently, reservations were established for the Yavapai at Fort McDowell, Camp Verde, Middle Verde, Clarkdale, and Prescott. All of these lie well east of the proposed SEZ. In the end, the Tolkapayas were the only subtribe for whom no reservation was established. The reservations proved to provide insufficient resources to support the populations for which they were intended. Yavapais, no longer able to support themselves in their traditional manner, took up wage labor outside their reservations, working as miners, ranch hands, and domestic servants. Those remaining on the reservations struggled to retain sufficient water rights for their own agricultural needs. Camp Verde, Middle Verde, and Clarkdale organized with a single council under the Indian Reorganization Act of 1934. Fort McDowell established a constitution under the same act and was successfully able to block the construction of the Orme Dam at the confluence of the Salt and Verde Rivers. The dam would have flooded 65% of the reservation, including all agricultural land. The Fort McDowell Reservation was also able to establish a casino (Fort McDowell Yavapai Nation 2010). The Prescott Reservation organized under the Article of Association in 1962 (Confederation of American Indians 1986; Khera and Mariella 1983; Mariella and Khera 1984a,b; Mitchell 1984).

Quechan

Sometimes referred to as the Yuma, the Quechan (Kwatsan) are a Yuman-speaking group closely allied with the Mohave, traditionally centered at the confluence of the Gila and Colorado Rivers. It is not clear when they arrived at the confluence. They were there by the 1770s but were not mentioned by Francisco Vasquez de Coronado, who passed through the area in 1540. Quechan tradition relates that the Tribe migrated south from the sacred mountain *Avikwaame*, in the Newberry Mountains near Laughlin, Nevada. They are thought to have arrived at the confluence sometime between the thirteenth and the eighteenth centuries. Traditionally, the Quechan practiced floodplain horticulture, depending on the annual floods of the Colorado River to replenish their fields with fresh silt. The fertility of the soil allowed multiple plantings and harvests, which the Quechan supplemented by gathering plants from the desert and by fishing. During the growing season they dispersed along the floodplains of the Colorado and the Gila Rivers, moving to the upper terraces during the winter. The Quechan prospered using simple technology. Their bows were simple and unbacked. Arrows often had no stone points. Digging sticks served for planting maize, and clothing was minimal (Bee 1983).

While their settlements were dispersed and independent, the Quechan had a sense that they were a Tribe, a nation occupying a specific territory. They acted together in warfare; with their allies, the Mohave, they were often at odds with the Halchidhoma, the Maricopa, and the Cocopah. They were on friendly terms with the Yavapai and gathered mountain resources in Yavapai territory.

The confluence of the Gila and Colorado Rivers was an important crossing along the Yuma Trail, which led to the coast. Important to the Spanish and later the Americans, the Spanish established a mission there in 1779, only to have it destroyed by the Quechan and Cahuilla two years later. The Hispanic connection remained important to the Quechan, who desired Spanish trade goods, for which they exchanged slaves captured during raids on their enemies (Knack 1981). Between 1826 and 1829 the Quechan joined the Mohave in driving out the Halchidhoma, who controlled another important river crossing. For a time, some Quechan moved into the Blythe, California area, but they had returned south by the second half of the nineteenth century (Bee 1983). After the defeat of Mexico in 1848, the United States established a fort at Yuma to control the crossing, which had become an important wagon road. A reservation was established for the Quechan in 1884.

Mohave

The Mohave were primarily at home along the Colorado River, from time to time extending as far south as Blythe, California. They appear to have entered the Mohave Valley sometime around A.D. 1150. They resided chiefly along the eastern bank of the Colorado, but travelled widely, for trade, to harvest seasonally available resources, and out of curiosity. They had sprawling settlements, rather than villages, with houses situated on low hills above the floodplain. They did not engage in irrigation agriculture, but relied on seasonal inundation to water and refresh their fields. Unlike most other Colorado Desert Tribes, families owned individual fields and individual mesquite trees (Stewart 1983). Most of the year the Mohave lived on terraces above the Colorado River, moving to the floodplain in the spring to plant crops after seasonal floods receded (Kroeber 1925).

The Mohave have traditionally thought of themselves as a nation inhabiting a territory under a hereditary great chief of the Malika clan. Divided into patrilineal clans, they came together for warfare and other purposes. War leaders and shaman had great influence, and power was gained by dreaming, often in sacred locations (Stewart 1983).

Halchidhoma

The Halchidhoma were a Yuman-speaking group who were once located south of the Mohave along the Colorado River. Like the Mohave they were floodplain cultivators and active traders. Culturally they were similar to the Mohave and the Quechan, but politically they were their enemies. Their ties were with the Maricopa and Cocopah, also Yuman speakers. Like the Mohave they were great travelers and traders, establishing the Cocomaricopa or Halchidhoma Trail, an east–west route later followed by Euro-American immigrants. Their clashes with the Mohave and Quechan came to a head sometime around 1825. The Halchidhoma were defeated and began to move to the Gila River to join their Maricopa allies. This process continued until 1840 (Harwell and Kelly 1983). The Yavapai were initially involved in their expulsion. The extent of friendly interaction is questionable.

8.1.17.1.3 History

After Christopher Columbus landed in the Caribbean in 1492, Spanish exploration of the Americas quickly ensued, with Spain claiming vast tracts of land in the New World in the name of King Ferdinand and Queen Isabella. There is some debate as to which of the Spanish explorers made the first entry into Arizona. Some historians believe it was Alvar Nunez Cabeza de Vaca, a Spaniard who shipwrecked off of the coast of Texas in 1528, and developed friendly relations with the Native Americans, who then helped guide him to Mexico City. It has been suggested that Cabeza de Vaca may have passed through the southeastern corner of Arizona on his travels, but because he did not have any way of recording where he was, his exact route is unknown. Cabeza de Vaca is important to the history of Arizona not only because he may have been the first European presence in the state, but also because he claimed to have been told about and seen the "Seven Cities of Cibola," fictitious cities that were full of gold and wealth, ripe for Spanish plundering. When Cabeza de Vaca eventually arrived in Mexico City in 1536, he spread the rumors of these fabled cities, which led to the desire of other Spaniards to search for riches, in the hopes of finding another civilization rich in gold similar to the Aztec in Mexico. The first documented expedition into what is today Arizona was made under the expedition headed by Fray Marcos de Niza in 1539. Fray Marcos de Niza wanted to assure the Native Americans that he encountered on his expedition that they would be treated well, as news of the poor treatment of Native Americans by the European explorers had preceded the actual presence of the explorers. Accompanying Fray Marcos was an African slave, Estebanico, who had survived the journey along with Cabeza de Vaca, and Francisco Vazquez de Coronado, the governor of a northern Mexican province. After stopping in Mexico at Vacapa, Fray Marcos sent Estebanico ahead with orders to scout the area and wait for the rest of the explorers. Estebanico did not heed Fray Marcos' orders and entered into Arizona, where he may have reached the Piman villages near Tucson, before heading farther north to the Zuni pueblo, Cibola. Estebanico was killed by the Zuni, and Fray Marcos followed his trail north, claiming all the land along the way in the name of New Spain. He claimed to have made his way to Cibola and, after returning to Mexico City, claimed to have seen vast riches at the city. In 1540, Francisco Vasquez de Coronado led an expedition to officially lay claim to these rumored cities of gold and led his expedition into eastern Arizona, following the Sonora and San Pedro Rivers and then into New Mexico, and may have made his way as far as Kansas before heading back to Mexico City empty-handed. Also funded by the Coronado expedition was Hernando de Alarcon, who sailed up the Gulf Coast of California and explored the Colorado delta area, perhaps going as far north as the Gila and Colorado River confluence. When Coronado came back without any gold or any prospects for further exploration, the Spanish stayed out of most of the hostile desert southwest for the next 40 years (BLM 2010b; Farish 1915; Kessell 2002; Sheridan 1995).

Antonio de Espejo explored portions of northern and central Arizona in 1583 in an effort to find precious metals. Espejo traded with the Hopi and discovered silver and copper deposits east of Prescott, Arizona, about 96 mi (155 km) northeast of the proposed Brenda SEZ. In 1604 Juan de Onate, a Mexican-born Spaniard who had settled in northern New Mexico, explored portions of Arizona north of the SEZ along the Bill Williams Fork, to its confluence with the Colorado River, and followed the Colorado River south to the Gulf of California, likely coming within 30 mi (50 km) west of the proposed Brenda SEZ (Kessell 2002; Sheridan 1995).

The Spanish did not maintain an established presence in Arizona, other than a few short-lived missions in the south central portion of the state, until the discovery of large silver deposits near Nogales in 1736, 230 mi (371 km) to the southeast of the proposed Brenda SEZ. Most of the prospectors who came to mine the silver and stayed in Arizona were forced to make their living as subsistence farmers and ranchers, as mining did not prove lucrative for another 100 years. The first permanent Spanish settlement in Arizona was at Tubac, just north of Nogales, in an effort to prevent uprisings of the O'odham Tribe. The Spanish attempted to build permanent settlements along the Lower Colorado River, but hostile Yuman Tribes prevented any sustained development. With Apache hostility in the northern and eastern portion of the state, Spanish settlement was basically restricted to the Tucson area and south (Kessell 2002; Sheridan 1995).

Missionary explorer Eusebio Francisco Kino made nine different expeditions into the territories of California and Arizona, establishing relationships with the Yuman and Piman groups in the area, likely traversing the lower Colorado to the west of the proposed Brenda SEZ. In 1775 Juan Batista de Anza was authorized by the viceroy of New Spain to lead a group of settlers from Tubac to the San Francisco Bay area. De Anza set out along the Santa Cruz River, which he followed to the Gila and Colorado confluence, and then into California. This expedition established a trail that eventually became a congressionally designated National Historic Trail, passing about 62 mi (100 km) to the south of the proposed Brenda SEZ.

In 1810 Mexicans declared their independence from Spanish colonial rule and in 1821 won the war. Mexican authority and control in Arizona was disjointed, and often states would act independently from the rest of the country. Increasingly tense relations between Native Americans and the non-Native occupiers were intensified with the expansion of ranchers and homesteaders into Native American areas, leading to several conflicts. The Mexican-American War began in 1846 with the United States eyeing the Rio Grande River and California Territory. Two years later the Treaty of Guadalupe Hidalgo was signed, giving the United States control of Texas, New Mexico (which included Arizona north of the Gila River), and California. When the Gadsen Purchase was made in 1854, the United States gained control of Arizona south of the Gila, and the Mesilla Valley of New Mexico; settlement of the area increased to unseen levels (Kessell 2002; Sheridan 1995).

Prior to the Mexican-American War, Americans had ventured into Arizona on fur-trapping expeditions. The first known American fur-trappers in Arizona were Sylvester Pattie and his son James in 1825, trapping along the San Francisco, Gila, and San Pedro Rivers, in the southeastern portion of Arizona. Frequent hostilities broke out between Native Americans and fur trappers, but the trappers did not remain in the state long enough to make much of an economic or ecological impact. One of the first of the largest U.S. expeditions to cross Arizona at the time was made by the Mormon Battalion in 1846. Led by Lieutenant Colonel Phillip St. George Cooke, the group intended to establish a wagon trail across the southern Great Plains and the Southwest. The Mormon Battalion was the first representative of the U.S. Government to encounter the Mexican population of Arizona, a nonconfrontational meeting. The trail that the Mormon Battalion took later became a part of the Gila Route, or Southern Overland Route, a network of Native American and European trails that entered the state in the east, converged on the Pima villages on the Gila River, and traversed the Gila River floodplain to the Colorado and Gila River confluence (Sheridan 1995).

Most occupation of Arizona after the acquisition of the territory by the U.S. Government was concentrated in the southern part of the state in mining ventures. It was not until the establishment of Fort Yuma on the California side of the Colorado River, and other nearby military garrisons (Camp Colorado near Parker and Camp Date Creek near La Paz), that Americans began to settle in the region near the proposed Brenda SEZ. The forts provided the necessary security against Native Americans, who resented the American occupation of their land and who were competing for the same resources as the miners and ranchers settling in the desert. After the start of the Civil War, most of the military personnel in Arizona were withdrawn, leaving the settlers to their own defenses until the end of the war (Sheridan 1995; Stone 1982).

In 1857, 20 mi (32 km) up the Gila River from the Colorado junction, Arizona's first boomtown, Gila City, was established after a gold strike. The largest and most prosperous gold mine in Arizona occurred at Vulture Mine, near Wickenburg, about 65 mi (105 km) northeast of the proposed Brenda SEZ. The creation of canals, roads, and other infrastructure developments helped to increase the population of Arizona and their ability to grow crops, export and import their goods, and to maintain the mines. The Phoenix Stage Route was established as part of this infrastructure, leading to Wickenburg becoming a transportation hub and the headquarters of the Arizona-California Stage Company. During the 1870s, copper, silver, gold, and other less valuable minerals were mined fervently throughout the state, and with the construction of railroads in 1881 and 1882, mining only increased. The Atchison, Topeka and Santa Fe Railroad was a key rail line that connected major cities in the American West, and a branch of this railroad passes just 4 mi (7 km) east of the proposed Brenda SEZ. Much of the early mining in Arizona was undertaken in Yuma County, and by 1910, Arizona was the largest producer of copper in the United States and continues to be so. In the vicinity of the proposed Brenda SEZ, mining occurred in the Bear Hills, just to the south of the SEZ, as well as in the Plomosa Mountains to the west and the Granite Wash Mountains and the Little Harquahala Mountains to the east (Sheridan 1995; Stone 1982).

Settlement, ranching, and mining in Arizona are dependent upon water regulation and dispersal, and consequently water control projects were started early in the development of Arizona. Often prehistoric canals were used and/or expanded in order to facilitate water usage. People would generally settle only in places where water was available. One of the earliest land scams in which people were conned into settling into an area with the promise of canals to be built occurred just north and east of the proposed Brenda SEZ, in the Bouse Wash area. In the late 1920s, two men from Los Angeles convinced several hundred families to move into the Bouse Wash area with the promise that canals would be constructed from the soon-to-be-built Hoover Dam. The canal system never materialized; the con-men were prosecuted; and by 1945 only six families remained in the area. Located immediately west of the SEZ are historic ranching structures, the Plomosa Windmill, cattle tank, and corral; however, whether this was affiliated with the Bouse Wash land scam or is the result of an independent homesteader is not known at this time. The Central Arizona Project (CAP) is a 336-mi (541-km) aqueduct that starts in Lake Havasu and stretches to the south of Tucson. Initial construction on the CAP began in 1973, and it was completed in 1993, delivering 1.5 million ac-ft (1.9 billion m^3) of water per year. Portions of the CAP pass just 4 mi (7 km) east of the proposed Brenda SEZ (Stone 1982).

In 1942, the U.S. Army identified 18,000 mi^2 (46,000 km^2) of desert in California and Arizona as a training area for troops in a desert environment in preparation for combat in North Africa. In 1943, the area came to be known as the Desert Training Center/California-Arizona Maneuver area, or Desert Training Center/California–Arizona Maneuver Area (DTC/C-AMA), as the massive training facility expanded its size to 31,500 mi^2 (81,600 km^2) and its range of activities from training troops to testing and developing equipment and supplies and to developing new techniques and tactics for desert warfare to large-scale training and maneuvering. It is estimated that more than 1 million men trained at the DTC/C-AMA. Although it operated only between 1942 and 1944, it represents a significant period in the nation's history and contains a number of archaeological features of importance, including remains of training camps, airfields, bivouacs, maneuver areas, and tank tracks (Bischoff 2000).

In a larger context, the DTC/C-AMA was a part of the early days of U.S. involvement in World War II. The German army was advancing across Europe, and the Italian army had struck out in Libya and Egypt. British forces had been able to successfully counterattack the Italian army, but this resulted in Germany entering North Africa to help the Italians. General Erwin Rommel of the German army was successfully advancing his desert army across Libya and then into Egypt against the British. The prospect of Germany and Italy controlling Egypt and the Japanese successes in India, propelling them toward Persia, leaving Russia wide open to attack, made it clear to the United States that the country would need to go to North Africa. General Lesley J. McNair, chief of staff for the Army General Headquarters, recognized the need for preparing American soldiers for desert warfare in a terrain similar to that of North Africa. He placed Major General George S. Patton Jr., who had previously conducted successful training maneuvers in Louisiana, in charge of the desert training center project (Bischoff 2000).

The location of the Desert Training Center was determined in March 1942, as General Patton toured the desert. Aside from the mountain ranges, the uninhabited desert of eastern California and western Arizona was deemed sufficiently similar to that of North Africa. Patton thought the area was ideal for large-scale training exercises, because it was remote and desolate yet water was available and three railroads supplied the area. In addition there were other military facilities nearby (in Riverside, Las Vegas, Indio, Yuma, and Blythe). Patton worked out deals with the railroad companies (UP, Santa Fe, and Southern Pacific) and the Municipal Water District in order to supply transportation and water for the troops. Camp Young was the first camp established near Blythe, and it became the DTC headquarters. Several other camps were constructed over the course of the duration of the DTC/C-AMA operation. The camps were temporary in nature, constructed mostly of tents with some wooden structures to house administrative centers or hospitals. The only permanent construction was open-air chapels and large relief maps. Associated with most of the camps were maneuver areas, rock-lined insignias, and arms ranges. By late summer 1942, Patton was ordered to North Africa under operation Torch, where he successfully commanded the western task force of the operation to victory. The DTC/C-AMA was quickly placed under the command of Major General Alvan Gillem, and the first set of maneuvers was conducted in the fall. This first set of maneuvers was considered unrealistic, and the DTC was ordered to act like a theater of operations in a combat setting, including the establishment of communication zones and combat zones. This was the first time the Army simulated a theater of operation. Riverine operations across the Colorado River were also added. At its height the DTC contained 14 camps, with 11 in California and 3 in Arizona, each capable of holding at least 15,000 soldiers during a typical 14-week training schedule. There were also airfields, hospitals, supply depots, and railheads. The importance of air support should not be overlooked, as it was seen as an integral part of the desert training experience. On-the-ground troops needed to be able to conceal themselves as much as possible to prevent detection during simulated air attacks. In 1943 as the need for desert training waned with the close of the North African campaign, the concept and name of the DTC changed to the C-AMA. Its mission was to conduct broader based large-scale training to toughen soldiers mentally and physically and provide battle conditions for conducting firing training and for testing and developing equipment, supplies, and training methods. The DTC/C-AMA saw its greatest amount of activity the summer and fall of 1943. In late 1943 personnel shortages (due to needs for personnel overseas) resulted in inefficient operation of the DTC/C-AMA, and General McNair recommended the facility be closed. The DTC/C-AMA was declared surplus in April 1944 by the War Department and was closed by the end of the month (Bischoff 2000).

