TABLE OF CONTENTS

Chapter Page

4. ENVIRONMENTAL CONSEQUENCES 4-v

4.1 Introduction 4-1
- 4.1.1 Scoping Comments on Resources and Resource Uses 4-2
- 4.1.2 General Methodology for Analyzing Impacts 4-5
- 4.1.3 Analytical Assumptions 4-6
- 4.1.4 Incomplete or Unavailable Information 4-8

4.2 Resources and Resource Uses 4-9
- 4.2.1 Air Quality and Air Quality-related Values 4-9
- 4.2.2 Greenhouse Gas Emissions and Climate Change 4-16
- 4.2.3 Cultural Resources 4-18
- 4.2.4 Energy and Minerals 4-28
- 4.2.5 Environmental Justice 4-33
- 4.2.6 Fish and Wildlife 4-36
- 4.2.7 Geology and Seismicity 4-46
- 4.2.8 Land Use and Realty 4-50
- 4.2.9 Livestock Grazing 4-63
- 4.2.10 National Trails 4-66
- 4.2.11 Native American Interests and Heritage Resources 4-69
- 4.2.12 Noise 4-75
- 4.2.13 Paleontological Resources 4-83
- 4.2.14 Public Health and Safety 4-88
- 4.2.15 Recreation 4-92
- 4.2.16 Socioeconomics 4-95
- 4.2.17 Soil Resources 4-105
- 4.2.18 Special Designations 4-113
- 4.2.19 Special Status Species 4-117
- 4.2.20 Travel Management 4-126
- 4.2.21 Vegetation 4-128
- 4.2.22 Visual Resources 4-137
- 4.2.23 Water Resources 4-161
- 4.2.24 Wild Horses and Burros 4-172
- 4.2.25 Wilderness Characteristics 4-175

4.3 Additional Mitigation Measures, Unavoidable Adverse Impacts, Irreversible and Irretrievable Commitment of Resources, and Relationship of Short-term Uses of the Environment to Long-term Productivity 4-179
- 4.3.1 Additional Mitigation Measures 4-179
- 4.3.2 Unavoidable Adverse Impacts 4-180
- 4.3.3 Irreversible and Irretrievable Commitment of Resources 4-182
- 4.3.4 Relationship of Short-term Uses of the Environment to Long-term Productivity 4-184

FIGURES

Page

4-1 Alternative 1: Maximum REDA on BLM-administered Lands within Five Miles of Special Designations 4-115
4-2 Key Observation Points of Proposed Agua Caliente SEZ: Photographs of KOPs 001-005 4-140
4-3 Key Observation Points of Proposed Agua Caliente SEZ: Photographs of KOPs 006-009 4-141
4-4 Viewshed Analysis of Proposed Agua Caliente SEZ: Potential Concentrated Solar Power Technology 650 Feet Tall 4-148
4-5 Visual Simulation of Eagletail Mountain Wilderness: Potential Concentrated Solar Power Technology 650 Feet Tall 4-149
4-6 Visual Simulation of Woolsey Peak and Signal Mountain Wilderness: Potential Concentrated Solar Power Technology 650 Feet Tall 4-150
4-7 Viewshed Analysis of Proposed Agua Caliente SEZ Analysis Area: Potential Concentrated Solar Power Technology 38 Feet Tall 4-151
4-8 Visual Simulation of Sears Point and Juan Bautista de Anza National Historic Trail: Potential Concentrated Solar Power Technology 650 Feet Tall 4-152
4-9 Viewshed Analysis of Proposed Agua Caliente SEZ Analysis Area: Potential Photovoltaic Solar Field 6 Feet Tall 4-154
4-10 Visual Simulation of Sears Point and Juan Bautista de Anza National Historic Trail: Potential Photovoltaic Solar Field 5 Feet Tall 4-156
4-11 Visual Simulations of Proposed Agua Caliente SEZ Analysis Area: Concentrated Solar Power Technology and Photovoltaic Solar Field 4-157

TABLES

Page

4-1 Conservation Potential Categories within the Proposed Agua Caliente SEZ by Alternative.....4-44
4-2 Construction Equipment Noise Levels at 50 Feet.....4-78
4-3 Comparison of Socioeconomic Effects in the Oil and Gas, Wind Energy, and Solar Energy Industries 4-97
4-4 Comparison of Projected Employment Impacts for Solar Development 4-98
4-5 Comparison of Projected Employment Impacts for Wind Development 4-99
4-6 Soil Orders in the REDA – Alternative 1 4-109
4-7 Soil Series in the Proposed Agua Caliente SEZ – Alternative 1 4-110
4-8 Soil Orders in the REDA – Alternative 2 4-110
4-9 Soil Series in the Proposed Agua Caliente SEZ – Alternative 2 4-110
4-10 Soil Orders in the REDA – Alternative 3 4-111
4-11 Soil Series in the Proposed Agua Caliente SEZ – Alternative 3 4-111
4-12 Soil Orders in the REDA – Alternative 5 4-112
4-13 Soil Orders in the REDA – Alternative 6 4-113
4-14 Potential Ecoregion Impacts in the REDA for Alternative 1 4-132
4-15 Vegetation Present in the Proposed SEZ by Alternative 4-133
4-16 Potential Ecoregion Impacts in the REDA for Alternative 2 4-134
4-17 Potential Ecoregion Impacts in the REDA for Alternative 3 4-134
4-18 Potential Ecoregion Impacts in the REDA for Alternative 4 4-135
4-19 Potential Ecoregion Impacts in the REDA for Alternative 5 4-136
4-20 Potential Ecoregion Impacts in the REDA for Alternative 6 4-136
4-21 Number and Acres of Sensitive Receptors within Five Miles of the REDA, Alternatives 1 and 4 4-146
4-22 Proposed Changes to Yuma Field Office VRM Classes 4-147
4-23 Number and Acres of Sensitive Receptors within Five Miles of the REDA, Alternative 2..... 4-158
4-24 Number and Acres of Sensitive Receptors within Five Miles of the REDA, Alternative 3..... 4-159
4-25 Number and Acres of Sensitive Receptors within Five Miles of the REDA, Alternative 5... 4-160
4-26 Number and Acres of Sensitive Receptors within Five Miles of the REDA, Alternative 6... 4-161
4-27 Alternative 1: Maximum REDA – BLM-administered Land Acres by Designated Water Resource Area 4-166
4-28 Alternative 2: Transmission REDA—BLM-administered Land Acres by Designated Water Resource Area 4-167
4-29 Alternative 3: Load Offset REDA—BLM-administered Land Acres by Designated Water Resource Area 4-168
4-30 Alternative 4: Water Conservation and Protection REDA—BLM-administered Land Acres by Designated Water Resource Area 4-169
4-31 Alternative 4: Water Conservation and Protection REDA—BLM-administered Land Acres in Each Water Protection Zone 4-170
4-32 Alternative 5: Land Tenure REDA—BLM-administered Land Acres by Designated Water Resource Area 4-170
4-33 Alternative 6: Collaborative-based REDA—BLM-administered Land Acres by Designated Water Resource Area 4-171
4-34 Alternative 6: Collaborative-based REDA—BLM-administered Land Acres in Each Water Protection Zone 4-172
4-35 Additional Mitigation Measures 4-180
4-36 Unavoidable Adverse Impacts 4-181
4-37 Irreversible and Irretrievable Commitment of Resources 4-183
4-38 Relationship of Short-term Uses of the Environment to Long-term Productivity 4-184

This page intentionally left blank.

CHAPTER 4
ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

This chapter presents the likely direct, indirect, and cumulative impacts on the human and natural environment that could occur from implementing the alternatives presented in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario. This chapter is organized by topic, similar to **Chapter 3**, Affected Environment. Each topic area includes a method of analysis section that identifies indicators, methods, and assumptions; a summary of effects common to all alternatives; and an analysis of impacts for each of the four alternatives. Separate sections describing cumulative impacts and irretrievable or irreversible commitment of resources are presented at the end of the chapter.

Many management actions proposed in Chapter 2 are planning-level decisions and do not result in direct impacts or on-the-ground changes. However, by planning for future potential renewable energy development on BLM-administered lands during the 20-year planning horizon, the analysis focuses on the indirect impacts that could eventually result from on-the-ground changes. This impact analysis identifies impacts that may result in some level of change to the resource, regardless of whether that change is beneficial or adverse. The impact analysis will not include a subjective qualifier (beneficial or adverse) to the impact; instead, it will state the nature, magnitude and/or context for the change (see **Section 4.1.2**, General Methodology for Analyzing Impacts, for more detail). The evaluations presented in this section are confined to the actions that have more prominent, immediate, or direct effects. Some of the proposed management actions, allocations, and potential future development may affect only certain resources and alternatives. If an activity or action is not addressed in a given section, no impacts are expected, or the impact is expected to be negligible based on professional judgment.

The BLM manages public lands for multiple uses in accordance with the FLPMA. Land use decisions are made to protect the resources while allowing for different uses of those resources, such as energy and mineral development, OHV use, recreation, and livestock grazing. When there are conflicts among resource uses or when a land use activity could result in unacceptable or irreversible impacts on the environment, the BLM may restrict or prohibit some land uses in specific areas. To ensure that the BLM meets its mandate of multiple use in land management actions, the impacts of the alternatives on resource users are identified and assessed as part of the RDEP planning process. The projected general impacts that are common to all alternatives are characterized and evaluated under an "Impacts Common to All Alternatives" heading under each resource and resource use topic; specific impacts related to the actions within an alternative are addressed under that specific alternative's section.

Impact analysis is a cause-and-effect process. The detailed impact analyses and conclusions are based on the BLM planning team's knowledge of resources and the planning area, reviews of existing literature, and information provided by experts in the BLM, other agencies, interest groups, and concerned citizens. The baseline used for the impact analysis is the current condition or situation, as described in **Chapter 3**, Affected Environment. Impacts on resources and resource uses are analyzed and discussed in detail commensurate with resources issues and concerns identified throughout the process. At times, impacts are described using ranges of potential impacts or in qualitative terms.

4.1.1 Scoping Comments on Resources and Resource Uses

During the scoping period for the RDEP, the BLM received numerous comments from the public requesting that the BLM consider the impacts on resources and resource uses and include descriptions of the mitigation measures that would avoid or lessen impacts. Following are the topics and issues that BLM will address in the impact analyses:

- Ensure that renewable energy policy and projects are carefully managed to maximize clean energy benefits while minimizing impacts on wildlands, wildlife habitat, clean air and water, recreation, and the many other resources and values found on our public lands.
- Consider wildlife habitat values, water resources, cultural resources, economic impacts, and scenic value as additional criteria to be analyzed in the EIS.
- Identify environmentally sensitive areas and areas with potential use conflicts, including 1) areas that contain threatened or endangered species, 2) migratory bird flyways, 3) aquatic resources, including wetlands and other Waters of the U.S., 4) bodies of water listed on the CWA 303(d) list, 5) ambient air

conditions and criteria pollutant nonattainment areas, 6) sole-source aquifers, 7) paleontological resources, 8) large residential areas nearby, and 9) military bases or areas with air and ground traffic. Include measures to either exclude these areas from development or identify appropriate stipulations to protect the resources.

- Quantify the potential environmental effect of each alternative to the greatest extent possible (for example, acres of wetlands impacted and tons per year of emissions produced).
- Identify landscape-level mitigation measures to minimize unacceptable impacts on sensitive resources in the surrounding landscape.
- Incorporate recommendations from the AZGFD May 2009 "Guidelines for Reducing Impacts to Wildlife from Wind Energy Development in Arizona."
- There are four nominated sites in northern Arizona that are near known locations or habitat for two federally listed plants and one candidate species. Desert tortoises occur near the Silvercreek Landfill nominated site.
- Consider whether a degraded site serves as wildlife habitat or a corridor. Some lands, even though degraded, can facilitate important dispersal movements for wide-ranging species.
- Limit qualified lands to only specific categories of significantly and permanently disturbed areas or parcels that render their cultural resource values beyond repair.
- Comply with NHPA Section 106, including cultural resource surveys and tribal consultation, even on previously disturbed parcels.
- Address Executive Order 13007, Indian Sacred Sites, and discuss how the BLM will avoid adversely affecting the physical integrity, accessibility, or use of any sacred sites.
- How will the BLM assess impacts on surface water and groundwater in the EIS analysis?
- Analyze the potential for alternatives to cause adverse impacts on aquatic resources, such as impacts on water quality and aquatic habitats.
- Describe the natural drainage patterns at the sites and areas, the drainage patterns of the areas during project operations, and whether any components of the proposed project would be within a 50- or 100-year floodplain.

- Describe existing restoration and enhancement efforts for CWA Section 303(d) waters in a project area.
- Avoid project activities in the Arizona Strip to allow for wilderness and recreation.
- Protect the San Pedro River Valley watershed from all intensive infrastructures.

There were also numerous comments received related to socioeconomics and environmental justice. Commenters suggested BLM implement the RDEP in a way that strengthens state and local socioeconomic conditions, provides local access to energy, ensures environmental justice, and protects human health and safety. Specific socioeconomic and environmental justice scoping issues are identified below:

- Discuss each alternative's potential to impact air traffic and safety in the vicinity of the proposed project.
- Given the size of many of the sites identified (less than 2,000 acres), there could be opportunities to advance community- or neighborhood-scale renewable energy development projects (for example, less than 100-MW capacity with a single end user of the power generated, not necessarily onsite).
- In the event that technology provides a better source of power, taxpayers must not bear the financial burden to remove the old technology.
- Discuss the economic benefits from a project (for example, to property taxes).
- Areas that can be restored and leased for grazing rights should be.
- Fifty percent of the generated power must remain in the state.
- Siting clean energy on previously disturbed or contaminated sites prevents unnecessary development of lands with other resources and values and can improve community well-being by cleaning up contamination and blight, benefiting local taxes, and bringing economic opportunities.
- How will the BLM ensure that disturbed sites (such as mineral sale/lease sites and mine sites) will accommodate public works projects? It is increasingly difficult to locate and permit aggregate sources.
- Evaluate environmental justice populations within the geographic scope of a project. Where populations exist, address the potential for disproportionate adverse impacts on minority and low-income populations, and the approaches used to foster public participation by these populations.

- Clarify what general measures will be incorporated to ensure that OHV and other users are not injured due to hazards associated with exposed collectors, piping, and transmission lines. Implement some safety precautions.

4.1.2 General Methodology for Analyzing Impacts

Potential impacts or effects[1] are described in terms of type, context, duration, and intensity, which are generally defined as follows:

- *Type of Impact* – Because types of impacts can be interpreted differently by different people, this chapter does not differentiate between beneficial and adverse impacts (except in cases where such characterization is required by law, regulation, or policy). The presentation of impacts for key planning issues is intended to provide the BLM decision maker and reader with an understanding of the multiple use tradeoffs associated with each alternative.
- *Context* – Context describes the area or location (site-specific, local, planning area-wide, or regional) in which the impact would occur. Site-specific impacts would occur at the location of the action, local impacts would occur within the general vicinity of the action area, planning area-wide impacts would affect a greater portion of the state, and regional impacts would extend beyond the planning area (state) boundaries.
- *Duration* – Duration describes the length of time an effect would occur, either short term or long term. Short term is defined as anticipated to begin and end within the first five years after the action is implemented. Long term is defined as lasting beyond five years to the end of or beyond a 20-year RDEP planning horizon.
- *Intensity* – This analysis discusses impacts using quantitative data wherever possible. If quantitative analysis is not possible, qualitative statements are used.
- *Direct and Indirect Impacts* – Direct impacts are caused by an action or implementation of an alternative and occur at the same time and place. Indirect impacts result from implementing an action or alternative but usually occur later in time or are removed in distance and are reasonably certain to occur.
- *Cumulative Impacts* – Cumulative impacts are described in **Chapter 5**, Cumulative Impacts. Cumulative impacts are the direct and indirect effects of a proposed project alternative's incremental impacts when they are added to other past, present, and reasonably foreseeable actions, regardless of who carries out the

[1] In the NEPA context, the terms "impacts" and "effects" are synonymous and interchangeable.

action (40 CFR Part 1508.7). The list of actions used for cumulative impact analysis is provided in **Section 5.1.2**, Past, Present, and Reasonably Foreseeable Future Actions.

Analysis shown under an alternative may be referenced in the other alternatives with such statements as "impacts would be the same as, or similar to, Alternative 2" or "impacts would be the same as Alternative 1, except for . . ." as applicable.

Irreversible and irretrievable commitment of resources, unavoidable adverse impacts, and the relationship of short-term uses of the environment to long-term productivity are discussed in **Section 4.3**. Each of these impacts discussions is required by the CEQ NEPA regulations at 40 CFR 1502.16 and summarizes information for resources and/or resources uses that may be affected.

The scope of the analysis focuses on impacts on resources and uses on BLM lands only, as the decisions being made by the BLM Arizona apply only to BLM-managed resources and uses. It may be that the characteristics and types of impacts when developing renewable energy projects on BLM-managed resources and uses would be similar to impacts on non-BLM managed resources and uses found on state lands, private lands, or lands managed by other federal agencies. Therefore, the type of impacts anticipated from renewable energy development may be useful to these other agencies and private land owners in understanding project development.

4.1.3 Analytical Assumptions

Several assumptions were made to facilitate the analysis of the projected impacts. These assumptions set guidelines and provide reasonably foreseeable projected levels of development that would occur within the RDEP planning area and timeframe. These assumptions should not be interpreted as constraining or redefining the management objectives and actions proposed for each alternative, as described in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario. The following general assumptions apply to all resource categories. Any specific resource assumptions are provided in the methods of analysis section for that resource.

- Several resources have been identified as an "Area with Known Sensitive Resources" in Chapter 2, **Table 2-1**, Areas with Known Sensitive Resources (Eliminated from REDA Consideration). As such, these lands have been eliminated from consideration as a REDA; therefore, negligible impact on the listed resources is anticipated.
- The nominated sites described in **Appendix C**, Solar and Wind Energy Assessment of Nominated Sites, do not have high quality/grade resources due to their disturbed nature.

- Sufficient funding and personnel would be available for implementing the final decision.
- Implementing actions from any of the alternatives would be in compliance with all valid existing rights, federal regulations, BLM policies, and other requirements.
- Additional site-specific NEPA and environmental analysis will be conducted on individual applications.
- The RDEP RFDS (**Appendix A**, Reasonably Foreseeable Development Scenario for Renewable Energy in Arizona) estimates that approximately 8,000 acres of land would be required to produce 1 GW of solar energy electricity, and 28,000 acres of land (10 percent of which would be disturbed) would be required to produce 1 GW of wind energy electricity.
- Based on the RFDS, the majority of BLM-administered land that is developable for solar energy projects occurs in the western half of Arizona, with smaller areas identified to the east; large tracts of land with no known technical or regulatory conflicts are identified along Interstates 8 and 10 to the west of Phoenix, and in the north, south, and west of Highway 389.
- Based on the RFDS, relatively few areas of BLM-administered lands are considered developable for wind energy projects across Arizona. No BLM-administered lands were found to contain the highest class of wind resources (Class 7), and only 69 acres were found to contain the second highest class of resources (Class 6).
- Direct and indirect impacts of implementing the RDEP decisions primarily occur on the public lands administered by the BLM Arizona.
- Local climate patterns of historic record and related conditions for plant growth would continue.
- In the future, as tools for predicting climate change in a management area improve and changes in climate affect resources and necessitate changes in how resources are managed, the BLM may be able to reevaluate decisions made as part of this planning process and adjust management accordingly.
- Appropriate maintenance would be carried out to maintain the functional capability of all developments.
- The discussion of impacts is based on the best available data. Knowledge of the planning area and professional judgment, based on observation and analysis of conditions and responses in similar areas, are used to infer environmental impacts where data are limited.

- Stipulations would apply, where appropriate, to all surface-disturbing activities (and occupancy) associated with land use authorizations, grants, and permits issued on BLM lands.
- Acreage figures and other numbers used in the analyses are approximate projections for comparison and analytic purposes only. Readers should not infer that they reflect exact measurements or precise calculations. Acreage calculations are rounded to the nearest hundred for the REDAs, and to the nearest 10 for the proposed Agua Caliente SEZ.

4.1.4 Incomplete or Unavailable Information

The CEQ established implementing regulations for NEPA requiring that a federal agency identify relevant information that may be incomplete or unavailable for an evaluation of reasonably foreseeable significant adverse effects in an EIS (40 CFR 1502.22). If the information is essential to a reasoned choice among alternatives, it must be included or addressed in an EIS. Knowledge and information is, and would always be, incomplete, particularly with complex ecosystems considered at various scales.

The best available information pertinent to the decisions to be made has been used in developing this EIS. Considerable effort has been taken to acquire and convert resource data into digital format for use in the EIS, both from BLM and from outside sources.

Certain information was unavailable for use in developing this plan because inventories have either not been conducted or are not complete. Some of the major types of data that are incomplete or unavailable include the following:

- Field inventory of soils and water conditions;
- Field inventory of vegetation composition;
- Field inventory of wildlife and special status species occurrence and condition; and
- Surveys for cultural and paleontological resources.

For these resources, estimates were made concerning the number, type, and significance of these resources based on previous surveys and existing knowledge. In addition, some impacts cannot be quantified given the proposed management actions. Where this gap occurs, impacts are projected in qualitative terms or, in some instances, are described as unknown. Subsequent project-level analysis will provide the opportunity to collect and examine site-specific inventory data required to determine appropriate application of the land use plan-level guidance. In addition, ongoing inventory efforts by BLM and other agencies in the planning area continue to update and refine information used to implement the RDEP.

4.2 RESOURCES AND RESOURCE USES

4.2.1 Air Quality and Air Quality-related Values

Evaluation Methodology, Resource Indicators, and Assumptions

The potential effects of renewable energy development were evaluated by assessing the effects that anticipated future actions consistent with the alternatives would have on air quality in the planning area. Because wind and solar technologies produce minimal air emissions during operation, the air quality analysis focuses primarily on impacts associated with their development, including construction activities and reclamation/abandonment activities. The analysis discusses short-term localized effects of development in relation to existing air quality conditions, site conditions, and meteorological conditions, as the effects of development, especially large-scale surface disturbance, are highly dependent upon these factors.

In addition to identifying construction-related impacts that are common to all alternatives, the air quality analysis discusses the potential operational effects associated with the various types of solar and wind technologies summarized in **Section 1.12**, Solar and Wind Technologies, and discussed in detail in **Appendix A**, Reasonably Foreseeable Development Scenario for Renewable Energy in Arizona, under Overview of Renewable Energy Technologies.

The primary indicators of air quality impacts are the ambient air quality standards documented in **Section 3.2**, Air Quality and Air Quality-related Values, that define ambient air quality, incremental degradation of air quality, and air quality-related values, including visibility. Indicators utilized for this analysis include the following:

- Location of REDAs and the Agua Caliente SEZ in relation to federal nonattainment areas; and
- Location of REDAs and the Agua Caliente SEZ in relation to Class I areas.

The following assumptions were used in the impact analysis:

- The overall development acreages for solar and wind development would be similar under each REDA alternative (the same MWs would be produced) even though the size of the REDA is different.
- Air quality impacts can be localized or regional depending upon the pollutant being analyzed.
- Weather-related events may cause local or regional air quality impacts.
- Design features and BMPs identified in **Appendix B**, Design Features and Best Management Practices, would be implemented

for site-specific projects as applicable to the specific project and site location to minimize construction- and operation-related emissions.

Impacts Common to All Alternatives

There would be no direct air quality impacts from the identification of a REDA. Indirect impacts on air quality associated with renewable energy development include construction-related emissions and, to a lesser extent, operational emissions. Solar development under each alternative would affect approximately 12,000 acres of BLM-administered lands state-wide. Wind development, which requires much less surface disturbance than solar, would disturb approximately 3,600 acres of BLM-administered lands state-wide. Emissions from individual renewable energy projects would be dispersed across the planning area and could occur throughout the planning timeframe. These projects would have short-term and long-term localized impacts at the project sites but would not contribute to regional degradation of air quality over the long term, as explained below.

Impacts associated with constructing and operating solar and wind facilities, including access roads and transmission lines, would vary greatly depending on the type of technology and the location and scale of the project, and potential impacts would be assessed on a site-specific basis during the ROW application process. However, a description of the types of air quality impacts that would be expected from the construction and operation of renewable energy facilities is provided below.

Solar Energy Development. The Draft Solar PEIS (BLM and DOE 2010) provides a thorough characterization of the types of air emission sources that are associated with each phase of solar facility development, including site characterization, construction, decommissioning/reclamation, and roads and transmission lines, as well as the types of air pollutants emitted (see BLM and DOE 2010, p. 5-145 to 5-149, for a detailed discussion of solar development-related impacts). As described in the Draft Solar PEIS, site characterization generally has negligible emissions except where deep soil coring is required to obtain geotechnical data, well drilling is required for groundwater characterization, or access roads must be developed to reach the site. In these cases, surface clearing would produce fugitive dust emissions, and coring and drilling equipment and heavy road equipment would produce criteria air pollutant emissions and small amounts of toxic air emissions associated with vehicle and equipment combustion processes.

Construction of a solar facility includes a number of operations, with most air quality impacts occurring during site preparation (clearing, grading, and cut and fill if needed to produce acceptable slopes) and facility construction. Depending on the size of the facility, construction would occur over months or years. For large facilities, construction activities would be staggered, such that different

activities would occur on different areas of the project site over the period of construction. As described in the Draft Solar PEIS (BLM and DOE 2010, p. 5-145), major equipment used during site preparation would include chain saws, chippers, dozers, scrapers, end loaders, trucks, cranes, rock drills, and blasting equipment if required. Major equipment used in the construction phase would include cranes, end loaders, backhoes, dozers, trucks, and a concrete batch plant if required.

The primary pollutants emitted during construction are fugitive dust (associated with site preparation, transmission line and road development, and vehicle and equipment use on unpaved surfaces) and exhaust emissions (associated with major equipment usage, construction worker commute traffic, and truck deliveries to the project site).

As described in detail in the Draft Solar PEIS (BLM and DOE 2010, p. 5-146), solar development has the potential to release large amounts of fugitive dust. These conditions are dependent upon the amount of surface disturbance, the soil conditions of the project site, and meteorological (wind) conditions. Under high-wind conditions in areas with highly erodible soils, fugitive dust could exceed ambient air quality standards at project site boundaries, causing short-term, localized, unavoidable impacts. Fugitive dust would have the greatest potential for impact in PM_{10} nonattainment or maintenance areas or at project sites that occur near sensitive receptors such as residences, schools, or Class I areas. It should be noted that most REDAs are not located in nonattainment areas, and most are in more remote areas where construction would be unlikely to affect residences or schools. REDAs are located within 62 miles of Class I areas, primarily southwest of Grand Canyon National Park and east and west of Petrified Forest National Park.

Fugitive dust impacts associated with site-specific actions on BLM-administered lands would be addressed during the ROW application process through the requirement of a Dust Abatement Plan and implementation of design measures and BMPs such as those contained in **Appendix B**, Design Features and Best Management Practices. These measures could include minimizing the amount of area disturbed at one time, surfacing roads and parking lots with aggregate, stabilizing disturbed area through watering, minimizing vehicle speeds on unpaved surfaces, and halting construction on windy days. Construction-related fugitive dust impacts would be short term and temporary, lasting until site soils were stabilized upon the completion of facility construction.

In addition to fugitive dust impacts, solar facility construction could result in substantial emissions of criteria air pollutants, volatile organic compounds, greenhouse gases (discussed further in **Section 4.2.2**, Greenhouse Gas Emissions and Climate Change), and small amounts of toxic air pollutants through the combustion of fuel in construction equipment, worker commute vehicles, and truck deliveries. For projects on BLM-administered lands,

emissions would be minimized through design measures and BMPs such as those listed in **Appendix B**, Design Features and Best Management Practices. Emission reduction measures could include measures such as requiring routine preventive maintenance, specifying the use of equipment that meets more stringent emission standards, requiring emission control devices or the use of ultra-low sulfur diesel fuel, and minimizing idling time. The specific measures would be determined during the ROW application process.

Wind Energy Development. The Wind Energy PEIS characterizes the types of air emission sources and air pollutants that are associated with various phases of wind energy development, including site monitoring and testing; site construction; site access, clearing, and grade alterations; foundation excavations and installations; wind turbine erection; and decommissioning (BLM 2005b).

Similar to solar energy development, wind energy development would result in the emissions of fugitive dust from surface disturbance and criteria pollutant, volatile organic compound, greenhouse gas, and hazardous air pollutant emissions associated with construction equipment, worker commute vehicles, and delivery vehicles. Unlike solar development, the primary source of fugitive dust emissions likely would occur during the construction of access roads, which sometimes must be developed through steeper terrain and may include blasting and cut and fill operations. The majority of areas with wind energy potential occur in REDAs that are outside of PM_{10} maintenance and nonattainment areas.

Like solar facility construction, wind energy facility construction could result in substantial emissions of criteria air pollutants, volatile organic compounds, greenhouse gases, and small amounts of toxic air pollutants through the combustion of fuel in construction equipment, worker commute vehicles, and truck deliveries. The greatest source of emissions would be during the development of access roads and during the development of foundations and erection of the wind turbines, which would require substantial use of heavy equipment, the possible use of diesel generators and concrete batch plants, delivery and set up of cranes, and delivery of wind turbine equipment.

Similar to solar energy facility construction, a Dust Abatement Plan and design features and BMPs identified in **Appendix B**, Design Features and Best Management Practices, would be required to minimize air quality impacts resulting from wind energy development on BLM-administered lands. The specific measures deemed necessary to reduce air quality impacts on an acceptable level would be determined during site-specific permitting of individual projects.

Solar Energy Operation. The Draft Solar PEIS describes the air emissions associated with operation of PV and CSP (parabolic trough and power tower) solar facilities (see BLM and DOE 2010, p. 5-147 for a detailed discussion of operational impacts).

PV solar facilities would result in negligible emissions of criteria air pollutants from operation of the solar generating equipment itself. Operation of a PV solar facility would result in minor emissions from personal and maintenance vehicles, limited delivery trucks, and limited equipment exhaust, as well as fugitive dust emissions from windborne dust and dust generated by vehicles on unpaved surfaces. Emergency diesel generators, space heating boilers, and emergency fire-water pump engines, if used, would emit minor amounts of criteria air pollutants and hazardous air pollutants. These sources would likely require stationary air permits from the state; such permits would include operational parameters such as allowable fuel type, required control equipment, and hours of use permitted per year.

CSP facilities would result in similar types of operational emissions as described for PV solar facilities, above. In addition, some CSP technologies (parabolic trough and power tower) would require small-scale boilers and cooling towers, which would emit criteria pollutants and small amounts of toxic air pollutants in the case of boilers and particulates in the case of wet cooling towers (though drift eliminators could be used to minimize particulate emissions from cooling towers).

The amount of air pollutants generated during operation of solar facilities would be much less than the amount emitted during facility construction. Some design measures and BMPs required to minimize construction-related emissions may also be required to minimize operational emissions, particularly fugitive dust, during facility operation.

Wind Energy Operation. Wind energy facilities would have negligible emissions associated with operation of the wind turbines themselves. Operational emissions would include minor levels of criteria pollutants from scheduled changes of lubricating and cooling fluids and greases, limited vehicle use for maintenance activities, and limited equipment exhaust from routine brush clearing.

Decommissioning and reclamation would have impacts similar to those described for construction for both solar and wind facilities, and measures to minimize impacts would likely be similar to those described in **Appendix B**, Design Features and Best Management Practices.

Impacts from the No Action Alternative

Under the No Action Alternative, solar and wind development applications would continue to be processed on a case-by-case basis. Solar and wind development would occur at its current pace. Projects would have short-term and localized impacts at the project sites during construction. Operational impacts would be much less and would not contribute to regional degradation of air quality over the long term. These impacts are discussed under Impacts Common to All Alternatives, above.

Impacts from Alternative 1

Impacts from Maximum REDA

The nature and type of air quality impacts would be the same as those described above for Impacts Common to All Alternatives. Because this alternative provides the most land area and the most flexibility for siting renewable energy projects, there is the potential for such projects to be dispersed over the widest area. To the extent that this alternative resulted in the need for longer access roads or gen-tie lines, temporary construction-related impacts could be greatest under this alternative. A Dust Abatement Plan described in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario, and design measures and BMPs described in **Appendix B** would be implemented to minimize impacts on air quality during construction and operation.

Impacts from Proposed Agua Caliente Solar Energy Zone

The nature and type of impacts likely to occur from utility-scale solar development within the proposed Agua Caliente SEZ would be similar to those described above for Impacts Common to All Alternatives. Alternative 1 is one of the alternatives that contains the largest SEZ land area and thus could potentially support the largest amount of utility-scale development. If multiple utility-scale projects were proposed and constructed, and particularly if construction periods of different projects overlapped, short-term localized impacts could occur from generation of fugitive dust on project sites and from construction traffic-related exhaust emissions on area roadways. A Dust Abatement Plan described in Chapter 2 and design measures and BMPs described in **Appendix B** would be required to minimize construction-related impacts within the proposed SEZ. The proposed Agua Caliente SEZ is not within 62 miles of any Class I area and is in an area that is in attainment with all of the ambient air quality standards.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

The nature and type of air quality impacts would be the same as those described for Impacts Common to All Alternatives. Because REDAs under this alternative only include lands within five miles of existing or certified transmission lines and utility corridors, the distance to connect the proposed developments to transmission would be minimized, potentially reducing construction-related impacts as compared with the No Action Alternative. Measures to minimize air quality impacts would be the same as described under Alternative 1.