There were three camps established in Arizona for the purposes of the DTC/CAMA. Camp Bouse, an artillery range base, was the closest camp to the SEZ, about 20 mi (33 km) to the north. Camp Horn and Camp Hyder were located south of the SEZ near Dateland and Hyder, Arizona, respectively. Also associated with the DTC/CAMA in Arizona was the Poston Japanese relocation camp, near Parker, Arizona, and the Yuma Testing Branch. The Yuma Testing Branch was an army testing operation of pontoon bridges and a training facility for engineers in building roads. Associated with the Yuma Testing Branch was Camp Laguna, the purpose of which was to train troops in mechanized warfare. The Luke Air Force Base was created as part of the DTC/CAMA northeast of Phoenix to train pilots. More than 12,000 pilots were trained here for World War II, and it continues to operate as a training facility. Also part of the Luke Air Force Base are the Barry M. Goldwater Range and the Gila Bend Auxiliary Air Field. These Air Force ranges also serve as training facilities for the U.S. Air Force in air-to-air training and air-to-gun training. The portion of the Luke Air Force Base complex closest to the proposed Brenda SEZ is about 72 mi (116 km) to the southeast, although the Brenda SEZ is within the U.S. Department of Defense's (DoD's) Airspace Consultation Area (Bischoff 2000; Stone 1982).

The Yuma Proving Ground (YPG) was established in 1963, covering 990,000 acres (4,006 km^2) north of the Gila River, the closest portion to the proposed Brenda SEZ being about 34 mi (55 km) to the southwest. While the YPG was not established until the mid-twentieth century, the presence of the U.S. Army in the Yuma area has been felt since the construction of the first fort there in 1850, and subsequent periodic occupation of the area by the military. The YPG consists of the Yuma Test Center, the Tropic Regions Test Center, and the Cold Regions Test Center, each center specializing in a specific type of military testing. The purpose of the YPG is as a test facility for all branches of the military, from artillery and bomb testing to automotive and helicopter tests (Stone 1982; Wullenjohn 2010).

8.1.17.1.4 Traditional Cultural Properties—Landscape

The Yavapai consider their traditional use area to be sacred land—the land where the Yavapai first emerged and the land that they are divinely required to protect. This sacred landscape is composed of an interrelated complex of important plants, animals, and places of power, tied together by a network of trails linking the Colorado and Gila Valleys (Stone 1986). From the Yavapai point of view, places, features, and artifacts of power are dangerous and can be handled, discussed, or visited safely only by powerful religious practitioners. Their locations and properties are not discussed openly. Many Yavapai are leery of "New Age" appropriation of Native spirituality and places of power (Ivakhiv 2001). Because the Yavapai reservations are located in the eastern part of their former traditional range and because many knowledgeable elders, familiar with the western part of their traditional territory, have passed away, over the years knowledge of ancestral places of power in the western part of Yavapai territory has been lost. Without specific knowledge, any artifacts of the past from these areas have the potential for being powerful and should be treated with respect (Bean et al. 1978).

Places of power include caves, mountains, and small rock shrines. Certain minerals were also thought to be imbued with power, particularly turquoise (Gifford 1936). Many of the most important Yavapai sacred places are located well to the east of the SEZ near Sedona and the Verde River. Montezuma Well, a spring-fed lake in a limestone sink now located in Montezuma Castle National Monument 135 mi (217 km) to the northeast, is considered by the Yavapai to be the place where their ancestors first emerged into this world. A cave in Boynton Canyon, 140 mi (226 km) to the northeast, located in the Sedona Red Rock Mountains of the Coconino National Forest, is the most sacred Yavapai site, the place where First Woman, the only survivor of the destruction of the third world according to Yavapai cosmology, lived. Mountains in general may be the home of the *qaqáqə,* or "little people," who may be called on for help in times of distress (Khera and Mariella 1983).

The Ranegras Plains, where the proposed Brenda SEZ is located, and surrounding mountains and valleys are areas where the Western Yavapai hunted and gathered. An aboriginal travel route from the Colorado River follows Bouse Wash along the Ranegras Plain about as far as the SEZ and then proceeds east through Granite Wash Pass to Centennial Wash, which it follows to the Gila River (Stone 1986). The Hakehelapa or Wiltaikapaya Band of the Western Yavapai were centered in the Harquahala and Harcuvar Mountains, 17 mi (28 km) and 12 mi (20 km) miles northeast of the proposed SEZ, respectively (Gifford 1936). Both ranges were well-watered and provided a variety of resources not available on the desert floor, as well as Bighorn Sheep habitat (BLM 2008b). The Granite Wash Mountains, northeast of the SEZ, links the two ranges and provides a bighorn migration route (BLM 2006) The Harquahala Mountains provide a "Sky Island," dominating the skyline for up to 100 mi (161 km) around. Archaeological remains likely resulting from Yavapai occupation are among the reasons it has been designated an ACEC including a Special Cultural Resource Management Areas (SCRMA). The Black Butte ACEC, located about 6 mi (10 km) to the east, was a local source of obsidian used for stone tools (BLM 2008b, 2010d). Evidence of Native American use of the Harcuvar Mountains includes camp sites, tool manufacturing areas, milling areas, rockshelters and rock art, pictographs as well as petroglyphs, and crystals and minerals important to Native Americans (BLM 2006, 2008b). Two SCRMAs have been established there (BLM 2007a). The SEZ is bordered on the southwest by the Plomosa Mountains, where petroglyph and lithic procurement sites have been reported (BLM 2006). It is 14 mi (23 km) north of the Kofa Mountains, also an area frequented by the Western Yavapai (Bean et al. 1978). As part of the traditional use area of the Western Yavapai, any archaeological sites associated with Native American populations, rock art panels such as those found at Granite Wash Pass, shrines, or geoglyphs found in the area are likely to be constituent parts of a cultural landscape important to the Yavapai.

8.1.17.1.5 Cultural Surveys and Known Archaeological and Historical Resources

No cultural resource surveys have been conducted in the proposed Brenda SEZ, and therefore no cultural resources have been identified in the boundaries of the SEZ. However, within 5 mi (8 km) of the SEZ, 25 surveys have been conducted, resulting in the recording of 37 sites, 10 of which are prehistoric, 18 historic, 1 multicomponent, and 9 of an unknown temporal identification.

The BLM has designated several ACECs in the vicinity of the proposed Brenda SEZ, because these areas have been determined to be rich in cultural resources. Located about 9 mi (14 km) southwest of the SEZ is the Dripping Springs ACEC. This multicomponent ACEC consists of large boulders with petroglyphs, as well as a two-room stone cabin. Located about 27 mi (43 km) north of the SEZ is the Swansea Historic District ACEC. Swansea was a mining district that saw its first prospectors in 1862, and the town became a part of the Arizona and Swansea Railroad in the early twentieth century. The Harquahala ACEC is situated about 24 mi (38 km) east of the SEZ and has been designated as an ACEC in order to protect its cultural resources and the historic Harquahala Peak Observatory. Several additional ACECs are located in excess of 25 mi (40 km) from the SEZ, but are relevant to resources in the region. The Big Marias ACEC is situated about 37 mi (59 km) west of the SEZ, along the Colorado River. This ACEC is made up of the single greatest concentration of geoglyphs in North America. The Sears Point ACEC is 60 mi (97 km) southeast of the proposed Brenda SEZ. This ACEC consists of the Sears Point Archaeological District, which is listed on the NRHP, and contains archaeological evidence for Archaic through Patayan and Hohokam occupation, in addition to rock art. Also a part of this ACEC is an historic travel corridor; the Juan Batista de Anza National Historic Trail, the Butterfield Overland Mail Route, the Mormon Battalion Trail, and the Gila Route pass through this ACEC.

The BLM has also identified SCRMAs close to the proposed Brenda SEZ, but only one of them is located within 25 mi (40 km) of the SEZ. The Harcuvar Mountain West SCRMA is located just 18 mi (29 km) to the northeast. Swansea, 27 mi (43 km) from the SEZ is also a SCRMA, in addition to its ACEC designation. The Harcuvar Mountain East SCRMA is 38 mi (61 km) to the northeast. Contained within the Big Marias ACEC is the Big Maria Terraces SCRMA, designated to protect the valuable geoglyphs from destruction. The Cibola Valley SCRMA is situated about 49 mi (79 km) southwest of the SEZ, an area valued for its cleared circles, rock alignments, circular mounds, trail networks, lithic scatters, intaglios, and petroglyphs. On the western side of the Colorado River is the Palo Verde Point SCRMA, 53 mi (85 km) southwest of the SEZ, an area unique in the pristine condition of its desert pavement sites, intaglios, petroglyphs, trail networks, rock alignments, cleared areas, and widespread lithic scatters. The Walkers Camp SCRMA, 56 mi (90 km) southwest of the SEZ, shows evidence of year-round occupation by Native Americans, along with desert pavement features and artifact scatters. This SCRMA also contains portions of the *Xam Kwitcam* migratory trail that pass through the area. The Harquahala SCRMA is a culturally sensitive area, almost entirely contained within the boundaries of the Harquahala ACEC. These SCRMAs are designated to conserve the sites or traditional use areas by Native Americans, in an effort to develop and interpret the sites for public visitation (BLM 2007a, 2010c). Also in the vicinity of the proposed Brenda SEZ are YPG and Luke Air Force Base (and associated ranges), which have contributed to the overall history and context of the region.

National Register of Historic Places

There are no historic properties listed in the NRHP in or within 5 mi (8 km) of the SEZ. However, several sites within 5 mi (8 km) of the SEZ are considered potentially eligible for inclusion in the NRHP. Three of these potentially eligible sites are prehistoric in nature, one is multicomponent, and seven are historic. One site is a prehistoric trail with associated ceramic sherds, located east of the SEZ. A second site is also situated east of the SEZ, consisting of a concentration of 10 rock rings. Another rock ring is situated northeast of the SEZ. The multicomponent site is an extensive prehistoric lithic scatter consisting of three different loci of activity, as well as an historic trash scatter associated with another site, one of the homesteads. Five sites are historic homesteads. One site is an historic homestead and historic church, and another is a temporary historic camp that likely dates to the 1920s. Several of the prehistoric sites within 5 mi (8 km) of the SEZ have not been evaluated for inclusion in the NRHP and, if evaluated to be significant cultural resources, could increase the total number of eligible sites in the 5-mi (8-km) boundary.[14]

Eight properties are listed in the NRHP in La Paz County, the closest properties being the Rhoda Nohlechek House, 20 mi (32 km) east in Wenden, Arizona, and the Harquahala Peak Observatory and Historic District, 29 mi (47 km) east in the Harquahala Mountains in Gladden, Arizona. Six other NRHP-listed properties are in Parker, Arizona, 36 mi (58 km) northwest, Ehrenberg, Arizona, 38 mi (61 km) west, and Hyder, Arizona, 57 mi (92 km) south.

8.1.17.2 Impacts

Direct impacts on significant cultural resources could occur in the proposed Brenda SEZ; however, further investigation is needed because no cultural resource surveys have been conducted within the boundaries of the SEZ. A cultural resources survey of the entire area of potential effect (APE) of a proposed project 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. The proposed Brenda SEZ has potential for containing prehistoric sites, especially in the eastern portion of the SEZ, as the Bouse Wash may have provided access to water and riparian resources during environmental conditions that were favorable for exploitation of the area. Additionally, some lithic materials/flakes were observed there during a preliminary site visit, further indicating the potential presence of significant prehistoric cultural resources. The potential for historic

[14] Source of data is a file search on AZSITE: Arizona's Cultural Resource Inventory, run by the Arizona State Museum, conducted on Dec. 11, 2009, and July 15, 2010.

resources also exists, with DTC/C-AMA activity and ranching/homesteading known to have occurred in the area. Possible impacts from solar energy development on cultural resources that are encountered within the SEZ or along related ROWs, as well as general mitigation measures, are described in more detail in Section 5.15. 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.

Programmatic design features to reduce water runoff and sedimentation would prevent the likelihood of indirect impacts on cultural resources resulting from erosion outside the SEZ boundary (including along ROWs).

The nearest transmission line corridor is approximately 19 mi (31 km) to the west, which, if a new corridor was constructed to it, would result in the disturbance of 575 acres (2.3 km^2). The transmission line corridor assessed in this PEIS would run from the southwest corner of the proposed Brenda SEZ to U.S. 60, at which point it would run alongside U.S. 60, to its junction with I-10, and then connect to the transmission line near U.S. 93. Impacts on cultural resources are possible in areas related to the ROW, because new areas of potential cultural significance could be directly affected by construction or opened to increased access from use. Indirect impacts, such as vandalism or theft, could occur if significant resources are close to the ROW. This designated energy corridor may affect known cultural resources; however, because the corridor is adjacent to existing highways, the impacts on these resources would be minimal as the resources have likely been affected by previous disturbance activities. Programmatic design features assume that the necessary surveys, evaluations, and consultations for the ROW will occur, as for the project footprint within the SEZ. No needs for new access roads have currently been identified, assuming existing roads would be used; therefore, no additional areas of cultural concern would be made accessible as a result of development within the proposed Brenda SEZ. However, 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 were to occur.

8.1.17.3 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, are provided in Appendix A, Section A.2.2.

SEZ-specific design features would be determined in consultation with the Arizona SHPO and affected Tribes following the completion of cultural surveys.

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8.1.18 Native American Concerns

As discussed in Section 8.1.17, Native Americans tend to view their environment holistically and share many 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. Specifically for the proposed Brenda SEZ, Section 8.1.17 discusses archaeological sites, structures, landscapes, trails, and traditional cultural properties; Section 8.1.8 discusses mineral resources; Section 8.1.9.1.3 discusses water rights and water use; Section 8.1.10 discusses plant species; Section 8.1.11 discusses wildlife species, including wildlife migration patterns; Section 8.1.13 discusses air quality; Section 8.1.14 discusses visual resources; Sections 8.1.19 and 8.1.20 discuss socioeconomics and environmental justice, respectively; and 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 Brenda SEZ have been contacted so that they could identify their concerns about solar energy development. The Tribes contacted with traditional ties to the Brenda SEZ are listed in Table 8.1.18-1. Appendix K lists all federally recognized Tribes contacted for this PEIS.

8.1.18.1 Affected Environment

The territorial boundaries of the Tribes that inhabited the Sonoran Desert appear to have been fluid over time. Depending on existing relationships or amity or enmity, resources were shared where abundant. The proposed Brenda SEZ lies within the traditional range of the Western Yavapai, but was accessible to the Quechan and the Mohave with whom they were on friendly terms. The Indian Claims Commission included the area in the Yavapai traditional territory (Royster 2008).

TABLE 8.1.18-1 Federally Recognized Tribes with Traditional Ties to the Proposed Brenda SEZ

Tribe	Location	State
Cocopah Indian Tribe	Somerton	Arizona
Colorado River Indian Tribes	Parker	Arizona
Fort McDowell Yavapai Nation	Fountain Hills	Arizona
Fort Mojave Indian Tribe	Needles	California
Quechan Indian Tribe of the Fort Yuma Reservation	Yuma	Arizona
Salt River Pima-Maricopa Indian Community	Scottsdale	Arizona
San Carlos Apache Tribe	San Carlos	Arizona
Yavapai-Apache Nation	Camp Verde	Arizona
Yavapai-Prescott Indian Tribe	Prescott	Arizona

8.1.18.1.1 Territorial Boundaries

Yavapai

The Western Yavapai or Tolkapya territory ranged from the mountains east of the Colorado, eastward to the western slopes of Kirkland Valley, although Tolkapaya also established gardens on the floodplain of the Colorado River adjacent to the Quechan. On the north, they ranged into the mountains north of the Bill Williams and Santa Maria Rivers. On the south they sometimes ranged as far as Yuma, but for the most part the mountains north of the Gila River formed their southwestern boundary. On the southeast it extended to the Gila River (Khera and Mariella 1983). Contrary to their relationships on their western border, they were not on good terms with neighboring Tribes to the north and south. Yavapai descendants are found primarily on the Fort McDowell, Camp Verde, Middle Verde, Clarkdale, and Prescott Yavapai reservations, as well as on the Cocopah and San Carlos Apache reservations.

Quechan

The heart of Quechan territory lies at the confluence of the Gila and Colorado Rivers well to the south of the SEZ. As presented to the Indian Claims Commission, their eastern boundary extended along the crest of the mountains east of the Colorado River as far north as Blythe, California, where it jogged westward to the channel of the Colorado River (ICC 1958). Quechan descendants occupy the Fort Yuma Indian Reservation in Arizona and California.

Mohave

The Mohave claimed lands on both banks of the Colorado River to the crests of the mountains from Black Canyon in the north as far south as the Dome Mountains, 22 mi (35 km) west of the proposed SEZ, which were also frequented by the Western Yavapai, along with a substantial area in southern California (CSRI 2002). Mohave descendants occupy the Fort Mojave Indian Reservation near Needles, California, and can be found on the reservation of the Colorado River Indian Tribes.

Halchidhoma

The Halchidhoma were forced off their lands along the Colorado River by neighboring Tribes about 1827 before the United States acquired the area from Mexico. They probably occupied territory around Blythe similar in extent to that claimed by the Mohave in that area. Their descendants have been integrated into the Maricopa Tribe and can be found on the Salt River Pima–Maricopa Indian Reservation in Arizona (Harwell and Kelly 1983).

8.1.18.1.2 Plant Resources

This section focuses on those Native American concerns with ecological as well as cultural components. 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 (Bean. et al 1978; Stoffle et al. 1990).

The traditional subsistence base shared by the Yavapai and the Quechan was a mixture of floodplain agriculture and hunting and gathering. The proportion of farming to gathering varied with the Tribe and the land they occupied. The proposed Brenda SEZ does not appear to be well suited for indigenous agriculture, lacking a reliable water source. Rather, it lies in a travel corridor connecting the Colorado River with the Gila River. It is a valley surrounded with relatively well-watered mountains, where Western Yavapai were known to reside. Because of the valley's proximity to inhabited mountains, it is likely that the Yavapai gathered the plant resources available there and hunted what game there was. While no archaeological surveys have been conducted within the boundaries of the SEZ, petroglyph panels have been recorded in the Dripping Springs ACEC in the Plomosa Mountains to the southwest, and in the Harcuvar and Harquahala Mountains to the northeast (BLM 2006, 2008b). The latter have been identified as in the heartland of a Western Yavapai band (Gifford 1936). The Yavapai and Quechan practiced a seasonal round in harvesting naturally occurring plant resources. Native Americans commenting on previous energy development projects in the area have voiced concern over the loss of culturally important plants used for food, medicine, and ritual purposes and for making tools, implements, and structures (Bean et al. 1978).

The plant communities observed or likely to be present in the proposed Brenda SEZ are discussed in Section 8.1.10. As shown in the Gap analysis, the land cover at the proposed Brenda SEZ is predominantly Sonora–Mojave Creosotebush–White Bursage Desert Scrub, interspersed with patches of Sonoran–Paloverde Mixed Cacti Desert Scrub. There is also a pocket of Sonora–Mojave Mixed Desert Scrub (USGS 2005a). While these communities appear sparse most of the year, seasonal rains often result in an explosion of ephemeral herbaceous species.