Impacts from Proposed Agua Caliente Solar Energy Zone

The nature and type of impacts likely to occur from utility-scale solar development within the proposed Agua Caliente SEZ would be similar to those described for Impacts Common to All Alternatives. Alternative 2 contains a smaller SEZ footprint compared with Alternative 1 and would likely result in a lesser amount of development within the proposed SEZ. Short-term impacts

related to construction would likely be less than described for Alternative 1. Measures to minimize air quality impacts would be the same as described under Alternative 1.

Impacts from Alternative 3

Impacts from Load Offset REDA

The nature and type of air quality impacts would be the same as those described for Impacts Common to All Alternatives. Limiting development to within 10 miles of load centers could encourage development closer to populated areas, resulting in potential localized short-term air quality impacts on sensitive receptors if such receptors were located adjacent to construction activities. Measures to minimize air quality impacts would be implemented to reduce emissions and ensure that ambient air quality standards at property boundaries were not exceeded. Development closer to population centers may reduce the miles of dirt access roads required compared with other action alternatives, potentially reducing regional fugitive dust impacts compared with these alternatives. Measures to minimize air quality impacts would be similar to those described under Alternative 1.

Impacts from Proposed Agua Caliente Solar Energy Zone

The nature and type of impacts likely to occur from utility-scale solar development within the Agua Caliente SEZ would be similar to those described for Impacts Common to All Alternatives. Alternative 3 contains the smallest SEZ footprint and would likely result in the least amount of development within the proposed SEZ and thus the lowest air emissions. Measures to minimize air quality impacts would be the same as described under Alternative 1.

Impacts from Alternative 4

Impacts from Water Conservation and Protection REDA

The nature and type of air quality impacts would be the same as those described for Impacts Common to All Alternatives. Alternative 4 includes the same land area as Alternative 1 but would limit technologies in water resource protection zones to dry-cooling technology. Prohibiting wet cooling may encourage PV solar over other solar technologies, slightly reducing potential operational-related emissions. Measures to minimize air quality impacts would be the same as described under Alternative 1.

Impacts from Proposed Agua Caliente Solar Energy Zone

Air quality impacts would be the same as described under Alternative 1.

Impacts from Alternative 5

Impacts from Land Tenure REDA

The nature and type of air quality impacts would be the same as those described for Impacts Common to All Alternatives. Alternative 5 would emphasize land exchanges for renewable energy development, resulting in less development on BLM-administered land and more development on non-federal lands. Because projects would be subject to permitting requirements on public or private lands,

this alternative would have impacts similar to the other alternatives. Measures to minimize air quality impacts would be the same as described under Alternative 1.

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

The nature and type of air quality impacts would be the same as those described for Impacts Common to All Alternatives. Alternative 6 would place renewable energy development near transmission and load centers while maintaining the water protection zones described for Alternative 3. Impacts would be similar to Alternative 2 in the size of the potential development area, similar to Alternative 3 in the potential effects to sensitive receptors close to load centers, and similar to Alternative 4 in prohibiting wet-cooling technology. Measures to minimize air quality impacts would be the same as described under these alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone

Air quality impacts would be the same as described under Alternative 2.

4.2.2 Greenhouse Gas Emissions and Climate Change

Evaluation Methodology, Resource Indicators, and Assumptions

The potential effects of renewable energy development were evaluated by assessing the effects that anticipated future actions consistent with the alternatives would have on the production of greenhouse gas emissions. Because wind and solar technologies produce minimal greenhouse gas emissions during operation, the analysis focuses primarily on impacts associated with their development, including construction activities and reclamation/abandonment activities. The analysis discusses short-term increases in greenhouse gas emissions during development versus the long-term effects related to the ability of renewable energy facilities to offset energy needs provided by fossil fuel-burning energy facilities.

The primary indicator of greenhouse gas-related impacts is the potential for the proposed action and alternatives to increase or decrease long-term levels of greenhouse gases and the potential resulting effects on global climate change.

The following assumptions were used in the impact analysis:

- The overall development acreages for solar and wind development would be the same under each alternative.
- The overall amount of energy provided by renewable sources would be the same under each alternative.
- There is believed to be a correlation between levels of greenhouse gases produced and climate change.

- The development of renewable energy facilities would offset energy provided by fossil fuel-burning energy facilities.
- Design features and BMPs identified in **Appendix B** would be implemented for site-specific projects as applicable to the specific project and site location to minimize construction- and operation-related greenhouse gas emissions.

Impacts Common to All Alternatives

Greenhouse gases are gases that contribute to the natural greenhouse effect, including carbon dioxide, methane, nitrous oxide, and water vapor, as well as gases that are manmade, including hydrofluorocarbons, chlorinated fluorocarbons, and sulfurhexafluoride. Greenhouse gases are often reported in units of carbon dioxide equivalents (CO_{2e}).

There would be no direct impacts from the identification of a REDA. Indirect impacts associated with solar and wind energy development would include permanent removal of vegetation, which releases carbon stored (sequestered) in the cleared vegetation, and greenhouse gas emissions resulting from fuel combustion associated with heavy construction equipment and vehicle and truck use. These activities, which are the primary source of greenhouse emissions associated with renewable energy development, would be short term and temporary, lasting only during the construction period. Design measures and BMPs that reduced equipment and vehicle exhaust emissions would also reduce greenhouse gas emissions.

Greenhouse gas emissions associated with operation of solar and wind facilities would be much less than during construction and would result from any fuel-burning equipment needed to maintain or operate the facility, such as boilers or generators, landscaping equipment, and vehicle use, as well as any fossil fuel-generated electricity needed to operate water pumps and lighting, if this energy could not be provided by the renewable energy source itself.

Greenhouse gas emissions associated with decommissioning/reclamation of solar and wind facilities would be similar to, but less than, those associated with construction. Design measures and BMPs that reduced equipment and vehicle exhaust emissions associated with decommissioning/reclamation would also reduce greenhouse gas emissions.

In addition to the direct greenhouse gas emissions from project construction, operation, and decommissioning/reclamation, indirect greenhouse gas emissions would be associated with the production and shipment of equipment used on the site and the reduced sequestration capacity if removed vegetation is not replaced.

Because solar and wind facilities operate for decades with minimal production of greenhouse gases, the potential greenhouse gas savings in the form of offsetting

energy produced by fossil fuel sources outweighs life-cycle emissions of greenhouse gases. Arizona receives approximately 68 percent of its power from fossil fuel plants (coal, gas, and oil), 25 percent from nuclear power plants, 6.48 percent from hydroelectric sources, and 0.07 percent from non-hydroelectric renewable sources. Increasing renewable energy output to 15 percent of the state's energy needs by 2025 would result in a substantial reduction in greenhouse gas emissions if a fossil fuel power plant would otherwise be in operation to supply the same amount of power. In Arizona, an estimated 1,700 pounds of CO_2 would be displaced annually per MW-hour of renewable energy produced (EPA 2007).

The EPA's Mandatory Greenhouse Gases Reporting Rule (74 Federal Register 56260, October 20, 2009) mandates the reporting of annual greenhouse gas emissions for certain sources as well as for facilities that emit more than 25,000 metric tons of CO_{2e} per year. Solar and wind energy facilities would likely have annual operating emissions well below this level and would not be subject to this rule.

Impacts from the No Action Alternative

Under the No Action Alternative, solar and wind development applications would continue to be processed on a case-by-case basis, and development would occur at its current pace. Short-term emissions, operational emissions, and life-cycle emissions of greenhouse gases from approved facilities would be similar to those described under Impacts Common to All Alternatives. Development of renewable energy facilities would result in potential greenhouse gas savings over the life of the facilities to the extent that these facilities offset energy produced by fossil fuel sources.

Impacts from Alternatives 1 through 6

Impacts from REDAs

Impacts under Alternatives 1 through 6 would be the same as those described under Impacts Common to All Alternatives regardless of where development occurred.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts from the proposed Agua Caliente SEZ would be the same as those described under Impacts Common to All Alternatives regardless of where development occurred.

4.2.3 Cultural Resources

Evaluation Methodology, Resource Indicators, and Assumptions

Chapter 3, **Section 3.4**, Cultural Resources, provides estimates that field inventories of new project areas would be expected to encounter a range of 2 to 10 archaeological sites per square mile (640 acres), based on local conditions and environmental contexts. Many of these sites could be evaluated as eligible for nomination to the NRHP. Specific project proposals would be reviewed in

compliance with the requirements of NHPA Section 106, including identification and evaluation of affected resources; consultations with the SHPO, Indian tribes, and the public; and cooperative efforts with these participants and the project applicant to avoid, mitigate, or otherwise resolve any adverse effects. Such consultations would be initiated early in the NEPA process and could address the siting and design of proposed projects.

Additionally, in assessing potential impacts within the REDA alternatives, the degree of potential impacts is contingent on a number of conditions, including:

- Prehistoric and historic land use patterns within the proposed REDA;
- The nature and eligibility status of previously recorded cultural resources within the proposed REDA;
- The presence of TCPs or other places of traditional cultural or religious importance within or near the REDA; and
- The location of development within the proposed REDA.

The primary concerns regarding impacts on cultural resources are the loss of physical integrity or the diminishment of the informational, historical, cultural, or other values that make them eligible for the NRHP or that are the basis for scientific research, traditional cultural use, or public education. Two major types of impacts from renewable energy development could adversely affect cultural resources:

- Direct or indirect physical impacts from ground disturbance during construction, operation, or reclamation; and
- Visual or auditory impacts on the setting of a resource, where integrity of setting is integral to its NRHP eligibility or use allocation.

Indirect adverse impacts are also a concern. For example, buried cultural resources may be subject to damage or destruction by erosion that is accelerated by construction disturbance. Moreover, improved access as a result of construction could lead to unauthorized collection or vandalism, depending on the proximity and visibility of archaeological sites.

Two general assumptions can be made regarding cultural resource density in Arizona:

- Human settlement tends to aggregate near reliable water resources; therefore, it can be assumed that cultural resource density increases in proximity to water. Any construction projects undertaken within the proposed REDAs that occur near major or

seasonal drainages, springs, or playa zones would increase the potential for impacts on prehistoric or historic cultural resources.

- Urban areas have a high potential for architecturally significant cultural resources such as NHRP-listed buildings, structures, and neighborhoods. This circumstance is particularly relevant for the Phoenix Basin/Middle Gila and Tucson/Santa Cruz cultural regions, which have large numbers of historic properties; however, smaller municipalities, such as Wickenburg and Winslow, also exhibit a significant number of historic buildings and districts in their respective downtown areas. Therefore, it can be assumed that any construction projects undertaken within the proposed REDAs that occur near urban areas, including nominated sites described in **Appendix C**, Solar and Wind Energy Assessment of Nominated Sites, have a greater potential for impacts, particularly visual impacts, to NRHP-listed properties, as well as to previously unidentified historic resources.

Impacts Common to All Alternatives

- Significant cultural resources, including historic properties listed or eligible for listing on the NRHP, could be affected by renewable energy development regardless of the technology employed. The potential for impacts on cultural resources from renewable energy development, including ancillary facilities such as access roads and transmission lines, is directly related to the amount of land disturbance and the location of a project. Indirect effects, such as impacts resulting from the erosion of disturbed land surfaces, increased accessibility to possible site locations, and visual, auditory, and atmospheric intrusions, are also considered. Potential types of impacts on cultural resources include:
- Complete destruction could result from the clearing, grading, and excavation of a project area and from construction of facilities and associated infrastructure if archaeological sites, historic structures, or traditional cultural properties are located within the project's footprint.
- Degradation and/or destruction of historic properties could result from the alteration of topography, alteration of hydrologic patterns, removal of soils, erosion of soils, runoff into and sedimentation of adjacent areas, and oil or other contaminant spills if sites are located on or near a project area. Such degradation could occur both within a project footprint and in areas downslope or downstream. While soil erosion could affect locations downstream of a project area by potentially eroding materials and portions of downstream archaeological sites, the accumulation of sediment could serve to protect some downstream sites by increasing the amount of protective cover. Erosion can also

destabilize historic structures. Agents of erosion and sedimentation include wind, water, downslope movements, and human and wildlife activities. Contaminants could affect the ability to conduct an analysis of material present at the site and thus the ability to interpret site components.

- Increases in human access and subsequent disturbance (e.g., looting, vandalism, trampling) of cultural resources could result from the establishment of corridors or facilities in otherwise inaccessible areas. Increased human access (including OHV use) may expose resources to greater probability of impact from a variety of stressors, depending on their accessibility and visibility. Standing structures, or other conspicuous site types such as petroglyphs, would be especially vulnerable.
- Visual intrusion into settings associated with significant cultural resources could result from the presence of a renewable energy development and associated land disturbances and ancillary facilities. This could affect properties for which visual integrity is a component of significance, such as TCPs, sacred sites, historic structures developed as interpretive sites, National Historic Trails, and historic landscapes.

Cultural resources are nonrenewable and, once damaged or destroyed, are not recoverable. Though aspects of setting could be restored through closure and reclamation of a facility, in general, if a cultural resource is damaged or destroyed during solar or wind energy development, this particular cultural location, resource, or object would be irretrievable.

Implementing mitigation measures could reduce or minimize adverse impacts on cultural resources. Avoidance is the preferred approach, by which projects would be sited or designed to exclude resources and to prevent damage to them. For cultural resources that are significant for their informational value, scientific data recovery is one way in which some information can be salvaged should a cultural resource site be adversely affected by development activity. Data-recovery procedures could involve excavations, mapping, artifacts and other material collection, geomorphological studies, archival research, or oral histories. Final reports would be required to document the results of fieldwork and analysis, with collections and data preserved for long-term research and public benefit in a museum or other approved facility. Indian tribes would be consulted in developing related research designs, plans, and procedures. Federal agencies would comply with the provisions of the Native American Graves Protection and Repatriation Act to address any discoveries of human remains and associated items protected under that law.

Other mitigation measures include implementing discovery plans to address any unexpected finds during construction, implementing monitoring plans to protect

avoided sites during construction and through the life of a project, and requiring education of workers to ensure that they understand and comply with cultural resource protection measures.

Impacts on settings, and the loss of value for education, heritage tourism, or traditional uses, are less easily mitigated and are best addressed through informed project siting. Visual intrusions could be mitigated through measures designed to reduce visual impacts by lowering the contrast of facilities with the surrounding terrain and viewshed. It may not be possible to mitigate all impacts of a proposed project. Creative or compensatory mitigation measures could be considered; these could involve such approaches as support for related archaeological or ethnographic studies, or associated public-education efforts such as publications or websites featuring project-related studies.

The technology-specific factor that could have a possible impact on the cultural resources assessment is the difference in land requirements of the various renewable energy technologies. Differences in land requirements, however, would not directly correspond to differences in impacts on cultural resources at the programmatic level (e.g., more land equates to greater magnitude of the impact). The magnitude or level of impact would depend on whether the specific location of a proposed solar or wind facility contains significant cultural resources, regardless of the overall size of the facility.

Areas available for solar or wind development are flat valley floors, and aside from trails or other linear features that might cross these valleys, the areas of potential cultural significance, whether prehistoric or historic, would most likely be near dry lake beds, in dune areas, or along washes. Those technologies that can be adjusted to avoid these areas with a higher likelihood to contain sites are less likely to result in impacts on historic properties. For example, dish engine technology is less position-driven with respect to individual units than some of the other linear technologies or the power tower (BLM and DOE 2010).

The different technologies also result in different viewsheds based on facility height differences. For cultural resources with a visual component, such as a historic trail or tribal sacred area, where integrity of setting is an important aspect of the resource's significance, technology choice could be a factor in determining whether a resource is adversely affected.

Differences in water requirements (e.g., water use and discharge) among the technologies are not likely to be a factor in determining levels of impact of surface runoff and possible effects on cultural resources. However, depending on the water source for solar technologies using cooling towers or steam generators, drawdown of surface water levels could increase the potential for erosion in some localities and could inadvertently expose cultural resources present along stream banks or lakeshores. These issues would be addressed at the site-specific level of analysis.

Impacts from the No Action Alternative

Under the No Action Alternative, renewable energy projects would be developed on a case-by-case basis through ROW authorizations in accordance with the BLM's existing land use plans. Therefore, the types of impacts on cultural resources described in Impacts Common to All Alternatives would still occur as renewable energy projects are developed on BLM-administered lands that allow development. The No Action Alternative does not include the additional design features or BMPs described in **Appendix B**, Design Features and Best Management Practices, that would give consistent, state-wide guidance for mitigating impacts; mitigation would be determined project by project and as needed based on the impact analysis for a specific proposal.

Impacts from Alternative 1

Impacts from Maximum REDA

Under Alternative 1, renewable energy development could occur in any area of the REDA. Areas with known sensitive cultural resources that are eliminated from the REDA include BLM ACECs, national monuments, national historic trails (0.25-mile buffer), and specific areas identified by agencies or the public as containing sensitive resources, such as the Gila River Terraces area west of Phoenix. Designated wilderness areas, lands with wilderness characteristics, and critical habitat areas are also eliminated and generally tend to contain sensitive cultural resources. An effort has been made to define REDA in areas of low resource sensitivity. However, as archaeological surveys have covered less than 10 percent of the state, and tribal consultations would be needed to identify important cultural resources, new inventories and consultations would be required to identify and evaluate the impacts of a proposed project in any specific REDA location.

Impacts on cultural resources of the types of impacts described in Impacts Common to All Alternatives would likely result from any ground-disturbing activities associated with the development of renewable energy projects. The likelihood that the selected acreage would contain cultural resources would be assessed by a Class I records search for previously recorded sites, and may entail conducting an intensive Class III survey in areas where existing information remains limited. Using the predictive equation, which estimates 1 cultural resource site per 59.5 acres, there is the potential that approximately 5,403 sites could occur within the 321,500 acres of BLM-administered lands of this alternative. However, as explained in Chapter 3, **Section 3.4.1**, Cultural Resources, RDEP Affected Environment, it is reasonable to expect lower site densities in many proposed REDAs.

Based on spatial data obtained from the NPS, 527 NRHP-listed properties have been identified inside or within 5 miles of Alternative 1, of which approximately 96 percent are architecturally significant historic buildings, structures, and districts. Because historic integrity is directly associated with aspects such as setting and location, these property types would be sensitive to visual and/or

atmospheric impacts. However, many of these NRHP-listed properties represent historic buildings and neighborhoods in the middle of cities and towns far from the REDAs. As such, it is unlikely that these properties would be affected by development within the REDAs.

Applying the proposed design features and BMPs in **Appendix B** would reduce or eliminate (if avoidance is determined the appropriate mitigation based on site-specific analysis) the noted potential impacts on cultural resources. For subsurface sites discovered accidentally during earth-moving activities, the requirements for data collection would salvage important scientific data for future use.

Impacts from Proposed Agua Caliente Solar Energy Zone
Based on known information about historic and prehistoric use in the area of the proposed SEZ (World War II training ranges and prehistoric trails; see **Section 3.4**, Cultural Resources), renewable energy development has the potential to physically impact prehistoric and historic military-related cultural resources, as described in Impacts Common to All Alternatives. In addition, there could be impacts on views from the Juan Bautista de Anza National Historic Trail and the Sears Point ACEC.

Application of the proposed design features and BMPs in **Appendix B** would reduce or eliminate (if avoidance is determine the appropriate mitigation) the noted potential impacts on cultural resources. For subsurface sites discovered accidentally during earth-moving activities, the requirements for data collection would salvage important scientific data for future use.

Impacts from Alternative 2
Impacts from Transmission Line and Utility Corridor REDA
Under Alternative 2, renewable energy development would occur only in a subset of the maximum REDA (Alternative 1), reducing the potential area available for development of renewable energy projects, which in turn reduces the potential for impacting cultural resources in the manner described in Impacts Common to All Alternatives. By using the predictive equation, there is the potential that 3,673 sites could occur within the 218,600 acres of BLM-administered lands in Alternative 2.

A total of 481 NRHP-listed properties have been identified inside or within 5 miles of the Alternative 2 REDA, of which approximately 96 percent are architecturally significant historic buildings, structures, and districts (see **Section 3.4**, Cultural Resources). Like Alternative 1, the historic integrity with aspects such as setting and location would be more sensitive to visual impacts. However, many of these NRHP-listed properties represent historic buildings and neighborhoods in the middle of cities and towns far from the REDA. As such, it is unlikely that that these properties would be affected by development within the REDA.

Like Alternative 1, the proposed design features and BMPs in **Appendix B** would help mitigate the impacts from renewable energy development and would reduce or eliminate the severity of the impacts on cultural resource values.

Impacts from Proposed Agua Caliente Solar Energy Zone
Based on known information about historic and prehistoric use in the area of the proposed SEZ (**Section 3.4**, Cultural Resources), renewable energy development could impact prehistoric and historic resources. The reduction in size of the SEZ, from 20,600 acres to 6,770 acres, would reduce the potential for impacts by eliminating the more-remote areas near mountains and major washes that could contain undisturbed archaeological sites. In addition, there could be impacts on views from the Juan Bautista de Anza National Historic Trail and the Sears Point ACEC.

Any future renewable energy development activities within these portions of the proposed SEZ under Alternative 2 would have the same types of impacts described in Alternative 1 and Impacts Common to All Alternatives. Applying the proposed design features and BMPs described in **Appendix B** would mitigate the impacts in the same manner as described in Alternative 1.

Impacts from Alternative 3
Impacts from Load Offset REDA
Under Alternative 3, renewable energy development would occur only in a subset of the Alternative 1 maximum REDA, reducing the potential area available for development of renewable energy projects, which in turn reduces the potential for impacting cultural resources in the manner described in Impacts Common to All Alternatives. By using the predictive equation, there is the potential that 2,182 sites could occur within the 129,800 acres of BLM-administered lands of Alternative 3.

A total of 490 NRHP-listed properties have been identified inside and within 5 miles of Alternative 3 REDA, of which approximately 96 percent are architecturally significant historic buildings, structures, and districts (**Section 3.4**, Cultural Resources). However, many of these NRHP-listed properties represent historic buildings and neighborhoods in the middle of cities and towns far from the REDAs. As such, it is unlikely that that these properties would be affected by development within the REDAs.

Like Alternative 1, the proposed design features and BMPs in **Appendix B** would help mitigate the impacts from renewable energy development and would reduce or eliminate the severity of the impacts by preserving important scientific information.

Impacts from Proposed Agua Caliente Solar Energy Zone
Based on known information about historic and prehistoric use in the area of the proposed SEZ (**Section 3.4**, Cultural Resources), renewable energy development could impact cultural resources. New facilities could introduce

visual impacts on the former White Wing Ranch, a potentially eligible historic resource. However, the large Agua Caliente Solar Project is being constructed on private land encompassing much of the ranch. The reduction in size of the SEZ to 2,760 acres would reduce the potential for impacts by eliminating areas away from modern development that could contain undisturbed archaeological sites. There could be impacts on views from the Juan Bautista de Anza National Historic Trail and the Sears Point ACEC.

Any future renewable energy development activities within the proposed SEZ under Alternative 3 would have the same types of impacts described in Alternative 1 and Impacts Common to All Alternatives. Applying the proposed design features and BMPs would mitigate the impacts in the same manner as described in Alternative 1.

Impacts from Alternative 4

Impacts from Water Conservation and Protection REDA

Under Alternative 4, renewable energy development would occur within the Alternative 1 maximum REDA, with the difference that the 321,500 acres on BLM-administered lands would be divided into three water management zones with increasing levels of stringent design features for protecting water resources. Impacts on cultural resources would be similar to those described for Alternative 1.

A total of 527 NRHP-listed properties have been identified inside or within 5 miles of Alternative 4 REDA, of which approximately 96 percent are architecturally significant historic buildings, structures, and districts (**Section 3.4**, Cultural Resources). However, many of these NRHP-listed properties represent historic buildings and neighborhoods in the middle of cities and towns far from the REDAs. As such, it is unlikely that that these properties would be affected by development within the REDAs.

Like Alternative 1, the proposed design features and BMPs in **Appendix B** would mitigate the impacts from renewable energy development and would reduce or eliminate the severity of impacts by preserving important scientific information. Alternative 4 has the additional design features developed for the WPZs; applying these design features would likely reduce erosion in some localities, thereby reducing the possibility of inadvertently exposing cultural resources along stream banks, lakeshores, or other areas vulnerable to erosion.

Impacts from Proposed Agua Caliente Solar Energy Zone

Based on known information about historic and prehistoric use in the area of the proposed SEZ (**Section 3.4**, Cultural Resources), renewable energy development could impact cultural resources. The impacts would be similar to those of Alternative 1 with an SEZ size of 20,600 acres. There could be impacts on views from the Juan Bautista de Anza National Historic Trail and the Sears Point ACEC.

Any future renewable energy development activities within the proposed SEZ under Alternative 4 would have the same types of impacts described in Impacts Common to All Alternatives and Alternative 1. Applying the proposed design features and BMPs in **Appendix B** would mitigate the impacts in the same manner as described in Alternative 1.

Impacts from Alternative 5

Impacts from Land Tenure REDA

Under Alternative 5, renewable energy development would occur only in a subset of the Alternative 1 maximum REDA, reducing the potential area available for development of renewable energy projects, which in turn reduces the potential for impacting cultural resources in the manner described in the Impacts Common to All Alternatives. By using the predictive equation, there is the potential that 734 sites could occur within the 43,700 acres of BLM-administered lands of Alternative 5.

Six NRHP-listed properties have been identified inside or within five miles of Alternative 5, consisting primarily of historic buildings and structures. However, most of these NRHP listed properties represent historic buildings and neighborhoods in cities and towns far from the REDAs. As such, it is unlikely that that these properties would be affected by development within the REDAs.

Like Alternative 1, the proposed design features and BMPs in **Appendix B** would help mitigate the impacts from renewable energy development and would reduce or eliminate the severity of impacts by preserving important scientific information.

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

Under Alternative 6, renewable energy development would occur only in a subset of the Alternative 1 maximum REDA, reducing the potential area available for development of renewable energy projects, which in turn reduces the potential for impacting cultural resources in the manner described in Impacts Common to All Alternatives. Using the predictive equation, there is the potential that 3,985 sites could occur within the 237,100 acres of BLM-administered lands of Alternative 6.

A total of 503 NRHP-listed properties have been identified inside or within 5 miles of the Alternative 6 REDA, of which approximately 96 percent are architecturally significant historic buildings, structures, and districts (**Section 3.4**, Cultural Resources). Like Alternative 1, the NRHP-listed properties are dominated by historic buildings and neighborhoods in the middle of cities and towns far from the REDAs. As such, it is unlikely that that these properties would be affected by development within the REDAs.

Like Alternative 1, the proposed design features and BMPs in **Appendix B** would mitigate the impacts from renewable energy development. Like

Alternative 4, this alternative has the additional design features prescribed for the WPZs. Applying these design features would likely reduce erosion in some localities, thereby reducing the possibility for inadvertently exposing cultural resources along stream banks or other zones vulnerable to erosion.

Impacts from Proposed Agua Caliente Solar Energy Zone
Based on known information about historic and prehistoric use in the area of the proposed SEZ (**Section 3.4**, Cultural Resources), renewable energy development could impact cultural resources. The impacts would be similar to those of Alternative 2, as the SEZ would include 6,770 acres. There could be impacts on views from the Juan Bautista de Anza National Historic Trail and the Sears Point ACEC.

Any future renewable energy development activities within these portions of the proposed SEZ under Alternative 6 would have the same types of impacts described in Impacts Common to All Alternatives and Alternative 1. Applying the proposed design features, including the water resource protection design features noted as part of this alternative and BMPs, would mitigate the impacts in the same manner as described in Alternative 4.

4.2.4 Energy and Minerals

Evaluation Methodology, Resource Indicators, and Assumptions
This section discusses impacts on leasable, locatable, and saleable minerals from proposed management actions described in **Chapter 2**, Description of Alternatives and Reasonably Foreseeable Development Scenario. There would be no direct impacts on energy and mineral resources from the identification of a REDA. The potential indirect effects of the alternatives were evaluated by assessing the impacts that anticipated future actions described in Chapter 2 would have on energy and mineral resources. Existing conditions of energy and mineral resources are described in **Chapter 3**, Affected Environment.

Leasable minerals in the planning area include oil and gas, geothermal, and potash. Locatable minerals include such commodities as copper, gold, manganese, tungsten, silver, and uranium. Salable minerals, also referred to as material minerals, include such commodities as sand and gravel, common varieties of building stone, cinders (clinker), common varieties of clay, decorative rock, and petrified wood.

Indicators for impacts on energy and mineral resources include the following:

- The amount of land made unavailable for mineral resource activities; and
- The restrictions that may be placed on mineral claiming, leasing, or development activities.

Potential impacts on energy and mineral resources could occur if reasonably foreseeable future actions were to result in the following:

- A reduction in federal leasing and development of oil and gas or potash;
- A reduction in exploration for or development of locatable or salable minerals; or
- The construction of transmission lines that would affect the feasibility of other energy development along the transmission corridor.

In areas that are open to mineral development, factors that affect mineral extraction and prospecting include, but are not limited to, permitting, regulatory policy, public perception and concerns, travel management, transportation, proximity to sensitive areas, low commodity prices, taxes, and housing and other necessities for workers.

Due to the inability to predict future solar and wind energy development scenarios, including types of development, timing, and location, the following impact analysis provides a general description of impacts on energy and mineral resources from renewable energy development within the REDA and solar development within the proposed SEZ. The analysis includes the following assumptions:

- Existing leases and claims would not be affected by identifying lands as the REDA or the proposed SEZ.
- Arizona's renewable energy goal will increase solar and wind energy development in the state.
- As the demand for energy increases, so will the demand for energy resources.

Impacts from the No Action Alternative

Leasable Minerals

Under the No Action Alternative, solar and wind energy development would continue to be permitted on a case-by-case basis. If solar or wind energy facilities are constructed, future leasable mineral activities would be precluded since most solar and wind facilities are incompatible with mineral leasing development activities. An exception to this could occur if the leasable mineral could be accessed under a solar or wind energy facility utilizing offset drilling technologies. Since there has been no oil and gas or geothermal production in the planning area, the impact on leasable minerals from solar and wind energy development is expected to be negligible.

Locatable Minerals

Mineral exploration and development of locatable minerals is allowed under the General Mining Law of 1872 on all BLM-administered lands unless it is withdrawn from mineral entry. Under the No Action Alternative, areas designated as open to locatable minerals could remain open to the location of mining claims. Existing valid mining claims would preclude solar or wind energy development. However, construction of solar or wind energy facilities and transmission lines would establish a superior right over subsequent mining claim location. As such, impacts on exploration and development could occur in areas of high potential for locatable minerals.

Salable Minerals

Mining mineral material predominately involves surface mining methods. Under this alternative, salable mineral development activities could continue in areas open to salable mineral development where surface-disturbing activities are permitted. In areas with no mining activities, solar and wind energy development would preclude future mining activities in those areas. However, the expected impact on salable minerals from solar and wind energy development is expected to be negligible because salable minerals are abundant and widespread in the planning area.

Impacts Common to All Action Alternatives – REDAs

Leasable Minerals

As noted in **Section 3.5**, Energy and Minerals, there are minimal oil and gas and geothermal resources within the REDA; if oil and gas or geothermal resources are discovered in the REDA, these resources could potentially be accessed using directional drilling methods, whereby the resource is accessed from outside the boundary of the project. Impacts on oil, gas, and geothermal resources from solar and wind energy development are therefore expected to be negligible.

The Holbrook Basin potash potential area has been identified as an "Area with Known Sensitive Resources" (Chapter 2, **Table 2-1**, Areas with Known Sensitive Resources [Eliminated from REDA Consideration]). As such, these lands have been eliminated from consideration as REDAs, and the impact on potash development would be negligible.

Locatable Minerals

As stated above, mineral exploration and development of locatable minerals is allowed under the General Mining Law of 1872 on all BLM-administered lands unless it is withdrawn from mineral entry. Under all action alternatives, metallic mineral districts and areas with high potential of known mineral deposits have been identified as "Areas with Known Sensitive Resources" (Chapter 2, **Table 2-1**, Areas with Known Sensitive Resources [Eliminated from REDA Consideration]) and eliminated from consideration as REDAs. Eliminating metallic mineral districts and areas with high potential of known mineral

deposits from consideration reduces impacts on locatable minerals from solar and wind energy development.

The total acreage of BLM-administered lands with existing mining claims cannot be determined at this time. However, prior to authorizing new solar or wind energy developments, BLM would investigate and identify the location of existing valid mining claims within the proposed project area. Where valid mining claims overlay the REDA, the BLM Authorized Officer would determine if it is possible to locate solar and wind energy facilities in or close to these areas in such a way as to avoid future adverse effects on mineral development activities. If mining claims are not present, solar and wind energy development (including authorized ROWs) could result in constraints on new mineral development activities if newly proposed activities are not compatible with existing uses.

Salable Minerals

Under all action alternatives, solar and wind energy development would preclude future salable mining activities in those areas. This would result in a localized impact on salable mineral development if these resources become sought after in areas where solar or wind facilities have been constructed and sources are limited. However, there are numerous locations of known occurrences and prospects for salable minerals throughout the planning area, so dispersed impacts on salable mineral development would be negligible.

Impacts Common to All Action Alternatives – SEZ

Impacts described under this section are common to all action alternatives, with the exception of Alternative 5, under which no SEZ would be proposed.

Leasable Minerals

The proposed SEZ is in an area identified as having less than moderate potential area for oil and gas and has no existing leases; oil and gas production in this area is not likely. If oil and gas resources are discovered in the proposed SEZ, these resources could potentially be accessed using directional drilling methods, whereby the resource is accessed from outside the boundary of the no surface occupancy requirement.

Although the proposed SEZ is within the geothermal potential area as identified by the BLM Geothermal Leasing PEIS (BLM 2008b), there are no active geothermal leases in the area and no geothermal exploration has occurred. As a result, solar energy development in the proposed SEZ is expected to have a negligible impact on geothermal resources. If geothermal resources are discovered after a solar facility is constructed, geothermal resources could potentially be accessed using directional drilling methods.

Locatable Minerals

Under all action alternatives (except Alternative 5, under which no SEZ would be proposed), BLM-administered lands identified as the proposed SEZ would be

recommended for withdrawal from the location of mining claims. Withdrawal or closure of an area to location of mining development removes the mineral resources in that area from being able to be accessed and extracted. The proposed SEZ does not have a high potential for mineral occurrence, nor are there active mining claims or active mines in the area. As a result, withdrawing the proposed SEZ from mineral entry would result in a direct but negligible impact on locatable minerals.

Salable Minerals

The proposed SEZ has moderate potential for salable minerals, including sand, gravel, aggregate, cinders, decorative rock, and building stones. Utility-scale solar development projects would be incompatible with salable mineral development, so once these facilities were constructed, the extraction of salable resources in the area would not be possible. This would result in a localized impact on salable mineral development if these resources become sought after in this area. However, there are numerous locations of known occurrences and prospects for salable minerals in and surrounding the proposed SEZ and no existing mines, so dispersed impacts on salable mineral development would be negligible.

Impacts from Alternative 1

Impacts from Maximum REDA

The nature and type of impacts on minerals and energy are described under Impacts Common to All Action Alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts on minerals are as described in Impacts Common to All Action Alternatives – SEZ, above. Under Alternative 1, the proposed 20,600 acres SEZ is larger than the 12,000 acres of BLM-administered lands that are estimated to be developed for renewable energy projects across Arizona by 2025. Installation of solar facilities on 80 percent of these lands at a generation rate of 8 acres per MW would result in a generation capacity of 2.1 GW on 16,480 acres.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

The nature and type of impacts on minerals and energy are described under Impacts Common to All Action Alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts on minerals are as described in Impacts Common to All Action Alternatives – SEZ, above. Under Alternative 2, the proposed 6,770-acre SEZ represents more than half than the 12,000 acres of BLM-administered lands that are estimated to be developed for renewable energy projects across Arizona by 2025. Development of the proposed SEZ for solar energy would be a major contribution to the portion of Arizona's renewable energy portfolio that would occur on BLM-administered lands. Installation of solar facilities on 80 percent of

these lands at a generation rate of 8 acres per MW would result in a generation capacity of 680 MW on 5,400 acres.

Impacts from Alternative 3

Impacts from Load Offset REDA

The nature and type of impacts on minerals and energy are described under Impacts Common to All Action Alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts on minerals are as described in Impacts Common to All Action Alternatives – SEZ, above. Under Alternative 3, the proposed 2,760-acre SEZ represents approximately one quarter of the 12,000 acres of BLM-administered lands that are estimated to be developed for renewable energy projects across Arizona by 2025. Development of the proposed SEZ for solar energy would be a substantial contribution to the portion of Arizona's renewable energy portfolio that would occur on BLM-administered lands. Installation of solar facilities on 80 percent of these lands at a generation rate of 8 acres per MW would result in a generation capacity of 275 MW on 2,200 acres.

Impacts from Alternative 4

Impacts from Water Conservation and Protection REDA

The nature and type of impact on minerals and energy is described under Impacts Common to All Action Alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone

Same as described in Impacts Common to All Action Alternatives – SEZ, above.

Impacts from Alternative 5

Impacts from Land Tenure REDA

The nature and type of impact on minerals and energy is described under Impacts Common to All Action Alternatives.

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

The nature and type of impacts on minerals and energy is described under Impacts Common to All Action Alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts on minerals are as described in Impacts Common to All Action Alternatives – SEZ, above. Impacts on renewable energy from the proposed SEZ under Alternative 6 would be the same as described above for Alternative 2.

4.2.5 Environmental Justice

Evaluation Methodology, Resource Indicators, and Assumptions

On February 11, 1994, Executive Order 12898 (Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations) was

published in the Federal Register (59 Federal Register 7629). The order requires each federal agency to recognize and address disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations. The EPA has defined environmental justice as the fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

As described in **Section 4.2.16**, Socioeconomics, counties within the planning area were examined for minority or low-income populations based on CEQ guidelines (20 percentage points higher than the national average or more, or 50 percent of the total population).

All socioeconomic impacts analysis was conducted using the largest proposed SEZ footprint. U.S. census tracts within a 25-mile radius of the proposed Agua Caliente SEZ were examined to identify any minority or low-income populations based on CEQ guidelines.

Potential impacts on environmental justice could occur if anticipated future actions described in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario, were found to:

- Result in actions that could lead to a potential reduced income/employment to these communities;
- Result in actions that could lead to an impediment to economic development in low-income or minority communities; or
- Result in actions that could lead to disproportionate potential for human health and safety impacts on low-income or minority communities.

Assumptions for the impact analysis of environmental justice are the same as those provided for **Section 4.2.16**, Socioeconomics.

Impacts Common to All Alternatives

Arizona, as a whole, is not a minority or low-income population compared with national averages. Four counties within the planning area meet CEQ guidelines as minority populations (Apache, Navajo, Santa Cruz, and Yuma Counties) (**Section 3.16**, Socioeconomics and Environmental Justice). It should be noted that the populations in Apache and Navajo Counties are predominantly American Indian. The planning area excludes tribal lands; therefore, impacts on these populations would likely be minimized. Some tribal lands are located adjacent to REDAs, and impacts on these populations would be analyzed prior to site-specific development, as appropriate. Santa Cruz and Yuma Counties have large Hispanic populations; should project actions result in disproportionate effects on these populations, impacts on environmental justice

populations could occur. No low-income populations were identified in the planning area, according to CEQ guidelines (**Section 3.16**, Socioeconomics and Environmental Justice).

Actions that may affect low-income or minority populations include, but are not limited to, noise and dust during the construction of renewable energy facilities, operations/maintenance-related noise, fugitive dust, traffic, and changes to public land access; visual changes to the environment; and impacts on the local community economic resources and social structure. Additional discussion of these factors is included in **Section 4.2.16**, Socioeconomics.

Impacts resulting from the construction and operation of facilities with the potential to affect low-income and minority populations are likely to be small due to the absence of a significant population near many sites suitable for development and the short-term nature of many of the construction-related impacts. Location-specific analysis would be conducted prior to project-specific permitting and development, and measures to mitigate any impacts would be undertaken.

For the proposed SEZ, U.S. census tracts in a 25-mile radius were examined for low-income and minority populations. Both Yuma County and two census tracts (Census Tracts 121 in Yuma County and 7233.02 in Maricopa County) were found to have a significant (over 50 percent) minority population predominantly comprised of Hispanic or Latino persons. No low-income populations were identified. Construction- and operations-related actions as describe above may result in impacts on this population.

Impacts from the No Action Alternative

Under the No Action Alternative, solar and wind development applications would continue to be processed on a case-by-case basis. Areas excluded from solar and wind development by statute, regulation, or orders would remain excluded, and administratively excluded areas would be assessed based on management in local land use plans. Impacts on environmental justice populations would be assessed on a project-specific level. In the absence of identifying the REDA, solar and wind project development would likely result in patchy, fragmented development. In addition, no standard set of design features or BMPs would be developed.

Impacts from Alternatives 1 through 6

Impacts from Maximum REDA

Impacts would be the same as described under Impacts Common to All Alternatives. Project-related design features and BMPs such as those for public health and safety, visual resources, noise, and air quality would mitigate many of the construction-related impacts (**Appendix B**, Design Features and Best Management Practices). Local community outreach would be undertaken to involve community members near sites of proposed development and gain input on site-specific actions and develop any relevant mitigation measures. Where

such environmental justice impacts were determined to be likely to occur, it is recommended that the developer make a plan to implement a number of mitigation measures to ease the potential environmental, economic, cultural, and health impacts on minority populations (**Appendix B**, Design Features and Best Management Practices).

Impacts from Proposed Agua Caliente Solar Energy Zone
Project actions within the proposed SEZ would be designed with the minority population in mind. Impacts would be similar to those described above. It is recommended that public relations materials be available in Spanish due to the large Hispanic population in the area.

4.2.6 Fish and Wildlife

Evaluation Methodology, Resource Indicators, and Assumptions
This analysis addresses potential impacts on fish and wildlife from implementing the management actions for the alternatives described in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario. Existing conditions concerning fish and wildlife are described in **Section 3.6**, Fish and Wildlife. This analysis focuses on solar and wind energy development that has the potential to physically harm, injure, or disturb wildlife, and alter or eliminate suitable habitat in the planning area.

Potential impacts on fish and wildlife would vary widely depending on a variety of factors, such as the size of animal community, population dynamics in a project area and the adjacent areas; season of construction; extent of the disturbance; type of renewable technology developed; rate of vegetative recovery and composition of this vegetative community; soil type, topography, and microhabitat of the developed sites; and animal species that are present.

Because specific development and site-specific information is not available, species-specific information will be analyzed in detail on a project-level basis.

Potential impacts on fish or wildlife could occur if anticipated future actions were to result in the following:

- Disturb, fragment, or eliminate habitats, food supplies, cover, breeding sites, and other habitat components necessary for population maintenance or used by any species to a degree that would lead to substantial population declines.
- Disturb or eliminate seasonally important habitat (e.g., critical for overwintering or successful breeding) to a degree that would lead to substantial population declines.
- Interfere with a species movement pattern to a degree that would lead to substantial population declines.

- Cause impacts specific to aquatic species and their habitats, including the following:
  - Increased sediment loading in waters containing sediment-intolerant fish species, loss of recruitment, stress, habitat alteration, and habitat loss.
  - Changes to habitat that make it nonfunctional for select species or more conducive to competitive species.
  - Reduce or eliminate streamside cover, leading to increased temperatures, stress, reduced productivity, and impacts on food webs.
  - Actions that alter important water quality parameters, including pH, dissolved oxygen, temperature, hardness, alkalinity/salinity, and turbidity.
  - Deplete water supply leading to loss of physical habitat, changes in water quality, sediment accumulation, habitat alteration, loss of habitat complexity, or food source reduction.

This analysis assumes the following:

- Wildlife habitat needs vary substantially by species. It is generally true, however, that healthy and sustainable wildlife populations can be supported where there is a diverse mix of plant communities with multiple seral stages to supply structure, forage, cover, and other specific habitat requirements. Habitat conditions and quality are directly linked to the health, vigor, and cover of vegetative communities, as well as soil conditions and water quality and quantity.
- Impacts on populations that exceed the current carrying capacity that would not reduce those populations below the carrying capacity would not be considered significant.
- Impacts on terrestrial wildlife from displacement depend on the location, extent, timing, or intensity of the disruptive activity. Furthermore, impacts from displacement would be greater for wildlife species that have limited habitat or a low tolerance for disturbance.
- Big game habitat would be managed in coordination with AZGFD management objectives.
- The BLM is responsible for wildlife habitat. Responsibility for animal population management is delegated to the state, specifically the AZGFD. For federally listed species, population-management responsibility falls to USFWS.

Impacts Common to All Alternatives

Wildlife in the project area is described in relation to available habitat (**Section 3.6**, Fish and Wildlife). Impacts on wildlife include the potential for injury or mortality to wildlife due to project activities (e.g., road collisions, collision with wind turbine blades, nesting disruptions resulting in reduced reproduction for a year, etc.). Surface-disturbing activities that alter vegetation characteristics such as the structure, composition, or production of the vegetative community have the potential to affect habitat suitability for wildlife, particularly where the disturbance removes or reduces cover or food resources. Impacts on vegetation are discussed in **Section 4.2.21**, Vegetation.

The degree of impacts on fish and wildlife would be dependent upon the project location, the project size, and the wildlife present on the site. Habitat disturbance would generally be larger for utility-scale solar or wind operations and less for non-utility scale solar or wind, which have smaller footprints. In general, impacts on rare species or on habitats not well represented in the surrounding area would be greater than impacts on abundant species in common habitat types. It should be noted that impacts described for each phase below represent the potential, non-mitigated impacts from utility-scale renewable energy development; impacts of site-specific development are likely to be reduced due to site-specific measures to avoid important habitat and mitigate impacts. Such measures are discussed in further detail by alternative.

Impacts on wildlife from utility-scale solar are described in the Draft Solar PEIS (Section 5.10, Table 5.10-2) and incorporated here by reference (BLM and DOE 2010). Impacts from non-utility-scale solar would be similar but at a smaller magnitude. Impacts on wildlife from wind operations are summarized in the PEIS on Wind Energy Development (BLM 2005b, Section 5.9.3). Impacts are most likely to occur during construction, operations and maintenance, and reclamation and abandonment. Impacts during siting and development are likely to be limited to temporary disturbance from vehicles and workers and would generally be present at a smaller scale than those during other phases of the project. Potential impacts from solar and wind developments by phase of development are summarized below.

<u>Construction</u>. The greatest potential for impacts on many fish and wildlife species is present during the construction phase of development, as this is the phase with the greatest amount of surface-disturbing activities. During construction, sites would be graded and vegetation cleared. There is the potential for animals to be injured, killed, or disturbed during these activities. The greatest risk would be for animals with limited mobility to avoid construction operations (e.g., reptiles, small mammals) or those that use burrows or are ground nesting (e.g., ground squirrels and other burrowing animals). Larger, more mobile fauna and birds would likely temporarily abandon the site by moving into adjacent habitat. The degree of disturbance would depend upon many factors, including the habitat value, seasonality (e.g., less

disturbance to birds outside of the breeding period), and acreage of disturbance. Additional potential for injury or mortality exists due to vehicle collisions along access roads, especially if these roads occur in wildlife concentration areas or travel corridors. ROW and access road development is also likely to increase the amount of human presence in the area, thus decreasing habitat values and increasing the potential for disturbance or removal of wildlife.

In addition to direct injury or mortality, site construction could result in habitat loss and disturbance. The clearing of vegetation in the construction footprint and increased disturbance in adjacent areas as well as transmission line corridors and access roads could lead to fragmentation of otherwise intact habitat and could have impacts if located in important habitat areas such as breeding sites or migration corridors. Habitat fragmentation could cause loss of genetic interchange among populations and thus reduce reproductive fitness. In addition, habitat fragmentation can increase the amount of edge habitat, making some individuals more vulnerable to predation, disease, and human disturbance.

Additional disturbances in habitat could result from construction noise. Principal sources of noise during construction would include vehicle traffic, operation of machinery, and, if necessary, blasting. Sound levels above 90 decibels are likely to adversely affect wildlife (Manci et al. 1988). Excessive noise levels can alter wildlife habitat use and activity patterns.

Aquatic habitats have additional potential impacts. Draining and filling of aquatic habitats within the construction footprint would result in direct loss of habitat. Vehicles or machinery used in aquatic habitats could kill or injure aquatic organisms. Soil erosion and sedimentation in aquatic habitats could occur as a result of surface disturbance during construction. The potential for erosion is related to the amount of surface disturbance, the proximity to aquatic habitats, the characteristics of site area soils, and degree of vegetative cover. The removal of riparian vegetation could potentially affect the temperature regime in aquatic systems by altering the amount of solar radiation that reaches the water surface, having potential impacts on fish and other biota that have narrow temperature ranges. Additional impacts on aquatic habitat include restrictions on stream movement due to culverts or steam crossings.

Additional potential impacts on wildlife during construction include the following:

- Increased presence of noxious weeds. Disturbed areas within and near a project area, including roadsides and transmission line ROWs, could be colonized by invasive plant species, which could exclude the reestablishment of native species for long periods and may have impacts on wildlife habitat;
- Potential for attraction of predators such as ravens that may harm native wildlife as a result of increased trash and perch sites;

- Disturbance due to fugitive dust from machinery and vehicle traffic;
- Exposure to contaminants in terrestrial or aquatic habitat. Wildlife could be exposed to accidental fuel spills or releases of other hazardous materials. Potential impacts on wildlife would vary according to the material spilled, volume of the spill, location of the spill, length and intensity of exposure (i.e., chronic versus acute exposure), and the exposed species;
- Increased potential for fires due to increased human presence and use of machinery. In general, the effects of fire on wildlife would be related to the impacts on vegetation, which, in turn, would affect habitat quality and quantity, including the availability of forage and shelter;
- Disturbance from site lighting; and
- Changes in hydrological dynamics within wetland and riparian areas due to site grading, affecting species dependent on these habitats.

Operations. Site operations and maintenance would have some of the same impacts as discussed for construction. Although disturbance would generally be reduced compared to construction, human presence, traffic on access roads, fugitive dust, site lighting, operational noise from equipment, and erosion and sedimentation would continue to affect animals on and off the site, resulting in avoidance or reduction in use of an area larger than the project footprint.

Throughout the operational period, the site would have reduced plant cover. The entire site for utility-scale soar facilities would generally be fenced. This would represent a direct loss of habitat and productivity on the site, and would create a barrier to most wildlife movements.

Additional disturbances during site operations include the following:

- Increase in perch locations for raptors and ravens, representing a potentially increased predator presence for native wildlife.
- Minor risk of electrocution or collision of avian species from project associated power lines.
- Reflectivity of solar panels may disturb wildlife and cause site avoidance.

Changes in water quantity and quality represent an additional potential impact. If the renewable energy technology used by a particular project requires water for producing steam for driving turbines or for cooling the produced steam during operation, there is a potential for surface or groundwater depletion and associated impacts on aquatic habitats. Reductions in water quantity could reduce base flow and affect wetlands and riparian habitats dependent on those water levels. Similarly, if the cooling water were discharged into existing surface

water, it could raise the temperature of the receiving water beyond the thermal tolerance of resident species.

Impacts unique to wind development include bird and bat collisions with turbines. Avian mortality estimates based on data collected from the various wind energy projects in the United States indicate an average of 2.19 avian fatalities per turbine per year for all species combined, and an average of 0.033 fatalities for raptors per turbine per year (BLM 2011c).

Decommissioning/Reclamation. In general, the impacts on wildlife associated with decommissioning would be short term and similar to those associated with facility construction, including noise, fugitive dust, increased human presence and traffic, and potential for injury or mortality.

During this phase, the site would be regraded, if needed, and revegetated with a seed mix approved by the BLM in attempts to restore the site to pre-disturbance conditions. Other reclamation activities may include re-establishing natural drainage and hydrological processes and limiting human access to the site. Although reclamation efforts may reintroduce native plants, it may take many years for the project site to be fully restored to pre-disturbance conditions.

In addition to the general impacts described above, impacts for select groups of wildlife are described below.

Migratory Birds. During construction, nests could be destroyed and eggs and nestlings could be harmed. In addition, loss of habitat associated with the proposed action would represent a potential long-term loss of breeding and foraging habitat. The possible violation of the MBTA would be avoided if construction were to occur outside of the breeding season. The migratory bird breeding season would vary dependent on site location, but would generally occur between March and August. Regulations and agreements, such as the MOU between the BLM and USFWS described in **Chapter 3**, Affected Environment, would help to reduce the likelihood for impacts by requiring protective measures for migratory birds.

Big Game. Impacts on big game could occur should project development occur in important habitat areas for these species, including but not limited to migration corridors and critical summer or winter habitat. Big game species would be susceptible to impacts described for general wildlife. In particular, fencing and exclusion of habitat would alter wildlife movement as well as behavior important to breeding.

Impacts from the No Action Alternative

Under the No Action Alternative, solar and wind development applications would continue to be processed on a case-by-case basis; impacts on fish and wildlife would be similar in scope and nature to those described under Impacts

Common to All Alternatives, above. Areas eliminated from solar and wind development by statute, regulation, or orders would remain eliminated, and administratively eliminated areas would be assessed based on local land use plans. Impacts on fish and wildlife would be assessed on a project-specific level, and measures to avoid important habitat and mitigate impacts would be undertaken. In the absence of identifying a REDA, however, solar and wind project development would likely result in patchy, fragmented development with an increased likelihood of habitat disturbance and fragmentation of wildlife habitat. In addition, no standard set of design features or BMPs would be developed for protection of fish and wildlife.

Impacts from Alternative 1

Impacts from Maximum REDA

There would be no direct impacts from the identification of a REDA. Indirect impacts on fish and wildlife would result from implementing the planning decisions and possible future ground-disturbing activities associated with construction of renewable energy facilities.

General Fish and Wildlife. Impacts on fish and wildlife would be similar in scope and nature to those described under impacts common to all alternatives above, but would be reduced in scale due to screening and removal of sensitive wildlife areas from consideration; the REDA has been developed to avoid important habitat areas for wildlife to the extent that these areas have been identified and mapped on a state-wide basis. Areas eliminated from the REDA include wildlife corridors identified by the AZGFD, and conservation potential areas ranked 4, 5, and 6 (the three highest conservation potential rankings). Conservation potential categories 1, 2, and 3 have lower conservation value and cover 121,400 acres, 106,700 acres, and 84,100 acres, respectively, on BLM-administered land within the REDA under Alternative 1.

Development of the REDA would reduce disturbance on lands with high wildlife value and encourage renewable energy development on previously disturbed parcels. For new renewable energy actions, BLM Arizona would require submission of proposals for retaining existing infrastructure and rehabilitating, restoring, reclaiming, and remediating the landscape to meet renewable energy design features. As a result, Alternative 1 would result in reduced impacts from disturbance and habitat fragmentation for fish and wildlife.

In addition, project design features and BMPs would require pre-disturbance surveys, as determined appropriate, to identify wildlife that may be present on a project site. Project siting would avoid biologically sensitive locations, including water and riparian habitat and known wildlife corridors. Construction would be timed to avoid, minimize, or mitigate impacts on wildlife. Design features and BMPs would minimize fragmentation, and would be designed to minimize dangers to wildlife from wind turbines, transmission lines, and other site structures, by requiring pre-project evaluation for structure siting, monitoring of

impacts on wildlife during operation, and incorporating best available science related to structure design to minimize impacts on wildlife. Design features and BMPs would also include restrictions on construction equipment and personnel to reduce project noise, vehicular collisions, and waste. Design features and BMPs also provide measures for a qualified biologist to monitor compliance and mitigation measures as well as create a site reclamation plan. Full details are included in **Appendix B**, Design Features and Best Management Practices. Assuming that all appropriate design features and BMPs are followed, impacts on fish and wildlife would be negligible.

Migratory Birds. Project design features and BMPs would limit impacts on migratory birds (**Appendix B**). If project timing was such that construction needed to occur during the breeding season, a pre-construction survey of occupied nests would be conducted, including burrowing and ground nesting species. Any discovered occupied nests would have no-construction buffers around them until such time that either the young have fledged the nests or the nests have been abandoned. In addition, recommendations contained in the Interim Golden Eagle Technical Guidance: Inventory and Monitoring Protocol; and Other Recommendations in Support of Golden Eagle Management and Permit Issuance (Pagel et al. 2010) shall be considered in project planning, as appropriate. The "Bald and Golden Eagle Protection Act–Golden Eagle National Environmental Policy Act and Avian Protection Plan Guidance for Renewable Energy" (Instruction Memorandum No. 2010-156) will need to be adhered to. Finally, all gen-tie lines would comply with the Avian Power Line Interaction Committee (2006) recommendations. Therefore, impacts on migratory birds would be negligible.

Big Game. AZGFD big game habitat, including known wildlife corridors, was eliminated from consideration as REDA, therefore impacts on big game should be minimal. While the potential for impacts on individual animals may still be present, population levels should not be impacted.

Impacts from Proposed Agua Caliente Solar Energy Zone

This section addresses wildlife (amphibians, reptiles, birds, and mammals) and aquatic biota that could occur within the potentially affected area of the proposed Agua Caliente SEZ. The affected area considered in this assessment included the area that would be physically modified during project development (i.e., where ground-disturbing activities would occur), as well as the area within one mile of the proposed SEZ boundary where ground-disturbing activities would not occur but could be affected by proposed project activities (e.g., surface runoff, dust, noise, lighting, and accidental spills in the proposed SEZ).

The maximum developed area within the proposed Agua Caliente SEZ under Alternative 1 would be 20,600 acres, and the primary land cover habitat type is Sonora-Mojave Creosotebush-White Bursage Desert Scrub (see **Section 4.2.21**, Vegetation). Wildlife associated with this habitat type is described in

Chapter 3, Affected Environment. Acreages of conservation potential categories are presented in **Table 4-1**, Conservation Potential Categories within the Proposed Agua Caliente SEZ by Alternative. Most of the area is considered to have low conservation potential. There are no perennial aquatic habitats in the affected area, although six main ephemeral washes run north-south within the proposed SEZ. Three of these washes support riparian habitat, which may serve as wildlife corridors for species such as mule deer and mountain lion. Areas within one mile of the proposed SEZ have similar habitats to those found within the proposed SEZ.

Table 4-1
Conservation Potential Categories within the Proposed Agua Caliente SEZ by Alternative

Conservation Potential Category	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 6
1	19,690	6,560	2,600	19,690	6,560
2	10	0	0	10	0
3	190	50	50	190	50
4	690	140	110	690	140
5	20	10	0	20	10
6	0	0	0	0	0

Source: AZGFD 2011a; BLM 2011a, 2011b

The types of impacts on wildlife that could occur from construction, operations and maintenance, and reclamation and abandonment of utility-scale solar energy facilities are discussed above under Impacts Common to All Alternatives. The acres of potentially affected habitat are presented in **Section 4.2.21**, Vegetation. Any such impacts would be minimized through the implementation of required design features described in **Appendix B**, Design Features and Best Management Practices, and as discussed under Impacts from Alternative 1.

Development of the proposed SEZ would remove and fragment wildlife habitat in the southern portion of the Palomas Plain WHA. As described in **Section 3.6.2**, Fish and Wildlife, Agua Caliente SEZ Affected Environment, this area is the largest unfragmented habitat remaining in southwest Arizona for bighorn sheep and mule deer. As such, effects from habitat loss and fragmentation could occur, such as those described above for general wildlife. Impacts would be reduced through the implementation of required design features described in **Appendix B**, Design Features and Best Management Practices.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

Impacts for Alternative 2 would be similar to those described for Alternative 1. Conservation potential categories 1, 2, and 3 cover 96,800 acres, 90,400 acres

and 21,100 acres, respectively, of BLM-administered land within the REDA under Alternative 2.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts on fish and wildlife would be similar to those described above for Alternative 1. However, the maximum developed area within the proposed SEZ under Alternative 2 would be 6,770 acres, and one wash would pass through the eastern portion of the proposed SEZ (Township 5 South, Range 11 West, Section 5). Acreages of conservation potential categories are presented in **Table 4-1**, Conservation Potential Categories within the Proposed Agua Caliente SEZ by Alternative. There are no conservation potential category 2 lands within the proposed SEZ this alternative. Potential impacts would be minimized through the implementation of required design features described in **Appendix B**, Design Features and Best Management Practices.

Impacts from Alternative 3
Impacts from Load Offset REDA
Impacts for Alternative 3 would be similar to those described for Alternative 1. Conservation potential categories 1, 2, and 3 cover 79,900 acres, 18,700 acres, and 15,800 acres, respectively, of BLM-administered land within the REDA under Alternative 3.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts on fish and wildlife would be similar to those described above for Alternative 1. However, the maximum developed area within the proposed SEZ under Alternative 3 would be 2,760 acres, and Alternative 3 would avoid all major washes. Acreages of conservation potential categories are presented in **Table 4-1**, Conservation Potential Categories within the Proposed Agua Caliente SEZ by Alternative. There are no conservation potential category 2 lands within the proposed SEZ under Alternative 3. Potential impacts would be minimized through the implementation of required design features described in **Appendix B**, Design Features and Best Management Practices.

Impacts from Alternative 4
Impacts from Water Conservation and Protection REDA
Impacts for Alternative 4 would be similar to those described for Alternative 1.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts on fish and wildlife would be similar to those described above for Alternative 1. The acres of the proposed SEZ for each conservation potential category are the same as those for Alternative 1 (**Table 4-1**, Conservation Potential Categories within the Proposed Agua Caliente SEZ by Alternative). Potential impacts would be minimized through the implementation of required design features described in **Appendix B**, Design Features and Best Management Practices.

Impacts from Alternative 5

Impacts from Land Tenure REDA

Impacts for Alternative 5 would be similar to those described for Alternative 1. Conservation potential categories 1, 2, and 3 cover 16,800 acres, 11,200 acres, and 2,200 acres, respectively, of BLM-administered land within the REDA under Alternative 5.

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

Impacts for Alternative 6 would be similar to those described for Alternative 1. Conservation potential categories 1, 2, and 3 cover 110,300 acres, 90,500 acres, and 27,300 acres, respectively, of BLM-administered land within the REDA under Alternative 6.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts on fish and wildlife would be similar to those described above for Alternative 1. However, the maximum developed area within the proposed SEZ under Alternative 6 would be 6,770 acres, and one wash would pass through the eastern portion of the proposed SEZ (Township 5 South, Range 11 West, Section 5). The acres of the proposed SEZ for each conservation potential category are the same as those for Alternative 2. Potential impacts would be minimized through the implementation of required design features described in **Appendix B**, Design Features and Best Management Practices.

4.2.7 Geology and Seismicity

Evaluation Methodology, Resource Indicators, and Assumptions

The potential effects of renewable energy development were evaluated by assessing the effects that anticipated future actions consistent with the alternatives would have on the geology and unique geologic resources of a project area. Indirect impacts could occur from subsequent development activities, including large-scale surface disturbances such as siting, construction activities, and reclamation/abandonment activities associated with renewable energy development.

Geologic features may contain paleontological or cultural resources or possess scenic or recreational values; impacts on these resources could also result in indirect impacts on the geologic feature. In this section, impacts on geologic features are evaluated only from the perspective of scientific value. Effects are quantified where possible; in the absence of quantitative data, qualitative descriptions and best professional judgment were used.

Seismic risk is more likely to impact renewable energy facilities than operation of the facilities is to increase seismic risk. None of the activities associated with current solar and wind energy technologies are likely to result in increasing seismic activity.

Subsidence can occur where groundwater is pumped from underground aquifers at a rate exceeding the rate that it is replenished. Most of the solar and wind development technologies require the use of water for construction, operations, and reclamation activities but at rates that would be unlikely to result in subsidence. Therefore, it is assumed that the potential for subsidence is low.

Impacts Common to All Alternatives

Large-scale unique geologic features (e.g., the Grand Canyon, the Vermilion Cliffs) are protected through designation as a national park or national monument. Smaller-scale unique geologic features (e.g., natural arches, caves, sources of unique geologic specimens) that are outside a national park, national monument, or designated wilderness, could be impacted by siting renewable energy development activities within their viewsheds or adjacent to their locations.

The potential impacts on geologic resources from renewable energy development mainly concern physical disturbance (e.g., movement, removal, or destruction). These impacts are considered long term, as they cannot be reclaimed. In most BLM RMPs, ROW areas must avoid sensitive geologic resources in order to be approved. Additional indirect impacts could result from greater public access to and atmospheric, visual, and aural intrusions on formerly inaccessible areas. Greater public access can result in increased wear and vandalism of sensitive geologic features. These impacts can be short term if roads are reclaimed.

Due to the inability to predict future development scenarios, including types of development, timing, and location, the following impact analysis provides a general description of common impacts on geologic features using four sequential phases: siting/design, construction, operations/maintenance, and reclamation of facilities (including any transmission lines, access roads, and collector cables) and abandonment. All these phases of renewable energy development could result in indirect impacts.. All components of a renewable energy project development (e.g., facilities, roads, etc.) would be at risk from geologic hazards if projects were in a seismically active area or prone to subsidence and land flows.

Impacts from the No Action Alternative

Under the No Action Alternative, renewable energy projects would be developed on a case-by-case basis through ROW authorizations in accordance with the BLM's existing land use plans and could result in higher or lower levels of consideration of and protections for unique geologic resources. The types of impacts on geologic resources that could occur would be similar to those described above as renewable energy projects are developed on available BLM-administered land. The number of acres likely to be affected under this alternative is unknown. Compliance with NEPA and conformance with

applicable BLM land use plans would still be required; in most BLM RMPs, ROW areas must avoid sensitive geologic resources in order to be approved, thereby reducing the potential for impacts. However, the No Action Alternative does not include additional design features or BMPs as described in **Appendix B**, , Design Features and Best Management Practices, which would give consistent, state-wide guidance for mitigating impacts resulting from renewable energy development. Mitigation would be determined on a project-by-project basis and as needed based on the impact analysis for a specific proposal.