Native American populations have traditionally made use of hundreds of native plants. Table 8.1.18.1-1 lists plants often mentioned as important by Native Americans that were either observed at the proposed Brenda 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 localized conditions and the season. Overall, creosotebush dominates the SEZ, while cacti, mesquite, and sparse wild grasses are present. Creosotebush is important in traditional Native American medicine. 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. Its blossoms are edible. Saltbush and buckwheat seeds were harvested, processed, and eaten. They, along with cactus fruit, were harvested in the summer (Khera and Mariella 1983).

TABLE 8.1.18.1-1 Plant Species Important to Native Americans Observed or Likely To Be Present in the Proposed Brenda SEZ

Common Name	Scientific Name	Status
Food		
Buckwheat	*Eriogonum* spp.	Possible
Cholla Cactus	*Opuntia* spp.	Observed
Creosotebush	*Larrea tridentata*	Observed
Honey Mesquite	*Prosopis Glandolosa*	Possible
Jojoba	*Simmondsia chinensis*	Possible
Prickly Pear Cactus	*Opuntia* spp.	Possible
Saguaro Cactus	*Carnegiea gigantean*	Observed
Saltbush	*Atriplex* spp.	Possible
Screwbean Mesquite	*Prosopis pubescens*	Possible
Yellow Palo verde	*Parkinsonia microphylla*	Possible
Medicine		
Creosotebush	*Larrea tridentata*	Possible

Sources: Field visit; Gifford (1936); Khera and Mariella (1983); and USGS (2005a).

8.1.18.1.3 Other Resources

The proposed Brenda SEZ also may have been a hunting ground. The mountains surrounding the SEZ provide habitat for deer and bighorn sheep. Traditionally, deer have been an important source of both food and bone sinew and hide to make a variety of implements. Although pronghorn antelope were present on the Harquahala Plain, they were not hunted by the Yavapai. While big game was highly prized, smaller animals such as black-tailed jackrabbits and desert cottontail, both present in the SEZ, traditionally provided a larger proportion of the protein in their diets (Gifford 1936). Animal species important to Native Americans are shown in Table 8.1.18.1-2.

Mineral resources important to Native Americans in the Colorado Desert include turquoise, stone for making tools, and quartz crystals considered to have healing properties. Obsidian and quartz have been reported in the surrounding mountains (BLM 2006, 2008b).

As long-time desert dwellers, Native Americans have a great appreciation for the importance of water in a desert environment. They have expressed concern over the use and availability of water for solar energy installations (Jackson 2009).

In addition, 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 8.1.18.1-2 Animal Species Used by Native Americans as Food Whose Range Includes the Proposed Brenda SEZ

Common Name	Scientific Name	Status
Mammals		
Badger	*Taxidea taxus*	All year
Bighorn sheep	*Ovis Canadensis*	All year
Black-tailed jackrabbit	*Lepus californicus*	All year
Bobcat	*Lynx rufus*	All year
Wood rats	*Neotoma* spp.	All year
Chipmunks	*Tamias* spp.	All year
Coyote	*Canis latrans*	All year
Desert cottontail	*Silvilagus audubonii*	All year
Kit fox	*Vulpes macotis*	All year
Mule deer	*Odocoileus hemionus*	All year
Rock squirrel	*Spermophilus variegates*	All year
Birds		
Gambel's Quail	*Callipepla gambelii*	Summer
Doves		
Inca dove	*Columbina inca*	All year
Common ground dove	*Columbina passerina*	All year
White-winged dove	*Zenaida asiatica*	Summer
Mourning dove	*Zenaida macrocura*	All year
Reptiles		
Desert tortoise	*Gopherus agassizii*	All year
Chuckwalla	*Sauromalus ater*	Observed

Sources: Field visit; USGS (2005b); Gifford (1936).

8.1.18.2 Impacts

To date, no comments have been received from the Tribes specifically referencing the proposed Brenda SEZ. However, in a response letter, the Quechan Indian Tribe of Fort Yuma indicates that some of the SEZs proposed in this PEIS lie within their Tribal Traditional Use Area. They stress the importance of evaluating impacts on landscapes as a whole. Because trails have both physical and spiritual components, from their perspective the intrusion of industrial development nearby would have negative effects on trails (Jackson 2009). Commenting on past transmission line projects in the area, the Quechan have expressed a general mistrust of irreversible development projects because of the loss of natural habitat, particularly as it would affect eagle and bighorn sheep populations (Bean et al. 1978). Commenting on the same project, rural Yavapai were much more concerned with wild plant resources and noted the dense stands of an important medicinal plant, creosotebush or *umi,* on the Ranegras Plains. Rural Yavapai expressed concerns for the following resources, in order of importance, game animals (deer, birds, rabbits, mountain sheep), viewshed, cremation or burial sites, wild food plants (squawbush, prickly pear, saguaro), minerals, rock art, sacred areas, medicinal plants, and fiber plants (Bean et al. 1978).

The impacts that would be expected from solar energy development within the proposed Brenda 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 cultural landscape that includes sacred mountains and other geophysical features tied together by a network of trails. Impacts may be visual, for example, the intrusion of an industrial feature in sacred space; audible, for example, noise from the construction, operation, or decommissioning of a facility, detracting from the traditional cultural values of the site; or demographic, for example, the presence of a larger number of outsiders in the area, increasing the chance that the cultural importance of the area would be degraded by more foot and motorized traffic. As consultation with the 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 SEZ on the landscape.

Localized effects could occur both within the proposed SEZ and in adjacent areas. Within the SEZ these effects would include destruction or degradation of important plant resources, destruction of the habitat of and interference with the movement of culturally important animal species, destruction of archaeological sites and burials, and the degradation or destruction of trails. Plant resources (e.g., creosotebush and saguaro cactus) are known to exist within the SEZ. Any ground-disturbing activity associated with development within the SEZ has the potential for destroying localized resources. However, significant tracts of Sonora–Mojave Creosotebush-White Bursage Desert Scrub and Sonoran–Paloverde Mixed Cacti Desert Scrub would remain outside the SEZ, and anticipated overall effects on these plant populations would be small. While the construction of utility-scale solar energy facilities would reduce the amount of habitat available to many animal species important to Native Americans, similar habitat is abundant and the effect on animal populations is likewise likely to be small.

Since solar energy facilities cover large tracts of ground, even taking into account the implementation of programmatic design features, it is unlikely that avoidance of all resources 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. Implementation of programmatic design features, as discussed in Appendix A, Section A.2.2, should eliminate impacts on Tribes' reserved water rights and the potential for groundwater contamination issues.

8.1.18.3 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 8.1.18-1. For example, the Quechan Tribe has requested that they be consulted at the inception of any solar energy project that would affect resources important to them. The Quechan also suggest that the clustering of large solar energy facilities be avoided; that priority for development be given to lands already disturbed by agricultural or military use; and that the feasibility of placing solar collectors on existing structures be considered, thus minimizing or avoiding the use of undisturbed land (Jackson 2009).

Mitigation of impacts on archaeological sites and traditional cultural properties is discussed in Section 8.1.17.3, in addition to design features discussed for historic properties in Section A.2.2 of Appendix A.

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8.1.19 Socioeconomics

8.1.19.1 Affected Environment

This section describes current socioeconomic conditions and local community services within the region of influence (ROI) surrounding the proposed Brenda SEZ. The ROI is a three-county area composed of La Paz County and Yuma County in Arizona, and Riverside County in California. It encompasses the area in which workers are expected to spend most of their salaries and in which a portion of site purchases and non-payroll expenditures from the construction, operation, and decommissioning phases of the proposed SEZ facility are expected to take place.

8.1.19.1.1 ROI Employment

In 2008, employment in the ROI stood at 846,901 (Table 8.1.19.1-1). Over the period 1999 to 2008, the annual average employment growth rate was higher in Yuma County (3.6%) than in Riverside County (2.5%), and La Paz County (0.6%). At 1.8%, the growth rate in the ROI as a whole was lower than that for Arizona (2.3%), but higher than the average rate for California (0.9%).

In the ROI in 2006, the services sector provided the highest percentage of employment at 44.3%, followed by wholesale and retail trade at 20.5% (Table 8.1.19.1-2). Smaller employment shares were held by construction (13.4%) and manufacturing (9.7%). Within the three counties in the ROI, the distribution of employment across sectors is similar to that of the ROI as a whole,

TABLE 8.1.19.1-1 ROI Employment in the Proposed Brenda SEZ

Location	1999	2008	Average Annual Growth Rate, 1999–2008 (%)
La Paz County, Arizona	6,621	7,023	0.6
Yuma County, Arizona	48,903	69,683	3.6
Riverside County, California	653,552	839,878	2.5
ROI	709,076	846,901	1.8
Arizona	2,355,357	2,960,199	2.3
California	15,566,900	17,059,574	0.9

Sources: U.S. Department of Labor (2009a,b).

TABLE 8.1.19.1-2 ROI Employment in the Proposed Brenda SEZ by Sector, 2006

	La Paz County		Yuma County		Riverside County		ROI	
Industry	Employment	% of Total	Employment	% of Total	Employment	% of Total	Employment	% of Total
Agriculture[a]	493	11.4	5,017	10.3	17,064	3.0	22,574	3.6
Mining	60	1.4	53	0.1	505	0.1	618	0.1
Construction	136	3.1	4,696	9.6	78,556	13.8	83,388	13.4
Manufacturing	381	8.8	3,374	6.9	56,582	9.9	60,337	9.7
Transportation and public utilities	83	1.9	1,471	3.0	21,835	3.8	23,389	3.8
Wholesale and retail trade	1,114	25.7	10,624	21.8	116,343	20.4	128,081	20.5
Finance, insurance, and real estate	120	2.8	1,874	3.8	26,964	4.7	28,958	4.6
Services	1,990	46.0	21,636	44.4	252,847	44.3	276,473	44.3
Other	10	0.2	10	0.0	89	0.0	109	0.0
Total	4,329		48,746		570,468		623,543	

[a] Agricultural employment includes 2007 data for hired farmworkers.

Sources: U.S. Bureau of the Census (2009a); USDA (2009a,b).

but employment in agriculture in La Paz County (11.4%) and Yuma County (10.3%) was higher than in the ROI as a whole, with lower employment shares in construction and manufacturing.

8.1.19.1.2 ROI Unemployment

Unemployment rates have been significantly different in the three counties in the ROI. Over the period 1999 to 2008, the average rate in Yuma County (17.4%) was much higher than those in La Paz County (6.7%) and Riverside County (6.0%) (Table 8.1.19.1-3). The average rate in the ROI over this period was 7.0%, higher than the average rates for California (5.8%) and Arizona (4.8%). Unemployment rates for the first 10 months of 2009 contrast with rates for 2008 as a whole; in Yuma County, the unemployment rate increased to 21.3%, while in Riverside County it reached 13.8%, and in La Paz County it reached 9.1%. The average rates for the ROI (14.4%) and for California (11.6%) and Arizona (8.4%) as a whole were also higher during this period than the corresponding average rates for 2008.

8.1.19.1.3 ROI Urban Population

The population of the ROI in 2008 was almost 68% urban, with the majority of urban areas located in the California portion of the ROI, in Riverside County. In La Paz County, there are two small cities, Quartzite (3,468), and Parker (3,116), where population growth between 2000 and 2008 has been relatively low or declining slightly, 0.4% in Parker and -0.1% in Quartzite. In Yuma County, there are three small cities in addition to Yuma (89,842): San Luis (24,654), Somerton (12,146), and Wellton (1,921). Population growth between 2000 and 2008 has been relatively high in Somerton (6.6%) and San Luis (6.1%), with annual growth rates of 1.9% in Yuma and 0.6% in Wellton.

TABLE 8.1.19.1-3 ROI Unemployment Rates (%) for the Proposed Brenda SEZ

Location	1999–2008	2008	2009[a]
La Paz County, Arizona	6.7	7.4	9.1
Yuma County, Arizona	17.4	17.1	21.3
Riverside County, California	6.0	8.6	13.8
ROI	7.0	9.3	14.4
Arizona	4.8	5.5	8.4
California	5.8	7.2	11.6

[a] Rates for 2009 are the average for January through November.

Sources: U.S. Department of Labor (2009a–c).

In the California portion of the ROI, the largest urban area, Riverside, had an estimated 2008 population of 293,225; other large cities in the western portion of the county include Moreno Valley (188,688) and Corona (148,346) (Table 8.1.19.1-4). In addition, there are eight cities in the county with a 2008 population between 50,000 and 99,999 persons. The majority of these cities are part of the larger urban region that includes Los Angeles, Riverside, and San Bernardino, and most are more than 150 mi (241 km) from the site of the proposed SEZ.

TABLE 8.1.19.1-4 ROI Urban Population and Income for the Proposed Brenda 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] (%)
Riverside	255,166	293,225	1.8	53,620	56,805	0.6
Moreno Valley	142,381	188,688	3.6	61,101	55,178	–1.1
Corona	124,966	143,346	2.2	76,755	78,120	0.2
Murietta	44,282	97,935	10.4	78,424	79,135	0.1
Temecula	57,716	95,859	6.5	76,628	77,394	0.1
Yuma	77,715	89,842	1.9	45,545	42,095	–0.9
Indio	49,116	83,480	6.9	44,579	53,824	2.1
Hemet	58,812	70,826	2.4	34,556	34,974	0.1
Perris	36,189	55,117	5.4	45,774	53,442	1.7
Cathedral City	42,647	51,793	2.5	50,068	42,026	–1.9
Lake Elsinore	28,928	50,494	7.1	53,926	58,496	0.9
Palm Desert	41,155	50,232	2.6	62,208	55,218	–1.3
La Quinta	23,694	43,232	7.8	70,237	78,898	1.3
Coachella	22,724	39,004	7.0	36,810	40,463	1.1
San Jacinto	23,779	37,477	5.9	39,433	47,127	2.0
Norco	24,157	26,456	1.1	80,537	78,141	–0.3
San Luis	15,322	24,654	6.1	29,569	23,305	–2.6
Desert Hot Springs	16,582	23,995	4.7	33,459	38,465	1.6
Blythe	12,155	21,650	7.5	45,480	37,937	–2.0
Rancho Mirage	13,249	16,582	2.8	77,027	NA[b]	NA
Somerton	7,266	12,146	6.6	34,176	NA	NA
Canyon Lake	9,952	11,064	1.3	90,263	NA	NA
Calimesa	7,139	7,479	0.6	48,731	NA	NA
Indian Wells	3,816	5,114	3.7	121,008	NA	NA
Quartzite	3,354	3,468	0.4	29,681	NA	NA
Parker	3,140	3,116	–0.1	44,580	NA	NA
Wellton	1,829	1,921	0.6	34,821	NA	NA

[a] Data are averages for the period 2006–2008.

[b] NA = data not available.

Source: U.S. Bureau of the Census (2009b,d).

Population growth rates among the larger cities in the western part of the county have varied over the period 2000 to 2008. Murietta grew at an annual rate of 10.4% during this period; higher-than-average growth was also experienced in Lake Elsinore (7.1%), Temecula (6.5%), and San Jacinto (5.9%). The cities of Hemet (2.4%), Corona (2.2%), and Riverside (1.8%) all experienced lower growth rates between 2000 and 2008.

A smaller group of cities, including Indio (83,480), Cathedral City (51,793), Palm Desert (50,494), Coachella (39,004), La Quinta (43,232), and Desert Hot Springs (23,995), is about 100 mi (161 km) from the SEZ site. Population growth in these cities between 2000 and 2008 has been relatively high, with annual growth rates of 7.8% in La Quinta, Coachella (7.0%), Indio (6.9%), and Desert Hot Springs (4.7%). One city, Blythe (21,650), is located on the eastern border of the county, on the Colorado River, less than 10 mi (16 km) from the proposed SEZ location, and had a relatively high population growth rate (7.5%) between 2000 and 2008.

8.1.19.1.4 ROI Urban Income

Median household incomes varied considerably across cities in the ROI. In each city in Yuma County and La Paz County, median household incomes in 1999 were lower than the average for the state ($57,399) (Table 8.1.19.1-4). Of these cities, Yuma ($45,545) had the largest median household income, followed by Parker ($44,580). Quartzite ($29,681) and San Luis ($29,569) had median household incomes that were close to half the state average.

Data on median household incomes for the period 2006 to 2008 were only available for two cities in the Arizona portion of the ROI. Median income growth rates for the period 1999 and 2006 to 2008 were negative in Yuma (–0.9%), with a fairly large decline in median incomes in San Luis (–2.6%). The average median household income growth rate for the state as a whole over this period was –0.2%.

A number of cities in the western part of Riverside County—Murietta ($79,135), Corona ($78,141), and Temecula ($77,394)—had median household incomes in 2006 to 2008 that were higher than the average for the state ($61,154) (Table 8.1.19.1-4). A number of cities in the western portion of the county had relatively low median household incomes, notably Hemet ($34,974) and San Jacinto ($47,127).

Among the cities in the western part of Riverside County, median household income growth rates between 1999 and 2006 to 2008 were highest in San Jacinto (2.1%) and Perris (1.7%), with lower annual growth rates elsewhere. Moreno Valley (–1.1%) and Norco (–0.3%) had negative median household income growth rates between 1999 and 2006 to 2008. The average median household income growth rate for the state as a whole over this period was less than 0.1%.

Elsewhere in the county, La Quinta ($78,898) had a median household income higher than the state average between 2006 and 2008, while other cities—Palm Desert ($55,218), Indio ($53,824), Cathedral City ($42,026), Coachella ($40,463), and Desert Hot Springs ($38,465)—

had median household incomes less than the state average. The median income in Blythe in 2006 to 2008 was $37,937. Growth rates in these cities over the period 1999 and 2006 to 2008 varied from 2.1% in Indio to -2.0% in Blythe.

8.1.19.1.5 ROI Population

Table 8.2.19.1-5 presents recent and projected populations in the ROI and each state as a whole. Population in the ROI stood at 2,301,221 in 2008, having grown at an average annual rate of 3.7% since 2000. Growth rates for the ROI were higher than those for both Arizona (3.0%) and California (1.0%) over the same period.

Each county in the ROI experienced growth in population between 2000 and 2008; population in Riverside County grew at an annual rate of 3.8%; in Yuma County population grew by 2.4%, with lower rates in La Paz County (0.2%). The ROI population is expected to increase to 3,267,002 by 2021 and to 3,397,476 by 2023.