Impacts from Alternative 1

Impacts from Maximum REDA

Under Alternative 1, there would be approximately 321,500 acres of BLM-administered land identified as available for priority renewable energy ROW application. Existing land use plans would be amended to reflect the goals, management actions, design features, and BMPs of this EIS, but individual field offices could modify these standards in keeping with pre-existing agreements on resource protections to create higher levels of protection in areas where development is currently governed through land use plan provisions or agreements.

Under Alternative 1, the potential for impacts on geologic resources would be the same as described under Impacts Common to All Alternatives. Impacts on geologic resources as well as reduced geologic hazards for projects would be reduced or avoided through consistent guidance for future renewable energy development, including building project structures in accordance with the design basis recommendations specified in the project-specific geotechnical investigation report (see **Appendix B**, Design Features and Best Management Practices, for a complete listing of requirements). Compliance with NEPA and conformance to applicable BLM land use plans would be required, further reducing the potential for significant impacts. It is expected that these measures, along with the measures outlined under visual resources, noise reduction, and air quality, would reduce the indirect impacts as a result of renewable energy development.

Impacts from Proposed Agua Caliente Solar Energy Zone

Under this alternative, the proposed Agua Caliente SEZ would be 20,600 acres. There are no known unique or sensitive geologic resources within the boundary of the proposed SEZ or within five miles of its boundary; so, there would be no impacts. Additionally, the area is not known to be seismically active; therefore, risk of damage from seismic activity is considered negligible.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

Under Alternative 2, there would be approximately 218,600 acres of BLM-administered land available for renewable energy ROW application. The anticipated impacts would be similar to those described for Alternative 1 and

Impacts Common to All Alternatives, and the suggested mitigation measures are the same.

Impacts from Proposed Agua Caliente Solar Energy Zone
Under this alternative, the proposed Agua Caliente SEZ would be 6,770 acres. The impacts would be the same as those described for Alternative 1 and Impacts Common to All Alternatives.

Impacts from Alternative 3
Impacts from Load Offset REDA
Under Alternative 3, there would be approximately 129,800 acres of BLM-administered land available for renewable energy ROW application. The anticipated impacts would be similar to those described for Alternative 1 and Impacts Common to All Alternatives, and the suggested mitigation measures are the same.

Impacts from Proposed Agua Caliente Solar Energy Zone
Under this alternative, the proposed Agua Caliente SEZ is 2,760 acres. The impacts would be to the same as those described for Alternative 1 and Impacts Common to All Alternatives.

Impacts from Alternative 4
Impacts from Water Conservation and Protection REDA
Under Alternative 4, there would be approximately 321,500 acres of BLM-administered lands available for renewable energy ROW application. The inclusion of additional water design features could indirectly result in reducing groundwater drawdown, further reducing the potential for subsidence. The anticipated impacts would be similar to those described for Alternative 1 and Impacts Common to All Alternatives, and the suggested mitigation measures are the same.

Impacts from Proposed Agua Caliente Solar Energy Zone
Under this alternative, the proposed Agua Caliente SEZ would be 20,600 acres. The impacts would be similar to those described for Alternative 1 and Impacts Common to All Alternatives.

Impacts from Alternative 5
Impacts from Land Tenure REDA
Under Alternative 5, there would be approximately 43,700 acres of BLM-administered land available for renewable energy ROW application. The anticipated impacts would be similar to those described for Alternative 1 and Impacts Common to All Alternatives, and the suggested mitigation measures are the same.

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

Under Alternative 6, there would be approximately 237,100 acres of BLM-administered land available for renewable energy ROW application. The anticipated impacts would be similar to those described for Alternative 1 and Impacts Common to All Alternatives, and the suggested mitigation measures are the same.

Impacts from Proposed Agua Caliente Solar Energy Zone

Under this alternative, the proposed Agua Caliente SEZ is 6,770 acres. The impacts would be similar to those described for Alternative 2, and Impacts Common to All Alternatives.

4.2.8 Land Use and Realty

Evaluation Methodology, Resource Indicators, and Assumptions

This section discusses impacts on land use and realty from proposed management actions, design features, and BMPs as noted in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario. Existing conditions concerning lands and realty are described in **Section 3.8**, Land Use and Realty. Impacts on land use and realty would result from actions that would alter existing or future land uses and access, increase the demand for or restrict the number or location of ROWs and other land use authorizations, or that would impact land tenure objectives on BLM-administered lands.

Land status baseline information in **Section 3.8**, Land Use and Realty, was reviewed for an understanding of current land use, lands and realty program goals, management practices, and ownership breakdown in the planning area. This known information was overlain with the actions found under each alternative in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario, and conclusions were drawn based on an understanding of how these types of actions may affect BLM-administered lands.

The analysis was based largely on information available from public sources, which were used to identify existing authorizations for use of the BLM lands. Spatial analysis included the use of project-specific GIS. Google Earth was used to provide context to the analysis and to cross-reference information sources. Existing BLM land use plans were also consulted. The proposed Agua Caliente SEZ was visited by assessment team members to provide site familiarity. All analyses were conducted using the largest SEZ footprint. The BLM Arizona State Office staff was consulted on specific issues.

The specific impacts of development of solar and wind energy facilities would depend on project location, technology and scale employed, size of the development, and proximity to existing roads and transmission lines. On the basis of the assumptions given in the RFDS report (**Appendix A**, Reasonably

Foreseeable Development Scenario for Renewable Energy in Arizona), land disturbance for solar facilities would be about 8 acres per MW, and about 10 percent of the acres per MW capacity are assumed to be disturbed for wind facilities. However, due to the uncertainty of specific solar and wind development that would occur as a result of identifying lands within the REDA as available for solar and wind energy, it is not possible to quantify the total acreage affected on BLM lands within the decision area, other than to identify the acreage of land that could be affected by maximum build-out. Implementation-level actions (development of specific solar and wind facilities) would be subject to further environmental review and would include quantifying the total acreage affected by site-specific development.

Potential impacts on land use and realty could occur if reasonably foreseeable future actions were to result in the following:

- Conflict with management goals and objectives set forth by the BLM in order to sustain the health, productivity, and diversity of BLM lands; or
- Result in proposed uses that are incompatible with existing or adjacent land uses and access.

The analysis includes the following assumptions:

- Existing ROWs would be managed per the terms and conditions of the ROW grant.
- The BLM would continue to process land tenure adjustments; and
- The demand for ROWs would increase over the life of the RMPs.

Impacts Common to All Alternatives

BLM lands where solar and wind energy development might occur within the planning area support a wide variety of activities, as described in **Section 3.8**, Land Use and Realty. These uses are allowed by the BLM in accordance with existing land use plans and may be authorized through the issuance of ROWs.

There are several direct impacts related to the actions being considered as part of the RDEP, as described in the **Section 2.3.2**, Elements Common to All Action Alternatives. Development of solar and wind energy facilities would be subject to the terms and conditions of existing ROWs, and the BLM may change these existing ROW authorizations unless the authorization change is tied to federal law requirement (such as the ESA). If a holder of a ROW agreed to modify an existing ROW, the project developer likely would be financially responsible for the cost of any modifications. Once a solar or wind facility is authorized, the area would be excluded from use for other lands and realty purposes that are inconsistent with operation of the facility. Because of the

potentially large size of solar and wind facilities (i.e., utility scale), these exclusions could serve as substantial barriers to other uses and public access.

In addition to direct impacts, there may also be indirect impacts on lands and realty associated with solar and wind energy development. The indirect impacts would be associated with changes to existing uses on BLM lands that may be adjacent to new development. Increased traffic and access to previously remote areas also could change the overall character of the landscape, including the visual quality of large areas. These indirect impacts would vary project by project and would be analyzed at the site-specific level.

Because of the large land area needed for any utility-scale solar or wind facility, this type of development would fragment large blocks of BLM-administered land and may create isolated BLM land parcels that would be hard to manage. Topography, land ownership pattern, existing land use designations (e.g., wilderness), and new access routes or transmission facilities are examples of features that could all combine with a solar or wind energy development to create fragmentation of BLM-administered lands. Although access would be maintained to surrounding BLM-administered lands, there is the potential to sever or alter existing access routes, requiring new access provisions, new road construction, and additional ROW grants. The potential magnitude and nature of these impacts would be considered in project-specific analyses.

In most areas of the decision area, solar and wind energy development would create an industrial landscape in stark contrast to the character of the existing undeveloped landscape. These developments would be visually intrusive and would affect lands that surround them. This would be especially true for lands with special designations based on wilderness and scenic values, including national parks and components of the NLCS (see discussion in the respective sections of this chapter).

Access to electrical transmission facilities is a major factor in siting utility-scale solar and wind facilities; availability of established and adequate transmission corridors is becoming critical, especially as the demand for renewable energy sources increases. Because solar and wind facilities would not be allowed in designated utility corridors, there would not be a reduction of the land available for use for other transmission facilities.

Due to the inability to predict future development scenarios, including types of technology, scale, timing and location, the following impact analysis provides a general description of common impacts on land use from solar and wind development. The actual amount of land required for specific solar or wind energy facilities will vary based on site-specific assessments of areas that need to be avoided and required distance from other pre-existing structures. Identifying land available for solar and wind development in the REDA and in the various proposed Agua Caliente SEZ would not create any direct impacts, including surface disturbances.

Impacts on land uses in the decision area include the possibility for increased traffic as a result of new or enhanced roads developed during the construction phase of solar and wind development. Additional roads could improve motorized and nonmotorized access to previously inaccessible areas, thereby increasing motorized traffic in those areas and possibly affecting activities such as grazing and recreation. The magnitude and extent of the impact would depend on the current land use in the specific area proposed for development, which is unknown at this time. The impact would last for the duration that the roads were in use (short term for construction phase, longer term during operation) but would be expected to be reclaimed in the reclamation and abandonment phase.

Lands converted to solar and wind use (CSP or PV power plants, wind turbines, access routes, and transmission lines) would result in long-term impacts on other uses such as grazing, recreation, hunting, and mining as development would displace these activities and uses. Short-term (lasting only the duration of the actual activity) impacts would include maneuvering construction and maintenance equipment and vehicles associated with the construction and operation activities.

Reclamation and abandonment activities include dismantling solar and wind facilities and reclaiming all disturbed areas. All disturbed lands would be reclaimed in accordance with BLM standards, and land uses and activities could resume according to applicable regulations.

Aviation Considerations

Developers of renewable energy facilities would have to consider the needs of, and likely restrictions posed by, nearby military and civilian aviation facilities, installations, airspace, and activities. The following subsections identify military and civilian aviation and other considerations affecting solar and wind development.

Development of solar facilities has the potential to affect both military and civilian aircraft operations, radar use, and other operations. Numerous civilian airfields, MTRs, SUAs, and Restricted Areas are located within the study area. The military airspace in the study area is intensively used and is important to maintaining overall training and readiness for all branches of the military. Many issues must be considered as part of the decision-making process in siting both utility-scale solar energy production facilities and transmission facilities, especially intrusion of facilities into low-level airspace in military training areas, and near military and civilian airports. If the project site is in the proximity of a military or civilian airport, or a common aircraft flight path, the potential for glint and glare from reflective surfaces to adversely affect pilot control of aircraft would have to be considered as potential aircraft hazards. Consideration of the effect of military overflights, especially supersonic flights, on solar facilities

should be considered (e.g., the potential for solar field equipment damage) as part of project design and location.

In addition, effects on airborne and ground-based radars, including weather radar, must be understood. Potential effects on aircraft performance and on pilots, such as the creation of thermal plumes, glare, and light pollution in both the visible and infrared spectra, are poorly understood and require further study. Finally, many planned solar facilities use wireless-controlled aiming devices to focus reflected sunlight on collecting towers. The effects of airborne electronic jamming in nearby military operating areas are not understood and could conceivably cause the mirrors to point in an unintended direction, thereby creating potential safety-of-flight impacts or other concerns.

The FAA will be involved in reviewing potential air space conflicts, including any solar energy facility construction proposed in proximity to civilian airports. The Obstruction to Navigation Federal Regulation (49 CFR Part 77) requires FAA approval of any project taller than 200 feet. An FAA Finding of No Hazard to Air Navigation does not address all military airspace and other issues; coordination with the military command responsible for management of the training space is still required.

Additional technology-specific impacts and considerations can be reviewed in the Solar PEIS (BLM and DOE 2010; pg. 5-18 through 5-19). Because a solar energy development project would have to meet appropriate military and FAA criteria, no adverse impacts on aviation would be expected.

For wind energy projects, the FAA requires a notice of proposed construction for a project so that it can determine whether it would adversely affect commercial, military, or personal air navigation safety (BLM 2005b). One of the triggering criteria is whether the project would be located within 20,000 feet or less of an existing public or military airport, depending upon the type of airport or heliport. If the potential site for a wind energy development project is known, an Internet database can be searched online to obtain this information (AirNav.com). Inputting the geographic coordinates allows identification of public, private, and military airports; balloon ports; glider ports; heliports; seaplane bases; short takeoff and landing airports (STOLports); and ultralight flight parks within a minimum radius of 6 miles to a maximum of 200 miles. Another FAA criterion triggering the notice of proposed construction is any construction or alteration of more than 200 feet in height above ground level. This criterion applies regardless of the distance from the proposed project to an airport (BLM 2005b). Because a wind energy development project would have to meet appropriate FAA criteria, no adverse impacts on aviation would be expected.

Additionally, wind energy developments could be in conflict with existing or proposed military testing and training operations. Military testing and training exercises involve the use of aircraft (sometimes in restricted air space), ground

troops, and weapons (including guided missiles). Restricted air space allows for real-world maneuvering room for high-speed military aircraft, while providing large buffer zones surrounding the test ground to ensure public safety (BLM 2005b). However, military test ranges are being challenged by encroachments such as population growth, urban expansion, growing airspace congestion, and, even as a result of the unintended consequences of environmental laws that reduce the flexibility of military training (BLM 2005b). The presence of turbines, permanent meteorological towers, and aboveground transmission lines associated with wind energy projects could add additional constraints to military testing and training operations that may occur at low altitudes (e.g., helicopter low-altitude tactical navigation areas, military operations areas, and military training routes). These structures may also be a source of ground-based and, more importantly, aircraft radar interference. The aforementioned constraints to military testing and training operations could be the basis for denial of a ROW authorization should there be no available mitigation alternatives.

Land Tenure

Where appropriate, the BLM would consider disposing of BLM-administered lands within the REDA via exchange and acquire non-federal lands within high-conservation priority areas. Determining when and which available parcels would be candidates for exchange would be consistent with local BLM and county land use plans. Disposing or acquiring lands would be consistent with goals of the BLM lands and realty program to manage public lands to support the goals and objectives of other resource programs, provide for uses of public lands in accordance with regulations and compatibility with other resources, and improve management of public lands through land ownership adjustments.

Renewable Energy

Under all alternatives, solar, wind and biomass project applications would be evaluated by the BLM on a case-by-case basis and would be processed to minimize or avoid impacts on sensitive resources in the natural or human environment. The number of renewable energy projects is expected to increase across the state in response to regulatory mandates and market demand for renewable energy. As detailed in the RFDS report (**Appendix A**, Reasonably Foreseeable Development Scenario for Renewable Energy in Arizona), it is estimated that 1.5 GW of renewable energy capacity would be developed on 12,000 acres of BLM lands by 2025. All REDA alternatives would provide sufficient land for the fulfillment of this estimate, since the acreages of BLM-administered lands range from 48,000 to 334,500.

Impacts from the No Action Alternative

Under this alternative, solar and wind energy projects would be developed on a case-by-case basis in accordance with current BLM land use plan decisions. BLM would identify existing land use conflicts and address the associated environmental impacts during the application process. However, in the absence of identifying the REDA, solar and wind project development would likely result

in fragmented and segregated land uses and access, and thereby not meet BLM's land use goals. Developments may be in areas of high-resource conflict and result in delays in processing ROW applications, or in increases in the cost of developing renewable energy on BLM-administered lands. Developers could respond by focusing their development efforts on state-owned, tribal, and private lands. Additionally, there could be increased unanticipated environmental impacts from the lack of planning for appropriate land uses, such as visual intrusions on sensitive landscapes, and could alter the character of rural areas.

As necessary, individual BLM land use plans may have to be amended for individual projects as a part of the project evaluation and approval, which could further delay decision making.

Impacts from Alternative 1

Impacts from Maximum REDA

Land Use and Access. As discussed throughout this EIS, not all BLM-administered lands are appropriate for solar or wind energy development. Under Alternative 1, certain categories of land that are known or believed to be unsuitable for solar and wind development would be excluded from development to guide solar and wind energy developers to areas where there are fewer resource conflicts and potential controversy. This screening process, described in **Section 2.2**, Alternative Development Process, would allow time and effort to be directed to those projects that have less likelihood of resulting in land use conflicts.

Under Alternative 1, the BLM would identify a renewable energy potential development area of approximately 321,500 acres of BLM-administered land. All of the impacts described in Impacts Common to All Alternatives would apply to Alternative 1. In the REDA, solar and wind energy development would preclude other land uses within any project footprint and could alter the character of rural areas if development occurred in these undeveloped areas. Development of supporting infrastructure (e.g., new transmission lines, roads) would also locally impact land use.

The large boundary for the REDA would provide opportunities to site future solar and wind facilities in areas that may be more appropriate for this type of use, and to minimize conflicts with other land uses and to surrounding public lands.

As discussed in **Section 2.3.3**, Alternative 1: Maximum REDA, legal access would be maintained to surrounding public lands; however, existing access to these areas may be altered. Areas where potential development is physically located would likely be closed to public access (e.g., if development is where a road is, the road might be rerouted around the development or moved to a different location). The large boundary for the REDA would provide opportunities to minimize conflicts to public access, including access to surrounding public lands, due to more land available for siting access routes.

However, the larger REDA would reduce access on public lands around the REDA.

Implementing the management actions, design features, and BMPs noted in **Section 2.3.3**, Alternative 1: Maximum REDA, would provide adequate mitigation for land use, access, and realty activities. In addition to these, the following mitigation measures are proposed to further reduce impacts on access issues (summarized in **Table 4-35**, Additional Mitigation Measures, at the end of this chapter):

- Consolidation of access and other supporting infrastructure should be considered for single projects and for cases in which there is more than one project in close proximity to another to maximize the efficient use of public land.
- Where there are existing BLM ROW authorizations within development areas, pursuant to Title 43, Part 2807.14 of the Code of Federal Regulations (43 CFR 2807.14), the BLM would notify ROW holders that an application that might affect their existing ROW has been filed and would request their comments. Early discussion with existing ROW holders should occur to ensure their interests are protected and any issues are resolved.

It is expected that all of these measures would effectively avoid or reduce impacts over the long term on land uses by identifying conflicts early in the process and requiring specific measures to maintain public use, access, and values.

Renewable Energy. Full development of the REDA under Alternative 1 is assumed to involve solar energy production on 80 percent of the 321,500 identified acres. At a rate of 8 acres per MW, development of the 257,200 acres would result in an estimated electrical capacity of 32.2 GW. About 1,400 acres of the REDAs under Alternative 1 have been identified as having wind potential of Class 3 or greater. Class 2 lands comprise 43,300 acres of the REDA under this alternative. Class 2 wind resources are generally considered less desirable for development; however, the data source used for analysis is the result of a nationwide modeling effort. These wind estimates include a margin of error that could result in some areas identified as Class 2 having actual wind speeds higher than those defined by that class. Additionally, the DOE wind data was based on theoretical modeling and not actual site-specific wind measurements. Wind speeds vary greatly based on localized topography and can only be verified through meteorological monitoring over time. Many applications for wind projects proposed in Arizona have project footprints on lands identified as Class 2. Wind development in these areas would likely involve other non-BLM surface-management agencies and land owners. Combined, the Class 2 and Class 3 lands comprise 44,700 acres. At a rate of 28 acres per megawatt,

development on 10 percent (4,470 acres) of these lands would result in an estimated electrical capacity of 1.6 GW.

Impacts from Proposed Agua Caliente Solar Energy Zone

Construction and Operations. Identifying the proposed Agua Caliente SEZ would reduce the demand for utility-scale solar projects on other BLM lands in Arizona, and focus industrial land use in areas more suitable to this type of development. Development of the proposed Agua Caliente SEZ for utility-scale solar energy production would establish a large industrial area that would exclude existing and potential uses of the land, perhaps in perpetuity. If the proposed Agua Caliente SEZ were developed, there would be conflict with existing land use (primarily recreation) within the proposed Agua Caliente SEZ. Impacts could be dispersed across the 20,600-acre site.

The proposed Agua Caliente SEZ is located adjacent to a 290-MW solar facility currently under construction on private land. Utility-scale solar energy development on the proposed site would be consistent with this type of use; however, since the proposed SEZ is mainly surrounded by rural and undeveloped lands, development of utility-scale solar energy would contribute to the increase of industrial-type land uses in the area. The relatively large boundary for the proposed Agua Caliente SEZ would provide opportunities to site future solar facilities in areas that may be more appropriate for this type of use and to minimize conflicts with other land uses.

As discussed in **Section 2.3.3**, Alternative 1: Maximum REDA, legal access would be maintained to the proposed Agua Caliente SEZ and surrounding BLM and state lands; however, existing access to these areas may be altered. Areas where potential development is physically located would likely be closed to public access (e.g., if development is right where a road is, the road might be rerouted around the development or moved to a different location). The large boundary for the proposed Agua Caliente SEZ would provide opportunities to minimize conflicts to public access, including access to surrounding BLM and state lands, due to more land available for siting access routes. However, the larger SEZ would reduce access on public lands around the SEZ.

Existing ROW authorizations in the proposed Agua Caliente SEZ are prior existing rights, and facilities within the ROWs would not be adversely affected by solar energy development. Should the proposed SEZ be identified in the ROD for this EIS, 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 one ROW present (a pipeline that runs east-west), it is not anticipated that approval of solar energy development would have a significant impact on public land available for future ROWs in the area.

Transmission Facilities and Other Off-Site Infrastructure. Transmission lines and access roads would be constructed within the proposed Agua Caliente SEZ as part of the development of the area. Delivery of energy produced in the proposed Agua Caliente 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 500-kV transmission line that is located approximately 0.5-mile south of the southern boundary. Due to the relatively large area of the proposed Agua Caliente SEZ, future solar facilities may be constructed at distances of up to approximately eight miles from this transmission line. This would require constructing the necessary infrastructure to establish connections to the existing transmission line.

Palomas Road is also located approximately 0.5-mile south of the proposed Agua Caliente SEZ, and it is assumed that access roads would be required to access the site via this road. Similar to transmission connections, future access roads may need to be provided for projects located at distances of approximately eight miles from Palomas Road.

Implementing the programmatic design features (e.g., stakeholder coordination/consultation, consolidation of infrastructure) described in **Appendix B**, Design Features and Best Management Practices, the management actions noted in **Section 2.3.3**, Alternative 1: Maximum REDA, and additional mitigation measures noted for Alternative 1 would effectively avoid or minimize impacts over the long term on land uses, including public access, by identifying conflicts early in the process and requiring specific measures to maintain public uses and values.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

Under Alternative 2, the BLM would identify a renewable energy potential development area of approximately 218,600 acres of public land. All of the impacts described for Impacts Common to All Alternatives would apply to Alternative 2. Solar and wind energy development would preclude other land uses within a project footprint and could alter the character of rural areas if development occurred in these undeveloped areas. Development of supporting infrastructure (e.g., new transmission lines, roads) would also locally impact land use.

Impacts on land use and realty would be similar to Alternative 1. The necessary transmission connections would be less due to the REDA boundaries being closer to existing infrastructure. However, due to the small size of the decision area, there would be less flexibility in siting solar and wind facilities and infrastructure. This would likely result in more land use and access conflicts within the boundaries of the proposed REDA. Similar to Alternative 1, legal access would be maintained to surrounding public lands; however, existing

access to these areas may be altered. The smaller REDA would allow for more access on public lands around the REDA.

Renewable Energy. Full development of the REDA under Alternative 2 is assumed to involve solar energy production on 80 percent of the 218,600 identified acres. At a rate of 8 acres per MW, development of the 174,880 acres would result in an estimated electrical capacity of 21.9 GW. No lands with wind resource Class 3 or higher were identified in the Alternative 2 REDAs. Class 2 lands comprise 28,000 acres of the REDAs under this alternative. At a rate of 28 acres per megawatt, development on 10 percent (2,800 acres) of these lands would result in an estimated electrical capacity of 1 GW.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts on land use and realty would be similar to Alternative 1. Overall, impacts on existing land use (primarily recreation) on BLM lands would be reduced because of the smaller footprint, as it does not include the northern area where most recreational hunting occurs (see **Section 3.15**, Recreation). However, due to the small size of the decision area, there would be less flexibility in siting a solar plant and infrastructure. This would likely result in more land use and access conflicts within the boundaries of the proposed Agua Caliente SEZ. Similar to Alternative 1, legal access would be maintained to surrounding BLM and state lands. The smaller proposed Agua Caliente SEZ would allow for more access on public lands around the proposed SEZ.

The necessary transmission connections and access roads would be less due to the boundaries being closer to existing infrastructure (approximately five miles). Because there are no existing ROWs, this alternative would have no impacts on existing ROWs and would not have a significant impact on public land available for future ROWs in the area.

Impacts from Alternative 3

Impacts from Load Offset REDA

Under Alternative 3, the BLM would identify a renewable energy potential development area of approximately 129,800 acres of public lands. All of the impacts described for Impacts Common to All Alternatives and Alternative 2 would apply to Alternative 3.

Impacts on land use and realty would be similar to Alternative 2. However, because solar and wind development would be concentrated near developed areas (e.g., cities, towns, or industrial areas), this type of development would likely be more consistent with surrounding land uses and would impact fewer rural landscapes. In addition, fewer transmission connections would be necessary due to the REDA boundaries being closer to existing infrastructure and load centers.

Due to the small size of the decision area, there would be less flexibility in siting solar and wind facilities and infrastructure. This would likely result in more land

use and access conflicts within the boundaries of the REDA. The smaller REDA would allow for more access on public lands around the REDA.

Renewable Energy. Full development of the REDA under Alternative 3 is assumed to involve solar energy production on 80 percent of the 129,800 identified acres. At a rate of 8 acres per MW, development of the 103,840 acres would result in an estimated electrical capacity of 13 GW. No lands with wind resource Class 3 or higher were identified in the REDAs under Alternative 3. Class 2 lands comprise 2,300 acres of the REDAs under this alternative. At a rate of 28 acres per megawatt, development on 10 percent (230 acres) of these lands would result in an estimated electrical capacity of 82 MW.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts on land use and realty would be similar to Alternative 2. Impacts could be dispersed across the 2,760-acre proposed Agua Caliente SEZ. However, due to the small size of the decision area, there would be less flexibility in siting a solar plant and infrastructure. This would likely result in more land use and access conflicts within the boundaries of the proposed Agua Caliente SEZ. The smaller proposed Agua Caliente SEZ would allow for more access on public lands around the REDA. The transmission connections and access roads would be less due to the boundaries being closer to existing infrastructure (approximately three miles).

Impacts from Alternative 4

Impacts from Water Conservation and Protection REDA

Under Alternative 4, the BLM would identify a renewable energy potential development area of approximately 321,500 acres of public lands (the same as Alternative 1). All of the impacts described for Impacts Common to All Alternatives and noted for Alternative 1 would apply to Alternative 4. Implementing the water design features, included as part of the water resource protection levels, may limit solar development to dry-cooling technologies only. The actual amount of land required for dry-cooling solar facilities would vary based on site-specific assessments of areas that need to be avoided and required distance from other pre-existing structures.

Renewable Energy. Full development of the REDA under Alternative 4 would result in similar energy production to that described under Alternative 1.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts on land use and realty would be the same as Alternative 1.

Impacts from Alternative 5

Impacts from Land Tenure REDA

Under Alternative 5, the BLM would identify a renewable energy potential development area of approximately 43,700 acres of public lands. All of the impacts described for Impacts Common to All Alternatives would apply to Alternative 5. Solar and wind energy development would preclude other land

uses within a project footprint and could alter the character of rural areas if development occurred in these undeveloped areas. Development of supporting infrastructure (e.g., new transmission lines, roads) would also locally impact land use.

Impacts on land use and realty would be similar to Alternative 1. Disposal of lands identified in this alternative would be consistent with goals of the BLM lands and realty program to manage public lands to support the goals and objectives of other resource programs, provide for uses of public lands in accordance with regulations and compatibility with other resources, and improve management of public lands through land ownership adjustments.

Due to the small size of the decision area, there would be less flexibility in siting solar and wind facilities and infrastructure. This would likely result in more land use and access conflicts within the boundaries of the proposed REDA. The smaller REDA would allow for more access on public lands around the REDA.

Renewable Energy. Full development of the REDA under Alternative 5 is assumed to involve solar energy production on 80 percent of the 43,700 acres identified. At a rate of 8 acres per MW, development of the 34,960 acres would result in an estimated electrical capacity of 4.4 GW. No lands with wind resource Class 3 or higher were identified in the REDAs under Alternative 5. Class 2 lands comprise 4,100 acres of the REDAs under this alternative. At a rate of 28 acres per megawatt, development on 10 percent (410 acres) of these lands would result in an estimated electrical capacity of 146 MW.

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

Under Alternative 6, the BLM would identify a renewable energy potential development area of approximately 237,100 acres of public lands. All of the impacts described for Impacts Common to All Alternatives would apply to Alternative 6. Solar and wind energy development would preclude other land uses within a project footprint and could alter the character of rural areas if development occurred in these undeveloped areas. Development of supporting infrastructure (e.g., new transmission lines, roads) would also locally impact land use.

Impacts on land use and realty would be similar to Alternatives 2, 3, and 4. This alternative would focus development of solar and wind facilities near existing load centers and transmission interconnections. Because solar and wind development would be concentrated near developed areas (e.g., cities, towns, or industrial areas), this type of development would likely be more consistent with surrounding land uses and would impact fewer rural landscapes. In addition, the necessary transmission connections would be less due to the REDA boundaries being closer to existing infrastructure and load centers. Disposal of BLM-administered lands identified in this alternative would be consistent with goals of the BLM lands and realty program to manage public

lands to support the goals and objectives of other resource programs, provide for uses of public lands in accordance with regulations and compatibility with other resources, and improve management of public lands through land ownership adjustments.

Renewable Energy. Full development of the REDA under Alternative 6 is assumed to involve solar energy production on 80 percent of the 237,100 identified acres. At a rate of 8 acres per MW, development of the 189,680 acres would result in an estimated electrical capacity of 23.7 GW. No lands with wind resource Class 3 or higher were identified in the REDAs under Alternative 6. Class 2 lands occur on 28,100 acres of the REDAs under this alternative. At a rate of 28 acres per megawatt, development on 10 percent (2,810 acres) of these lands would result in an estimated electrical capacity of 1 GW.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts on land use and realty would be the same as Alternative 2.

4.2.9 Livestock Grazing

Evaluation Methodology, Resource Indicators, and Assumptions
This analysis addresses potential impacts on livestock grazing from implementing the management actions under the alternatives described in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario. Existing conditions concerning livestock grazing are described in **Section 3.9**, Livestock Grazing. This analysis focuses on solar and wind energy development that has the potential for disturbance of livestock or alterations to authorized grazing allotments whether in availability of use or due to changes in forage availability.

Site-specific impacts would be influenced by location, magnitude, technology, type of development, and soil and vegetation conditions of developed sites.

Impacts would be considered significant if:

- Management action leads directly or indirectly to a decrease in permitted AUMs in areas that are currently available to livestock grazing due to resource conflicts; or
- Management action prohibits the ability to construct range improvements and conduct treatments (infrastructure and vegetation).

This analysis assumes the following:

- Grazing activities would be excluded from areas developed for utility-scale solar energy production but may be compatible with other solar or wind development.

- All existing leases and permits would be subject to terms and conditions by the authorizing officer as established by BLM regulations.
- Vegetation would be reestablished through reclamation practices upon decommissioning of renewable energy projects to the standards required by BLM regulations and project-specific design criteria.
- Livestock grazing on public lands is tied to permittee-owned or controlled base property on private land.

Impacts Common to All Alternatives

Where grazing occurs on public lands, it is authorized either through a grazing permit or lease, as described in **Chapter 3**, Affected Environment. BLM grazing regulations provide that permits or leases can be cancelled with a two-year notification to the grazing permittee (CFR 4110.4-2(b)). The grazing regulations also provide for reimbursement to grazing permittees for their share of the value of range improvements. Depending on site-specific conditions, reductions in authorized grazing use may be necessary for individual leases/permits because of the loss of all or a portion of the forage base and/or range improvements (e.g., fencing, water development, seedlings) supporting the grazing operation.

The portions of grazing permits or leases within areas developed for utility-scale solar energy production that would become unavailable for grazing and leases would be cancelled or modified. On the basis of the amount of land required for comparably rated facilities, power tower, dish engine, and PV technologies require about 80 percent more land area than parabolic trough technologies, resulting in larger areas being excluded from grazing use (BLM and DOE 2010). Non-utility-scale solar would have a smaller footprint and reduced impacts. In addition, wind farms would generally not prevent livestock grazing other than in the areas physically occupied by towers or service roads. The Dry Lake Wind Project, the first commercial wind farm in Arizona, is an example of a large wind operation on which livestock grazing is a compatible use (Arizona Cattlelog 2010).

Impacts could occur from renewable energy siting and exploration, operations and maintenance, and reclamation and abandonment, as well as associated transmission lines. Impacts include but are not limited to:

- Social and economic impacts on individual ranchers and communities where ranching is historically important due to loss of public grazing land;
- Degradation of grazing land due to changes to rangeland from increased human influences, including spread of noxious weeds and increased potential from wildfire; and

- Increased chance of cattle injury or death from vehicular collision due to additional roads and increased traffic associated with development.

Impacts from the No Action Alternative

Under the No Action Alternative, solar and wind development applications would continue to be processed on a case-by-case basis. Areas excluded from solar and wind development by statute, regulation, or orders would remain excluded, and administratively excluded areas would be assessed based on management in local land use plans. Impacts on grazing would be assessed on a project-specific level. In the absence of identifying the REDA, solar and wind project development would likely result in patchy, fragmented development. In addition, no standard set of design features or BMPs would be developed for protection of livestock grazing resources.

Impacts from Alternative 1

Impacts from Maximum REDA

Indirect impacts on rangeland and livestock grazing would result from implementing the planning decisions and possible future ground-disturbing activities associated with construction of renewable energy facilities. A total of 321,500 acres of grazing allotments would occur within the Alternative 1 REDA. Potential impacts include reductions in authorized grazing use (AUMs) and loss of range improvements described under Impacts Common to All Alternatives. The degree of impact would depend upon the location, size, and acres disturbed for development within the REDA.

Design features and BMPs include provisions to prevent livestock disturbance, including appropriate fencing, cattle guards, and signs (**Appendix B**, Design Features and Best Management Practices).

Impacts from Proposed Agua Caliente Solar Energy Zone

The entire proposed SEZ (20,600 acres) is located within the Palomas allotment. This ephemeral allotment has had no grazing in the recent past; therefore, impacts on livestock grazing would be negligible.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

A total of 218,600 acres of grazing allotments would occur within the Alternative 2 REDA. The nature and type of impacts would be similar to those described for Alternative 1; however, the impacts would occur over a smaller area.

Impacts from Proposed Agua Caliente Solar Energy Zone

The nature and type of impacts would be similar to those described for Alternative 1, except that the proposed SEZ in Alternative 2 encompasses a total of 6,730 acres. Therefore, impacts would occur over a smaller area.

Impacts from Alternative 3

Impacts from Load Offset REDA

A total of 129,800 acres of grazing allotments would occur within the Alternative 3 REDA. The nature and type of impacts would be similar to those described for Alternative 1; however, the impacts would occur over a smaller area.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts would be similar to those described under Alternative 1; however, under Alterative 3, the proposed SEZ encompasses 2,760 acres. As such, impacts would occur over a smaller area.

Impacts from Alternative 4

Impacts from Water Conservation and Protection REDA

Impacts would be the same as those described for Alternative 1.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts would be the same as those described for Alternative 1.

Impacts from Alternative 5

Impacts from Land Tenure REDA

A total of 43,700 acres of grazing allotments would occur within the Alternative 5 REDA. The nature and type of impacts would be similar to those described for Alternative 1; however, the impacts would occur over a smaller area.

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

A total of 237,100 acres of grazing allotments would occur within the Alternative 6 REDA. The nature and type of impacts would be similar to those described for Alternative 1; however, the impacts would occur over a larger area.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts would be the same as those described for Alternative 2.

4.2.10 National Trails

Evaluation Methodology, Resource Indicators, and Assumptions

Impacts were evaluated by analyzing the number of acres of the REDA and the proposed Agua Caliente SEZ occurring within a five-mile buffer of the three national trails identified in **Section 3.10**, National Trails. These trails, along with a 0.25-mile buffer on either side, were removed from the REDA under all alternatives. A five-mile buffer from the trail corridors was used as the region of influence for analysis. For the purposes of this analysis, five miles was considered to be a reasonable distance to consider visual impacts for most landscapes under most circumstances. Thus, for each alternative, the analysis identifies the

number of acres of REDA lands that occur within 5 miles of the trail corridors, or within 5.25 miles of the actual trail footprints.

Potential impacts on national trails could occur if future actions were to result in:

- Conflict with management goals and objectives set forth by the agency or agencies responsible for trail-wide management and by the BLM with on-site jurisdiction in order to sustain these resources and their visual or historic qualities;
- Proposed uses that are incompatible with maintaining identified trails and the qualities for which the trails were designated within and adjacent to their boundaries;
- Utilize all or any portion of a trail during any phase of renewable energy project development; or
- Install facilities or transmission lines within a trail's historic or scenic landscape.

BLM would coordinate with the NPS as part of NEPA analysis for site-specific projects regarding impacts on any potentially affected trails, and such impact concerns would be addressed through modifications to project plans or through mitigation.

Impacts Common to All Alternatives

The types of impacts that could occur on national trails from renewable energy development would be similar to those described for cultural resources (see **Section 4.2.3**, Cultural Resources). Specifically, impacts could result in several ways, including the following:

- Degradation and/or destruction could result from the alteration of topography, alteration of hydrologic patterns, removal of soils, erosion of soils, and runoff into and sedimentation of adjacent areas if trails are located near the project area; and
- Visual degradation of settings associated with national trails could result from the presence of an utility-scale solar energy development and associated land disturbances and ancillary facilities. This would affect national historic trails for which visual integrity is a component of the trails' significance, such as its historic landscape, associated historic structures, and possible archaeological sites.

Impacts from the No Action Alternative

Under the No Action Alternative, ROW applications would continue to be processed according to restrictions outlined in the applicable RMP. Impacts on

national trails would be considered during NEPA analysis for new ROWs. The number of acres likely to be affected under this alternative is unknown.

The case-specific studies required prior to issuance of a ROW grant would be expected to prevent many impacts on national scenic and historic trails. Development would require construction of facilities and transmission lines, which could alter the historic or scenic landscape of the affected trails. Under this alternative, no comprehensive list of design features and BMPs would be distributed to serve as consistent guidance for future renewable energy development. This would result in fragmented and segregated planning for preventing impacts on national scenic and historic trails, which often exponentially increases recognized environmental impacts. Due to the uncertainty of total acreage considered for ROWs under this alternative, it is not possible to quantify the total acreage affected on BLM-administered lands.

Impacts from Alternative 1

Impacts from Maximum REDA

Approximately 22,000 acres of BLM-administered lands within the Maximum REDA occur within 5.25 miles of the 3 National Trails in the planning area. Renewable energy development on these lands would require construction of facilities and transmission lines, which could alter the historic or scenic landscape of the affected trails.

Under Alternative 1, the BLM land use plans identified in **Section 1.5.1**, Decisions on the REDA, would be amended to include management actions, design features, and BMPs that would reduce impacts on national scenic and historic trails. Specifically, the cultural resources management action detailed under **Section 2.3.3**, Alternative 1: Maximum REDA, would allow the BLM to restrict surface-disturbing activities within the viewshed of portions of a trail that are potentially eligible for listing on the NRHP and for which eligibility is tied to the visual setting.

Impacts from Proposed Agua Caliente Solar Energy Zone

The Juan Bautista de Anza National Historic Trail corridor is located approximately five miles south of the proposed SEZ, and some developments, such as CSP towers, may be visible from the trail. To the extent that visual resources contribute to the trail's significance, the experience from the trail could be impacted by landscape modifications in the proposed SEZ. See **Section 4.2.22**, Visual Resources, for more information.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

Impacts on national trails under Alternative 2 would be the same as described for Alternative 1, except that the acreage of BLM-administered lands within the REDA that occurs within 5.25 miles of the 3 national trails would be 17,500 acres.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts would be the same as described for Alternative 1.

Impacts from Alternative 3
Impacts from Load Offset REDA
Impacts on national trails under Alternative 4 would be the same as described under Alternative 1, except that the acreage of BLM-administered lands within the REDA that occurs within 5.25 miles of the 3 national trails would be 17,800 acres.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts would be the same as described for Alternative 1.

Impacts from Alternative 4
Impacts from Water Conservation and Protection REDA
Impacts on national trails under Alternative 3 would be the same as described under Alternative 1. The acreage of BLM-administered lands within the REDA that occurs within 5.25 miles of the 3 national trails would be 22,000 acres.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts would be the same as described for Alternative 1.

Impacts from Alternative 5
Impacts from Land Tenure REDA
Impacts on national trails under Alternative 5 would be the same as described under Alternative 1, except that the acreage of BLM-administered lands within the REDA that occurs within 5.25 miles of the 3 national trails would be 4,700 acres.

Impacts from Alternative 6
Impacts from Collaborative-Based REDA
Impacts on national trails under Alternative 6 would be the same as described under Alternative 1, except that the acreage of BLM-administered lands within the REDA that occur within 5.25 miles of the 3 national trails would be 21,800 acres.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts would be the same as described for Alternative 1.

4.2.11 Native American Interests and Heritage Resources

Evaluation Methodology, Resource Indicators, and Assumptions
Tribal coordination and consultations on programmatic actions, including identifying REDAs and the proposed Agua Caliente SEZ were initiated prior to public scoping efforts and have continued through the course of the EIS process. Identifying a REDA or a SEZ is a land use planning decision that does not grant any rights or authorize any specific activities that immediately affect tribal

interests or resources; therefore, the impact analysis focuses on the anticipated future actions consistent with the implementation of the alternatives described in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario.

BLM policy states that BLM shall consult with affected tribes to identify and consider their concerns in land use planning and decision making (Manual 8120, Tribal Consultation under Cultural Resource Authorities). The purpose of consultation is also to coordinate BLM and tribal land use policies and programs, and to seek consistency between land use plans affecting public land and tribal land. The purposes of tribal consultation under NEPA are to identify potential conflicts that would otherwise not be known to the BLM, and to seek alternatives that would avoid, reduce, or resolve the conflicts.

In initiating and continuing government-to-government consultations, the BLM contacted 23 affected federally recognized Indian tribes to identify tribal interests, treaty rights, and heritage resources within the RDEP planning area and the area specifically associated with the proposed Agua Caliente SEZ. A summary of tribal coordination and consultation actions is presented in **Chapter 6**, Consultation and Coordination. Also, all laws, regulations, and policies pertinent to determining effects on tribal interests and resources (such as Executive Order 13007, Native American Sacred Sites) were considered and included in the impacts criteria. This known information was overlain with the actions found under each alternative in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario, and conclusions were drawn based on an understanding of how these types of actions may affect known resources and those yet to be identified by tribes through project-specific consultations or ethnographic studies.

Potential impacts on tribal interests or heritage resources could occur if anticipated future actions consistent with implementing the actions described in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario, were to result in the following:

- Conflict with land uses, management, and the economic wellbeing of adjacent or nearby reservations, trust lands, restricted Indian allotments, and federally tribal-dependent Indian communities;
- Conflict with the exercise of off-reservation treaty and reserved rights, including grazing rights, hunting and fishing rights, gathering rights and interests, and water rights;
- Conflict with federal trust responsibilities to tribes and individual Indians regarding real property, physical assets, or intangible property rights;

- Conflict with existing court decisions, laws, policies, executive orders, and agency agreements with tribes regarding land and resource use;
- Result in activities that are incompatible with the continued existence or use of places of traditional religious and cultural importance;
- Have an adverse effect on historic properties or their settings, including traditional cultural properties eligible for the NRHP under Section 106 of the NHPA (36 CFR 800);
- Impact or restrict access to traditionally used hunting, fishing, and gathering areas and species;
- Have an adverse effect on culturally important plant or animal species;
- Change or reduce access to traditionally used or culturally important water sources, including springs; or
- Impact sacred sites or their settings, access, or use.

This analysis assumes the following:

- Areas proposed for renewable energy development within a REDA or the proposed SEZ could include lands where there are tribal interests and heritage resources that are not currently identified; and
- The BLM would coordinate with Indian tribal governments to identify issues and concerns during all phases of the NEPA and NHPA Section 106 processes and would consult with tribes to accomplish avoidance, mitigation, and resolution of adverse effects.

Impacts Common to All Alternatives

Types of impacts that could occur from the phases of renewable energy development (e.g., siting/design, construction, operations and maintenance, and reclamation/abandonment) include direct disturbance of locations associated with traditional beliefs, resource gathering or hunting areas, water sources, ancestral sites, human remains, and trails. Other impacts could result from alterations of visual, aural, and atmospheric aspects of the setting of a place of traditional religious or cultural importance; increased public access, which could lead to incidents of vandalism or unauthorized collection of ancestral sites; decreased tribal member access or interference with cultural uses and practices such as resource gathering or hunting; and the potential for erosion, pollution, habitat loss, and less tangible changes to natural features and resources that tribal members may consider as traditionally important to their culture or are located on tribal lands near a REDA (for example, lands owned by the Pueblo of

Zuni near the REDA potentially suitable for wind energy development in eastern Arizona).

While it may be possible to restore visual and aural settings and some habitats, it is possible that some cultural uses and religious value may be permanently lost.

The following discussion analyzes the general environmental consequences expected to occur as a result of implementing the alternatives described in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario. Impacts are discussed generically, because the presence, absence, or location of tribal interests and heritage resources and their relation to potential renewable energy development are not fully known and would be identified through project-specific consultations.

Impacts from the No Action Alternative

Under the No Action Alternative, renewable energy projects would be developed on a case-by-case basis through ROW authorizations and land disposal actions in accordance with the BLM's existing land use plans. Projects would not be directed toward REDAs or other areas evaluated as most suitable for energy development. The types of impacts on tribal heritage resources that could occur would be similar to those described above as renewable energy projects are developed on available BLM-administered land. The number of acres likely to be affected under this alternative is unknown. Compliance with NEPA, NHPA, the Native American Graves Protection and Repatriation Act, and Executive Orders 13007 and 13084 would still be required, reducing the potential for impacts through project siting, efforts to identify and avoid impacts on cultural or natural resources of tribal concern, and efforts to resolve and mitigate adverse impacts. However, the No Action Alternative does not include the additional design features or BMPs as described in **Appendix B**, , Design Features and Best Management Practices, which would give consistent, state-wide guidance for mitigating impacts; mitigation would be determined project-by-project and as needed based on the impact analysis for a specific proposal.

Impacts from Alternative 1

Impacts from Maximum REDA

Under Alternative 1, there would be approximately 321,500 acres of BLM-administered land available for renewable energy ROW application. Existing land use plans would be amended to reflect the goals, management actions, design features, and BMPs of this EIS, but individual field offices could modify these standards in keeping with pre-existing agreements on resource protections to create higher levels of protection and consideration of tribal interests and heritage resources in areas where development is currently governed through land use plan provisions or agreements.

Under Alternative 1, the potential for impacts on tribal interests and heritage resources would be the same as described under Impacts Common to All

Alternatives. Areas with sensitive cultural and natural resources, including ACECs, would be eliminated from REDA. Impacts on tribal interests and resources on most BLM-administered lands would be reduced or avoided through consistent guidance for future renewable energy development, and by avoiding important plant and wildlife species and habitats, rock art sites, springs, and Native American archaeological sites whenever possible (see **Appendix B**, Design Features and Best Management Practices, for a complete listing of requirements). For all lands available, compliance with NHPA, and Executive Orders 13007 and 13084 would be required, reducing the potential for impacts. It is expected that these measures, along with the measures outlined under cultural resources, will minimize impacts on tribal interests and heritage resources. However, there may be residual effects that are difficult or impossible to adequately mitigate, such as permanent loss of some cultural uses or valued qualities of places within traditional tribal territories.

Impacts from Proposed Agua Caliente Solar Energy Zone

Under this alternative, the proposed Agua Caliente SEZ would be 20,600 acres. Malcolm Rogers, an archaeologist who explored western Arizona in the mid-1900s, defined three prehistoric trails that appeared to pass through the area and may have served as travel routes between the Colorado and Gila Rivers. However, their existence has not been verified and their exact location is uncertain (Becker and Altschul 2008). It is possible that other prehistoric sites, such as rock features, camps, or additional trails, are present and were associated with these trails. Archaeological inventories or tribal consultations may result in new information at a later date that would need to be considered in future development. The proposed SEZ is within 10 miles of the Sears Point ACEC, a significant Native American heritage site that many tribes noted of specific concern during consultations. It is possible that there would be visual, aural or atmospheric impacts (as noted in Impacts Common to All Alternatives and **Section 4.2.22**, Visual Resources) to the area should additional development within the proposed SEZ boundaries occur. Implementation of the design features and BMPs for cultural resources, Native American concerns, noise reduction, air quality and air quality-related values, and visual resources would all contribute to reducing these impacts. Additionally, continuing consultation with tribes could result in additional mitigation measures that would further reduce the impacts.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

Under Alternative 2, there would be approximately 218,600 acres of BLM-administered land available for renewable energy ROW application. The anticipated impacts would be the same as those described for Alternative 1 and Impacts Common to All Alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone

Under this alternative, the proposed Agua Caliente SEZ would be 6,770 acres. The impacts would be the same as those described for Alternative 1 and Impacts Common to All Alternatives; however, the smaller proposed SEZ would likely eliminate portions of the recorded trails and zones likely to contain archaeological sites such as near the mountains, on desert pavement and along major washes. Implementation of the design features for cultural resources, Native American concerns, noise reduction, air quality and air quality-related values, and visual resources would all contribute to reducing noted impacts. Additionally, continuing consultation with tribes could result in additional mitigation measures that would further reduce the impacts.

Impacts from Alternative 3

Impacts from Load Offset REDA

Under Alternative 3, there would be approximately 129,800 acres of BLM-administered land available for renewable energy ROW application. The anticipated impacts would be the same as those described for Alternative 1 and Impacts Common to All Alternatives. Implementation of the design features for cultural resources, Native American concerns, noise reduction, air quality and air quality-related values, and visual resources would all contribute to reducing noted impacts. Additionally, continuing consultation with tribes could result in additional mitigation measures that would further reduce the impacts.

Impacts from Proposed Agua Caliente Solar Energy Zone

Under this alternative, the proposed Agua Caliente SEZ would be 2,760 acres. The impacts would be the same as those described for Alternative 1 and Impacts Common to All Alternatives. However, with a smaller footprint, there would be less room to microsite a development should Native American heritage sites be found in the area. Implementation of the design features for cultural resources, Native American concerns, noise reduction, air quality and air quality-related values, and visual resources would all contribute to reducing noted impacts. Additionally, continuing consultation with tribes could result in additional mitigation measures that would further reduce the impacts.

Impacts from Alternative 4

Impacts from Water Conservation and Protection REDA

Under Alternative 4, there would be approximately 321,500 acres of BLM-administered land available for renewable energy ROW application. The inclusion of additional water design features in Water Protection Zones 3 and 2 could indirectly result in reducing impacts on water sources Native American tribes consider sacred or culturally important by preventing depletion of spring flows. Implementation of the design features for cultural resources, Native American concerns, noise reduction, air quality and air quality-related values, and visual resources would all contribute to reducing noted impacts. Additionally, continuing consultation with tribes could result in additional mitigation measures that would further reduce the impacts.

Impacts from Proposed Agua Caliente Solar Energy Zone
Under this alternative, the proposed Agua Caliente SEZ would be 20,600 acres. The impacts would be the same as those described for Alternative 1 and Impacts Common to All Alternatives. Implementation of the design features for cultural resources, Native American concerns, noise reduction, air quality and air quality-related values, and visual resources would all contribute to reducing noted impacts. Additionally, continuing consultation with tribes could result in additional mitigation measures that would further reduce the impacts.

Impacts from Alternative 5
Impacts from Land Tenure REDA
Under Alternative 5, there would be approximately 43,700 acres of BLM-administered land available for renewable energy ROW application. The anticipated impacts would be the same as those described for Alternative 1 and Impacts Common to All Alternatives. Implementation of the design features for cultural resources, Native American concerns, noise reduction, air quality and air quality-related values, and visual resources would all contribute to reducing noted impacts. Additionally, continuing consultation with tribes could result in additional mitigation measures that would further reduce the impacts.

Impacts from Alternative 6
Impacts from Collaborative-Based REDA
Under Alternative 6, there would be approximately 237,100 acres of BLM-administered land available for renewable energy ROW application. The anticipated impacts would be the same as those described for Alternative 4 and Impacts Common to All Alternatives. The inclusion of additional water design features could indirectly result in reducing impacts on water sources Native American tribes consider sacred or culturally important by preventing depletion of spring flows.

Impacts from Proposed Agua Caliente Solar Energy Zone
Under this alternative, the proposed Agua Caliente SEZ would be 6,770 acres. The impacts would be the same as those described for Impacts Common to All Alternatives and Alternative 2. Implementation of the water resources design features included as part of this alternative, as well as the design features and BMPs for cultural resources, Native American concerns, noise reduction, air quality and air quality-related values, and visual resources, would all contribute to reducing noted impacts. Additionally, continuing consultation with tribes could result in additional mitigation measures that would further reduce the impacts.

4.2.12 Noise

Evaluation Methodology, Resource Indicators, and Assumptions
The potential effects of renewable energy development on the acoustic environment were evaluated by assessing the effects that anticipated future

actions consistent with the alternatives would have on the areas surrounding such actions. The analysis discusses short-term effects related to construction as well as long-term effects related to operation of wind and solar facilities.

The primary indicator of noise impacts is the introduction of a noise source or sources in an area that is susceptible to changes in the ambient noise environment, such as near residences, schools, hospitals, or recreational areas where quiet is an essential element of the recreational experience.

The following assumptions were used in the impact analysis:

- Design features and BMPs identified in **Appendix B**, Design Features and Best Management Practices, would be implemented for site-specific projects as applicable to the specific project and site location to avoid or minimize construction- and operation-related noise impacts. In particular, the following two measures would be implemented at the planning stage to ensure that solar and wind facilities would not impact sensitive receptors:
  - Project developers shall take measurements to assess the existing background ambient sound levels both within and outside a project site and compare them with the anticipated noise levels associated with a proposed facility. The ambient measurement protocols of all affected land management agencies shall be considered and utilized. Nearby residences and likely sensitive human and wildlife receptor locations shall be identified at this time.
  - Prepare a noise monitoring and mitigation plan. Design a project to minimize noise impacts on sensitive noise receptors, limit increases to less than a 5- to 10-dBA increase above ambient levels, and not exceed local noise standards. Address project-generated noise impacts as much as possible.

Impacts Common to All Alternatives

There would be no direct impacts from the identification of a REDA. Indirect noise impacts associated with renewable energy development include construction-related impacts and operational impacts. Specific impacts associated with constructing and operating solar and wind facilities, including access roads and transmission lines, would depend on the type of technology, the location and scale of a project, and the presence of sensitive noise receptors in a project area. Potential impacts would be assessed on a site-specific basis during the ROW application process. However, a description of the types of noise impacts that would be expected from the construction and operation of renewable energy facilities is provided below.

Solar Energy Development. The Draft Solar PEIS (BLM and DOE 2010) characterizes the types of equipment, associated noise levels, and potential

impacts for each phase of solar facility development, including site characterization, construction, decommissioning/reclamation, and roads and transmission lines (see BLM and DOE 2010, p. 5-204 to 5-214, for a detailed discussion of solar development-related impacts). As described in the Draft Solar PEIS, site characterization generally has negligible emissions except where deep soil coring is required to obtain geotechnical data, well drilling is required for groundwater characterization, or access roads must be developed to reach the site. These activities could generate a substantial, though temporary, amount of noise.

Construction of a solar facility includes a number of operations. As described in the Draft Solar PEIS (see BLM and DOE 2010, p. 5-205), major equipment used during site preparation would include chain saws, chippers, dozers, scrapers, end loaders, trucks, cranes, rock drills, and blasting equipment, if required. Major equipment used in the construction phase would include cranes, end loaders, backhoes, dozers, trucks, and a concrete batch plant if, required. **Table 4-2**, Construction Equipment Noise Levels at 50 Feet, shows the individual noise levels of construction typically used in solar facility construction. Noise levels during construction would depend on the type and level of activity and the number and type of equipment operating at a time.

Construction would generate a measurable, short-term increase in ambient noise levels. The type, location, and level of noise would vary over the course of the construction period. Some phases, such as site preparation, would produce a consistent elevation in ambient noise levels during construction hours, while other operations such as blasting or pile driving would have a more distinct noise profile. The level of impact would depend upon both the noise itself and the distance to sensitive noise receptors in a given project area. In addition to on-site construction noise, commute and truck delivery routes could experience an increase in traffic-related noise. For projects requiring pile driving or rock drilling, ground-borne vibrations could occur.

Noise impacts associated with site-specific actions on BLM-administered lands would be addressed during the ROW application process through the implementation of design features and BMPs such as those contained in **Appendix B**, Design Features and Best Management Practices.

Wind Energy Development. The Wind Energy PEIS characterizes the types of noise impacts that are associated with various phases of wind energy development, including site monitoring and testing; site construction; site access, clearing, and grade alterations; foundation excavations and installations; wind turbine erection; and decommissioning (see BLM 2005b, p. 5-20 to 5-27, for a detailed discussion of wind energy-related impacts).

Table 4-2
Construction Equipment Noise Levels at 50 Feet

Equipment	Noise Level (dBA) 50 feet from Source
Backhoe	78
Blasting	94
Chain Saw	84
Concrete Batch Plant	83
Concrete Mixer Truck	85
Concrete Pump Truck	82
Dozer	82
Crane	85
Drill Rig Truck	79
Dump Truck	76
Excavator	81
Flatbed Truck	74
Front End Loader	79
Generator	82
Grader	83
Pickup Truck	75
Pneumatic Tools	85
Post Driver	72
Rock Drill	81
Roller	85
Scraper	84

Source: U.S. Federal Highway Administration 2006

Similar to solar energy development, wind energy development would produce short-term noise impacts associated with construction equipment usage and with worker commute vehicles and delivery vehicles along transportation routes. The primary noise associated with wind development would be access road construction, blasting for turbine foundations, and wind turbine construction activities requiring the use of heavy equipment. The noise levels would vary between projects and between phases of the same project, depending on such factors as type, model, size, and condition of equipment; operation schedule; and condition of the area being worked. Design features and BMPs identified in **Appendix B**, Design Features and Best Management Practices, could be incorporated into project plans to minimize noise impacts resulting from wind energy development. The specific measures deemed necessary to reduce noise impacts on an acceptable level would be determined during site-specific permitting of individual projects.

Solar Energy Operation. The Draft Solar PEIS describes noise associated with operation of PV and CSP (parabolic trough and power tower) solar facilities

(see BLM and DOE 2010, p. 5-206 to 5-207 for a detailed discussion of operational impacts).

PV solar facilities would have minimal noise associated with operation of the solar field. Noise sources during operation would include inverters, transformers, landscaping equipment, vehicles, and some maintenance activities. Emergency generators and fire water pump engines would also produce noise but would generally only operate during monthly testing.

CSP facilities have similar noise sources as described for PV solar facilities, above. In addition, some CSP technologies (parabolic trough and power tower) would require a power block that would include steam turbine generators, various pumps for circulating water and heat transfer fluids, small-scale boilers to maintain a minimum temperature of fluid during power downtime, and a heat-rejection system such as wet cooling towers or air-cooled condensers. The Draft Solar PEIS (BLM and DOE 2010) identifies cooling towers as the greatest source of noise within a power block.

Design features and BMPs described in **Appendix B**, Design Features and Best Management Practices, include siting noise-generating equipment such that noise levels are attenuated at site boundaries and nearby sensitive receptors. Potential impacts would be assessed on a site-specific basis during the ROW application process, and specific measures would be identified to avoid or minimize noise impacts.

Wind Energy Operation. Operational noise impacts associated with wind energy facilities are described in detail in the Wind Energy PEIS (BLM 2005b, p.5-22 to 5-26). Noise sources identified include mechanical and aerodynamic noise, landscaping equipment, vehicles, and some maintenance activities. Emergency generators and fire water pump engines would also produce noise but would generally only operate during monthly testing.

Wind turbines would produce mechanical noise and aerodynamic noise, with aerodynamic noise being the dominant noise source from newer wind turbines. Mechanical noise would be produced by the gearbox, generators, yaw drives, and cooling fans. The hub, rotor, and turbine could amplify the noise, however, transmitting the sound over a greater distance (BLM 2005b, p. 5-23). Aerodynamic noise would originate from the flow of air over and past the blade of the turbine. This noise, which cannot be avoided, would produce a pulsing (whooshing) sound. The actual noise produced by wind turbine operation would depend on a number of factors, including the type of wind turbine, the configuration of the turbines, the speed at which the turbine was operating, and atmospheric conditions. The Wind Energy PEIS estimated a sound pressure level of 58 to 62 dBA at 164 feet from the turbine, with turbines attenuating to background levels approximately 2,000 feet from the wind turbine. The level of impact of a wind facility would depend upon existing ambient noise levels at a project site as well as the presence of noise-sensitive land uses in the

surrounding area. Please refer to the Wind Energy PEIS for a detailed discussion of wind turbine-related noise.

In addition to the wind turbines, switchgear and transformers would be sources of operational noise. Potential impacts would be assessed on a site-specific basis during the ROW application process, and specific measures would be identified to avoid or minimize noise impacts.

Transmission-Related Noise. Wind and solar facilities would require the ability to deliver generated power to the grid. Noise related to the delivery of power would include potential corona discharge from transmission lines. Corona discharge is the electrical breakdown of air into charged particles and can produce a crackling or hissing noise as well as a humming noise. Corona noise is affected by weather and by altitude and temperature. It occurs when air ionizes near irregularities on the conductor surface of operating transmission lines. During dry conditions, modern transmission lines produce a limited amount of noise. During wet conditions, however, water drops on the lines provide favorable conditions for corona discharge (BLM 2005b, p. 5-26). Given the arid climate of the planning area, corona noise impacts would be limited.

Decommissioning and reclamation would have impacts similar to those described for construction for both solar and wind facilities, and measures to minimize impacts would likely be similar to those described in **Appendix B**, Design Features and Best Management Practices.

Impacts from the No Action Alternative

Under the No Action Alternative, solar and wind development applications would continue to be processed on a case-by-case basis. Solar and wind development would occur at its current pace. Projects would have short-term and localized noise impacts at the project sites, along area roadways, and along new transmission or generation tie-in routes during construction. Operational impacts would depend upon the presence of sensitive receptors near proposed project sites. No standard list of design features and BMPs would be in place to avoid or mitigate noise impacts; however, permitting for individual projects would require analysis and mitigation of short-term and long-term impacts. These impacts are discussed under Impacts Common to All Alternatives.

Impacts from Alternative 1

Impacts from Maximum REDA

The nature and type of noise impacts would be the same as those described for Impacts Common to All Alternatives. Because this alternative provides the most land area, this alternative has the most flexibility for siting renewable energy projects, both in terms of location and technology. Operational impacts would depend upon the presence of sensitive receptors near proposed project sites. Design features and BMPs shown in **Appendix B**, Design Features and Best Management Practices, would require that individual projects avoid or mitigate noise impacts on sensitive land uses in a project area.

Impacts from Proposed Agua Caliente Solar Energy Zone

The nature and type of noise impacts would be the same as those described for PV and CSP solar developments under Impacts Common to All Alternatives. From a review of aerial photography and field visits to the site, no sensitive receptors (e.g., hospitals, schools, or nursing homes) appear to exist within one mile of the proposed Agua Caliente SEZ. The nearest obvious residence to the proposed SEZ boundary is about 1.5 miles to the northeast of the northeastern corner. Given the lack of sensitive receptors in the planning area, short-term and long-term noise impacts would be expected to be minimal. Short-term noise impacts may occur if access roads or transmission line routes occur near residences; given the linear nature of these features, the duration of construction in any one location would be short. Design features and BMPs described in **Appendix B**, Design Features and Best Management Practices, would be required to minimize noise impacts for projects within the proposed SEZ.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

The nature and type of noise impacts would be the same as those described for Impacts Common to All Alternatives. Because the REDA under this alternative only include lands within five miles of existing or certified transmission lines and utility corridors, the distance to connect the proposed developments to transmission would be minimized, reducing construction-related noise impacts associated with transmission line construction as compared with Alternative 1. Measures to minimize noise impacts would be the same as described for Alternative 1.

Impacts from Proposed Agua Caliente Solar Energy Zone

Noise impacts would be the same as described for Alternative 1, though Alternative 2 contains a smaller proposed SEZ footprint and would likely result in a lesser amount of development within the proposed SEZ. Given the lack of sensitive receptors within one mile of the proposed SEZ, impacts would be expected to be minimal.

Impacts from Alternative 3

Impacts from Load Offset REDA

The nature and type of noise impacts would be the same as those described for Impacts Common to All Alternatives. Limiting development to within 10 miles of load centers could encourage development closer to populated areas, resulting in potential short-term noise impacts on sensitive receptors if such receptors were located adjacent to construction activities. However, measures to minimize noise impacts would be implemented to reduce noise and ensure that noise standards at property boundaries were being met. These measures would be similar to those described for Alternative 1. Because this alternative encourages development near load centers, there is the potential that this alternative would favor PV over CSP technologies or smaller wind turbines over

larger turbines. To the extent that this occurred, operational noise impacts may be reduced under this alternative.

Impacts from Proposed Agua Caliente Solar Energy Zone
Noise impacts would be similar to those described for Alternative 1. Alternative 3 contains the smallest proposed SEZ footprint and would likely result in the least amount of development within the proposed SEZ and thus would introduce the least amount of noise-generating activities. Given the lack of sensitive receptors within one mile of the proposed SEZ, impacts would be expected to be minimal.