8.1.19.1.6 ROI Income

Total personal income in the ROI stood at $68.1 billion in 2007 and has grown at an annual average rate of 4.0% over the period 1998 to 2007 (Table 8.1.19.1-6). Per-capita income also rose over the same period at a rate of 0.6%, increasing from $28,174 to $29,910. Per-capita incomes were higher in Riverside County ($30,713) than La Paz County ($25,124) and Yuma County ($22,194) in 2007. Growth rates in total personal income have been slightly higher in

TABLE 8.1.19.1-5 ROI Population for the Proposed Brenda SEZ

Location	2000	2008	Average Annual Growth Rate, 2000–2008 (%)	2021	2023
La Paz County, Arizona	19,715	20,005	0.2	25,757	26,302
Yuma County, Arizona	160,026	193,299	2.4	276,132	285,531
Riverside County, California	1,545,387	2,087,917	3.8	2,965,113	3,085,643
ROI	1,725,128	2,301,221	3.7	3,267,002	3,397,476
Arizona	5,130,632	6,499,377	3.0	8,945,447	9,271,163
California	33,871,648	36,580,371	1.0	44,646,420	45,667,413

Sources: U.S. Bureau of the Census (2009e,f); Arizona Department of Commerce (2010); California Department of Finance (2010).

TABLE 8.1.19.1-6 ROI Personal Income for the Proposed Brenda SEZ

Location	1998	2007	Average Annual Growth Rate, 1998–2007 (%)
La Paz County, Arizona			
Total income[a]	0.4	0.5	3.3
Per-capita income	19,345	25,124	2.6
Yuma County, Arizona			
Total income[a]	3.3	4.5	3.0
Per-capita income	22,314	22,194	−0.1
Riverside County, California			
Total income[a]	42.2	63.1	4.1
Per-capita income	28,886	30,713	0.6
ROI			
Total income[a]	45.9	68.1	4.0
Per-capita income	28,174	29,910	0.6
Arizona			
Total income[a]	149.2	215.8	3.8
Per-capita income	30,551	33,558	0.9
California			
Total income[a]	1,231.7	1,573.6	2.5
Per-capita income	37,339	41,821	1.1

[a] Unless indicated otherwise, values are reported in $ billion 2008.

Sources: U.S. Department of Commerce (2009); U.S. Bureau of the Census (2009e,f).

Riverside County, with higher growth rates in per-capita income in La Paz County. Personal income growth rates in the ROI were higher than the rate for Arizona (3.8%) and California (2.5%), but per-capita income growth rates in the ROI were slightly lower those in California (1.1%) and Arizona (0.9%) as a whole.

Median household income over the period 2006 to 2008 varied from $58,168 in Riverside County, to $40,079 in Yuma County and $30,797 in La Paz County (U.S. Bureau of the Census 2009d).

8.1.19.1.7 ROI Housing

In 2007, 856,660 housing units were located in the three ROI counties, with about 88% of these located in Riverside County (Table 8.1.19.1-7). Owner-occupied units compose approximately 69% of the occupied units in the three counties, with rental housing making up 31% of the total. Vacancy rates in 2007 were 38.5% in La Paz County, 19.8% in Yuma County, and 14.2% in Riverside County; 8.2% of housing units in the ROI were used for seasonal or recreational purposes in 2000. With an overall vacancy rate of 15.2% in the ROI, there were 130,551 vacant housing units in the ROI in 2007, of which 40,222 are estimated to be rental units that would be available to construction workers. There were 55,110 units in seasonal, recreational, or occasional use at the time of the 2000 Census.

Housing stock in the ROI as a whole grew at an annual rate of 3.5% over the period 2000 to 2007, with 182,713 new units added to the existing housing stock (Table 8.1.19.1-6).

The median value of owner-occupied housing in 2006 to 2008 varied between $95,300 in La Paz County, $147,400 in Yuma County, and $380,600 in Riverside County (U.S. Bureau of the Census 2009g).

8.1.19.1.8 ROI Local Government Organizations

The various local and county government organizations in the ROI are listed in Table 8.1.19.1-8. In addition, there are 15 Tribal governments located in the county, with members of other Tribal groups located in the area, but whose Tribal governments are located in adjacent counties or states.

8.1.19.1.9 ROI Community and Social Services

This section describes educational, health care, law enforcement, and firefighting resources in the ROI.

Schools

In 2007, the three-county ROI had a total of 544 public and private elementary, middle, and high schools (NCES 2009). Table 8.1.19.1-9 provides summary statistics for enrollment and 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 Riverside County schools (22.1) is slightly higher than that in Yuma County schools (20.2), and in La Paz County (16.2), and the level of service is slightly higher in Riverside County (9.3) than in Yuma County (8.9) and La Paz County (8.0), where there are fewer teachers per 1,000 population.

TABLE 8.1.19.1-7 ROI Housing Characteristics for the Proposed Brenda SEZ

Parameter	2000	2007[a]
La Paz County, Arizona		
Owner-occupied	6,521	7,312
Rental	1,841	2,322
Vacant units	6,771	6,029
Seasonal and recreational use	5,234	NA[b]
Total units	15,133	15,663
Yuma County, Arizona		
Owner-occupied	38,911	48,658
Rental	14,937	20,774
Vacant units	20,292	17,150
Seasonal and recreational use	11,668	NA
Total units	74,140	86,582
Riverside County, California		
Owner-occupied	348,532	446,017
Rental	157,686	201,426
Vacant units	78,456	106,972
Seasonal and recreational use	38,208	NA
Total units	584,674	754,415
ROI		
Owner-occupied	393,964	501,987
Rental	174,464	224,522
Vacant units	105,519	130,551
Seasonal and recreational use	55,110	NA
Total units	673,947	856,660

[a] 2007 data for number of owner-occupied, rental, and vacant units for California counties are not available; data are based on 2007 total housing units and 2000 data on housing tenure.

[b] NA = data not available.

Sources: U.S. Bureau of the Census (2009dh-j).

Health Care

The total number of physicians (3,277) is much higher in Riverside County than elsewhere in the ROI, but the number of physicians per 1,000 population in Riverside County (1.6) is only slightly higher than in Yuma County (1.4), which is still higher than in La Paz County (1.0) (Table 8.1.19.1-10).

TABLE 8.1.19.1-8 ROI Local Government Organizations and Social Institutions in the Proposed Brenda SEZ ROI

Governments	
City	
Apache Junction	Perris
Parker	Cathedral City
Quartzite	Lake Elsinore
San Luis	Palm Desert
Somerton	La Quinta
Wellton	Coachella
Westmoreland	San Jacinto
Yuma	Norco
Riverside	Desert Hot Springs
Moreno Valley	Blythe
Corona	Rancho Mirage
Murietta	Canyon Lake
Temecula	Calimesa
Indio	Indian Wells
Hemet	
County	
La Paz County, Arizona	Riverside County, California
Yuma County, Arizona	
Tribal	
Agua Caliente Band of Cahuilla Indians of the Agua Caliente Indian Reservation, California	
Augustine Band of Cahuilla Mission Indians of the Augustine Reservation, California	
Cabazon Band of Mission Indians, California	
Cahuilla Band of Mission Indians of the Cahuilla Reservation, California	
Colorado River Indian Tribes of the Colorado River Indian Reservation, Arizona and California	
Fort McDowell Yavapai Nation, Arizona	
Ione Band of Miwok Indians of California	
Cocopah Tribe of Arizona	
Morongo Band of Cahuilla Mission Indians of the Morongo Reservation, California	
Pechanga Band of Luiseno Mission Indians of the Pechanga Reservation, California	
Quechan Tribe of the Fort Yuma Indian Reservation, California and Arizona	
Ramona Band or Village of Cahuilla Mission Indians of California	
Santa Rosa Band of Cahuilla Indians, California	
Soboba Band of Luiseno Indians, California	
Torres Martinez Desert Cahuilla Indians, California	

Sources: U.S. Bureau of the Census (2009b); U.S. Department of the Interior (2010).

TABLE 8.1.19.1-9 ROI School District Data for the Proposed Brenda SEZ, 2007

Location	Number of Students	Number of Teachers	Student-Teacher Ratio	Level of Service[a]
La Paz County, Arizona	2,591	160	16.2	8.0
Yuma County, Arizona	36,287	1,800	20.2	8.9
Riverside County, California	421,642	19,105	22.1	9.3
ROI	460,520	21,065	21.9	9.3

[a] Number of teachers per 1,000 population.

Source: NCES (2009).

TABLE 8.1.19.1-10 Physicians in the Proposed Brenda SEZ ROI, 2007

Location	Number of Primary Care Physicians	Level of Service[a]
La Paz County, Arizona	20	1.0
Yuma County, Arizona	268	1.4
Riverside County, California	3,277	1.6
ROI	3,565	1.6

[a] Number of physicians per 1,000 population.

Source: AMA (2009).

Public Safety

Several state, county, and local police departments provide law enforcement in the ROI (Table 8.1.19.1-11). La Paz County has 36 officers who would provide law enforcement services to the SEZ; there are 68 officers in Yuma County and 1,965 officers in Riverside County. Levels of service of police protection are 1.8 officers per 1,000 population in La Paz County, 1.0 in Riverside County, and 0.4 in Yuma County. Currently, there are 2,346 professional firefighters in the ROI (Table 8.1.19.1-11).

8.1.19.1.10 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

TABLE 8.1.19.1-11 Public Safety Employment in the Proposed Brenda SEZ ROI

Location	Number of Police Officers[a]	Level of Service[b]	Number of Firefighters[c]	Level of Service[b]
La Paz County, Arizona	36	1.8	14	0.7
Yuma County, Arizona	68	0.4	127	0.7
Riverside County, California	1,965	1.0	2,205	1.1
ROI	2,001	0.9	2,346	1.0

[a] 2007 data.

[b] Number per 1,000 population.

[c] 2008 data; number does not include volunteers.

Sources: U.S. Department of Justice (2008); Fire Departments Network (2009).

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 growth in population is between 5 and 15% in smaller rural communities, alcoholism, depression, suicide, social conflict, divorce, and delinquency would increase and levels of community satisfaction would deteriorate (BLM 1980, 1983, 1996). Data on violent crime and property crime rates and on alcoholism and illicit drug use, mental health, and divorce, which might be used as indicators of social change, are presented in Tables 8.1.19.1-12 and 8.1.19-1.13, respectively.

There is some variation in the level of crime across the ROI, with higher rates of violent crime in La Paz County (11.3 per 1,000 population) than in Riverside County (3.5), and Yuma County (3.1) (Table 8.1.19.1-12).

Property-related crime rates are also higher in La Paz County (105.5) than in Riverside County (27.5) and Yuma County (21.1); that is, overall crime rates in La Paz County (116.8) were higher than in Riverside County (31.0), and Yuma County (24.2).

Data on 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 three counties are located; rates for alcoholism and illicit drug are slightly higher in the region in which Riverside County is located and rates of mental illness are slightly higher in the region in which La Paz County and Yuma County are located (Table 8.1.19.1-13).

TABLE 8.1.19.1-12 County and ROI Crime Rates for the Proposed Brenda SEZ[a]

	Violent Crime[b]		Property Crime[c]		All Crime	
	Offenses	Rate	Offenses	Rate	Offenses	Rate
La Paz County, Arizona	226	11.3	2,111	105.5	2,337	116.8
Yuma County, Arizona	637	3.1	4,376	21.1	5,013	24.2
Riverside County, California	7,351	3.5	57,839	27.5	65,190	31.0
ROI	8,214	3.6	64,326	28.0	72,540	31.5

[a] Rates are the number of crimes per 1,000 population; data are for 2008.

[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 8.1.19.1-13 Alcoholism, Drug Use, Mental Health, and Divorce in the Proposed Brenda SEZ ROI[a]

Geographic Area	Alcoholism	Illicit Drug Use	Mental Health[b]	Divorce[c]
Arizona Rural South Region (includes Yuma County)	7.3	2.6	8.8	NA[d]
California Region 13 (includes Riverside County)	8.5	3.2	8.6	NA
Arizona				3.9
California				4.3

[a] Data for alcoholism and drug use represent percentage of the population over 12 years of age with dependence or abuse of alcohol, 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. Arizona data are for 2007; California data are for 1990.

[d] NA = not applicable.

Sources: SAMHSA (2009); CDC (2009).

8.1.19.1.11 ROI Recreation

There are various areas in the vicinity of the proposed SEZ that 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 areas are discussed in Section 7.2.5.

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 Appendix M).

Another method 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 development, 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, 82,375 people were employed in the ROI in the various sectors identified as recreation, constituting 9.5% of total ROI employment (Table 8.1.19.1-14). Recreation spending also produced almost $2,479 million in income in the ROI in 2007. The primary sources of recreation-related employment were eating and drinking places.

8.1.19.2 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 developments employing various solar energy technologies are analyzed in detail in subsequent sections.

8.1.19.2.1 Common Impacts

Construction and operation of a solar energy facility at the proposed Brenda 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.

TABLE 8.1.19.1-14 Recreation Sector Activity in the Proposed Brenda SEZ ROI, 2007

ROI	Employment	Income ($ million)
Amusement and recreation services	5,385	174.5
Automotive rental	693	38.0
Eating and drinking places	60,063	1,214.1
Hotels and lodging places	8,956	309.2
Museums and historic sites	304	21.1
Recreational vehicle parks and campsites	934	26.0
Scenic tours	1,936	124.2
Sporting goods retailers	4,104	571.3
Total ROI	82,375	2,478.5

Source: MIG, Inc. (2010).

Socioeconomic impacts common to all utility-scale solar energy developments 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 accommodation otherwise used for recreational visits, thus reducing recreational 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 developments 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, and 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 less than 0.1% in ROI population during construction of the trough technology, with smaller increases for the power tower, dish engine and PV 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, make it likely that many workers will commute to the SEZ from larger communities elsewhere in the ROI, reducing the potential impact of solar developments 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 developments 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

Cattle ranching and farming supported 628 jobs and $7.4 million in income in the ROI in 2007 (MIG, Inc. 2010). The construction and operation of solar facilities in the Brenda SEZ could result in a decline in the amount of land available for livestock grazing. However, because the amount of acreage that would be used in the proposed SEZ would be small compared with the overall size of local land allotments, acreage loss would not have a significant impact on overall grazing operations. Livestock management changes, or the provision of additional livestock management facilities, would mean that no loss of AUMs is anticipated.

Transmission Line Impacts

The impacts of transmission line construction could include the addition of 98 jobs in the ROI (including direct and indirect impacts) in the peak year of construction (Table 8.1.19.2-1). Construction activities in the peak year would constitute less than 1% of total ROI employment. A transmission line would also produce $5.1 million in ROI income. Direct sales taxes and direct income taxes would be $0.1 million.

TABLE 8.1.19.2-1 ROI Socioeconomic Impacts of a 230-kV Transmission Line at the Proposed Brenda SEZ[a]

Parameter	Construction	Operations
Employment (no.)		
Direct	39	<1
Total	98	1
Income[b]		
Total	5.1	<0.1
Direct state taxes[b]		
Sales	0.1	<0.1
Income	0.1	<0.1
In-migrants (no.)	31	0
Vacant housing[c] (no.)	16	0
Local community service employment		
Teachers (no.)	0	0
Physicians (no.)	0	0
Public safety (no.)	0	0

[a] Construction impacts assume 19 mi (31 km) of transmission line are required for the Brenda SEZ. Construction impacts are assessed for the peak year of construction.

[b] Unless indicated otherwise, values are reported in $ million 2008.

[c] Construction activities would affect vacant rental housing; operations activities would affect vacant owner-occupied housing.

Given the likelihood of local worker availability in the required occupational categories, construction of a transmission line would mean that some in-migration of workers and their families from outside the ROI would be required, with 37 persons in-migrating into the ROI during the peak construction year. Although in-migration may potentially affect local housing markets, the relatively small number of in-migrants and the availability of temporary accommodation (hotels, motels, and mobile home parks) would mean that the impact of solar facility construction on the number of vacant rental housing units is not expected to be large, with 19 rental units expected to be occupied in the ROI. This occupancy rate would represent less than 1% of the vacant rental units expected to be available in the ROI in the peak year.

No new community service employment would be required in order to meet existing levels of service in the three ROIs.

Total operations employment impacts in the ROI (including direct and indirect impacts) of a transmission line would be 1 job during the first year of operation (Table 8.1.19.2-1) and would produce less than $0.1 million in income. Direct sales taxes would be less than $0.1 million in the first year, with direct income taxes of less than $0.1 million. Operation of a transmission line would not require the in-migration of workers and their families from outside the ROI; consequently, no impacts on housing markets in the ROI would be expected, and no new community service employment would be required in order to meet existing levels of service in the ROI.

8.1.19.2.2 Technology-Specific Impacts

The economic impacts of solar energy development in the proposed SEZ were measured in terms of employment, income, state tax revenues (sales and income), 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 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 one project could be constructed within a given year, with a corresponding maximum land disturbance of up to 3,000 acres (12 km^2). For operations impacts, a representative first year of operations was assumed to be 2023 for trough and power tower and 2022 for the minimum facility size for dish engine and PV, and 2023 was assumed for the maximum facility size for these technologies. 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 technologies would be up to 5,245 jobs (Table 8.1.19.2-2). Construction activities would constitute 0.4% of total ROI employment. A solar facility would also produce $309.0 million in income. Direct sales taxes would be $13.7 million, and direct income taxes, $6.3 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 743 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 371 rental units expected to be occupied in the ROI. This occupancy rate would represent 0.6% 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 employment (education, health, and public safety). An increase in such employment would be required to meet existing levels of service in the ROI. Accordingly, 7 new teachers, 1 physician, and 1 public safety employee (career firefighters and uniformed police officers) 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) of a build-out using solar trough technologies would be 217 jobs (Table 8.1.19.2-2). Such a solar facility would also produce $8.1 million in income. Direct sales taxes would be $0.2 million, and direct income taxes, $0.2 million. Based on fees established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010h), acreage rental payments would be $0.2 million, and solar generating capacity payments would total at least $4.1 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 17 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 15 owner-occupied units expected to be occupied in the ROI.

No new community service employment would be required to meet existing levels of service in the ROI.

Power Tower

Construction. Total construction employment impacts in the ROI (including direct and indirect impacts) from the use of power tower technologies would be up to 2,089 jobs (Table 8.1.19.2-3). Construction activities would constitute 0.2% of total ROI employment. Such a solar facility would also produce $123.1 million in income. Direct sales taxes would be less than $5.5 million, with direct income taxes of $2.5 million.

TABLE 8.1.19.2-2 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Brenda SEZ with Trough Facilities[a]

Parameter	Maximum Annual Construction Impacts	Operations Impacts
Employment (no.)		
Direct	1,744	131
Total	5,245	217
Income[b]		
Total	309.0	8.1
Direct state taxes[b]		
Sales	13.7	0.2
Income	6.3	0.2
BLM payments ($ million 2008)		
Rental	NA[c]	0.2
Capacity[d]	NA	4.1
In-migrants (no.)	743	17
Vacant housing[e] (no.)	371	15
Local community service employment		
Teachers (no.)	7	0
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 one facility with a combined capacity of up to 600 MW (corresponding to 3,000 acres [12 km^2] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 620 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 2010h), 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.