Impacts from Alternative 4
Impacts from Water Conservation and Protection REDA
The nature and type of noise impacts would be the same as those described for Impacts Common to All Alternatives. Alternative 4 includes the same land area as Alternative 1 but would limit technologies in water resource protection zones to dry-cooling technology. Prohibiting wet cooling may encourage PV solar over other solar technologies, slightly reducing potential operational-related noise emissions associated with power block equipment. Measures to minimize noise impacts would be the same as described for Alternative 1.

Impacts from Proposed Agua Caliente Solar Energy Zone
Noise impacts would be the same as described for Alternative 1.

Impacts from Alternative 5
Impacts from Land Tenure REDA
The nature and type noise impacts would be the same as those described for Impacts Common to All Alternatives. Alternative 5 would emphasize land exchanges for renewable energy development, resulting in less development on BLM-administered land. Measures to minimize noise impacts would be the same as described for Alternative 1.

Impacts from Alternative 6
Impacts from Collaborative-Based REDA
The nature and type of noise impacts would be the same as those described for Impacts Common to All Alternatives. Alternative 6 would place renewable energy development near transmission and load centers while maintaining the water protection zones described for Alternative 4. Impacts would be similar to Alternative 2 in the size of the potential development area, similar to Alternative 3 in the potential effects to sensitive receptors close to load centers, and similar to Alternative 4 in prohibiting wet-cooling technology . Measures to minimize noise impacts would be the same as described for these alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone
Noise impacts would be the same as described for Alternative 2.

4.2.13 Paleontological Resources

Evaluation Methodology, Resource Indicators, and Assumptions

Sensitivity levels were determined based on the PFYC system used by the BLM. Literature research, institutional record searches, and the PFYC provided the information necessary to assign a sensitivity level of high, low, or moderate/undetermined to the planning area. Any future provisions for mitigation of adverse impacts on significant paleontological resources exposed during construction-related activities are based upon these determinations of sensitivity level. The terms "high sensitivity level," "moderate/undetermined sensitivity level," and "low sensitivity level" are defined in **Section 3.13**, Paleontological Resources.

The alternatives give variations in acreages of geological units with PFYC levels 3, 4, and 5 (moderate/undetermined to high sensitivity) that could be impacted by ground-disturbing activities during construction. Geological units within the REDAs have been assigned to one of the five PFYC levels, with PFYC level 3, Moderate/Undetermined potential for containing paleontological resources, being most common.

The RFDS (**Appendix A**, Reasonably Foreseeable Development Scenario for Renewable Energy in Arizona) assumes that in order for Arizona to meet its goal of 15 percent renewable electrical generation by 2025, 12,000 and 3,600 acres of BLM-administered lands would be required for solar and wind energy generation facilities, respectively. Solar energy facilities occupy smaller project areas than wind facilities, but are assumed to disturb 100 percent of a project area, whereas wind energy facilities occupy larger project areas, but are assumed to disturb only 10 percent of a project area. Therefore, 12,000 and 360 acres of BLM-administered lands would be disturbed for solar and wind energy generation facilities, respectively. There are negligible differences in ground-disturbance requirements between the various viable utility-scale solar technologies.

The primary concern regarding impacts on paleontological resources is the loss of scientifically significant fossils and their contextual data. Impacts on paleontological resources would result from implementing the planning decisions.

An impact on paleontological resources is considered potentially significant and, therefore, an indicator if it would result in a loss of or inaccessibility to scientifically significant paleontological resources. The primary concern regarding impacts on paleontological resources is that direct damage to or destruction of fossils would result in the loss of important scientific information. It is possible that ground disturbance, such as grading, could encounter important paleontological resources. In addition, other potential impacts associated with construction activities are a concern. For example, fossils could

be subject to damage or destruction by erosion accelerated by construction disturbance. Improved access and increased visibility as a result of construction could cause fossils to be damaged, destroyed, or collected as a result of unauthorized collection or vandalism. Excavation often reveals significant fossils that would otherwise remain buried and unavailable for scientific study. Such fossils can be collected properly and catalogued into the collection of a museum repository so that they can be available for scientific study.

The following assumptions were made to conduct the impacts analysis:

- Future projects on BLM-administered lands would be required to inventory, assess, and mitigate potential impacts on paleontological resources.
- The creation and implementation of a Paleontological Resource Management Plan that will include mitigation measures such as avoidance, removal of fossils (data recovery), stabilization, monitoring, protective barriers and signs, and other physical or administrative protection measures would properly reduce impacts on paleontological resource to negligible levels. Furthermore, this would properly preserve the scientific information inherent to paleontological resources.

Impacts Common to All Alternatives

The potential for impacts on paleontological resources from renewable energy development, including ancillary facilities such as access roads and transmission lines, is directly related to the location of a project regardless of the technology employed. Other effects, such as impacts resulting from the erosion of disturbed land surfaces and from increased accessibility to possible site locations, are also considered.

Impacts on paleontological resources could result as follows:

- Complete destruction of the resource and loss of valuable scientific information could result from the clearing, grading, and excavation of a project area and from construction of facilities and associated infrastructure if paleontological resources are located within the development area.
- Degradation and/or destruction of near-surface paleontological resources and their stratigraphic context could result from the alteration of topography; alteration of hydrologic patterns; removal of soils; erosion of soils; and runoff into and sedimentation of adjacent areas if near-surface paleontological resources are located on or near a project area. Such degradation could occur both within a project footprint and in areas downslope or downstream. While the erosion of soils could negatively affect near-surface paleontological localities downstream of a project area by

potentially eroding materials and portions of sites, the accumulation of sediment could serve to remove from scientific access, but otherwise protect, some localities by increasing the amount of protective cover. Agents of erosion and sedimentation include wind, water, downslope movements, and both human and wildlife activities.

- Increases in human access and subsequent disturbance (e.g., looting and vandalism) of near-surface paleontological resources could result from the establishment of corridors or facilities in otherwise intact and inaccessible areas. Increased human access (including OHV use) exposes paleontological sites to a greater probability of impact from a variety of stressors.

Paleontological resources are nonrenewable and, once damaged or destroyed, cannot be recovered. Therefore, if a paleontological resource (specimen, assemblage, or site) is damaged or destroyed during renewable energy development, this scientific resource would become irretrievable. Data recovery and resource removal are ways in which at least some information can be salvaged should a paleontological site be affected, but certain contextual data would be invariably lost. The discovery of otherwise unknown fossils would contribute to the scientific record and the public good, but only as long as sufficient data can be recorded.

Impacts from the No Action Alternative

Under the No Action Alternative, renewable energy projects would still be developed through ROW authorizations in accordance with the BLM's existing lands and realty policies. Impacts on paleontological resources would be of the types described above, with mitigation measures being included on a case-by-case basis. Any additional design features or required BMPs would be determined from the existing land use plan where a future project is proposed. Paleontological resources would not be impacted in areas excluded from development such as national monuments, national conservation areas, and wilderness areas.

Impacts from Alternative 1

Impacts from Maximum REDA

The types of impacts resulting from implementation of the planning decisions under Alternative 1 are described under Impacts Common to All Alternatives. Under Alternative 1, there are 137,900 acres of BLM-administered land with geological units assigned to PFYC levels 3, 4, or 5 (Moderate/Undetermined to High Sensitivity). The alternative contains management actions (described in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario), and design features and BMPs (described in **Appendix B**) that would reduce the likelihood and severity of the noted types of impacts. The application of these measures would reduce or eliminate the potential for adverse impacts on significant paleontological resources. If avoidance is chosen

as the preferred mitigation measure, projects could be located, designed, or modified to avoid impacts on significant resources. An additional mitigation measure that would reduce impacts related to vandalism or increased human presence in an area would include the use of training/education programs to reduce the amount of inadvertent destruction to paleontological sites; this could reduce the occurrences of human-related disturbances to nearby sites (summarized in **Table 4-35**, Additional Mitigation Measures, at the end of this chapter). The specifics of these management practices would be established in project-specific coordination between the project developer and the BLM.

Impacts from Proposed Agua Caliente Solar Energy Zone

Under Alternative 1, the proposed Agua Caliente SEZ contains 4,070 acres with geological units assigned to PFYC level 3; there are no PFYC level 4 or 5 units within the proposed SEZ. A more detailed investigation of the alluvial deposits as well as the residual materials, especially where Tertiary units are shallow or exposed, is recommended prior to a project being approved. A paleontological survey may be needed following consultation with the BLM, following the guidance in BLM IM2008-009 and IM2009-011. The types of impacts that could occur on any significant paleontological resources found within the proposed SEZ are the same as those described above. Impacts would be reduced through the implementation of required programmatic design features described in **Appendix B**, Design Features and Best Management Practices.

Indirect impacts on paleontological resources outside of the proposed SEZ, such as through looting or vandalism, are unknown but possible if any such resources are at or near the surface. Programmatic design features for controlling water runoff and sedimentation would prevent erosion-related impacts on buried deposits outside of the proposed SEZ. Applying the same training/education programs as described above would reduce the amount of inadvertent destruction to paleontological sites and could reduce the occurrences of human-related disturbances to nearby sites.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

Under Alternative 2, the impacts would be the same as those described for Alternative 1 and Impacts Common to All Alternatives, except that it includes 58,400 acres with geological units assigned to PFYC levels 3, 4, or 5 (Moderate/Undetermined to High Sensitivity). Applying the management actions, design features, BMPs, and additional suggested mitigation for training/education programs would reduce impacts as described for Alternative 1.

Impacts from Proposed Agua Caliente Solar Energy Zone

Under Alternative 2, the proposed Agua Caliente SEZ impacts would be the same as those described for Alternative 1 and Impacts Common to All Alternatives, except that it includes 490 acres with geological units assigned to PFYC level 3. No formations have been assigned to PFYC level 4 or 5. The

results of applying the management actions, design features, and BMPs would be the same as those described for Alternative 1. Including the mitigation measures for training/ education programs as noted in Alternative 1 would further reduce impacts on any nearby paleontological sites from human-related disturbance.

Impacts from Alternative 3

Impacts from Load Offset REDA

Under Alternative 3, the impacts would be the same as those described for Alternative 1 and Impacts Common to All Alternatives, except that it includes 41,300 acres with geological units assigned to PFYC levels 3, 4, or 5. Applying the management actions, design features, BMPs, and additional suggested mitigation for training/education programs would reduce impacts as described for Alternative 1.

Impacts from Proposed Agua Caliente Solar Energy Zone

Under Alternative 3, the proposed Agua Caliente SEZ contains 10 acres with geological units assigned to PFYC level 3; there are no PFYC level 4 or 5 units within the proposed SEZ. The results of applying the management actions, design features, and BMPs would be the same as those described under Alternative 1. Including the mitigation measures for training/education programs as noted in Alternative 1 would further reduce impacts on any nearby paleontological sites from human-related disturbance.

Impacts from Alternative 4

Impacts from Water Conservation and Protection REDA

Under Alternative 4, the impacts would be similar to those described for Alternative 1 and Impacts Common to All Alternatives, except that it would affect 63,000, 54,600, and 10,500 acres of BLM-administered lands with geological units assigned to PFYC levels 3, 4, or 5 for Water Protection Zones 1, 2, and 3, respectively (Moderate/Undetermined to High Sensitivity). Applying the management actions, design features, BMPs, and additional suggested mitigation for training/education programs would reduce impacts as described for Alternative 1.

Impacts from Proposed Agua Caliente Solar Energy Zone

Under Alternative 4, the size of the proposed Agua Caliente SEZ and associated impacts would be the same as those that would occur under Alternative 1, as described above. The results of applying the management actions, design features, and BMPs as described in Alternative 3 would be the same as those described under Alternative 1. Including the mitigation measures for training/education programs (as noted in Alternative 1) would further reduce impacts on any nearby paleontological sites from human-related disturbance.

Impacts from Alternative 5

Impacts from Land Tenure REDA

Under Alternative 5, the impacts would be the same as those described for Alternative 1 and Impacts Common to All Alternatives, except that it includes

7,900 acres with geological units assigned to PFYC levels 3, 4, or 5. Applying the management actions, design features, BMPs, and additional suggested mitigation for training/education programs would reduce impacts as described for Alternative 1.

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

Under Alternative 6, the impacts would be the same as those described for Alternative 1 and Impacts Common to All Alternatives, except that it includes 18,800, 32,200, and 10,500 acres of BLM-administered lands with geological units assigned to PFYC levels 3, 4, or 5 for Water Protection Zones 1, 2, and 3, respectively (Moderate/Undetermined to High Sensitivity). Applying the management actions, design features, BMPs, and additional suggested mitigation for training/education programs would reduce impacts as described for Alternative 1.

Impacts from Proposed Agua Caliente Solar Energy Zone

Under Alternative 6, the size of the proposed Agua Caliente SEZ and associated impacts would be the same as those that would occur under Alternative 2, as described above. The results of applying the management actions, design features, and BMPs would be the same as those described under Alternative 2. Including the mitigation measures for training/education programs as noted in Alternative 2 would further reduce impacts on any nearby paleontological sites from human-related disturbance.

Additional Mitigation Measures

The use of training/education programs to reduce the amount of inadvertent destruction on paleontological sites could reduce the occurrences of human-related disturbances to nearby sites. The specifics of these management practices would be established in project-specific coordination between the project developer and the BLM.

4.2.14 Public Health and Safety

Evaluation Methodology, Resource Indicators, and Assumptions

Potential effects of solar and wind development on public health and safety were evaluated by examining the typical hazards associated with all phases of such development, as described in **Section 3.14**, Public Health and Safety, and discussing the likelihood of those effects occurring within the REDA and the various proposed Agua Caliente SEZs.

Potential impacts on health and safety could occur if reasonably foreseeable future actions were to result in the following:

- Create a hazard to workers or the public through the routine transport, use, or disposal of hazardous materials;

- Create a hazard to workers or the public through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment;
- Emit hazardous emissions or result in handling of hazardous or acutely hazardous materials, substances, or waste within 0.25-mile of an existing or proposed school; or
- Be located on a site that is included on a list of hazardous materials sites compiled by the federal or state government and, as a result, would create a hazard to workers or the public.

The following assumptions were used in the impact analysis:

- Occupational Safety and Health Administration health and safety guidelines would be followed by all workers during all construction, operation, and decommissioning phases of all projects.
- Construction areas would be fenced to exclude public entry.
- Design features and BMPs identified in **Appendix B** would be implemented for all renewable energy projects.

Impacts Common to All Alternatives

There would be no direct impacts from the identification of a REDA. Indirect impacts on public health and safety would result from implementing the planning decisions and possible future ground-disturbing activities associated with construction of renewable energy facilities.

Solar Energy Developments

Health and safety risks to the general public can include physical hazards from unauthorized access to construction or operational areas of solar facilities; increased risk of traffic accidents in the vicinity of solar facilities; risk of eye damage from glare from mirrors, heliostats, and power tower receivers; and aviation safety interference. Because of the remote nature of most solar facilities, the health and safety risks are generally low but would be addressed in facility health and safety plans.

Risks from public exposure to hazardous substances through air emissions from solar facilities are low, because the few substances that are stored and used at the facilities in large quantities have low volatility and inhalation toxicity. Small quantities of combustion-related hazardous substances may be emitted from diesel-burning construction equipment. In addition, during operations there may be emissions of similar contaminants from steam boilers using natural gas or coal as an energy source at certain times. Because these would be supplemental boilers using small amounts of fuel, however, emissions and corresponding health risks are likely to be small. Nevertheless, the health risks of such emissions should be evaluated at the project-specific level.

Electrically energized equipment and conductors associated with solar facilities and the transmission lines that serve them represent electrical hazards. Proper signage or engineered barriers (e.g., fencing) would be necessary to prevent access to these electrical hazards by unauthorized individuals.

Public exposures to magnetic fields associated with solar facilities would be expected to be negligible because setback zones would require homes and occupied buildings to be located well away from solar facilities and transmission lines.

Wind Energy Developments
Potential public safety hazards during the site monitoring and testing phases are minimal. During construction, operation, and decommissioning of a wind energy development project, the hazards are greater but they can be effectively mitigated. These hazards include risks associated with major construction sites, rare tower failures, human-caused fire, EMF exposure, aviation safety interference, EMI, low-frequency sound, and shadow flicker.

Impacts from the No Action Alternative
All of the risks identified in **Section 3.14**, Public Health and Safety, would apply under the No Action Alternative. Solar and wind energy project applications would be submitted to the BLM from energy developers based on resource availability, economics, and site suitability. Given the impact analysis assumptions, these impacts would be similar to the risks associated with any other kind of construction projects. Impacts under the No Action Alternative are expected to be negligible.

Impacts from Alternative 1
Impacts from Maximum REDA
Under this alternative, the types of impact would be the same as described under Impacts Common to All Alternatives.

The development of low sensitivity lands, including some lands that have been previously disturbed and contain varying levels of contamination, may result in the cleanup and securing of contaminated lands that would otherwise be open to the public and could be sources of possible exposure to hazardous substances.

Implementation of this alternative would amend the BLM land use plans identified in **Section 1.5.1**, Decisions on the REDA, to require, as deemed appropriate by the BLM authorized officer for individual renewable project applications, the following plans:

- Dust Abatement Plan;
- Facility Vector Control Plan;
- Fire Management and Protection Plan;

- Hazardous Materials and Waste Management Plan;
- Health and Safety Program;
- Integrated Pest Management Plan;
- Noise Monitoring and Mitigation Plan; and
- Spill Prevention and Emergency Response Plan.

Implementation of these plans would address precautions and response actions related to various health and safety concerns for both workers and the public, such as the release of hazardous materials into the environment. Based on implementation of these management actions, design features, and BMPs, impacts are expected to be negligible.

Impacts from Proposed Agua Caliente Solar Energy Zone
Under this alternative, the types of impacts would be as described under Impacts Common to All Alternatives. Unexploded ordnance could pose a risk of explosion during ground-disturbing operations, which could result in injury or death of construction workers. Strategies to address the possible presence of unexploded ordnance would be developed as part of a Hazardous Materials Management Plan that would be prepared by the project proponent of any project proposed in the SEZ.

Based on implementation of the management actions, design features, and BMPs described as part of this alternative, impacts are expected to be negligible.

Impacts from Alternative 2
Impacts from Transmission Line and Utility Corridor REDA
Under this alternative, the types of impact would be the same as described for Alternative 1 and Impacts Common to All Alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts would be the same as described for Alternative 1.

Impacts from Alternative 3
Impacts from Load Offset REDA
Under this alternative, the types of impact would be the same as described for Alternative 1 and Impacts Common to All Alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts would be the same as described for Alternative 1.

Impacts from Alternative 4
Impacts from Water Conservation and Protection REDA
Under this alternative, the types of impact would be the same as described for Alternative 1 and Impacts Common to All Alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts would be the same as described for Alternative 1.

Impacts from Alternative 5
Impacts from Land Tenure REDA
Under this alternative, the types of impact would be the same as described for Alternative 1 and Impacts Common to All Alternatives.

Impacts from Alternative 6
Impacts from Collaborative-Based REDA
Under this alternative, the types of impact would be the same as described for Alternative 1 and Impacts Common to All Alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts would be the same as described for Alternative 1.

4.2.15 Recreation

Evaluation Methodology, Resource Indicators, and Assumptions
Special Recreation Management Areas have been identified as "Areas with Known Sensitive Resources" (Chapter 2, **Table 2-1**, Areas with Known Sensitive Resources [Eliminated from REDA Consideration]). As such, these lands have been eliminated from consideration as a REDA. In addition, some non-BLM-administered lands that provide valuable recreational opportunities and experiences, including wilderness and national monuments managed by other agencies, national parks, and others, are also eliminated from the REDA.

Potential impacts on recreation could occur if reasonably foreseeable future actions were to result in the following:

- Result in long-term elimination or reduction of recreation opportunities, activities, or experiences;
- Conflict with recreation management objectives for the area; or
- Result in proposed land uses that are incompatible with existing or adjacent recreational opportunities or experiences.

Impacts Common to All Alternatives
Because utility- and community-scale solar energy development sites are usually fenced and off-limits to the public, they directly impact recreation through loss of land available for recreational activities. Indirect impacts include degradation of the recreational setting characteristics and increased access through the construction of new or improved roads that may be integrated with local trail and road systems used for hiking, OHV riding, and other recreational activities. However, visitors looking for a remote and undisturbed recreational experience may decide to go elsewhere.

Wind energy development can result in similar direct impacts, although limited on-site recreational access may be allowed because many sites are not fenced. Indirect impacts also include site characteristics degradation and improved access and connectivity.

Excluding SRMAs and other areas important for recreation would limit impacts under all alternatives.

Impacts from the No Action Alternative

Under the No Action Alternative, solar and wind energy development applications would continue to be processed on a case-by-case basis. Without a coordinated, programmatic approach, SRMAs and the user benefits they provide would be vulnerable to impacts such as degradation of the physical setting characteristics and loss of land to development. Where development occurs, access would also improve, making less-visited recreation areas and destinations more accessible.

Impacts from Alternative 1

Impacts from Maximum REDA

Recreation would experience the most widespread impacts under Alternative 1. With 321,500 acres available for renewable energy development, there would be greater potential for conflict with recreational opportunities and experiences. Impacts would be mitigated through avoidance of areas with unique or important recreation resources and by the potential replacement of lost OHV access. As a result, popular recreation areas would most likely remain free of renewable energy development, and OHV enthusiasts could potentially retain access to the same number of miles of trails and roads. There would still be potential for impacts if replacement access were not of similar quality or if nonmotorized trails were located in an area slated for development (the BMP regarding replacement of lost access pertains to OHV use only).

Impacts from Proposed Agua Caliente Solar Energy Zone

Locating renewable energy development in 20,600 acres currently managed as an SRMA would result in the direct, long-term loss of recreational opportunities and experiences. Activities that would be impacted include those dispersed activities for which the SRMA is managed, including hunting and OHV riding. Hunting especially is popular on BLM-administered portions of the proposed SEZ; if development were to occur in or near that portion, opportunities would be lost. As a result of any development in the proposed SEZ, recreationists would have to go elsewhere in the SRMA or decision area to attain benefits similar to those offered by the developed area.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

Because the 218,600-acre REDA would be located exclusively in close proximity to transmission lines and utility corridors, development would be concentrated in a smaller area. As a result, fewer acres would likely be developed and the

potential for conflict with recreation sites and areas would be decreased. However, the smaller REDA could force development to become more concentrated, meaning its impacts on nearby recreation resources could be amplified.

Impacts from Proposed Agua Caliente Solar Energy Zone
Under this alternative, the proposed SEZ would cover 6,770 acres and would not include the northern portion of the proposed SEZ under Alternative 1. As a result, fewer acres of hunting opportunities would be impacted, although noise, vehicles, and other disturbances during construction and, to a lesser extent, operation could drive animals away, degrading the hunting experience.

Impacts from Alternative 3
Impacts from Load Offset REDA
The types of impacts would be similar to those described under Impacts Common to All Alternative, but by concentrating the 129,800-acre REDA in areas close to towns, cities, and other load centers, impacts on developed recreation would be more likely than those to dispersed recreation, which typically occurs in middle- or backcountry settings.

Impacts from Proposed Agua Caliente Solar Energy Zone
The proposed SEZ would cover only 2,760 acres, the smallest area of any alternatives, thereby reducing impacts on recreation. In addition, popular hunting access provided in the area north of the proposed SEZ would be preserved, limiting impacts on hunting in a manner similar to that described under Alternative 1.

Impacts from Alternative 4
Impacts from Water Conservation and Protection REDA
The types of impacts under Alternative 4 would be similar to those described under Alternative 1, occurring over 321,500 acres. Designing the REDA around water conservation features would have a negligible impact on recreation.

Impacts from Proposed Agua Caliente Solar Energy Zone
The types of impacts on recreation from the proposed SEZ under Alternative 4 would be similar to those described under Alternative 1.

Impacts from Alternative 5
Impacts from Land Tenure REDA
Under Alternative 5, the REDA would be composed of 43,700 acres identified for disposal in existing RMPs, which does not include areas highly valued for their recreational resources. As a result, impacts on recreation would be negligible.

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

Locating the 237,100-acre REDA near load centers would likely reduce impacts on primitive or backcountry recreation at the expense of day-use recreation areas, which are more typically located front country near the urban interface. This, along with limiting development to utility corridors and in close proximity to transmission lines, would likely concentrate development in a smaller area, meaning impacts on adjacent recreation areas would be magnified. However, avoiding areas with unique or valuable recreation resources would minimize impacts. Incorporating water conservation features similar to those under Alternative 3 would have no impact on recreation.

Impacts from Proposed Agua Caliente Solar Energy Zone

The proposed SEZ under Alternative 6 would be the same size and location as under Alternative 2. Therefore, impacts would be similar.

4.2.16 Socioeconomics

Evaluation Methodology, Resource Indicators, and Assumptions

The specific impacts of development of solar and wind energy facilities on social and economic conditions would depend on project location, technology and scale employed, size of the development, and proximity to existing communities. Analysis for jobs is provided on the basis of the assumptions given in the project RFDS (**Appendix A**, Reasonably Foreseeable Development Scenario for Renewable Energy in Arizona). However, due to the uncertainty of specific solar and wind development that would occur as a result of identifying lands within the REDA as available for solar and wind energy development, quantitative community-level impacts cannot be conducted. Qualitative analysis is provided for tax revenue, property value change, socioeconomic impacts due to changes in other land uses, non-market value, and social indicators. Implementation-level actions (development of specific solar and wind facilities) would be subject to further environmental review and would include quantifying impacts affected by site-specific development.

Potential impacts on social and economic conditions could occur if anticipated future actions described in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario, were to alter the following:

- Employment and income at the personal, household, business, or community level;
- Tax revenues (sales and state income);
- Property values; or
- Other land uses which provide social or economic benefits to the local community or region.

Social indicators are those related to the value of sense of place and sense of well-being, including factors such as people's interaction with the landscape; community perceptions of quality of life; attitudes and beliefs regarding the local environment, its uses, and sense of place; and limiting or expanding community growth.

This analysis assumes the following:

- Visitor use and demand for use of public land for recreation purposes is expected to increase as population increases. Increased visitation would have economic impacts on communities that serve as stopping points for services near public lands.
- Management actions that influence employment, demand for goods and services, business growth, and visitation will affect socioeconomics. Impacts will most greatly be felt in small rural communities that economically and socially rely, at least partially, on resource uses on public lands, including vegetation products, lands and realty, livestock grazing, minerals, recreation, and travel.
- Landowners may be willing to sell or lease land for renewable energy.
- Actions that increase renewable energy production will tend to stimulate the local and regional economies, both through increased employment and demand for goods and services for the operation itself. The duration of this effect will depend upon the magnitude of energy production and market demand for the products.

Impacts Common to All Alternatives

Due to the inability to predict future development scenarios, including types of technology, scale, timing, and location, the following impact analysis provides a general description of common impacts on socioeconomics from solar and wind development. The specific location of development and community-specific impacts would be determined in subsequent NEPA analysis prior to development. Impacts common to energy development include, but are not limited to, effects on jobs, population growth, property taxes, changes to tourism and recreation, and changes to the social community and quality of life. A comparison of the impacts of renewable energy development with oil and gas development impacts is **Table 4-3**, Comparison of Socioeconomic Effects in the Oil and Gas, Wind Energy, and Solar Energy Industries.

Impacts on Employment

Impacts on social and economic conditions include the creation of jobs related to renewable energy plant construction and operations, such as jobs directly created at plants and those indirectly created through the increase in local economic spending. Workers necessary for construction and operations and

Table 4-3
Comparison of Socioeconomic Effects in the Oil and Gas, Wind Energy, and Solar Energy Industries

	Oil and Gas	Wind	Solar
Job Creation	+ +	Negligible	Negligible
Population Growth	−−	Negligible	Negligible
Lease Payments	+	+	+/−
Property Taxes	+	+ +	Negligible
Tourism	NA	+/−	+/−
Recreation	NA	+/−	+/−
Quality of Life	NA	+/−	+/−
Social Cohesion	NA	+/−	+/−

Source: Fernandes et al. 2010
A "+" indicates a benefit while a "−" indicates a cost. A "+/−" indicates the effect could be a cost or benefit and a double symbol indicates a significant effect.

maintenance activities are direct sources of job creation. Indirect and long-term job creation for renewable energies is more abstract and can be influenced by many factors, including future prices for both conventional fuel and renewable energy (Singh et al. 2001).

Jobs can be estimated per MW based on estimated labor demands. To calculate impacts, representative data from a range of renewable energy development projects in the western U.S. were used. **Table 4-4**, Comparison of Projected Employment Impacts for Solar Development, takes job projections from final NEPA and California Environmental Quality Act documents, project fact sheets, or similar sources to provide an estimate of jobs per MW produced. In general, PV projects tend to be less labor-intensive, as peak construction jobs range from a low of 0.52 job per MW to a high of 1.38 jobs per MW, and operations and maintenance jobs range from a low of 0.05 job per MW to a high of 0.09 job per MW. CSP projects tend to be more labor intensive, as construction jobs range from a low of 0.60 job per MW to a high of 5.47 jobs per MW, and operations and maintenance jobs range from a low of 0.05 job per MW to a high of 0.47 job per MW. As an average, the solar technologies provide a low of 0.60 job per MW to a high of 1.38 jobs per MW for construction (average 1.90) and a range of 0.05 to 0.47 job per MW for operations and maintenance (average 0.20). Based on the solar RFDS (**Appendix A**, Reasonably Foreseeable Development Scenario for Renewable Energy in Arizona), development in the planning area can be expected to result in a generating capacity of 9,500 MW, including 1,500 MW on BLM-administered lands by 2025. Using the estimates provided above, the projections for BLM-administered lands include a low of 900 jobs to a high of 2,070 jobs for construction (average 2,850) and 75 to 705 for operations and maintenance (average 293).

Table 4-4
Comparison of Projected Employment Impacts for Solar Development

Project Name	Technology	MW	Construction Jobs (Peak)	Construction Jobs/MW	O&M Jobs	O&M Jobs/MW
Agua Caliente*	PV	290	275	0.95	18	0.06
Lucerne Valley Solar Project	PV	45	45	1.00	3	0.07
Solar Ranch One	PV	230	300	1.30	20	0.09
Abengoa Mojave Solar Project	CSP	250	1,162	4.65	68	0.27
Beacon Solar Energy Project	CSP	250	836	3.34	66	0.26
Calico Solar Project (Formerly SES Solar One Project)*	CSP	663.5	400	0.60	136	0.20
Crescent Dunes Solar Energy Project*	CSP	110	475	4.31	50	0.45
Genesis Solar*	CSP	250	646	2.58	65	0.26
Imperial Valley Solar Project (Formerly SES Solar Two Project)	CSP	750	731	0.97	164	0.22
Nevada Solar One*	CSP	64-70	350	5.00-5.47	30	0.43-0.47
Rice Solar Energy Project	CSP	150	438	2.92	47	0.31
Solar Millennium Blythe*	CSP**	1,000	1,004	1.00	221	0.22
Solar Millennium Palen*	CSP	500	1,145	2.29	134	0.27
Solar Millennium Ridgecrest	CSP	250	633	2.53	84	0.34
Solar Partners Ivanpah Solar Electric Generating System*	CSP	370	959	2.59	90	0.24
Technology averages			Construction Jobs/MW		O&M Job/MW	
Average CSP			Range 0.60-5.47 Average 1.08		Range 0.05-0.47 Average 0.07	
Average PV			Range 0.52-1.38 Average 2.73		Range 0.05-0.09 Average 0.32	
Average solar			Range 0.60-1.38 Average 1.90		Range 0.05-0.47 Average 0.20	

Source: Fernandes et al. 2010; DOE 2010 (Agua Caliente); BLM 2010d (Calico Solar Project); BLM 2010e (Crescent Dunes Solar Energy Project); BLM 2010f (Genesis Solar); National Renewable Energy Lab 2011 (Nevada Solar One); California Energy Commission 2010a (Solar Millennium Blythe); California Energy Commission 2010b (Solar Millennium Palen); California Energy Commission 2010c (Solar Millennium Ridgecrest); California Energy Commission 2010d (Solar Partners Ivanpah Solar Electric Generating System).
* Note that some jobs/MW figures are higher because for some projects, construction and/or operations and maintenance is calculated in phases, meaning that there would be waives of hires for certain labor needs. Numbers given are projected numbers, regardless of whether or not the project has begun construction or finished construction. For projects with a range provided an average was selected for this analysis.
** The Solar Millennium Blythe Project has been changed from CSP to at least 50 percent PV technology (Kaufmann 2011). The original jobs/MW analysis is sourced from California Energy Commission 2010a.
*** O&M = operations and maintenance

Table 4-5, Comparison of Projected Employment Impacts for Wind Energy, examines the jobs per MW during the construction and operations and maintenance phases of utility-scale wind projects. The table uses data from environmental reports and project profile fact sheets of wind projects as well as summary data from a recent National Renewable Energy Lab study in order to assess the typical impacts of wind projects on job creation. Wind projects tend to be less labor intensive both for construction and for operations and maintenance activities than similarly sized solar projects (particularly CSP projects). For wind, peak construction jobs range from a low of 0.75 job per MW to a high of 3.17 jobs per MW and operations and maintenance jobs range from a low of 0.05 job per MW to a high of 0.15 job per MW. Other job estimates per MW of wind power vary. According to an National Renewable Energy Lab study, wind power projects produce 40 to 140 jobs during construction per 100 MW (and less than this for new projects), and 6 to 20 permanent operations and maintenance jobs per 100 MW (average of 10 jobs per 100 MW), This means that during the construction phase, there is, on average, 0.4 to 1.4 jobs per MW, and during the operations and maintenance phase there is, on average, 0.06 to 0.20 job per MW (Flowers 2005).

Table 4-5
Comparison of Projected Employment Impacts for Wind Development

Project Name	MW	Construction Jobs (peak)	Construction Jobs/MW	O&M Jobs	O&M Jobs/MW
Granite Mountain Wind	58.8-88.4	80-100	0.90-1.70	5-8	0.06-0.14
China Mountain Wind	425	396	0.93	34	0.09
Tule Wind Project	200	150	0.75	10	0.05
Dry Lake Wind Project	63	200	3.17	5-10	0.08-0.15
Twin Buttes Wind Project	75	100	1.33	5-6	0.07-0.08
National Renewable Energy Lab study	100	40-140	0.40-1.40	6-20	0.06-0.20
Average Jobs/MW			Range 0.40-3.75 Average 1.32	Range 0.05-0.20 Average 0.09	

Sources: BLM 2010h (Granite Mountain Wind); BLM 2011c (China Mountain Wind); Iberdola Renewables 2008 (Tule Lake Wind Project); Iberdola Renewables 2010a (Dry Lake Wind Project); Iberdola Renewables 2010b (Twin Buttes Wind Power Project).
Note that for consistency, in all of the above projects, the numbers given are projected numbers, regardless of whether or not the project has begun construction or finished construction.
* O&M = operations and maintenance

Based on the wind RFDS for the project (**Appendix A**, Reasonably Foreseeable Development Scenario for Renewable Energy in Arizona), development in the planning area can be expected to result in a generating capacity of 820 MW, including 130 MW on BLM-administered lands by 2025. Using the estimates provided above, the RFDS for the BLM-administered lands include a low of 52 to a high of 487 jobs for construction (average 172 jobs) and 6.5 to 26 jobs for operations and maintenance (average 12 jobs).

For both wind and solar, the majority of jobs are available during the construction phase; generally, operation and maintenance require far fewer jobs. Renewable energy construction and operation and maintenance demands skilled labor, and this skilled labor may or may not be available through the local workforce. Many developers try to hire local construction companies and local operators; however, when this is not possible, construction companies are often brought on from outside of the county or even the state (Pedden 2006). Therefore, the impacts on the local labor force are contingent upon the availability of skilled labor, natural resources, and industries that exist in the area. Similarly, revenue brought into the local community may vary. Wages of construction and operations and maintenance workers would differ based upon skill level required, local costs of living, demand for employment at the time of development, and other local and national economic factors. In addition to direct income, workers may spend money in the local economy, contributing a secondary source of revenue for local businesses. Indirect revenues would vary based on the variables discussed above.

Impacts on Tax Revenue

Increased spending as a result of renewable energy development in local communities is likely to increase tax revenue. The degree of increase in sales tax revenue that is allotted from solar and wind projects depends upon many factors, including the existing local infrastructure that might accommodate the influx of workers, and the overall increase in workers in the area. Various benefits to local communities and counties may result from construction payrolls, local purchases of materials and supplies, and sales tax revenues generated by expenditures (California Energy Commission 2011e).

The impact on communities varies with the size and available infrastructure-related resources of that community. Small communities may experience leakage, which is when taxes are paid to other counties or municipalities due to a lack of available infrastructure in the immediate vicinity where money would otherwise be spent. As a result, small communities may see less economic benefits than a larger community able to provide a greater number of services, as workers at renewable energy projects would commute to nearby towns that provide more services (Pedden 2006).

Impacts on Property Values

There is currently limited research that assesses the impact renewable energy projects have on property values. A 2009 study by the Lawrence Berkeley National Laboratory examined the influence of wind energy facilities on property values (Hoen et al. 2009). The study's methodology entailed collecting sales data on single-family homes situated within 10 miles of existing wind facilities. There was no conclusive evidence of the existence of any widespread property value impacts that affect communities surrounding wind energy facilities. In addition, the Draft Solar PEIS (BLM and DOE 2010) concludes that while there may be a small negative effect on property values in the immediate

vicinity (i.e., less than one mile) of facilities, this effect is often temporary and associated with announcements related to specific project phases, such as site selection, the start of construction, or the start of operations. At larger distances or over longer project durations, no significant, enduring decrease in property value as a result of renewable energy development has been found (BLM and DOE 2010).

Furthermore, there is some evidence that property values may increase as a result of renewable energy projects in the vicinity. A study completed in 2003 examined price changes in property values for 10 different wind projects. For the majority of projects, the property values in the viewshed went up faster than values in the comparable region (Sterzinger et al. 2003). Commercial property value may be impacted differently than single family homes due to the potential for increased development opportunities near renewable plants. Similarly, transmission line development may have impacts on property values. Property value impacts would be examined for site-specific development.

Changes to Current Land Use

Current land use may be impacted by renewable energy development. As further discussed in **Sections 4.2.22**, Visual Resources, and **4.2.15**, Recreation, changes to the visual landscape and public access to public lands, respectively, may be impacted when wind or solar is introduced to a previously undisturbed parcel of land. Open space that may have been used for OHV use, hiking, camping, sightseeing, bird watching, or similar recreational use could be impacted if construction occurred in areas where these activities were valued. Social impacts could occur on local communities if access to these resources was a valued component of the community. Economic impacts can occur if associated visitor spending for tourism or recreation purposes is affected. Recreation can be negatively impacted because lands that were previously used for recreation can be replaced by the infrastructure of the project, or access routes to lands can be deemed inaccessible due to construction or other project development. In other cases, the creation of infrastructure such as transmission can create corridors or access to large areas of land where access did not previously exist (BLM 2011a, 2011b).

In addition, changes to availability of land for other land uses such as livestock grazing or mineral extraction may impact area socioeconomics. In communities dependent on ranching, reduction in AUMs on public land allotments may increase the costs of grazing due to the higher fees for use of private lands and may impact adjacent land value. Furthermore a loss of public grazing lands may change the social structure of the community in areas where this economic sector was of historical importance. The potential magnitude and nature of these impacts should be considered in project-specific analyses.

Social Changes to Local Communities

Social changes could occur that would impact local communities. Construction- and operation-related impacts could change the local quality of life by altering values such as air quality due to fugitive dust, visual resources due to site infrastructure, or area traffic due to workers travelling to a work site. A population influx in a community could influence various factors such as transportation, including traffic associated with site workers; availability of health care workers or public service officers; demands on public safety officers; housing, particularly in cases where housing vacancy rates are low; and waste disposal, water availability, or telecommunications services if these services are only adequate for the current population. Impacts would predominantly be related to construction and therefore temporary in nature, as renewable energy plants have minimal permanent operations and maintenance workers requirements. The degree of impact is contingent upon the size of the community, the local infrastructure, and the influx of workers anticipated.

Non-Market Values

Public lands provide services to the region and to local community residents by providing a source of public open space that may be important for local residents for the feel of a community or for recreational use. In addition, the BLM-administered lands may produce a wide range of valuable ecosystem services (the resources and processes that are supplied by natural ecosystems), including agriculture, drinking water, flood control, carbon sequestration, recreation, and preservation of cultural resources. Ecosystem services are generally understood to be the benefits of nature to individuals, communities, and economies (DOI 2011). Impacts would be determined by local area communities and conditions.

Impacts from the No Action Alternative

The impacts related to renewable energy development under the No Action Alternative would be the same as those described in Impacts Common to All Alternatives. Developing solar and wind energy projects on a case-by-case basis through ROW authorizations are not expected to directly affect land uses and access because the BLM is required to identify and address environmental impacts of all ROW authorizations and conform to existing land use plan decisions. However, in the absence of identifying the REDA, solar and wind project development would likely result in fragmented and segregated land uses and access. Additionally, there could be increased unanticipated environmental impacts from the lack of planning for appropriate land uses, which could alter the character of rural areas and increase the potential for social or economic impacts on local communities. As necessary, individual BLM land use plans would have to be amended for individual projects as a part of the project evaluation and approval, which could delay the process. No standard set of BMPs or design features would be developed.

Impacts from Alternative 1

Impacts from Maximum REDA

Under Alternative 1, impacts would be similar to those described under Impacts Common to All Alternatives. While the exact location of development cannot be determined, the REDA would direct renewable energy development on public lands to specific regions in the planning area. While smaller parcels of land within the REDA can be found throughout the state, the largest concentrations are found within the Sonoran Desert south and west of Phoenix, centered near the intersection of Highway 85 and Interstate 8 near Gila Bend; in Mohave County north of Interstate 40 near Kingman; and on the southern half Navaho and Apache Counties. The REDA on public lands reflects the same general distribution, particularly in the Sonoran Desert and in Mohave County (**Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario). The majority of areas available for development would not be located adjacent to large population centers. Impacts on local communities during construction could occur should a large number of workers be required to temporarily move to the area. Should a large development occur in the Sonoran Desert, for example, a strain on housing and service resources may occur in the Gila Bend community, although it is likely that workers could be drawn from the existing pool of those seeking employment in the greater Phoenix region and no large population influx would occur. Availability of housing and workers would be influenced by local economic conditions at the time of development and would be analyzed in site-specific NEPA analysis.

Impacts from construction such as dust and noise as well as impacts on community watersheds would be minimized through project design criteria and BMPs. Jobs and related income, tax revenue, and social changes to local communities would differ depending on the location of site-specific development. Due to the temporary nature of construction activities and the small number of full-time employees required for renewable energy plants, long-term impacts would likely be minimal. In addition, the RDEP encourages development on previously disturbed lands and those lands with fewer resource conflicts, thus retaining lands with high value for community use as well as lands providing valuable ecosystem services.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts would be to the same as those described under Impacts Common to All Alternatives. The proposed Agua Caliente SEZ is located adjacent to a 290-MW solar facility currently under construction on private land mainly surrounded by rural and undeveloped lands; therefore, there are likely to be minimal social and economic impacts immediately surrounding the site. Based on analysis provided in Impacts Common to All Alternatives, development in the proposed SEZ would likely require between 18 to 40 temporary construction jobs and 2 to 14 permanent operations and maintenance jobs. While the proposed SEZ is located in an area with a low population base, due to the small number of workers required, workers could likely be drawn from the region,

and a large population influx would not be anticipated. Similarly, workers for project construction and operation are not likely to have a long-term significant impact on local community economies.

If the proposed Agua Caliente SEZ were developed, there could be conflicts with existing land uses (primarily recreation) within the proposed SEZ. Implementing the programmatic design features such as stakeholder coordination/consultation as described in **Appendix B**, Design Features and Best Management Practices, would provide adequate mitigation for activities.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

Impacts would be similar in scope and nature to those described for Alternative 1. The necessary transmission connections would be less due to the REDA boundaries being closer to existing infrastructure; therefore, impacts on communities from this infrastructure would be reduced. However, due to the fewer acres in the Alternative 2 REDA, there would be less flexibility in siting solar and wind facilities and infrastructure, which may result in additional impacts on current land use as described under Alternative 1.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts would be similar in scope and nature to those described for Alternative 1. Overall, impacts on existing land use such as recreation on BLM lands would be reduced because of the smaller footprint.

Impacts from Alternative 3

Impacts from Load Offset REDA

Impacts would be similar in scope and nature to those described under Alternative 1. However, under this alternative solar and wind development would be concentrated near developed areas (e.g., cities, towns, or industrial areas). Due to location, workers for construction and operation are more likely to be available in the existing pool of employees in the area. Area public services for workers are also more likely to be available and the strain on these services would therefore be minimal. When project siting occurs in industrial areas, this type of development would likely be more consistent with surrounding land uses and would be less likely to impact land used for dispersed recreation, which typically occurs in less developed backcountry settings. Impacts, however, would be more likely to occur on developed recreation areas in close proximity to population centers. Impacts from construction on local communities may be present should siting occur near residential populations. Project-related BMPs and design features should reduce impacts.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts would be similar in scope and nature to those described for Alternative 1. Under this alternative; however, the proposed SEZ footprint is very small (2,760 acres), with the boundaries close to the existing solar energy

development and away from key recreational areas, resulting in a reduction of impacts on existing land uses such as recreation.

Impacts from Alternative 4

Impacts from Water Conservation and Protection REDA

Impacts would be similar in scope and nature to those described for Alternative1 due to the size of the REDA and the location and percentage of developable land.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts would be same as those described under Alternative 1.

Impacts from Alternative 5

Impacts from Land Tenure REDA

Impacts would be similar in scope and nature to those described for Alternative 1. Only BLM-administered lands are identified for potential solar and wind energy development; therefore, overall potential for employment would be decreased, as would related impacts on local and regional economic and social structure.

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

Impacts would be similar in nature to those described under Impacts Common to All Alternatives and Alternatives 1, 2, and 3. However, developable land in the REDA would be located in proximity to existing transmission lines and communities, as described for Alternatives 2 and 3, which would reduce the impacts on local communities.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts would be similar in scope and nature to those described under Alternative 2.

4.2.17 Soil Resources

Evaluation Methodology, Resource Indicators, and Assumptions

This section discusses impacts on soils from proposed management actions, design features, and BMPs as noted in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario. Existing conditions concerning soil resources are described in **Section 3.17**, Soils Resources. Impacts on soils would result from actions that cause ground-disturbing activities, alter vegetative cover, or otherwise affect the potential for soil erosion.

NRCS data were consulted to provide an overview of baseline soil conditions for the planning area in **Chapter 3**, Affected Environment. Soils throughout the planning area are described by soil order for general geographic areas. Soils in the proposed Aqua Caliente SEZ are described by acres of soil unit type.

The specific impacts of development of solar and wind energy facilities would depend on project location, technology and scale employed, size of the development, and site-specific soil conditions. Due to the uncertainty of specific solar and wind development, it is not possible to quantify the total acreage affected on lands within the planning area or identify the soil units that would be impacted, other than to identify the acreage of land that could be affected by maximum build-out. Implementation-level actions (development of specific solar and wind facilities) would be subject to further environmental review and would include quantifying the total acreage affected by site-specific development.

Potential impacts on soil resources could occur if anticipated future actions described in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario, were to result in the following:

- Alter vegetative cover;
- Alter road density;
- Result in developments or other activities causing surface disturbance on soils with high wind or water erosion potential; or
- Result in disturbances from management activities that damage the surface cover provided by desert pavement or biological soil crusts.

This analysis assumes the following:

- Soil resources will be managed to meet the Arizona Land Health Standards and Guidelines.
- Substantial surface disturbance to soil, including exposure of bare ground, loss of vegetative cover, or rutting on unsurfaced roads will increase water runoff and downstream sediment loads and lower soil productivity, thereby degrading water quality, altering channel structure, and affecting overall watershed health.
- The degree of impact attributed to any one disturbance or series of disturbances would be influenced by several factors, including the disturbance's location within the watershed, the time and degree of disturbance, the existing vegetation, and levels of precipitation at the time of the disturbance.
- Any access roads will be properly designed.
- Stockpiling of surface soils will occur for future restoration after grading or excavation.
- Design features and BMPs identified in **Appendix B** would be implemented for site-specific projects.

Impacts Common to All Alternatives

Renewable energy development impacts on soil resources would predominantly be related to surface-disturbing activities, which may result in soil compaction, disruption of biological crusts or desert pavement, or other changes affecting the rate of or spatial locations of soil erosion or deposition. In turn, erosion can affect soil productivity by carrying away soil particles and nutrients normally held in the upper level or horizon of soil. The ability of the soil to recover productivity is affected by loss or degradation of the upper horizons. Given the low precipitation and limited vegetation levels in the planning area, soil productivity will be slow to recover once it has been reduced by erosion.

No field inventory of soils was available for this project. Site-specific NEPA analysis conducted prior to project approval and development would examine impacts on soil resources in further detail, including an analysis of soil types and associated soil features. Overall, the RFDS (**Appendix A**, Reasonably Foreseeable Development Scenario for Renewable Energy in Arizona) for solar development predicts that up to 12,000 acres of BLM-administered land may be disturbed for solar energy production by 2020. Similarly, the RFDS for wind approximates that 3,600 acres of BLM-administered land would be developed for wind energy by 2020. Of the 3,600 acres of wind projects on BLM-administered lands, approximately 360 of those acres are expected to be disturbed in the development process.

Due to the inability to predict future development scenarios, including types of development, timing, and location, the following impact analysis provides a general description of common impacts on soil resources during project construction, operations and maintenance, and reclamation and abandonment. Impacts during siting and development would be minimal due to lack of significant surface disturbance and are not discussed further.

Construction

Site construction for renewable energy projects would involve vegetation removal and site grading, which may disrupt drainage patterns and cause surface disturbance and erosion, resulting in impacts on soil resources. The magnitude of the impact would depend on the project size, renewable technology developed, erosion potential of the soil, local terrain, vegetation cover, and the distance from a site to nearby surface water bodies. Major factors that could contribute to soil erosion include the following:

- Amount of ground surface disturbance on project sites, construction laydown areas, along access roads, and along transmission line routes. Disturbance includes, but is not limited to, disruption of protective soil crusts;
- Amount of foot traffic from construction workers and heavy equipment traffic from construction vehicles; and
- Surface runoff pattern disturbance due to grading or excavation.

Addition potential impacts include exposure of workers and the local environment to contaminated soils disturbed during construction. Contaminated soils are of particular importance for disturbed sites nominated for renewable energy development due to potential contamination from previous uses. Additional details are included in **Section 4.2.14**, Public Health and Safety.

Operations and Maintenance
Impacts during the operation phase would largely be limited to soil erosion induced by vehicle traffic on unpaved roads. Additional impacts may include soil subsidence from use of groundwater for renewable energy, particularly wet-cooling. Additional details are included in **Section 4.2.23**, Water Resources.

Reclamation and Abandonment
Impacts during reclamation and abandonment would be similar to those described for construction, as soils would be disturbed again with the removal of all access roads, on-site roads, substations, buildings, and other structures. Use of site decommissioning and site reclamation plans would restore exposed soils in the long term.

Additional impacts could result to prime farmlands. Soil productivity in prime farmlands may be impacted by erosion should development occur in these areas. Site-specific NEPA analysis would include analysis for prime farmlands.

Impacts from the No Action Alternative
Under the No Action Alternative, solar and wind development applications would continue to be processed on a case-by-case basis. Areas excluded from solar and wind development by statute, regulation, or orders would remain excluded, and administratively excluded areas would be assessed based on local land use plans. Solar and wind energy project applications would be submitted to the BLM by energy developers based on resource availability, economics, and site suitability. No standard set of design criteria or BMPs for soil resources would be developed. The acreage of impacted soil resources is unknown.

Impacts from Alternative 1
Impacts from Maximum REDA
There would be no direct impacts from the identification of a REDA. Indirect impacts on soil resources could result from implementing the planning decisions and possible future ground-disturbing activities associated with construction of renewable energy facilities. Under Alternative 1, solar and wind energy project applications would be submitted to the BLM from energy developers based on resource availability, economics, and site suitability. Potential impacts would be similar in nature to those described under Impacts Common to All Alternatives. BMPs and design features (**Appendix B**, Design Features and Best Management Practices) would be employed to minimize soil erosion. In addition, wind erosion control techniques would be put in place, native vegetation cover and soils would be maintained to the extent possible, grading and excessive slopes

would be minimized, construction would be conducted in stages to limit the areas of exposed soil at any given time, and roads would be built according to BLM standards to avoid erosion. Additionally, measures would be put in place to minimize risks from contaminated soils. If any newly found potentially contaminated soils are discovered, contractors would stop work immediately in that area and notify the project proponent, and a qualified professional would inspect the site.

The acres of the REDA by soil order are shown in **Table 4-6**, Soil Orders in the REDA – Alternative 1. The REDA is composed primarily of Aridisols, which due to characteristic sparse vegetative cover and low organic content, are highly susceptible to erosion. It should be noted that the acreage in Table 4-6 represents the amount of BLM-administered land in the REDA; the amount of soil impacted by ground-disturbing activities would be significantly less. Site-specific soil characteristics and erosion potential would be examined during subsequent NEPA analysis for site-specific projects. Implementing BMPs and design features, as appropriate, would reduce impacts on soil resources.

Table 4-6
Soil Orders in the REDA – Alternative 1

Soil Order	BLM-administered Land (acres)
Alfisols	3,800
Aridisols	294,100
Entisols	16,300
Inceptisols	0
Mollisols	1,600
Vertisols	2,200
Miscellaneous	3,500

Source: NRCS 2011a

Impacts from Proposed Agua Caliente Solar Energy Zone

Soil resources in the proposed SEZ would be impacted by construction, operations, and reclamation activities as described in Impacts Common to All Alternatives. As described in **Section 3.17**, Soil Resources, soils in the proposed SEZ have low to moderate susceptibility to erosion. Under Alternative 1, the proposed SEZ is dominated by Ligurta-Cristobal complex, 2 to 6 percent slopes, which has low potential for both water and wind erosion. Acres of each soil in the proposed SEZ are shown in **Table 4-7**, Soil Series in the Proposed Agua Caliente SEZ – Alternative 1. Soil features as well as site design features and BMPs would limit the potential for impacts on soil resources.

Table 4-7
Soil Series in the Proposed Agua Caliente SEZ – Alternative 1

Soil Name	Acres in Proposed SEZ
Carrizo very gravelly sand	2,470
Cherioni-Rock outcrop complex, 25- to 70-percent slopes	10
Harqua-Tremant complex	3,680
Ligurta-Cristobal complex, 2- 6-percent slopes	14,430

Source: NRCS 2011f

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

The nature and type of impacts would be the same as those described under Impacts Common to All Alternatives and Alternative 1, except that the size of the REDA is reduced compared to Alternative 1, so the scale of impacts would be less. Acres within the planning area by soil order are shown in **Table 4-8**, Soils Orders in the REDA – Alternative 2.

Table 4-8
Soil Orders in the REDA – Alternative 2

Soil Order	BLM-administered Land (acres)
Alfisols	0
Aridisols	210,000
Entisols	6,500
Inceptisols	0
Mollisols	300
Vertisols	0
Miscellaneous	1,800

Source: NRCS 2011a

Impacts from Proposed Agua Caliente Solar Energy Zone

The nature and type of impacts would be the same as those described under Impacts Common to All Alternatives and Alternative 1, except that the size of the SEZ is reduced compared to Alternative 1, so the scale of impacts would be less. Acres within the proposed SEZ by soil type are shown in **Table 4-9**, Soil Series in the Proposed Agua Caliente SEZ – Alternative 2.

Table 4-9
Soil Series in the Proposed Agua Caliente SEZ – Alternative 2

Soil Name	Acres in Proposed SEZ
Carrizo very gravelly sand	240
Cherioni-Rock outcrop complex, 25- to 70-percent slopes	0
Harqua-Tremant complex	1,580
Ligurta-Cristobal complex, 2- to 6-percent slopes	4,950

Source: NRCS 2011f

Impacts from Alternative 3

Impacts from Load Offset REDA

The nature and type of impacts would be the same as those described under Impacts Common to All Alternatives and Alternative 1, except that the size of the REDA is reduced compared to Alternative 1, so the scale of impacts would be less. Acres within the proposed SEZ by soil type are shown in **Table 4-10**, Soil Orders in the REDA – Alternative 3.

Table 4-10
Soil Orders in the REDA – Alternative 3

Soil Order	BLM-administered Land (acres)
Alfisols	0
Aridisols	122,000
Entisols	6,600
Inceptisols	0
Mollisols	200
Vertisols	0
Miscellaneous	1,000

Source: NRCS 2011a

Impacts from Proposed Agua Caliente Solar Energy Zone

The nature and type of impacts would be the same as those described under Impacts Common to All Alternatives and Alternative 1, except that the size of the SEZ is reduced as compared to Alternative 1, so the scale of impacts would be less. Acres within the proposed SEZ by soil order are shown in **Table 4-11**, Soil Series in the Proposed Agua Caliente SEZ – Alternative 3.

Table 4-11
Soil Series in the Proposed Agua Caliente SEZ – Alternative 3

Soil Name	Acres in Proposed SEZ
Carrizo very gravelly sand	210
Cherioni-Rock outcrop complex, 25- to 70-percent slopes	0
Harqua-Tremant complex	800
Ligurta-Cristobal complex, 2- to 6-percent slopes	1,750

Source: NRCS 2011f

Impacts from Alternative 4

Impacts from Water Conservation and Protection REDA

The scale and nature of impacts would be similar to those described under Impacts Common to All Alternatives and Alternative 1; however, design features under this alternative would limit the impacts of water usage on soils, most importantly, soil subsidence.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts would be the same as those described under Impacts Common to All Alternatives and Alternative 1.

Impacts from Alternative 5
Impacts from Land Tenure REDA
The nature and type of impacts would be the same as those described under Impacts Common to All Alternatives and Alternative 1, except that the size of the REDA is reduced as compared to Alternative 1, so the scale of impacts would be less. Acres within the planning area by soil order are shown in **Table 4-12**, Soil Orders in the REDA – Alternative 5.

Table 4-12
Soil Orders in the REDA – Alternative 5

Soil Order	BLM-administered Land (acres)
Alfisols	0
Aridisols	41,400
Entisols	1,800
Inceptisols	0
Mollisols	0
Vertisols	0
Miscellaneous	500

Source: NRCS 2011a

Impacts from Alternative 6
Impacts from Collaborative-Based REDA
The nature and type of impacts would be the same as those described under Impacts Common to All Alternatives and Alternative 1, except that the size of the REDA is reduced as compared to Alternative 1, so the scale of impacts would be less. As in Alternative 4, additional design features under this alternative would limit the impacts of water usage on soils, most importantly, soil subsidence. Acres within the planning area by soil order are shown in **Table 4-13**, Soil Orders in the REDA – Alternative 6.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts would be the same as those described under Impacts Common to All Alternatives and Alternative 2.

Table 4-13
Soil Orders in the REDA – Alternative 6

Soil Order	BLM-administered Land (acres)
Alfisols	0
Aridisols	226,200
Entisols	8,600
Inceptisols	0
Mollisols	500
Vertisols	0
Miscellaneous	1,800

Source: NRCS 2011a

4.2.18 Special Designations

Evaluation Methodology, Resource Indicators, and Assumptions

Areas with special designations (see **Section 3.18**, Special Designations) have been identified as "Areas with Known Sensitive Resources" (Chapter 2, **Table 2-1**, Areas with Known Sensitive Resources [Eliminated from REDA Consideration]). As such, these lands have been eliminated from consideration as a REDA, and direct impacts are not anticipated. However, special designation areas may experience impacts from solar or wind energy development on adjacent or nearby REDA or SEZ lands. As such, a five-mile radius around REDA lands and the proposed Agua Caliente SEZ was analyzed for potential impacts on those values and resources identified for protection under any special designations within that area.

Potential impacts on special designations could occur if reasonably foreseeable future actions were to result in the following:

- Conflict with management goals and objectives set forth by the BLM and other agencies in order to categorize, protect, and manage special designation areas;
- Conflict with conservation goals for the area; or
- Result in proposed land uses that are incompatible with existing or adjacent special designation areas.

Impacts from the No Action Alternative

Under the No Action Alternative, solar and wind energy development applications would continue to be processed on a case-by-case basis. Most congressionally designated areas in the planning area (see **Section 3.18**, Special Designations) are precluded from renewable energy development; therefore, it is anticipated that impacts on congressional designations would be negligible. In administrative designations, where wind and solar energy development is not

automatically precluded, field offices would determine if wind and solar energy development would be in conformance with the prescriptions outlined in the relevant land use plan(s).

If wind or solar energy development was permitted in a special designation area, prior to any activity occurring, resources and values identified for protection under the designation would be analyzed for potential impacts. Activities affecting resources and values identified for protection in these areas would be prohibited, resulting in negligible impacts on special designations.

Impacts from Alternative 1

Impacts from Maximum REDA

Areas with special designations have been eliminated from consideration as a REDA. Within five miles of the REDA, there are 33 ACECs, 3 backcountry byways, 3 national conservation areas, 5 national monuments, 5 national parks, 37 wilderness areas, and 2 WSAs (see **Figure 4-1**, Alternative 1: Maximum REDA within 5 miles of Special Designations). Within 5 miles of BLM-administered lands within the REDA, there are 19 ACECs, 2 backcountry byways, 2 national conservation areas, 5 national monuments, 5 national parks, 28 wilderness areas, and 1 WSA. Solar and wind energy development within the REDA could impact these areas by affecting scenic, cultural, or fish and wildlife resources as described in **Sections 4.2.22**, Visual Resources, **4.2.3**, Cultural Resources, and **4.2.6**, Fish and Wildlife, respectively.

Impacts from Proposed Agua Caliente Solar Energy Zone

There are no special designations within the proposed Agua Caliente SEZ under Alternative 1. The Sears Point ACEC is within five miles of the proposed SEZ however solar energy development is not anticipated to alter the cultural resources for which the ACEC was designated. To the extent that cultural resources for which the ACEC was designated rely on an unmodified viewshed to protect the values, the ACEC may be impacted by CSP development in the proposed SEZ as CSP development would be visible from the ACEC. See **Section 4.2.22**, Visual Resources, for more information.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

Under Alternative 2, the type of impact would be the same as those described for Alternative 1, but fewer special designation areas have the potential to be impacted. Within 5 miles of the REDA, there are 27 ACECs, 3 backcountry byways, 3 national conservation areas, 4 national monuments, 17 national parks, 30 wilderness areas, and 1 WSA. Within 5 miles of BLM-administered lands within the REDA, there are 18 ACECs, 2 backcountry byways, 2 national conservation areas, 4 national monuments, 2 national parks, 25 wilderness areas, and 1 WSA. Solar and wind energy development within the REDA could impact

these areas by affecting scenic, cultural, or fish and wildlife resources as described in **Sections 4.2.22**, Visual Resources, **4.2.3**, Cultural Resources, and **4.2.6**, Fish and Wildlife, respectively.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts on special designations from the proposed SEZ under Alternative 2 would be similar to those described for Alternative 1.

Impacts from Alternative 3
Impacts from Load Offset REDA
Under Alternative 2, the type of impact would be the same as those described for Alternative 1, but fewer special designation areas have the potential to be impacted. Within 5 miles of the REDA, there are 21 ACECs, 3 backcountry byways, 3 national conservation areas, 3 national monuments, 12 national parks, 25 wilderness areas, and 1 WSA. Within 5 miles of BLM-administered lands within the REDA, there are 13 ACECs, 1 backcountry byway, 2 national conservation areas, 4 national monuments, 4 national parks, 19 wilderness areas, and 1 WSA. Solar and wind energy development within the REDA could impact these areas by affecting scenic, cultural, or fish and wildlife resources as described in **Sections 4.2.22**, Visual Resources, **4.2.3**, Cultural Resources, and **4.2.6**, Fish and Wildlife, respectively.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts on special designations from the proposed SEZ under Alternative 3 would be similar to those described for Alternative 1.

Impacts from Alternative 4
Impacts from Water Conservation and Protection REDA
Impacts on special designations under Alternative 4 would be the same as those described for Alternative 1. The number of special designation areas within five miles of the REDA would be the same as under Alternative 1.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts on special designations from the proposed SEZ under Alternative 4 would be the same as those described for Alternative 1.

Impacts from Alternative 5
Impacts from Land Tenure REDA
Under Alternative 2, the type of impact would be the same as those described for Alternative 1, but fewer special designation areas have the potential to be impacted. Within 5 miles of the REDA, there are 8 ACECs, 2 national conservation areas, 4 national monuments, 4 national parks, 14 wilderness areas, and 1 WSA. Solar and wind energy development within the REDA could impact these areas by affecting scenic, cultural, or fish and wildlife resources as described in **Sections 4.2.22**, Visual Resources, **4.2.3**, Cultural Resources, and **4.2.6**, Fish and Wildlife, respectively. There are no backcountry byways within five miles of the REDA.

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

Impacts on special designations under Alternative 6 would be similar to those described for Alternative 1. Within 5 miles of the REDA, there are 29 ACECs, 3 backcountry byways, 3 national conservation areas, 4 national monuments, 14 national parks, 30 wilderness areas, and 1 WSA. Within 5 miles of BLM-administered lands within the REDA, there are 18 ACECs, 2 backcountry byways, 2 national conservation areas, 4 national monuments, 4 national parks, 25 wilderness areas, and 1 WSA. Solar and wind energy development within the REDA could impact these areas by affecting scenic, cultural, or fish and wildlife resources as described in **Sections 4.2.22**, Visual Resources, **4.2.3**, Cultural Resources, and **4.2.6**, Fish and Wildlife, respectively.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts on special designations from the proposed SEZ under Alternative 6 would be similar to those described for Alternative 1.

Unavoidable Adverse Impacts

Solar and wind energy development within the REDA could impact special designation areas within five miles of the REDA by affecting scenic, cultural, or fish and wildlife resources. Impacts would depend on a project's location and extent, timing, technology, and topography between the proposed site and the potentially affected special designation area.