TABLE 8.1.19.2-3 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Brenda SEZ with Power Tower Facilities[a]

Parameter	Maximum Annual Construction Impacts	Operations Impacts
Employment (no.)		
Direct	695	68
Total	2,089	94
Income[b]		
Total	123.1	3.3
Direct state taxes[b]		
Sales	5.5	<0.1
Income	2.5	0.1
BLM payments ($ million 2008)		
Rental	NA[c]	0.2
Capacity[d]	NA	2.3
In-migrants (no.)	296	9
Vacant housing[e] (no.)	148	8
Local community service employment		
Teachers (no.)	3	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 one facility with a combined capacity of up to 333 MW (corresponding to 3,000 acres [12 km^2] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 345 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 2010h), 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.

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 296 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 148 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, 3 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) of a build-out using power tower technologies would be 94 jobs (Table 8.1.19.2-3). Such a solar facility would also produce $3.3 million in income. Direct sales taxes would be less than $0.1 million, and direct income taxes, $0.1 million. Based on fees established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010h), acreage rental payments would be $0.2 million, and solar generating capacity payments would total at least $2.3 million.

Given the likelihood of local worker availability in the required occupational categories, operation of a solar facility means that some in-migration of workers and their families from outside the ROI would be required, with 9 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 8 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.

Dish Engine

Construction. Total construction employment impacts in the ROI (including direct and indirect impacts) from the use of dish engine technologies would be up to 849 jobs (Table 8.1.19.2-4). Construction activities would constitute 0.1% of total ROI employment. Such a solar facility would also produce $50.1 million in income. Direct sales taxes would be less than $2.2 million, and direct income taxes, $1.0 million.

TABLE 8.1.19.2-4 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Brenda SEZ with Dish Engine Facilities[a]

Parameter	Maximum Annual Construction Impacts	Operations Impacts
Employment (no.)		
Direct	282	66
Total	849	92
Income[b]		
Total	50.1	3.2
Direct state taxes[b]		
Sales	2.2	<0.1
Income	1.0	0.1
BLM payments ($ million 2008)		
Rental	NA[c]	0.2
Capacity[d]	NA	2.3
In-migrants (no.)	120	8
Vacant housing[e] (no.)	60	8
Local community service employment		
Teachers (no.)	1	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 one facility with a combined capacity of up to 333 MW (corresponding to 3,000 acres [12 km^2] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 345 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 2010h), 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.

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 120 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 60 rental units expected to be occupied in the ROI. This occupancy rate would represent 0.1% 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, one new teacher 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) of a build-out using dish engine technologies would be 92 jobs (Table 8.1.19.2-4). Such a solar facility would also produce less than $3.2 million in income. Direct sales taxes would be less than $0.1 million, and direct income taxes, $0.1 million. Based on fees established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010h), acreage rental payments would be $0.2 million and solar generating capacity payments would total at least $2.3 million.

Given the likelihood of local worker availability in the required occupational categories, operation of a dish engine solar facility means that some in-migration of workers and their families from outside the ROI would be required, with 8 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 8 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.

Photovoltaic

Construction. Total construction employment impacts in the ROI (including direct and indirect impacts) from the use of PV technologies would be up to 396 jobs (Table 8.1.19.2-5). Construction activities would constitute less than 0.1% of total ROI employment. Such a solar development would also produce $23.4 million in income. Direct sales taxes would be $1.1 million, and direct income taxes, $0.5 million.

TABLE 8.1.19.2-5 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Brenda SEZ with PV Facilities[a]

Parameter	Maximum Annual Construction Impacts	Operations Impacts
Employment (no.)		
Direct	132	7
Total	396	9
Income[b]		
Total	23.4	0.3
Direct state taxes[b]		
Sales	1.1	<0.1
Income	0.5	<0.1
BLM payments ($ million 2008)		
Rental	NA[c]	0.2
Capacity[d]	NA	1.8
In-migrants (no.)	56	1
Vacant housing[e] (no.)	28	1
Local community service employment		
Teachers (no.)	1	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 one facility with a combined capacity of up to 333 MW (corresponding to 3,000 acres [12 km^2] of land disturbance) could be built. Operations impacts were based on full build-out of the site, producing a total output of 345 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 2010h), assuming full buildout of the site.

[e] Construction activities would affect vacant rental housing; operations activities would affect owner-occupied housing.

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 56 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 28 rental units expected to be occupied in the ROI. This occupancy rate would represent less than 0.1% 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, 1 new teacher 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) of a build-out using PV technologies would be 9 jobs (Table 8.1.19.2-5). Such a solar facility would also produce $0.3 million in income. Direct sales taxes would be less than $0.1 million, and direct income taxes, less than $0.1 million. Based on fees established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010h), acreage rental payments would be $0.2 million, and solar generating capacity payments would total at least $1.8 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 one person 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 1 owner-occupied unit expected to be required in the ROI.

No new community service employment would be required to meet existing levels of service in the ROI.

8.1.19.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features addressing socioeconomic impacts have been identified for the proposed Brenda 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.

8.1.20 Environmental Justice

8.1.20.1 Affected Environment

On February 11, 1994, the President signed Executive Order 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 76297, 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 of the geographic distribution of low-income and minority populations in the affected area is undertaken; (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 a solar energy project in the proposed SEZ could affect environmental justice if any adverse health and environmental impacts resulting from either phase of development are significantly high and if these impacts disproportionately affect 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 an associated 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 who 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 origin. In addition, persons who classify themselves as being of multiple racial origins 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 should 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.

This PEIS applies both criteria in using the Census 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 8.1.20.1-1 show the minority and low-income composition of total population located in the proposed SEZ 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 Arizona, 34.3% of the population is classified as minority, while 19.2% is classified as low-income. The number of minority individuals does not exceed 50% of the total population in the area and the number of minority individuals does not exceed the state average by 20 percentage points or more; thus, there is no minority population in 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 SEZ.

In the California portion of the 50-mi (80-km) radius, 52.3% of the population is classified as minority, while 21.8% is classified as low-income. Although the number of minority individuals does not exceed the state average by 20 percentage points or more, the number of minority individuals exceeds 50% of the total population in the area; thus, there is a minority population in 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

TABLE 8.1.20.1-1 Minority and Low-Income Populations within the 50-mi (80-km) Radius Surrounding the Proposed Brenda SEZ

Parameter	Arizona	California
Total population	30,377	19,262
White, non-Hispanic	19,951	9,189
Hispanic or Latino	7,278	7,922
Non-Hispanic or Latino minorities	3,148	2,151
One race	2,686	1,800
Black or African American	262	1,255
American Indian or Alaskan Native	2,260	299
Asian	110	186
Native Hawaiian or Other Pacific Islander	12	37
Some other race	42	23
Two or more races	462	351
Total minority	10,426	10,073
Low-income	5,708	4,145
Percentage minority	34.3	52.3
State percentage minority	24.5	40.5
Percentage low-income	19.2	21.8
State percentage low-income	13.9	14.2

Sources: U.S. Bureau of the Census (2009k,l).

not exceed 50% of the total population in the area; thus, there are no low-income populations in the SEZ.

Figures 8.1.20.1-1 and 8.1.20.1-2 show the locations of the minority and low-income population groups, respectively, within the 50-mi (80-km) radius around the boundary of the SEZ.

At the individual block group level there are minority populations in numerous census block groups, located to the west and northwest of the SEZ, including the towns of Blythe and Parker and the Colorado River Indian Reservation, and to the southeast of the site, in Yuma County, where the minority population is more than 20 percentage points higher than the state average. There are also a number of block groups where the minority population exceeds 50% of the total population, located in the cities of Parker, Blythe, and in eastern Riverside County.

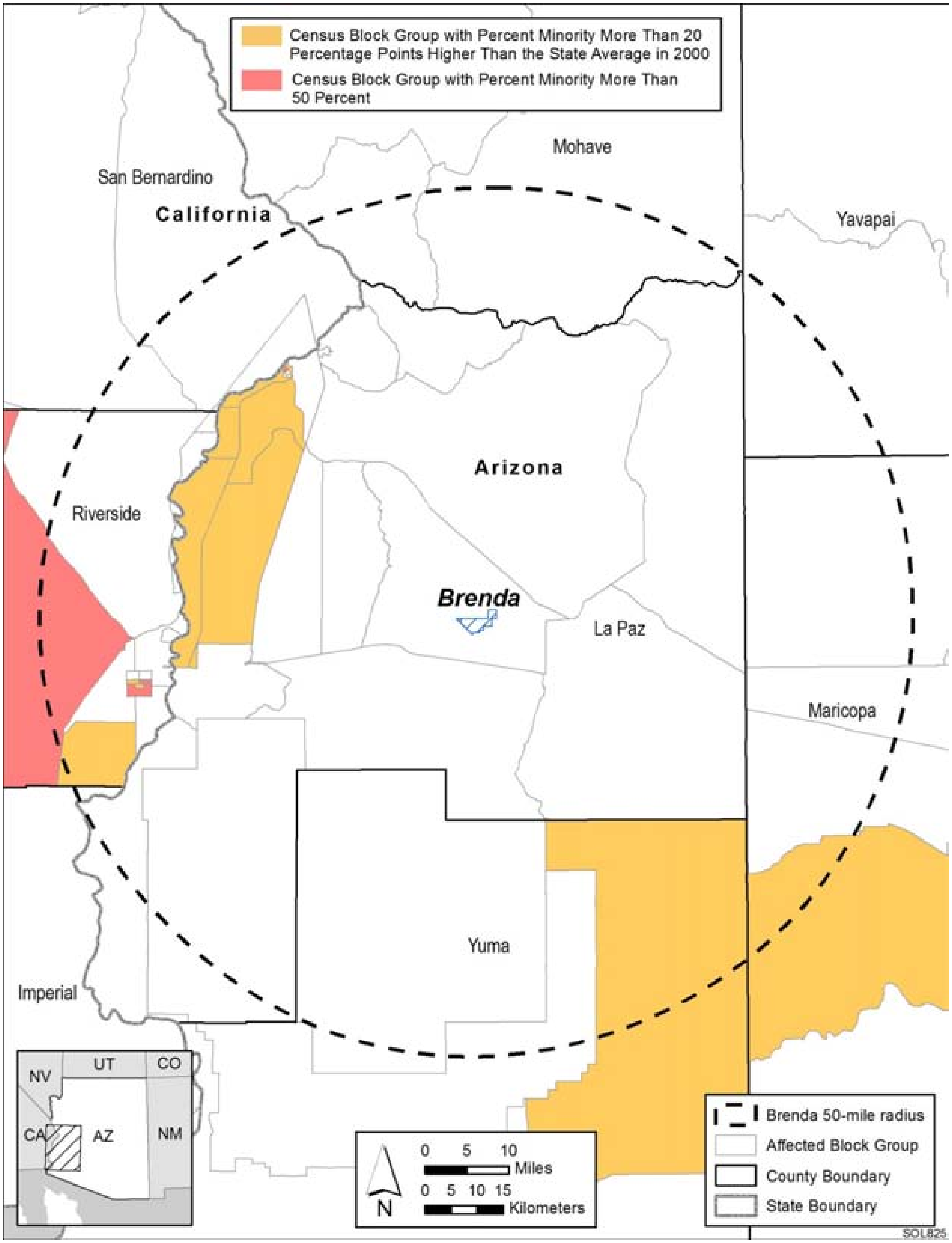

FIGURE 8.1.20.1-1 Minority Population Groups within the 50-mi (80-km) Radius Surrounding the Proposed Brenda SEZ

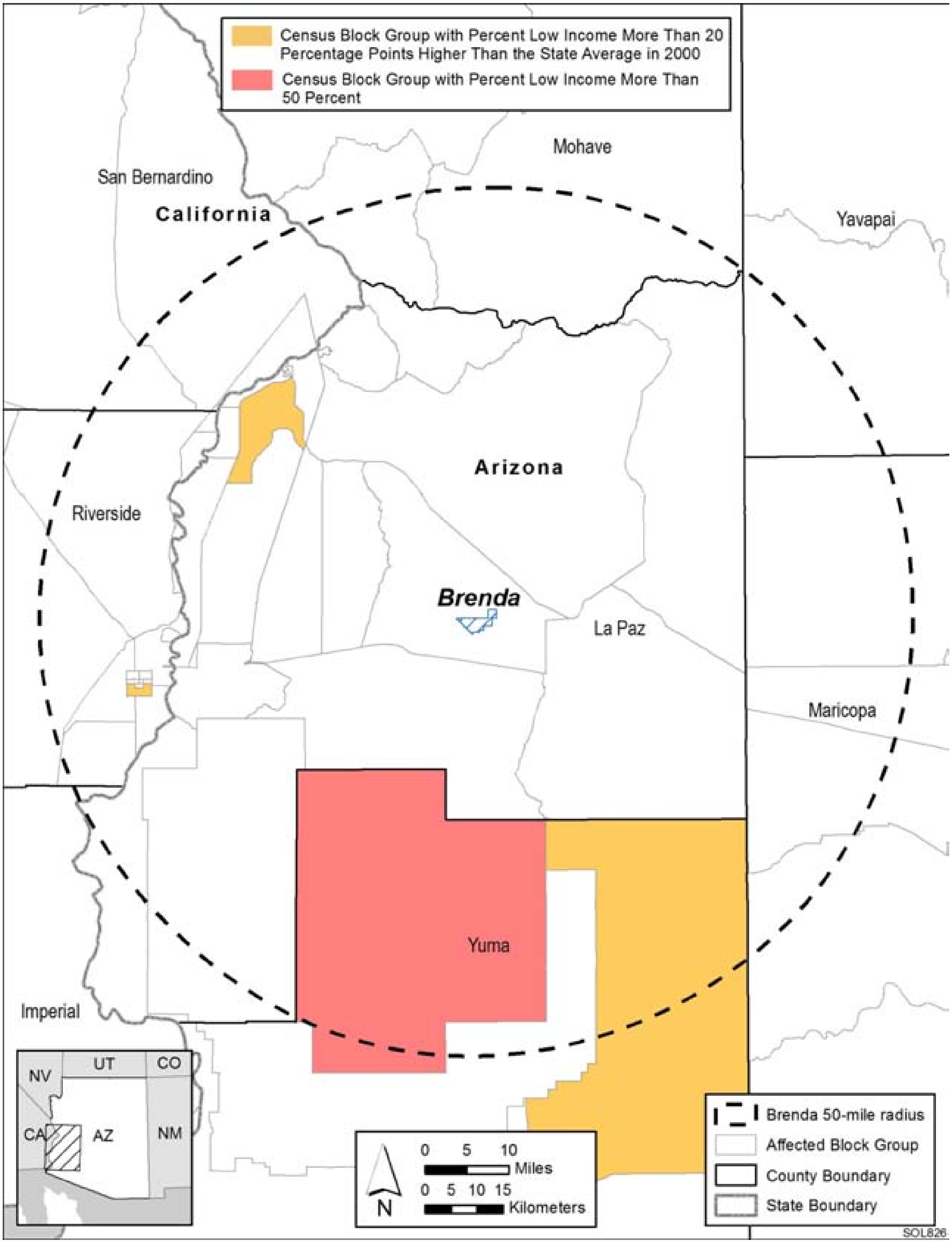

FIGURE 8.1.20.1-2 Low-Income Population Groups within the 50-mi (80-km) Radius Surrounding the Proposed Brenda SEZ

Census block groups with low-income populations more than 20 percentage points higher than the state average are located to the northwest of the SEZ, including the Colorado River Indian Reservation, in the city of Blyth, and to the southeast of the site, in Yuma County. There is one block group where the low-income population exceeds 50% of the total population, located to the south of the SEZ, in Yuma County.

8.1.20.2 Impacts

Environmental justice concerns common to all utility-scale solar energy facilities are described in detail in Section 5.18. These impacts will be minimized through the implementation of the programmatic design features described in Appendix A, Section A.2.2, which address the underlying environmental impacts contributing to the concerns. The potentially relevant environmental impacts associated with solar facilities within the proposed Brenda SEZ include noise and dust during the construction; noise and electromagnetic field (EMF) effects associated with operations; 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 as 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 Brenda SEZ; no low-income populations are present (Section 8.1.20.1).

Potential impacts on low-income and minority populations could be incurred as a result of the construction and operation of solar facilities involving each of the four technologies. Although impacts are likely to be small, there are minority populations defined by CEQ guidelines (Section 8.1.20.1) within the 50-mi (80-km) radius around the boundary of the SEZ, meaning that any adverse impacts of solar projects could disproportionately affect minority populations. Because there are low-income populations within the 50-mi (80-km) radius, there would be impacts on low-income populations.

8.1.20.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features addressing environmental justice impacts have been identified for the proposed Brenda 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.

8.1.21 Transportation

The proposed Brenda SEZ is accessible by road and rail. One interstate highway (I-10) and one U.S. highway (U.S. 60), as well as a regional railroad, serve the immediate area. A number of smaller airports serve the area. General transportation considerations and impacts are discussed in Sections 3.4 and 5.19, respectively.

8.1.21.1 Affected Environment

U.S. 60 runs southwest–northeast along the southeast border of the Brenda SEZ, as shown in Figure 8.1.21.1-1. To the southwest, U.S. 60 terminates at I-10 about 6 mi (10 km) away. The town of Quartzsite is an additional 12 mi (19 km) to the west along I-10. The small town of Salome is 18 mi (29 km) northeast along U.S. 60. The western edge of the Phoenix metropolitan area is approximately 100 mi (161 km) east of the SEZ along I-10. In the opposite direction, the Los Angeles area is approximately 230 mi (370 km) away along I-10. Several local unimproved dirt roads cross the SEZ. The area is designated for OHV travel as "limited to designated roads and trails" (BLM 2007a). As listed in Table 8.1.21.1-1, U.S. 60 carries an annual average daily traffic (AADT) volume of about 1,500 vehicles in the vicinity of the Brenda SEZ (ADOT 2010).

The Arizona and California (ARZC) railroad serves the area (RailAmerica 2010). This regional railroad originates in the west at Cadiz, California, where it has an interchange with the Burlington Northern Santa Fe (BNSF) Railroad. The ARZC Railroad passes into Arizona through Parker and travels southeast to Vicksburg, the closest rail stop to the Brenda SEZ, about an 11-mi (18-km) drive. The railroad continues to Matthie (adjacent to Wickenburg [70 mi (113 km)]) to the northeast, where it again has an interchange with the BNSF Railroad.

Four small airports open to the public are within a driving distance of approximately 85 mi (137 km) of the proposed Brenda SEZ, as listed in Table 8.1.21.1-2. None of these airports have regularly scheduled passenger service. The nearest public airports are the Blythe and Avi Suquilla Airports, which are both approximately 50 mi (80 km) away. The nearest large airports are Sky Harbor in Phoenix (125 mi [201 km]) to the east and Yuma International in Yuma (104 mi [167 km]) to the south. A number of additional smaller airports can be found in the Phoenix area (>100 mi [161 km]) as well.

8.1.21.2 Impacts

As discussed in Section 5.19, the primary transportation impacts are anticipated to be from commuting worker traffic. Single projects could involve up to 1,000 workers each day, with an additional 2,000 vehicle trips per day (maximum). The volume of traffic on U.S. 60 would represent an increase in traffic of about 130% in the area of the Brenda SEZ for a solar project. Such traffic levels would represent about a 10 or 100% increase in the traffic levels experienced on I-10 or State Route 72 at their junctions with U.S. 60, respectively, if all project

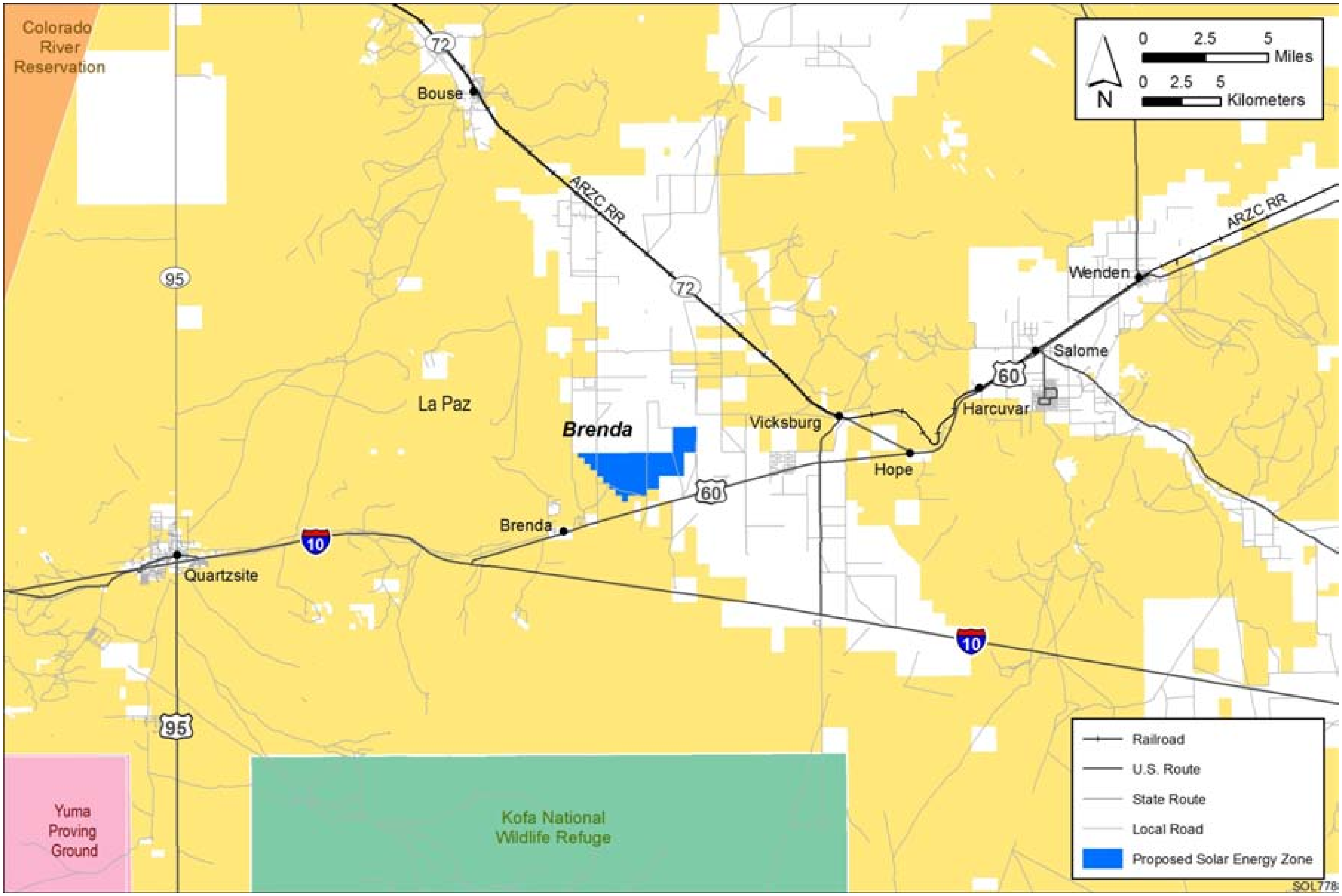

FIGURE 8.1.21.1-1 Local Transportation Network Serving the Proposed Brenda SEZ

TABLE 8.1.21.1-1 AADT on Major Roads near the Brenda SEZ for 2008

Road	General Direction	Location	AADT (Vehicles)
I-10	East–west	Exit 19 to exit 26 (east end of Quartzsite to Gold Nugget Road)	19,500
		Exit 26 to exit 31 (Gold Nugget Road to U.S. 60)	18,000
		Exit 31 to exit 45 (U.S. 60 to Vicksburg Road)	18,000
		Exit 45 to exit 53 (Vicksburg Road to Hovatter Road)	20,000
U.S. 60	Southwest–northeast	I-10 exit 31 to Vicksburg Road	1,500
		Vicksburg Road to State Route 72	1,500
		State Route 72 to Buckeye Road	2,500
		Buckeye Road to 2nd St. (in Wenden)	2,000
		2nd St. (in Wenden) to State Route 71	1,600
		State Route 71 to Wickenburg Airport Road	1,600
State Route 72	Northwest–southeast	U.S. 60 to Bousse	2,000
		Bousse to U.S. 95	2,600
State Route 95	North–south	I-10 to Tyson Drive (in Quartzsite)	3,300
		Tyson Drive (in Quartzite) to State Route 72	2,500
		North of State Route 72 to Ehrenberg Road	5,200
U.S. 95	North–south	I-10 to Kuehn Road (in Quartzsite)	3,000
		Kuehn Road to La Paz Valley Road	1,400

Source: ADOT (2010).

traffic were to be routed through I-10 or State Route 72. Because higher traffic volumes would be experienced during shift changes, traffic on I-10 or State Route 72 could experience minor slowdowns during these time periods in the area of their junctions with U.S. 60. Local road improvements would be necessary on any portion of U.S. 60 that might be developed so as not to overwhelm the local access roads near any site access point(s).

Solar development within the SEZ would affect public access along OHV routes designated open and available for public use. If there are any designated as open within the proposed SEZ, open routes crossing areas granted ROWs for solar facilities 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.

TABLE 8.1.21.1-2 Airports Open to the Public in the Vicinity of the Proposed Brenda SEZ

			Runway 1			Runway 2		
Airport	Location	Owner/Operator	Length (ft [m])	Type	Condition	Length (ft [m])	Type	Condition
Blythe	Off I-10, in Blythe, California, 48 mi (77 km) west of the SEZ	County of Riverside/ City of Blythe	5,800 (1,768)	Asphalt	Good	6,543 (1,994)	Asphalt	Good
Avi Suquilla	In Parker, approximately 52 mi (84 km) by way of U.S. 60 and State Route 72 northwest of the SEZ	Colorado River Indian Tribes	6,250 (1,905)	Asphalt	Good	NA[A]	NA	NA
Wickenburg Municipal	In Wickenburg, 70 mi (113 km) northeast off U.S. 60	Town of Wickenburg	6,100 (1,859)	Asphalt	Good	NA	NA	NA
Buckeye Municipal	In Buckeye, 85 mi (137 km) east near I-10 on the western edge of the Phoenix metropolitan area	Town of Buckeye	5,500 (1,676)	Asphalt	Good	NA	NA	NA

[a] NA = not applicable.

Source: FAA (2010).

8.1.21.3 SEZ-Specific Design Features and Design Feature Effectiveness

No SEZ-specific design features have been identified related to impacts on transportation systems around the proposed Brenda SEZ. 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 to 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.

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8.1.22 Cumulative Impacts

The analysis presented in this section addresses the potential cumulative impacts in the vicinity of the proposed Brenda SEZ in La Paz County, Arizona. The CEQ guidelines for implementing NEPA define cumulative impacts as environment 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 further than 5 to 10 years in the future.

The land surrounding the proposed Brenda SEZ is undeveloped with few permanent residents living in the area. The nearest population centers are the small community of Brenda, approximately 3 mi (5 km) southwest of the SEZ, and Vicksburg, about 6 mi (10 km) east of the SEZ. Two RV parks are located on both sides of U.S. 60 in the town of Brenda. Irrigated agricultural land is about 8 mi (13 km) east of the SEZ. The Plomosa Mountain range is about 5 mi (8 km) west of the SEZ. The New Water Mountains WA is about 7 mi (11 km) southwest of the SEZ, and the Kofa NWR is about 10 mi (16 km) south of the SEZ. In addition, the Brenda SEZ is located about 45 mi (72 km) northeast of the Bullard Wash SEZ. For some resources the geographic extent of effects of the two SEZs overlap.

The geographic extent of the cumulative impacts analysis for potentially affected resources near the proposed Brenda SEZ is identified in Section 8.1.22.1. An overview of ongoing and reasonably foreseeable future actions is presented in Section 8.1.22.2. General trends in population growth, energy demand, water availability, and climate change are discussed in Section 8.1.22.3. Cumulative impacts for each resource area are discussed in Section 8.1.22.4.

8.1.22.1 Geographic Extent of the Cumulative Impacts Analysis

The geographic extent of the cumulative impacts analysis for potentially affected resources evaluated near the proposed Brenda SEZ is provided in Table 8.1.22.1-1. These geographic areas define the boundaries encompassing potentially affected resources. Their extent may vary based on the nature of the resource being evaluated and the distance at which an impact may occur (thus, e.g., the evaluation of air quality may have a greater regional extent of impact than visual resources). The BLM, the USFS, and the DoD administer most of the land around the SEZ; the Colorado River Reservation Tribal lands are also about 25 mi (40 km) northwest of the SEZ. The BLM administers approximately 58% of the lands within a 50-mi (80-km) radius of the SEZ.

TABLE 8.1.22.1-1 Geographic Extent of the Cumulative Impacts Analysis by Resource Area: Proposed Brenda SEZ

Resource Area	Geographic Extent
Land Use	Primarily southern La Paz and northern Yuma Counties; also Mohave, Yavapai, and Maricopa Counties in Arizona and San Bernardino and Riverside Counties in California
Specially Designated Areas and Lands with Wilderness Characteristics	Within a 25-mi (40-km) radius of the Brenda SEZ
Rangeland Resources	
Grazing	Grazing allotments within 5 mi (8 km) of Brenda SEZ
Wild Horses and Burros	A 50-mi (80-km) radius from the Center of the Brenda SEZ
Recreation	Southern La Paz and northern Yuma Counties
Military and Civilian Aviation	Southern La Paz and northern Yuma Counties
Soil Resources	Areas within and adjacent to the Brenda SEZ
Minerals	Southern La Paz and northern Yuma Counties
Water Resources	
Surface water	Bouse Wash (intermittent stream); Alamo Wash and Cunningham Wash (both washes flow into the Bouse Wash); Colorado River
Groundwater	Ranegras Plain groundwater basin
Air Quality and Climate	A 31-mi (50-km) radius from the center of the Brenda SEZ
Vegetation, Wildlife and Aquatic Biota, Special Status Species	A 50-mi (80-km) radius from the center of the Brenda SEZ, including portions of La Paz, Yuma, Mohave, Yavapai, and Maricopa Counties in Arizona, and San Bernardino and Riverside Counties in California
Visual Resources	Viewshed within a 25-mi (40-km) radius of the Brenda SEZ
Acoustic Environment (noise)	Areas adjacent to the Brenda SEZ
Paleontological Resources	Areas within and adjacent to the Brenda SEZ
Cultural Resources	Areas within and adjacent to the Brenda SEZ for archaeological sites; viewshed within a 25-mi (40-km) radius of the Brenda SEZ for other properties, such as traditional cultural properties
Native American Concerns	Areas within and adjacent to the Brenda SEZ; viewshed within a 25-mi (40-km) radius of the Brenda SEZ
Socioeconomics	A 50-mi (80-km) radius from the center of the Brenda SEZ
Environmental Justice	A 50-mi (80-km) radius from the center of the Brenda SEZ
Transportation	Interstate 10; U.S. 60 and U.S. 95

8.1.22.2 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 legislation 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 phase 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 foreseeable and potential solar energy projects within 50 mi (80 km) of the proposed SEZ (Section 8.1.22.2.1); 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 8.1.22.2.2). 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.

8.1.22.2.1 Energy Production and Distribution

In November 2006, the Arizona Corporation Commission adopted final rules to expand the state's Renewable Energy Standard to 15% by 2025, with 30% of the renewable energy to be derived from distributed energy (DSIRE 2010).

Reasonably foreseeable future actions related to renewable energy production and energy distribution within 50 mi (80 km) of the proposed Brenda SEZ are identified in Table 8.1.22.2-1 and are described in the following sections. One solar energy project was identified, but no foreseeable wind or geothermal projects have been identified.

TABLE 8.1.22.2-1 Reasonably Foreseeable Future Actions Related to Energy Development and Distribution near the Proposed Brenda SEZ[a]

Description	Status	Resources Affected	Primary Impact Location
Fast-Track Solar Energy Projects on BLM-Administered Land			
Solar Millennium Blythe Solar Project (CACA 48811), 986-MW trough facility; 9,480 total acres	NOI to prepare an EIS issued on Nov. 23, 2009	Land use, visual, terrestrial habitats, wildlife, groundwater	About 45 mi (72 km) west of Brenda SEZ, within Riverside East SEZ
Transmission and Distribution Systems			
None			

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 under way 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 is one fast-track project application within 50 mi (80 km) of the proposed Brenda 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. These proposals are considered together as a general level of interest in development of renewable energy in the region.

Table 8.1.22.2-1 lists one foreseeable fast-track solar energy project, the Solar Millennium Blythe Solar Project. The location of the project is shown on Figure 8.1.22.2-1. Other, more numerous, pending regular-track ROW applications shown in the figure are discussed collectively at the end of this section. No major new transmission projects have been identified.

Foreseeable Renewable Energy Project

Solar Millennium Blythe Solar Project (CACA 48811). This proposed fast-track project would be a parabolic trough facility with an output of 986 MW. The project site would be on public land within the eastern portion of proposed Riverside East SEZ, approximately 8 mi (13 km) west of Blythe, California, adjacent to the I-10 transmission corridor. The proposed facility would occupy approximately 9,480 acres (38.4 km^2) and disturb about 7,030 acres

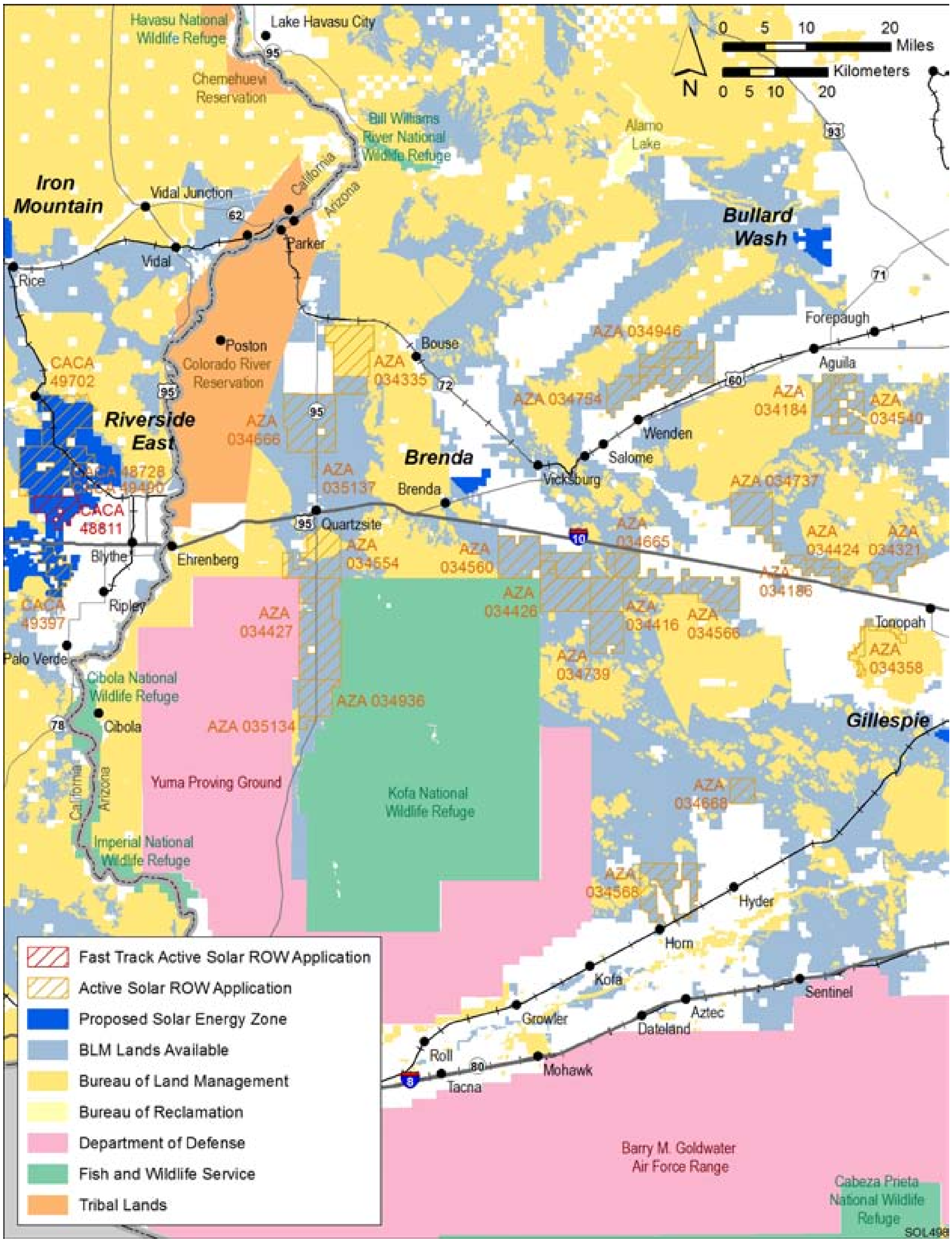

FIGURE 8.1.22.2-1 Locations of Renewable Energy Project ROW Applications within a 50-mi (80-km) Radius of the Proposed Brenda SEZ

(28.5 km^2). The facility would employ four adjacent and independent solar troughs with nominal output of 250 MW each. It would employ dry cooling and would require about 600 ac-ft/yr (0.74 million m^3/yr) of groundwater drawn from two on-site wells for mirror washing and other uses. Water requirements during the proposed 2011 to 2015 construction period are estimated to be 620 ac-ft/yr (0.77 million m^3/yr). The facility would connect to a planned new substation, the Colorado River Substation, to be built approximately 5 mi (8 km) southwest of the project location. To supply auxiliary boilers, a 10-mi (16-km) long natural gas pipeline would be built to connect to an existing pipeline south of I-10. An average of 604 workers would be employed during construction of the facility and 221 full-time employees would be required for operations (BLM and CEC 2010).

Project construction would result in a direct loss of low- to moderate-quality habitat for desert tortoise over the project site and would fragment and degrade adjacent native plant and wildlife communities. The project could also promote the spread of invasive non-native plants and desert tortoise predators such as ravens. Five species of California-listed sensitive plant species are present. Habitat is also present for Western burrowing owl, loggerhead shrike, Le Conte's thrasher, black-tailed gnatcatcher, and California horned lark (BLM and CEC 2010).

Pending Solar Applications on BLM-Administered Lands

In addition to the fast-track solar project described above, 28 regular-track ROW applications for solar projects have been submitted to the BLM that would be located within 50 mi (80 km) of the SEZ. Table 8.1.22.2-2 provides a list of all solar projects that had pending applications submitted to BLM as of March 2010 (BLM and USFS 2010b). Figure 8.1.22.2-1 shows the locations of these applications. There are no pending wind or geothermal ROW applications within this distance.

The likelihood of any of the regular-track application projects actually being developed is uncertain but is generally assumed to be less than that for fast-track applications. The projects are all listed in Table 8.1.22.2-2 for completeness and as an indication of the level of interest in development of solar energy in the region. Some, but not all, of these applications would be expected to result in actual projects. Thus, the cumulative impacts of these potential projects are analyzed in their aggregate effects.

The following description of the Quartzsite Solar Energy Project is an example of one of the pending regular-track solar applications. The description gives an indication of the status of the development and approval of the proposed project.

Quartzsite Solar Energy Project (AZA 34666). Quartzsite Solar Energy proposes to construct a 100-MW CSP/tower facility in La Paz County, Arizona, about 10 mi (16 km) west–northwest of the Brenda SEZ. The project would also include a thermal energy storage system. The generation plant, power line, and ancillary facilities would be on BLM-administered land

TABLE 8.1.22.2-2 Pending Renewable Energy Project ROW Applications on BLM-Administered Land within 50 mi of the Proposed Brenda SEZ[a]

Serial Number	Applicant	Application Received	Size (acres)[b]	MW	Technology	Status (NOI Date)	Field Office
Solar Applications							
AZA 034184	Boulevard Assoc. LLC (Aguila)	June 26, 2007	7,375	500	CSP/trough	Pending	Hassayampa
AZA 034186	Boulevard Assoc., LLC (Big Horn)	June 26, 2007	6,232	500	CSP/trough	Pending	Hassayampa
AZA 034321	Ausra Az II, LLC (Palo Verde)	Oct. 1, 2007	5,748	840	CSP/CLFR	Pending	Hassayampa
AZA 034335	Boulevard Assoc., LLC	June 8, 2007	24,221	500	CSP/trough	Pending	Lake Havasu: Yuma
AZA 034358	First Solar (Saddle Mtn.)	Nov. 6, 2007	5,997	300	PV	Pending	Lower Sonoran
AZA 034416	Pacific Solar Invst., Inc. (Iberdrola) (Eagle Trail)	Dec. 2, 2007	19,000	1,500	CSP/trough	Pending	Yuma
AZA 034424	Pacific Solar Invst., Inc. (Iberdrola) (Big Horn)	Dec. 4, 2007	13,440	900	CSP	Pending	Hassayampa
AZA 034426	Pacific Solar Invst., Inc. (Iberdrola) (Ranegras)	Dec. 2, 2007	25,860	2,000	CSP/trough	Pending	Yuma
AZA 034427	Pacific Solar Invst., Inc. (Iberdrola)	Sept. 6, 2007	32,000	2,000	CSP/trough	Pending	Yuma
AZA 034540	Horizon Wind Energy, LLC (Aguila)	March 4, 2008	11,535	250	CSP/trough	Pending	Hassayampa
AZA 034554	Nextlight Renewable Power, LLC	March 26, 2008	20,699	500	CSP/trough	Pending	Yuma
AZA 034560	Nextlight Renewable Power, LLC	March 26, 2008	15,040	500	CSP/trough	Pending	Yuma
AZA 034566	Nextlight Renewable Power, LLC	March 26, 2008	13,428	500	CSP/trough	Pending	Yuma
AZA 034568	Nextlight Renewable Power, LLC (Palomas)	March 26, 2008	20,165	500	CSP/tough	Pending	Yuma
AZA 034665	Solarreserve, LLC (Black Rack Hill)	May 27, 2008	5,600	600	CSP/tower	Pending	Yuma
AZA 034666	Solarreserve, LLC (Quartzsite)	May 27, 2008	25,204	100	CSP/tower	Jan. 14, 2010	Yuma
AZA 034668	Solarreserve, LLC (Agua Caliente)	May 27, 2008	5,678	600	CSP/tower	Pending	Yuma
AZA 034737	Arizona Solar Invst., Inc. (Haraquahala)	July 10, 2008	14,047	500	CSP/trough	Pending	Hassayampa
AZA 034739	IDIT, Inc.	July 9, 2008	15,000	1,000	CSP/trough	Pending	Yuma
AZA 034754	Horizon Wind Energy, LLC	March 4, 2008	28,760	250	CSP/trough	Pending	Lake Havasu
AZA 034936	Wildcat Quartzsite, LLC	Jan. 29, 2009	11,960	800	CSP/tower	Pending	Yuma
AZA 034946	Wildcat Harcuvar South, LLC	Jan. 28, 2009	10,947	800	CSP/tower	Pending	Lake Havasu
AZA 035134	E-On Climate & Renewables (La Posa)	July 2, 2009	1,780	–	–	Pending	Yuma
AZA 035137	E-On Climate & Renewables (Castle Dome)	July 2, 2009	590	100	PV	Pending	Yuma
CACA 48728	FPL Energy	Jan. 31, 2007	20,608	250	CSP	Pending	Palm Springs-Southcoast
CACA 49397	First Solar (Desert Quartzite)	Sept. 28, 2007	7,548	600	PV	Pending	Palm Springs-Southcoast
CACA 49490	Enxco, Inc.	Nov. 13, 2007	20,608	300	CSP	Pending	Palm Springs-Southcoast
CACA 49702	Bull Frog Green Energy, LLC	June 1, 2008	22,717	2,500	PV	Pending	Palm Springs-Southcoast

[a] Total 28 solar application acres = 421,268; total solar MW = 20,658.

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

(BLM 2010e). The lead federal agency dealing with the Quartzsite Solar Energy application is the Western Area Power Authority (WAPA); the BLM is a cooperating agency. WAPA intends to prepare an EIS on the application. The applicant has applied to WAPA to interconnect the proposed project to WAPA's transmission system.

8.1.22.2.2 Other Actions

Other major ongoing and foreseeable actions identified within 50 mi (80 km) of the proposed Brenda SEZ are listed in Table 8.1.22.2-3 and are described in the following subsections.

Other Ongoing Actions

Palo Verde–Devers 500-kV Transmission Line. The existing Palo Verde–Devers 500-kV transmission line route connects the Palo Verde Nuclear Generating Station with the Devers Substation in California west of Palm Springs. This line runs through the northern portion of the Kofa NWR and is about 20 mi (32 km) south of the Brenda SEZ at its nearest point.

Bouse-Kofa 161-kV Transmission Line. The Western Area Power Association Bouse-Kofa 161-kV transmission line parallels U.S. 95 in the vicinity of Quartzsite and will be connected to the Quartzsite Solar Energy Project currently under review (*Federal Register* Vol. 75, No. 9, pp. 2133–2134 January 14, 2010).

Parker Dam and Powerplant. Parker Dam is located on the Colorado River, 17 mi (27 km) northeast of the town of Parker and about 40 mi (64 km) northwest of the SEZ. The reservoir behind the dam is 20,390 acres (82.5 km^2). The hydroelectric power plant, located on the California side of the river, houses four 30-MW hydroelectric generating units. The plant has been operating since 1942 (U.S. Bureau of Reclamation 2003).

Other Foreseeable Actions

Proposed Reopening of the Copperstone Mine. American Bonanza proposes to reopen the Copperstone Mine located 9.5 mi (15 km) north of Quartzsite and 18 mi (29 km) northwest of the SEZ. The mine, operated from 1987 until 1992, consisted of an open pit, ore-crushing facility, cyanide heap-leaching and vat-leaching gold recovery systems, a tailing pond, and waste rock dump. The project area to be reopened consists of 335 contiguous unpatented lode mining claims, and the project expects to mine and mill 450 tons (457,000 kg) per day of ore, producing 35,000 to 55,000 ounces (1,090 to 1,710 kg) of gold per year for 7 to 10 years (BLM 2010f).

TABLE 8.1.22.2-3 Other Major Actions near the Proposed Brenda SEZ[a]

Description	Status	Resources Affected	Primary Impact Location
Palo Verde–Devers 500-kV Transmission Line	Operating	Terrestrial habitat, wildlife, vegetation, visual	Corridor passes 20 mi (32 km) south of the SEZ
Bouse-Kofa 161-kV Transmission Line	Operating	Terrestrial habitat, wildlife, vegetation, visual	Corridor runs parallel to U.S. 95 in Quartzsite, Ariz., about 18 mi (29 km) west of the SEZ
Parker Dam and Powerplant	Operating since 1942	Aquatic biota	40 mi (64 km) northwest of the SEZ
Reopening of the Copperstone Mine	EA May 2010	Groundwater, terrestrial habitat, wildlife, air quality, noise/ vibration, cultural, visual	9.5 (15 km) north of Quartzite and 18 mi (29 km) northwest of the SEZ
Wild Burro Reduction Cibola-Trigo Herd Management Area	EA July 2010	Terrestrial habitat, wildlife	About 20 mi (32-km) west of the SEZ
Impact Area Expansion Yuma Proving Ground	EA March 2010	Terrestrial habitat, wildlife	Boundary about 30 mi (48 km) south–southwest of the SEZ
Limiting Mountain Lion Predation on Desert Bighorn Sheep on the Kofa National Wildlife Refuge	EA Dec. 2009	Wildlife	Boundary 10 mi (16 km) south of the SEZ
Algae Biomass Project	Private Enterprise expected to begin operation in 2010	Land use, terrestrial habitat, visual	Near Vicksburg, about 6 mi (10 km) east of the SEZ

[a] Projects operating or in later stages of agency environmental review and project development.

Wild Burro Reduction Cibola-Trigo HMA. The BLM Yuma Field Office proposes to remove 100 excess wild burros from the Cibola-Trigo HMA, approximately 20 mi (32 km) west of the SEZ. The HMA is 635,685 acres (2752 km^2) of federal, state, military withdrawn, and private lands (BLM 2010g).

Impact Area Expansion Yuma Proving Ground. The Yuma Proving Ground encompasses about 836,000 acres (3,380 km^2). The closest boundaries to the SEZ are about 30 mi (48 km) to the south and southwest. The Kofa Region (374,600 acres [1516 km^2]) has been heavily contaminated from munitions testing since the early 1950s. The Army is proposing to expand the existing designated impact areas in the region. The proposed impact areas would encompass approximately 80,000 acres (325 km^2) (U.S. Army Garrison Yuma Proving Ground 2010).

Limiting Mountain Lion Predation on Desert Bighorn Sheep on the Kofa National Wildlife Refuge. The USFWS proposes to limit predation by mountain lions on desert bighorn sheep in the Kofa NWR, 10 mi (16 km) south of the SEZ. This would include removal of "offending" mountain lions by either lethal means or translocation. An offending mountain lion is defined as one that has killed two or more desert bighorn sheep within a 6-month period (USFWS 2009b).

Algae Biomass Project. Phyco BioSciences, Inc. intends to develop a 160-acre (0.65-km^2) algae biomass project near Vicksburg, Arizona, about 6 mi (10 km) east of the SEZ. Four 40-acre (0.16-km^2) fields will produce 7,500 tons (7,600 metric tons) per year of dry algae solids that will be processed at an algae mill. The final products include extracted oils to be converted to biofuels, nutritional oils, and dry algae meal for pet foods and animal feed (XL Renewables 2009).

Grazing Allotments

One grazing allotment exists in the Brenda SEZ. The Crowder-Weisser authorization includes 234,645 acres (950 km^2) of public lands and permits grazing by 1,450 cattle (equivalent to 1,578 AUMs) each year through February 2018.

Mining

The BLM Geocommunicator Database (BLM and USFS 2010a) shows four active mining placer claims on file with BLM about 3 to 5 mi (5 to 8 km) from the southwest boundary of the Brenda SEZ.

8.1.22.3 General Trends

8.1.22.3.1 Population Growth

Over the period 2000 to 2008, the counties in the ROI experienced growth in population. The population in La Paz County grew at an annual rate of 0.2%; Yuma County grew by 2.4%; and Riverside County grew by 3.8%. The population of the ROI in 2008 was 2,301,221, having grown at an average annual rate of 3.7% since 2000. The growth rate for the state of Arizona as a whole was 3.0% (Section 8.1.19.1.5).

8.1.22.3.2 Energy Demand

The growth in energy demand is related to population growth through increases in housing, commercial floorspace, transportation, manufacturing, and services. Given that the population in La Paz and Yuma Counties is expected to grow between 2006 and 2016, an increase in energy demand is also expected. However, the 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).

8.1.22.3.3 Water Availability

As described in Section 8.1.9.1.2, depth to groundwater in the Ranegras Plain Basin varies from 438 ft (134 m) to 75 ft (23 m) below ground surface. Groundwater depth in the proposed Brenda SEZ ranges from 158 to 239 ft (48 to 73 m) below ground surface and has declined at an average rate of 0.34 to 4.6 in./yr (0.85 to 11.5 cm/yr) between 1948 and 2006. There is an estimated 21.7 million ac-ft (26.8 billion m^3) of water available in the basin, and natural recharge estimates range from less than 1,000 ac-ft/yr (1.2 million m^3/yr) to more than 6,000 ac-ft/yr (7.4 million m^3/yr).

Recorded water level declines from 1945 to 2006 ranged from 25 to 146 ft (7.6 to 44 m) throughout the Ranegras Plain Basin, but have rebounded up to 60 ft (18 m) in some locations. The withdrawals have caused a cone of depression to form in the eastern part of the basin, approximately 10 mi (16 km) from the Brenda SEZ. Subsidence of the land surface of up to 4 in. (10 cm) has also occurred in the area of highest drawdown of the aquifer (Section 8.1.9.1.2).

In 2005, water withdrawals from surface waters and groundwater in La Paz County were 704,009 ac-ft/yr (86 million m^3/yr), of which 87% came from surface waters and 13% came from groundwater. The largest water use category was irrigation, at 698,886 ac-ft/yr (86 million m^3/yr), while public supply/domestic water uses were 4,697 ac-ft/yr

(5.7 billion m^3/yr), and mining water uses were on the order of 303 ac-ft/yr (386,000 m^3/yr). Annual groundwater withdrawals within the Ranegras Plain Basin have averaged about 30,000 ac-ft since 1991 and have likewise been dominated by agriculture (Section 8.1.9.1.3).

8.1.22.3.4 Climate Change

A report on global climate change in the United States prepared by the U.S. Global Research Program (GRCP 2009) documents current temperature and precipitation conditions and historic trends. Excerpts of the conclusions from this report indicate the following for the Southwest region of the United States, which includes Arizona:

- 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 have occurred. For example, winter precipitation in Arizona is already becoming more variable, with a trend toward both more frequent extremely dry and extremely wet winters.

- 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 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 Phoenix, 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.

8.1.22.4 Cumulative Impacts on Resources

This section addresses potential cumulative impacts in the proposed Brenda SEZ on the basis of the following assumptions: (1) because of the small size of the proposed SEZ (<10,000 acres [<40.5 km^2]), only one project would be constructed at a time, and (2) maximum total disturbance over 20 years would be about 3,102 acres (12.6 km^2) (80% of the entire proposed SEZ). For this analysis, it is also assumed that no more than 3,000 acres (12.1 km^2) would be disturbed per project annually and 250 acres (1.01 km^2) monthly on the basis of construction schedules planned in current applications. It is also assumed that 575 acres (2.3 km^2) would be disturbed to construct 19 mi (30 km) of new transmission line to reach an existing 161-kV line and to connect to the regional grid. Regarding site access, the nearest major road is U.S. 60, which runs along the southeastern border of the SEZ. It is assumed that no new access road would need to be constructed 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.

8.1.22.4.1 Lands and Realty

The area covered by the proposed Brenda SEZ is largely isolated and undeveloped. In general, the areas surrounding the SEZ are rural in nature. U.S. 60, which runs within a half mile of the southern boundary, would provide access to the southern portion of the SEZ, while a county road crosses through the western portion of the SEZ (Section 8.1.2.1).

Development of the SEZ for utility-scale solar energy production would establish an isolated, industrial area that would exclude many existing and potential uses of the land, perhaps in perpetuity. Since the SEZ is rural and undeveloped, utility-scale solar energy development would be a new and dominant land use in the area. Access to such areas by both the general public and much wildlife would be eliminated.

As shown in Table 8.1.22.2-2 and Figure 8.1.22.2-1, there is one fast-track solar application, one pending solar development application, one pending wind site testing application, and 28 other pending solar applications on public land within a 50-mi (80-km) radius of the proposed Brenda SEZ. There are currently no wind or geothermal applications within this distance and no solar applications within the SEZ. The Solar Millennium Blythe Solar Energy Project fast-track solar application lies about 45 mi (72 km) west of the SEZ. The large number of pending solar energy applications indicates strong interest in solar energy development within 50 mi (80 km) of the proposed SEZ, but only the fast-track solar application is considered a firmly foreseeable development (Section 8.1.22.2.1).

The other foreseeable projects on private land identified in Section 8.1.22.2.2 are small in number and size and would have minimal impacts on land use near the SEZ.

The development of utility-scale solar projects in the proposed Brenda SEZ in combination with other ongoing, foreseeable, and potential actions within the geographic extent of effects, nominally 50 mi (80 km), could have cumulative effects on land use in the vicinity of the proposed SEZ. Ongoing, foreseeable, and potential actions on or near the SEZ could result in small cumulative impacts on land use through impacts on land access and use for other purposes, on groundwater availability, and on visual resources, especially if the SEZ is fully developed with solar projects. Cumulative impacts on land use could rise to moderate if a major portion of the pending solar applications in the region were to result in actual projects, but projects within the SEZ would make only a small contribution to cumulative impacts because of its relatively small size.

8.1.22.4.2 Specially Designated Areas and Lands with Wilderness Characteristics

There are eight specially designated areas within 25 mi (40 km) of the proposed Brenda SEZ in Arizona that potentially could be affected by solar energy development within the SEZ. Most of these areas are more than 5 mi (8 km) from the SEZ (Section 8.1.3.1). Potential exists for cumulative visual impacts on these areas from the construction of utility-scale solar energy facilities within the SEZ and outside the SEZ within the geographic extent of effects and from the construction of transmission lines and roads outside the SEZ that would serve both. The exact nature of cumulative visual impacts on the users of these areas would depend on the specific solar technologies employed and the locations of solar facilities, transmission lines, and roads actually built within and outside the SEZ. About 10 pending solar applications lie within 25 mi (40 km) of the proposed SEZ (Figure 8.1.22.2-1), some of which, if built, would affect some of the same sensitive areas as facilities built within the SEZ. Such effects could include visual impacts, wilderness characteristics, reduced accessibility, and ecological effects.

8.1.22.4.3 Rangeland Resources

The proposed Brenda SEZ contains less than 2% of one perennial grazing allotment (Section 8.1.4.1.1). If utility-scale solar facilities were constructed on the SEZ, those areas occupied by the solar projects would be excluded from grazing. The development of other potential solar energy projects within 50 mi (80 km) of the SEZ could result in cumulative impacts on grazing due to the number and relative proximity of several of the proposed facilities to the proposed SEZ. However, the contribution of such effects from projects within the SEZ would be minimal due to the small area affected.

A number of BLM HMAs and HAs occur within the 50-mi (80-km) SEZ region for the proposed Brenda SEZ (Section 8.1.4.2.1), but none occur within the proposed SEZ or within the 5-mi (8-km) area of indirect effects. Thus, solar developments in the SEZ would not contribute to cumulative effects on wild horses and burros.

8.1.22.4.4 Recreation

Limited outdoor recreation, mainly OHV use, occurs in the area of the proposed SEZ (Section 8.1.5.1). While there are no current solar applications within the proposed SEZ, construction of utility-scale solar projects on the SEZ would preclude recreational use of the affected lands for the duration of the projects. Road closures and access restrictions within the proposed SEZ would affect OHV use in particular. However, such effects are expected to be small due to low current use. Foreseeable and potential actions, mainly pending solar applications, would also affect areas of low recreational use and would have similar minimal effects on current recreational activities individually. However, small cumulative impacts on recreation within the geographic extent of effects, for example on hunting opportunities, might be possible from the aggregate presence of several new solar facilities within the area if a large number of projects with pending applications are ultimately built.

8.1.22.4.5 Military and Civilian Aviation

The entire proposed SEZ is covered by a total of three MTRs with 300-ft (91-m) AGL operating limits (Section 8.1.6.1). The military has indicated that construction of solar or transmission facilities in excess of 250 ft (76 m) tall would adversely affect the use of the MTRs (Section 8.1.6.2). Potential new solar facilities and associated new transmission lines outside the SEZ could present additional concerns for military aviation, depending on the eventual location of such facilities with respect to training routes, and thus could result in cumulative impacts on military aviation. The closest civilian airports in Blythe, California, 48 mi (77 km) west, and the Parker (Avi Suquilla) airport, 38 mi (61 km) northwest of the SEZ, are too far away to be affected by developments in the SEZ.

8.1.22.4.6 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 construction of other potential solar energy facilities and other ongoing activities, including

OHV use. Cumulative impacts on soil resources from other foreseeable projects within the geographic extent of effects are possible. Potential new solar facilities outside the SEZ would contribute incremental impacts on soil erosion, the extent of which would depend on the number and location of facilities actually built. Cumulative impacts, including from any development in the SEZ, would be 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 potential solar projects and other activities outside the SEZ. However, with the required programmatic design features in place, cumulative impacts would likewise be small.

8.1.22.4.7 Minerals (Fluids, Solids, and Geothermal Resources)

As discussed in Section 8.1.8, there are currently no active oil and gas leases within the proposed Brenda SEZ, and there are no mining claims or proposals for geothermal energy development pending. 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. It bears noting, however, that the proposed reopening of the Copperstone Mine 9.5 mi (15 km) north of Quartzite is in a location on or near pending solar applications (Figure 8.1.22.2-1), so potential impacts on mining appear possible in the region.

8.1.22.4.8 Water Resources

Section 8.1.9.2 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 all evaluated solar technologies would be 1,387 to 2,014 ac-ft (1.7 million to 2.5 million m^3). During operations, with full development of the SEZ over 80% of its available land area, the amount of water needed for all evaluated solar technologies would range from 18 to 9,316 ac-ft/yr (22,000 to 11 million m^3/yr). The amount of water needed during decommissioning would be similar to or less than the amount used during construction. As discussed in Section 8.1.22.3.3, water withdrawals in 2005 from surface waters and groundwater in La Paz County were 704,009 ac-ft/yr (86 million m^3/yr), of which 87% came from surface waters and 13% came from groundwater. The largest water use category was irrigation, at 698,886 ac-ft/yr (862 million m^3/yr). Therefore, cumulatively the additional water resources needed for solar facilities in the SEZ during operations would constitute from a relatively very small (0.003%) to a small (1.3%) increment (the ratio of the annual water requirement for operations to the annual amount withdrawn in La Paz 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 8.1.9.1.3, since 1991, groundwater withdrawals from the Ranegras Plain basin, where the proposed SEZ is located, have hovered around 30,000 ac-ft/yr (37 million m^3/yr), a level that far exceeds estimates of natural recharge, which range from less than 1,000 ac-ft/yr (1.2 million m^3/yr) to more than 6,000 ac-ft/yr (7.4 million m^3/yr) (Section 8.1.9.2). Thus, solar developments on the SEZ would have the capacity to exceed even the upper end of estimates of basin recharge using wet-cooling, while full development with dry-cooled solar trough technologies could require up to 940 ac-ft/yr (1.2 million m^3/yr) (Section 8.1.9.2.2), or from 15% to approximately 100% of estimated recharge in the basin (Section 8.1.9.2.2).

While solar development of the proposed SEZ with water-intensive technologies would likely be judged infeasible due to already strained groundwater supplies, if employed, intensive groundwater withdrawals could affect groundwater flow patterns, cause drawdown of groundwater, modify natural drainage pathways and recharge zones, cause land subsidence, and affect ecological habitats in the Ranegras Plain basin (Section 8.1.9.2). Cumulative impacts on groundwater could occur when combined with other future developments in the region. The proposed fast-track Solar Millennium Blythe Solar Energy Project would be located about 45 mi (72 km) west of the SEZ on the other side of the Colorado River in the proposed Riverside East SEZ in California and would use dry cooling. Thus, this project would not likely contribute to groundwater impacts in the Ranegras Plain basin. However, it would be expected that some number of the other 28 pending solar applications within 50 mi (80 km) of the proposed SEZ (Section 8.1.22.2.1) will ultimately be built and that some of these projects could contribute to cumulative effects on groundwater supplies and surface ecological habitats from water use, soil erosion, and drainage effects.

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 9 to 74 ac-ft (11,000 to 91,000 m^3) during the peak construction year and would range from 0.4 to 9 ac-ft/yr (up to 11,000 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 98 to 176 ac-ft/yr (120,000 to 220,000 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.

8.1.22.4.9 Vegetation

The proposed Brenda SEZ is located within the Sonoran Basin and Range ecoregion, which supports creosotebush-bursage plant communities with large areas of palo verde-cactus shrub and saguaro cactus communities. Lands within the SEZ are classified primarily as Sonora–Mojave Creosotebush–White Bursage Desert Scrub. Sensitive habitats on the SEZ include desert dry wash woodlands and desert chenopod scrub/mixed salt desert scrub. In the 5-mi (8-km) area of indirect effects, the predominant cover types are Sonora–Mojave Creosotebush–White Bursage Desert Scrub and Sonoran–Paloverde Mixed Cacti Desert Scrub (Section 8.1.10.1). 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 small impacts on all cover types (Section 8.1.10.2.1). Intermittently flooded areas downgradient from solar projects or access roads could be affected by ground-disturbing activities. Alteration of surface drainage patterns or hydrology could adversely affect downstream dry wash communities, including woodlands and chenopod scrub habitats. In addition, mesquite bosque communities that depend on accessible groundwater could be affected by lowered groundwater levels if solar projects were to draw heavily on this resource.

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, mining, agriculture, recreation, and transportation activities. The cumulative dust loading could result in reduced productivity or changes in plant community composition. Similarly, surface runoff from project areas after heavy rains could increase sedimentation and siltation in areas downstream. Implementation of programmatic design features would 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, Sonoran–Mojave Mixed Salt Desert Scrub is relatively uncommon, representing 0.2 % of the land area within the region. Thus, other ongoing and reasonably foreseeable future actions could have a cumulative effect on this and other rare cover types, as well as on more abundant species. Such effects would likely be small for foreseeable development due to the abundance of the primary species and the relatively small number of foreseeable actions within the geographic extent of effects. However, given the large number of pending solar applications within this area and the large acreages potentially disturbed (Section 8.1.22.2.1), depending on where any eventual projects are located, up to moderate cumulative effects on some rare cover types are possible. In addition, cumulative effects on wetland species could occur from water use, drainage modifications, and stream sedimentation from these and any other potential future developments in the region. The magnitude of such effects is difficult to predict at the current time.

8.1.22.4.10 Wildlife and Aquatic Biota

Wildlife species that could potentially be affected by the development of utility-scale solar energy facilities in the proposed Brenda 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 have an impact on 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 a narrowly defined habitat within a restricted area. The required design features would reduce the severity of impacts on wildlife. The design features include pre-disturbance biological surveys to identify key habitat areas used by wildlife, followed by avoidance or minimization of disturbance to those habitats.

As noted in Section 8.1.22.2, other ongoing, reasonably foreseeable and potential future actions within 50 mi (80 km) of the proposed SEZ include one fast-track solar application and

28 other pending solar development applications (Figure 8.1.22.2-1). Impacts from full build-out over 80% of the proposed SEZ would result in small impacts on amphibian, reptile, bird, and mammal species (Section 8.1.11), while impacts from foreseeable development within the 50-mi (80-km) geographic extent of effects would likewise be small. Many of the wildlife species present within the proposed SEZ that could be affected by other actions have extensive available habitat within the region, while only one foreseeable solar project and no other major foreseeable projects have been identified within the geographic extent of effects. However, given the fact that there are as many as 28 other pending solar applications in the region, cumulative effects on some species could rise to a level of moderate, given the large acreages potentially disturbed and depending on the number and location of projects actually built.

There are no surface water bodies or perennial streams, seeps, springs, or wetlands within the proposed Brenda SEZ or within the 5-mi (8-km) area of indirect effects. Bouse wash, an intermittent wash, runs through the eastern edge of the SEZ. This and other ephemeral washes in the SEZ are typically dry and flow only after precipitation. Thus, no standing aquatic communities are likely to be present in the proposed SEZ. Aquatic communities do exist within the 50-mi (80-km) geographic extent of effects, including in the Colorado River about 33 mi (53 km) west of the SEZ (Section 8.1.11.2), but these habitats are too far away to be affected by solar development in the SEZ. Thus, there would be no contributions to cumulative impacts on aquatic biota and habitats resulting from groundwater drawdown or soil transport to surface streams from solar facilities within the SEZ.

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

On the basis of recorded occurrences or suitable habitat, as many as 20 special status species could occur within the Brenda SEZ. Of these species, two are known or are likely to occur within the affected area of the SEZ (including the SEZ, the 5-mi [8-km] area of indirect effects, and road and transmission ROWs): desert tortoise (Sonoran population), and California leaf-nosed bat. Section 8.1.12.1 discusses the nature of the special status listing of these two 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 States of Arizona or California or listed as a sensitive species by the BLM (Section 8.1.12.1). 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 and related facilities (e.g., access roads and transmission line connections) outside the SEZ include avoidance of habitat and minimization of erosion, sedimentation, and dust deposition. Ongoing effects on special status species include those from roads, transmission lines, and recreational activities in the area. While the amount of foreseeable development within the geographic extent of effects is low, primarily one fast-track solar project 45 mi (72 km) west of the SEZ, as many as 28 pending applications for solar projects within the same 50-mi (80-km) area are pending. Cumulative impacts on protected species are expected to be relatively low, but could rise if a large number of the pending solar applications are actually built. Actual impacts would further depend on the location and cooling technologies of projects that are built. Projects would employ mitigation measures to limit effects.

8.1.22.4.12 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 projects outside the proposed Brenda 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, the maximum 24-hour PM_{10} concentration at or near the SEZ boundaries could at times exceed the applicable standard of 150 $\mu g/m^3$. The dust generation from the construction activities can be controlled by implementing aggressive dust control measures, such as increased watering frequency or road paving or treatment.

Because the area proposed for the SEZ is rural and undeveloped land, there are no significant industrial sources of air emissions in the area. The only type of air pollutant of concern is dust generated by winds. While there are a number of potential solar projects, as well as the proposed reopening of the Copperstone Mine 18 mi (29 km) northwest of the SEZ, that could produce fugitive dust emissions within the geographic extent of effects, few such projects are likely to overlap significantly in both time and affected area for any projects within the SEZ. Thus, cumulative air quality effects due to dust emissions during any overlapping construction periods would be small.

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 8.1.13.2.2, 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 small SEZs, such offsets are fairly modest. For example, if the Brenda SEZ were fully developed (80% of its acreage) with solar facilities, the quantity of pollutants avoided could be as large as 1.6% of all emissions from the current electric power systems in Arizona.

8.1.22.4.13 Visual Resources

The proposed Brenda SEZ is located the Ranegras Plain, which extends more than 40 mi (64 km) from northwest to the southeast and is about 10 mi (16 km) wide. The SEZ is bounded by mountain ranges on the east, northeast, south, and west (Section 8.1.14.1). The area is sparsely inhabited, remote, and rural in character. Currently, there is a low level of cultural disturbance, including from dirt roads, a corral, a well, and from grazing. Construction of utility-scale solar facilities on the SEZ and associated transmission lines outside the SEZ would significantly alter the natural scenic quality of the area. Other potential solar projects and related roads and transmission lines outside the proposed SEZ would cumulatively affect the visual resources in the area.

There is currently only one fast-track solar facility application, about 45 mi (72 km) west of the SEZ, and as many as 28 other pending solar applications within 50 mi (80 km) of the SEZ (Figure 8.1.22.2-1). While the contribution to cumulative impacts in the area of foreseeable and potential projects would depend on the location of facilities that are actually built, it may be concluded that the general visual character of the landscape within this distance could be significantly altered by the presence of solar facilities, transmission lines, and other new infrastructure. Because of the topography of the region, such developments, located in basin flats, would be visible at great distances from surrounding mountains, which include sensitive viewsheds. Given the proximity of several of the pending solar applications to the proposed SEZ and to each other, it is possible that two or more facilities would be viewable from a single location. 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 above and the large number of pending solar applications in the region, moderate cumulative visual impacts could occur within the geographic extent of effects from future solar and other existing and future development.

8.1.22.4.14 Acoustic Environment

The areas around the proposed Brenda SEZ are relatively quiet. Existing noise sources around the SEZ include road traffic, railroad traffic, infrequent aircraft flyover, cattle grazing, and occasional community activities and events. 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 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 8.1.22.2. Because proposed projects and nearest residents are relatively far from the SEZ with respect to noise impacts and the area is sparsely populated, cumulative noise effects during the construction or operation of solar facilities are unlikely.

8.1.22.4.15 Paleontological Resources

The proposed Brenda SEZ has unknown potential for the occurrence of significant fossil material over its entire extent and requires further investigation prior to project approval (Section 8.1.16.1). Any paleontological resources encountered during a paleontological survey would be mitigated to the extent possible. Cumulative impacts on paleontological resources would be dependent on whether significant resources are found within the SEZ and in additional project areas in the region.

8.1.22.4.16 Cultural Resources

The proposed Brenda 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, both prehistoric and historic, especially in the eastern portion of the SEZ. No surveys have been conducted within the boundaries of the SEZ, but 25 surveys have been conducted within 5 mi (8 km) of the SEZ, resulting in the recording of 37 sites within this range (Section 8.1.17.1.5). It is possible, but unlikely, that the development of utility-scale solar energy projects in the SEZ, when added to other potential projects likely to occur in the area, could contribute cumulatively to cultural resource impacts occurring in the region. The amount of foreseeable development is low within the 25-mi (40-km) geographic extent of effects; however, numerous potential solar projects with pending applications lie within this distance (Section 8.1.22.2). 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 Arizona 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 avoidance of all NRHP-eligible sites and mitigation of all impacts may not be possible, 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.

8.1.22.4.17 Native American Concerns

Government-to-government consultation is under way with federally recognized Native American Tribes with possible traditional ties to the Brenda area, including the Yavapai, Quechan, and Mohave Tribes. 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 Brenda SEZ. However, the Quechan Indian Tribe of Fort Yuma have expressed concerns for landscapes as a whole and for the intrusion of industrial development on traditional trails specifically, while game and wild plant resources have been a concern of the Yavapai in the past. Potential impacts on existing water supplies, ecological fragmentation, and land disturbance are also of concern to Tribes (Section 8.1.18). The development of solar energy facilities in combination with the development of other planned and foreseeable projects in the area would likely reduce the traditionally important plant and animal resources available to the Tribes. Such effects would likely be small for foreseeable development due to the abundance of the most culturally important plant species and the relatively small number 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 Brenda SEZ.

8.1.22.4.18 Socioeconomics

Solar energy development projects in the proposed Brenda SEZ could cumulatively contribute to socioeconomic effects in the immediate vicinity of the SEZ and in the surrounding multicounty 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 other new development in the area, including other renewable energy projects. The number of workers involved in the construction of solar projects (including the transmission line) in the peak construction year could range from about 130 to 1,700, 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 400 (solar PV) to as high as 5,200 (solar trough). Cumulative socioeconomic effects in the ROI from 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 developments in the area, including from the fast-track Solar Millennium Blythe Solar Energy Project, which would be 45 mi (72 km) east of the proposed SEZ, and from some number of the other 28 pending solar applications within 50 mi (80 km) of the proposed SEZ. Based on the assumption of full build-out of the SEZ (Section 8.1.19.2.2), the number of workers needed at the solar facilities in the SEZ would range from 7 to 130, with approximately 10 to 220 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.

8.1.22.4.19 Environmental Justice

Any impacts from solar development could have cumulative impacts on minority and 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 8.1.20.2). Actual impacts would depend on where low-income populations are located relative to solar and other proposed facilities and on the geographic range of effects. Overall, effects from facilities within the SEZ are expected to be small, while other foreseeable and potential actions would not likely combine with negative effects from the SEZ on minority or low-income populations, with the possible exception of visual impacts from solar development in the region. Thus, it is not expected that the proposed Brenda SEZ would contribute to cumulative impacts on minority and low-income populations.

8.1.22.4.20 Transportation

U.S. 60 runs along the southeast border of the proposed Brenda SEZ. The nearest public airports are the Parker and Blythe Airports, which are both approximately a 50-mi (80-km) drive away. The closest rail stop is in Vicksburg, about 11 mi (18 km) 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, which could increase the AADT on these roads by 2,000 vehicle trips for each facility under construction. Traffic on I-10 or State Route 72 could experience minor slowdowns near their junctions with U.S. 60 (Section 8.1.21.2). This increase in highway traffic from construction workers could likewise have small cumulative impacts in combination with existing traffic levels and increases from additional future development in the area, including from construction of potential solar facilities with pending applications in the region, should construction schedules overlap. Local road improvements on portions of U.S. 60 near the SEZ may be necessary. 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 would have little contribution to cumulative impacts.

8.1.23 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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