4.2.19 Special Status Species

Evaluation Methodology, Resource Indicators, and Assumptions

This section discusses impacts on special status species from the proposed allocation decisions, management actions, design features, and BMPs as noted in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario, and in **Appendix B**, Design Features and Best Management Practices.

This analysis addresses potential impacts on special status species from implementing the management actions under the alternatives described in Chapter 2. Existing conditions concerning special status species, including detailed species lists, are included in **Section 3.19**, Special Status Species. Impacts on general wildlife, including big game and migratory birds, are addressed in **Section 4.2.6**, Fish and Wildlife. This analysis focuses on solar and wind energy development that has the potential for physical harm, disturbance, or harassment of species, as well as loss or alteration of habitat.

Potential impacts on special status species would vary widely depending on a variety of factors such as the dynamics of the habitat (e.g., the community type, size, shape, complexity, stage, and condition of plant or animal communities); season of construction; extent of the disturbance; type of renewable technology developed; rate of vegetative recovery and composition of this vegetative

community; change in vegetation structure and value, soil type, topography and microhabitat of the developed sites; animal species that are present; and the ability of individual species to adapt or move from a site following a disturbance.

Because specific development and site-specific information is not available, species-specific information will be analyzed in detail on a project-level basis, with the exception of the proposed SEZ.

Potential impacts on special status species could occur if anticipated future actions as described in Chapter 2 were to result in the following:

- Harm, harass, or adversely affect any federally listed threatened or endangered species or federally proposed or candidate species;
- Adversely affect the recovery objectives of a federally listed species recovery plan or promote the likelihood of or need for listing under the ESA;
- Destroy or deteriorate federally listed threatened or endangered species' or federally proposed or candidate species' habitat, migration corridors, breeding areas, or designated or proposed critical habitat;
- Decrease population viability or contribute to the need for a federal listing of any federal candidate species or BLM sensitive species; or
- Result in loss of habitat function or habitat value in BLM sensitive species habitats.

Indicators include the following:

- Location, type, and intensity of disturbances relative to known or potential special status species habitat.
- Extent of disturbance and amount of habitat removed.
- Tolerance of a given special status species to disturbance.
- Likelihood for an activity to cause a special status species population to drop below self-sustaining numbers or cause a substantial loss or disturbance to habitat.
- Likelihood for adverse effects on a federally listed or proposed species, as defined under the ESA.
- Effects to the constituent elements required to support a listed species.
- Likelihood for an activity to contribute to the need to list any BLM sensitive or federal candidate species.

This analysis assumes the following:

- Qualitative analysis represents estimates only since many special status species may potentially use habitats that are currently unoccupied and populations fluctuate.
- Ground-disturbing activities could lead to modification of habitat and/or loss or gain of individuals, depending on the amount of area disturbed, nature of the disturbance, the species affected, and the location of the disturbance.
- Implementation-level actions would be further assessed at an appropriate spatial and temporal scale and level of NEPA analysis. Additional field inventories would likely be needed to determine whether any special status species could be present in a given project area.
- Requirements for consultation with USFWS would be followed as appropriate.
- BMPs and standard operating procedures, outlined in **Appendix B**, Design Features and Best Management Practices, are used for analysis purposes and would be implemented to reduce impacts on special status species. These are subject to modification based on subsequent guidance.

Impacts Common to All Alternatives

Special status species within the planning area include those species that are listed by USFWS as federally endangered, threatened, proposed, or candidate species under the ESA, Section 4, as amended; Arizona BLM Sensitive Species; Wildlife of Special Concern by the AZGFD; or are protected under the Arizona Native Plant List by the AZDA.

Impacts on special status species from utility-scale solar are described in the Draft Solar PEIS (Section 5.10, Table 5.10-4) and are incorporated here by reference (BLM and DOE 2010). Impacts from non-utility-scale solar would be similar but at a smaller magnitude. Impacts on special status species from wind operations are summarized in the PEIS on Wind Energy Development (BLM 2005b, Section 5.9).

Impacts on special status species are fundamentally similar to or the same as those described for impacts on vegetation (**Section 4.2.21**) and on fish and wildlife (**Section 4.2.6**). Special status species, however, may be more vulnerable to impacts than common species due to small population size, limited geographic range, reliance on rare habitat types, and habitat conversion. These factors make them more vulnerable to the effects of habitat fragmentation, habitat alteration, habitat degradation, human disturbance and harassment, mortality of individuals, and the loss of genetic diversity.

For special status species like the Sonoran desert tortoise, design features are included in this document to protect species, including but not limited to education of workers on the identification of and protection measures for special status species, pre-disturbance surveys for special status species and habitats, and clearing and translocation of special status species as determined appropriate on a project-specific basis. These measures would be required for projects as appropriate based on habitat and likelihood of species occurrence. Detailed design features and BMPs are included in **Appendix B**, Design Features and Best Management Practices.

Impacts from the No Action Alternative

Under the No Action Alternative, solar and wind development applications would continue to be processed on a case-by-case basis. Areas excluded from solar and wind leasing by statute, regulation, or orders would remain excluded, and administratively excluded areas would be assessed based on local land use plans. Impacts on special status species would be assessed on a project-specific level and measures to avoid important habitat and mitigate impacts would be undertaken. In the absence of identifying the REDA, however, solar and wind project development would likely result in patchy, fragmented development with an increased likelihood of habitat disturbance and fragmentation for special status species. In addition, no standard set of design features or BMPs would be developed for protection of special status species.

Impacts from Alternative 1

Impacts from Maximum REDA

The REDA has been designed to minimize impacts on special status species by directing future development to areas where current habitat values are poor or fragmented and potential for special status species occupation is limited. As discussed in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario, areas eliminated from REDA consideration include USFWS critical habitat, AZGFD locations of special status species, including ESA-listed and proposed species, BLM sensitive species habitat, and desert tortoise habitat in priority habitat categories.

While the limited potential for special status species to be injured, killed, or disturbed due to project construction or operations remains, impacts would be minimal due to the exclusion of important habitat areas and the existing uses of the REDA, which are disturbed sites and do not provide suitable special status species habitat. In addition, some impacts may occur due to changes in habitat adjacent to that used by special status species. Alteration in habitat may impact species by reducing the areas available for use as corridors, fragmenting habitat or otherwise impeding movement of individuals which could in turn impact genetic flow and diversity. Design features and BMPs as described in **Appendix B**, Design Features and Best Management Practices, would require pre-operations site surveys and mitigation and monitoring as appropriate. It is assumed that these and other general BMPs for wildlife protection would limit

impacts on special status species. Site-specific NEPA analysis would be conducted to determine impacts for species at the project level.

Impacts from Proposed Agua Caliente Solar Energy Zone

The nature and types of impacts that special status species could incur from construction, operations/maintenance, and reclamation/abandonment of utility-scale solar energy facilities are discussed in **Sections 4.2.21**, Vegetation, and **4.2.6**, Fish and Wildlife. The affected areas would be the same as those described for the proposed SEZ in **Section 4.2.6**, Fish and Wildlife. This analysis is based on the potentially occurring special status species listed for the proposed SEZ in **Section 3.19**, Special Status Species. No special status species have been recorded within the proposed SEZ.

Abert's Towhee. The woodlands and thickets within the proposed SEZ and surrounding areas could provide potential foraging habitat for Abert's towhee, though no nesting habitat is present. The nature and types of potential impacts would be similar to those described in **Section 4.2.6**, Fish and Wildlife. Design features in **Appendix B**, Design Features and Best Management Practices, such as requiring pre-construction surveys, avoiding occupied sensitive animal species habitats, and preparing a mitigation and monitoring plan, would reduce the likelihood of impacts on Abert's towhee.

Cactus Ferruginous Pygmy Owl. Three of the six main washes within and around the proposed SEZ support riparian vegetation that could provide potential nesting and foraging habitat for the cactus ferruginous pygmy owl. The nature and types of potential impacts would be similar to those described in **Section 4.2.6**, Fish and Wildlife. Design features in **Appendix B**, Design Features and Best Management Practices, such as avoiding land disturbance and road construction in desert washes, would protect habitat from removal associated with solar energy development. Other design features would minimize disturbance caused by construction noise and disruptions during the breeding season. These design features would reduce the likelihood for impacts on cactus ferruginous pygmy owl.

Ferruginous Hawk. The open scrublands within the proposed SEZ and surrounding areas could provide potential foraging habitat for ferruginous hawk, though no nesting habitat is present. The nature and types of potential impacts would be similar to those described in **Section 4.2.6**, Fish and Wildlife. Design features in **Appendix B**, Design Features and Best Management Practices, such as requiring pre-construction surveys, avoiding occupied sensitive animal species habitats, and preparing a mitigation and monitoring plan, would reduce the likelihood of impacts on ferruginous hawk.

Gila Woodpecker. The creosote bush scrub within and around the proposed SEZ could provide potential nesting and foraging habitat for gila woodpecker. The nature and types of potential impacts would be similar to those described in **Section 4.2.6**, Fish and Wildlife. Design features in **Appendix B**, such as

requiring pre-construction nesting bird surveys, establishing buffer areas, and using noise-reduction devices, would reduce the likelihood of impacts on gila woodpecker.

Gilded Flicker. The creosote bush scrub and ironwood within and around the proposed SEZ could provide potential nesting and foraging habitat for gilded flicker. The nature and types of potential impacts would be similar to those described in **Section 4.2.6**, Fish and Wildlife. Design features in **Appendix B**, such as requiring pre-construction nesting bird surveys, establishing buffer areas, and using noise-reduction devices, would reduce the likelihood of impacts on gilded flicker.

Golden Eagle. All of the proposed SEZ and surrounding areas could provide potential foraging habitat for golden eagle, though no nesting habitat is present. The nature and types of potential impacts would be similar to those described in **Section 4.2.6**, Fish and Wildlife. Design features in **Appendix B**, Design Features and Best Management Practices, such as requiring adherence to BLM and USFWS golden eagle guidance as well as incorporating actions to avoid eagle disturbance, would reduce the likelihood for impacts on golden eagle.

LeConte's Thrasher. The creosote bush scrub within and around the proposed SEZ could provide potential nesting and foraging habitat for LeConte's thrasher. The nature and types of potential impacts would be similar to those described in **Section 4.2.6**, Fish and Wildlife. Design features in **Appendix B**, such as requiring pre-construction nesting bird surveys, establishing buffer areas, and noise reduction devices, would reduce the likelihood for impacts on LeConte's thrasher.

Mountain Plover. The open scrublands within the proposed SEZ and surrounding areas could provide potential wintering habitat for mountain plover, though no nesting habitat is present. The nature and types of potential impacts would be similar to those described in **Section 4.2.6**, Fish and Wildlife. Design features in **Appendix B**, such as requiring pre-construction surveys, avoiding occupied sensitive animal species habitats, and preparing a mitigation and monitoring plan, would reduce the likelihood of impacts on mountain plover.

Western Burrowing Owl. Some of the desert scrub habitat within and around the proposed SEZ has suitable soils and erosional features that could be used by burrowing owls for nesting and foraging. The nature and types of potential impacts would be similar to those described in **Section 4.2.6**, Fish and Wildlife. Design features in **Appendix B**, such as requiring pre-construction nesting bird surveys, establishing buffer areas, and noise reduction devices, would reduce the likelihood for impacts on burrowing owl.

Arizona Pocket Mouse. The desert scrub habitat within and around the proposed SEZ could provide potential habitat for Arizona pocket mouse. The nature and types of potential impacts would be similar to those described in

Section 4.2.6, Fish and Wildlife. Design features in **Appendix B**, such as requiring pre-construction surveys, avoiding occupied sensitive animal species habitats, and preparing a mitigation and monitoring plan, would reduce the likelihood of impacts on Arizona pocket mouse.

California Leaf-Nosed Bat, Cave Myotis, Mexican Free-tailed Bat, Pale Townsend's Big-Eared Bat, Pocketed Free-tailed Bat, Spotted Bat, Western Yellow Bat, Yuma Myotis. The desert scrub habitat within and around the proposed SEZ could provide potential foraging habitat for sensitive bat species. In addition, the riparian habitat within the proposed SEZ could provide potential roosting habitat for western yellow bat. The nature and types of potential impacts would be similar to those described in **Section 4.2.6**, Fish and Wildlife. Design features in **Appendix B**, such as requiring cactus salvage, requiring noise-reduction devices, and avoiding land disturbance and road construction in desert washes, would reduce the likelihood of impacts on sensitive bat species.

Harquahala Southern Pocket Gopher. The desert scrub habitat within and around the proposed SEZ could provide potential habitat for Harquahala southern pocket gopher. The nature and types of potential impacts would be similar to those described in **Section 4.2.6**, Fish and Wildlife. Design features in **Appendix B**, such as requiring pre-construction surveys, avoiding occupied sensitive animal species habitats, and preparing a mitigation and monitoring plan, would reduce the likelihood of impacts on Harquahala southern pocket gopher.

Harris' Antelope Squirrel. The desert scrub habitat within and around the proposed SEZ could provide potential habitat for Harris' antelope squirrel. The nature and types of potential impacts would be similar to those described in **Section 4.2.6**, Fish and Wildlife. Design features in **Appendix B**, such as requiring pre-construction surveys, avoiding occupied sensitive animal species habitats, and preparing a mitigation and monitoring plan, would reduce the likelihood of impacts on Harris' antelope squirrel.

Kit Fox. The desert scrub habitat within and around the proposed SEZ could provide potential habitat for kit fox. The nature and types of potential impacts would be similar to those described in **Section 4.2.6**, Fish and Wildlife. Design features in **Appendix B**, such as requiring pre-construction surveys, avoiding occupied sensitive animal species habitats, and preparing a mitigation and monitoring plan, would reduce the likelihood of impacts on kit fox.

Little Pocket Mouse. The desert scrub habitat within and around the proposed SEZ could provide potential habitat for little pocket mouse. The nature and types of potential impacts would be similar to those described in **Section 4.2.6**, Fish and Wildlife. Design features in **Appendix B**, such as requiring pre-construction surveys, avoiding occupied sensitive animal species habitats, and preparing a mitigation and monitoring plan, would reduce the likelihood of impacts on little pocket mouse.

Sonoran Pronghorn. The proposed SEZ and surrounding area could provide potential habitat for Sonoran pronghorn. The nature and types of potential impacts would be similar to those described in **Section 4.2.6**, Fish and Wildlife. Design features in **Appendix B**, such as requiring pre-construction surveys, avoiding occupied sensitive animal species habitats, and preparation of a mitigation and monitoring plan, would reduce the likelihood for impacts on Sonoran pronghorn.

Flat-tailed Horned Lizard. The desert scrub habitat within and around the proposed SEZ could provide potential habitat for flat-tailed horned lizard. The nature and types of potential impacts would be similar to those described in **Section 4.2.6**, Fish and Wildlife. Design features in **Appendix B**, such as requiring pre-construction surveys, avoiding occupied sensitive animal species habitats, and preparation of a mitigation and monitoring plan, would reduce the likelihood for impacts on flat-tailed horned lizard.

Rare Plants. Several rare plant species could occur in the proposed SEZ, including blue sand lily, California fan palm, Schott wire lettuce, and senita. None of these species is federally listed, but all are BLM sensitive and/or state-protected. The nature and types of potential impacts would be similar to those described in **Section 4.2.21**, Vegetation. Design features in **Appendix B**, such as requiring pre-construction surveys, establishing buffer areas, and preparation of a mitigation and monitoring plan, would reduce the likelihood for impacts on rare plants.

Desert Tortoise. There is no potential desert tortoise habitat within the proposed SEZ; however, the species has the potential to occur to the west and north of the proposed SEZ. As such, activities within the proposed SEZ could impact desert tortoise, mainly through reduction of potential movement corridor, noise, human presence, and increased vehicle traffic. The nature and types of potential impacts would be similar to those described in **Section 4.2.6**, Fish and Wildlife. Design features in **Appendix B**, such as requiring noise reduction devices, timing activities to avoid sensitive periods for wildlife, and establishing buffer zones, would reduce the likelihood for impacts on desert tortoise.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

Impacts would be similar to those described for Impacts Common to All Alternatives and Alternative 1. Locating energy development near existing transmission lines and utility corridors would indirectly protect special status species habitat from removal and fragmentation by reducing the need for new habitat disturbance associated with ROW development.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts on special status species from the proposed Agua Caliente SEZ under Alternative 2 would be similar to those described for Alternative 1. However,

the maximum developed area within the proposed SEZ under Alternative 2 would be 6,770 acres, and one wash would pass through the eastern portion of the proposed SEZ (Township 5 South, Range 11 West, Section 5). As such, there would be fewer impacts on those special status species that rely on riparian and desert wash habitats.

Impacts from Alternative 3

Impacts from Load Offset REDA

Impacts would be to the same as those described for Impacts Common to All Alternatives and Alternative 1.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts on special status species from the proposed Agua Caliente SEZ under Alternative 3 would be similar to those described for Alternative 1. However, the maximum developed area within the proposed SEZ under Alternative 3 would be 2,760 acres, and Alternative 3 would avoid all major washes. As such, there would be fewer impacts on those special status species that rely on riparian and desert wash habitats.

Impacts from Alternative 4

Impacts from Water Conservation and Protection REDA

Impacts would be similar to those described for Impacts Common to All Alternatives and Alternative 1. The focus on protection of the groundwater supply in Alternative 4, however, would benefit special status species by maintaining water available to vegetation, which would thereby maintain wildlife habitats.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts on special status species from the proposed Agua Caliente SEZ under Alternative 4 would be the same as those described for Alternative 1.

Impacts from Alternative 5

Impacts from Land Tenure REDA

Impacts would be similar to those described for Impacts Common to All Alternatives and Alternative 1. However, development on lands identified for disposal in existing RMPs would reduce impacts on special status species, as these lands would not have special status species populations or habitats.

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

Impacts would be similar to those described for Impacts Common to All Alternatives and Alternative 1. Alternative 6 reduces impacts on special status species by combining the protective features of all the alternatives. This would maximize avoidance of special status species habitats and would reduce habitat disturbance and fragmentation.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts on special status species from the proposed Agua Caliente SEZ under Alternative 6 would be to the same as those described for Alternative 2.

4.2.20 Travel Management

Evaluation Methodology, Resource Indicators, and Assumptions
BLM backcountry byways are the only access-focused designation that have been identified as "Areas with Known Sensitive Resources" (Chapter 2, **Table 2-1**, Areas with Known Sensitive Resources [Eliminated from REDA Consideration]) and eliminated from consideration as a REDA.

Potential impacts on travel management could occur if reasonably foreseeable future actions were to result in long-term elimination or reduction of access.

Impacts Common to All Alternatives
Utility- and community-scale solar and wind energy development would temporarily impact travel management through increased traffic during construction. Unless a project reduces or eliminates access on designated or existing routes (or in areas where intensive cross-country use is allowed), operation of renewable energy projects is likely to have a negligible impact on travel management.

For both construction and operation, impacts on travel management would be reduced through the implementation of design features and BMPs. These include road improvements, maintaining proper traffic flows, speed limit reductions, the preparation of transportation and traffic management plans, and more (see **Appendix B**, Design Features and Best Management Practices).

Impacts from the No Action Alternative
Under the No Action Alternative, solar and wind energy development applications would continue to be processed on a case-by-case basis. Field offices would determine if wind and solar energy development would be in conformance with the travel management decisions in the relevant land use plan(s), but there would not be any guaranteed protection for travel management.

Impacts from Alternative 1
Impacts from Maximum REDA
Alternative 1 would result in more areas (321,500 acres) available to renewable energy development and a greater potential for conflict with travel management. However, by implementing design features and BMPs discussed above (and presented in detail in **Appendix B**, Design Features and Best Management Practices), impacts would be negligible.

Impacts from Proposed Agua Caliente Solar Energy Zone

The proposed 20,600-acre Agua Caliente SEZ contains numerous routes that could be impacted by renewable energy development. Use on these routes is light and all are classified as "digital linear features" (i.e., linear features appearing on aerial photos that need to be field-checked and may not exist) or "non-motorized routes" by the Yuma Field Office RMP (BLM 2010g). Therefore, impacts on motorized travel are expected to be negligible. Although some routes within the proposed SEZ are classified as non-motorized routes, impacts on non-motorized travel are expected to be minor because the routes receive light use.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

The Alternative 2 REDA would cover 218,600 acres, focusing on utility corridors and areas near transmission lines, which often provide access, especially for motorized vehicles. Concentrating development in these areas may conflict with access, though impacts would be mitigated through the use of design features and BMPs.

Impacts from Proposed Agua Caliente Solar Energy Zone

The types of impacts on travel management from the proposed SEZ under Alternative 2 would be similar to those described for Alternative 1, except the impacts would occur over a smaller area (6,770 acres).

Impacts from Alternative 3

Impacts from Load Offset REDA

Locating the 129,800-acre Alternative 3 REDA near cities, towns, and other load centers would likely result in development in areas where roads and trails receive higher use, thereby increasing impacts. Design features and BMPs would reduce but not eliminate impacts. Impacts would be most prominent during construction, when more vehicles are needed for transporting equipment and personnel.

Impacts from Proposed Agua Caliente Solar Energy Zone

The types of impacts on travel management from the proposed SEZ under Alternative 3 would be similar to those described for Alternative 1, except the impacts would occur over a smaller area (2,760 acres).

Impacts from Alternative 4

Impacts from Water Conservation and Protection REDA

The types of impacts under Alternative 4 would be the same as those described for Alternative 1. Designing the REDA around water conservation features would have negligible impact on travel management.

Impacts from Proposed Agua Caliente Solar Energy Zone

The proposed SEZ under Alternative 4 would be the same size and location as under Alternative 1. Therefore, impacts would be the same as Alternative 4.

Impacts from Alternative 5

Impacts from Land Tenure REDA

Under Alternative 5, the REDA would be composed of 43,700 acres identified for disposal in existing RMPs, which would not include areas highly valued for their access to adjacent lands. As a result, impacts on travel management would be negligible.

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

Locating the 237,100-acre Alternative 6 REDA near load centers would likely increase impacts on travel management because development would occur in areas where roads and trails receive more use. This, along with concentrating development in utility corridors and in close proximity to transmission lines, would increase the potential for development to conflict with access on existing routes. Design features and BMPs would reduce impacts, especially during construction, but locating development in areas less likely to experience high use levels would further limit impacts on travel management. Incorporating water conservation features similar to those under Alternative 4 would have negligible impact on travel management.

Impacts from Proposed Agua Caliente Solar Energy Zone

The proposed SEZ under Alternative 6 would be the same size and location as under Alternative 2. Therefore, impacts would be the same as Alternative 2.

4.2.21 Vegetation

Evaluation Methodology, Resource Indicators, and Assumptions

This analysis addresses potential impacts on vegetation, riparian areas, and weeds from implementing the management actions under the alternatives described in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario. Existing conditions concerning vegetation are described in **Section 3.21**, Vegetation. This analysis focuses on solar and wind energy development that has the potential for physical disturbance of vegetation, loss of habitat, and loss or disturbance of riparian/wetland areas or their functioning condition in the planning area.

The effects of solar and wind energy development on vegetation and riparian areas may vary widely, depending on a variety of factors such as the type of soils, precipitation, soil moisture, topography, and plant reproductive characteristics. Surface disturbance disrupts the soil, removes existing vegetation, and can increase opportunities for noxious weeds and invasive species establishment, reducing vegetation diversity, production, and desirable plant cover.

Indirectly, this could reduce the ecological health of vegetative communities. Increasing surface disturbance could increase erosion rates and decrease riparian functioning conditions. Impacts on vegetation resources also vary

depending on the seral stage and composition of vegetation communities, which in Arizona can be generally classified as desert scrub, grassland, forest and woodland, and riparian areas. These classifications are based on the major species found in the vegetation types listed in **Chapter 3**, Affected Environment. Quantitative data were used, where possible, to calculate the acres of potentially affected vegetation communities. EPA Level III ecoregions were used to calculate impacts for the REDAs, while SWReGAP data (USGS National Gap Analysis Program 2004) were used to calculate impacts for the proposed Agua Caliente SEZ. In the absence of quantitative data, best professional judgment was used, and impacts are sometimes described using ranges of potential impacts or in qualitative terms, if appropriate.

Potential impacts on vegetation could occur if anticipated future actions as described in Chapter 2 were to result in the following:

- Removal of a vegetation community's unique attributes or ability to support other resource values.
- Acceleration of erosion and runoff, thereby altering the physical characteristics of terrestrial, wetland, and riparian vegetation.
- Replacement or substantial invasion of native communities with noxious and invasive weeds to the degree that such invasions cannot be successfully controlled.

The analysis is based on the following assumptions:

- Design features and BMPs in **Appendix B** would be required to avoid, minimize, or mitigate impacts on vegetation.
- The degree of impact attributed to any one disturbance or series of disturbances would be influenced by several factors, including location in the watershed; the type, time, and degree of disturbance; existing vegetation; precipitation; and mitigating actions applied to the disturbance.
- Noxious and invasive weeds would continue to be introduced and spread as a result of ongoing vehicle traffic in the REDA and proposed SEZ, recreational activities, wildlife and livestock grazing and movements, and surface-disturbing activities.
- Ecological health and ecosystem function depend on a number of factors, including vegetative cover, species diversity, nutrient cycling and availability, water infiltration and availability, and percent cover of weeds.
- Climatic fluctuation would continue to influence the health and productivity of plant communities on an annual basis.

- The proposed Agua Caliente SEZ would be fully developed, causing impacts on all of the vegetation within that area.

Impacts Common to All Alternatives

Impacts on vegetation from solar and wind energy development would vary depending on the project, location of proposed activities, and type of technology used. In general, impacts would occur during construction, operations and maintenance, and reclamation and abandonment. Impacts would be negligible during project siting and design, as there are no surface-disturbing activities associated with this phase. A summary of potential impacts on vegetation associated with utility-scale solar energy development and wind energy development is presented in the Draft Solar PEIS (BLM and DOE 2010, Section 5.10.1) and PEIS on Wind Energy Development (BLM 2005b, Section 5.9), respectively. The nature and type of vegetation impacts from non-utility-scale solar energy development would be similar to those from utility-scale solar but at a smaller magnitude. Potential impacts on vegetation associated with each phase of development are described below.

The greatest impacts on vegetation are likely to occur during the construction phase of development, as this is the phase with the greatest amount of surface-disturbing activities. During construction, both temporary and permanent impacts on vegetation would occur from clearing for access roads, staging areas, placement of solar or wind facilities (e.g., PV panels, wind turbines), associated facilities (e.g., transformers, maintenance buildings), and transmission lines. Native vegetation communities would be destroyed, and these may include sensitive communities such as riparian areas and wetlands.

Vegetation removal would also leave barren areas that would be susceptible to the introduction or spread of noxious weeds and invasive plant species. In some cases, invasive species may completely displace native species. Other adverse impacts associated with the spread of invasive species may include a decrease in biological diversity of ecosystems; a reduction in water quality and availability for wildlife species; a decrease in the quality of habitats for wildlife; alterations in habitats needed by threatened and endangered species; and health hazards, because some species are poisonous to humans, wildlife, and livestock.

Other impacts on vegetation resulting in changes to plant community composition, plant productivity, and plant health include the following:

- Soil compaction, which reduces water infiltration and soil aeration and may affect plant health;
- Habitat fragmentation (see **Section 4.2.6**, Fish and Wildlife);
- Increased erosion and sedimentation, which would reduce soil availability and could impact the health of terrestrial, riparian, and wetland vegetation;

- Fugitive dust, which could affect photosynthesis and plant productivity;
- Changes to the hydrologic regime caused by grading or facility placement, which could cause a reduction in the duration, frequency, or extent of inundation or soil saturation;
- Increased risk of fire caused by equipment and workers on-site; and
- Contamination, caused by spills of fuel or other hazardous materials.

It is anticipated that impacts on vegetation communities would be reduced through the use of as the design features and BMPs in **Appendix B** that would require projects to be planned to avoid, minimize, or mitigate impacts on aquatic habitats, wetland habitats, other special aquatic sites, unique biological communities, and crucial wildlife habitats. The design features also require preparation of a weed control plan that would be implemented to reduce the likelihood of weed introduction and spread. Another requirement includes reclamation and revegetation of those areas that are not needed for facility operation, such as temporary access roads and staging areas. The success of revegetation efforts may vary, as many of the desert communities within Arizona are sensitive to disturbance and may take decades to recover. Fewer impacts on vegetation would occur during the operations and maintenance phase, as there would be few surface-disturbing activities. For solar projects, vegetation would likely remain cleared or maintained at a low stature within fenced areas throughout the life of the project. Since wind projects generally have a smaller permanent footprint than solar projects, fewer areas would need to be cleared and revegetated. The likelihood of weed invasion during operations/maintenance is lower than during construction, but workers and vehicles accessing sites could still introduce or spread weeds into developed areas over time. Design features (**Appendix B**, Design Features and Best Management Practices), such as implementing vegetation management and weed control plans, would help to reduce impacts.

Impacts from reclamation and abandonment would be similar to those described for construction of projects, as surface-disturbing activities would occur and vehicles and personnel on-site would increase for a period of time. After all facilities are removed, the affected areas would be reclaimed, and vegetation and habitats would be restored. Design features (**Appendix B**), such as implementing a decommissioning and site reclamation plan, would help to reduce impacts.

Impacts from the No Action Alternative

Under the No Action Alternative, solar and wind development applications would continue to be processed on a case-by-case basis. Areas excluded from solar and wind development by statute, regulation, or orders would remain

excluded, and administratively excluded areas would be assessed based on management in local land use plans. The number of acres of vegetation that could be disturbed is unknown; however, impacts would be site-specific and similar to the types of impacts described for vegetation in Impacts Common to All Alternatives. However, without a programmatic approach to solar and wind energy development, planning for vegetation may be fragmented and segregated, which often increases impacts.

Impacts from Alternative 1

Impacts from Maximum REDA

The nature and type of impacts on vegetation likely to occur from Alternative 1 would be similar to those described for Impacts Common to All Alternatives. Ecoregions that would be potentially impacted under Alternative 1 are presented in **Table 4-14**, Potential Ecoregion Impacts in the REDA for Alternative 1. Sonoran Basin and Range and Mojave Basin and Range are the ecoregions that would be most likely to be affected on lands within the REDA planning area.

Table 4-14
Potential Ecoregion Impacts in the REDA for Alternative 1

Ecoregion	Planning Area (acres)
Arizona/New Mexico Mountains	3,500
Arizona/New Mexico Plateau	56,100
Chihuahuan Desert	100
Madrean Archipelago	7,300
Mojave Basin and Range	81,100
Sonoran Basin and Range	172,900
Colorado Plateau	600

Source: EPA 2011b

Impacts from Proposed Agua Caliente Solar Energy Zone

The nature and type of impacts on vegetation likely to occur from Alternative 1 within the proposed Agua Caliente SEZ would be similar to those described for Impacts Common to All Alternatives. Vegetation communities that would be potentially impacted under all alternatives in the proposed SEZ are presented in **Table 4-15**, Potential Vegetation Impacts in the Proposed SEZ by Alternative. Sonora-Mojave Creosotebush-White Bursage Desert Scrub is the community that would be most likely to be affected in the SEZ. Other potentially affected communities include Invasive Southwest Riparian Woodland and Shrubland, Sonoran Paloverde-Mixed Cacti Desert Scrub, and Agricultural Lands.

Table 4-15
Vegetation Present in the Proposed SEZ by Alternative

SWReGAP Cover Type	No Action Alter-native (acres)	Alter-native 1 (acres)	Alter-native 2 (acres)	Alter-native 3 (acres)	Alter-native 4 (acres)	Alter-native 5 (acres)	Alter-native 6 (acres)
Sonora-Mojave Creosote-bush–White Bursage Desert Scrub	0	20,260	6,610	2,640	20,260	0	6,610
Invasive Southwest Riparian Woodland and Shrubland	0	240	110	90	240	0	110
Sonoran Paloverde–Mixed Cacti Desert Shrub	0	70	20	20	70	0	20
Agriculture	0	20	30	20	20	0	30

Source: USGS National Gap Analysis Program 2004

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

The nature and type of impacts on vegetation likely to occur under Alternative 2 would be similar to those described for Impacts Common to All Alternatives. Ecoregions that would be potentially impacted under Alternative 2 are presented in **Table 4-16**, Potential Ecoregion Impacts in the REDA for Alternative 2. The ecoregions most likely to be affected would be the same as those described for Alternative 1. Locating energy development near existing transmission lines and utility corridors would indirectly protect vegetation from removal and fragmentation by reducing the need for vegetation removal associated with new ROW development.

Impacts from Proposed Agua Caliente Solar Energy Zone

The nature and type of impacts on vegetation likely to occur from Alternative 2 within the proposed Agua Caliente SEZ would be to the same as those described for Impacts Common to All Alternatives. Vegetation communities that would be potentially impacted under all alternatives in the proposed SEZ are presented in **Table 4-15**, Vegetation Present in the Proposed SEZ by Alternative. Sonora-Mojave Creosotebush-White Bursage Desert Scrub is the community that would be most likely to be affected in the SEZ under Alterative 2.

Other potentially affected communities include Invasive Southwest Riparian Woodland and Shrubland, Sonoran Paloverde-Mixed Cacti Desert Scrub, and Agricultural Lands.

Table 4-16
Potential Ecoregion Impacts in the REDA for Alternative 2

Ecoregion	Planning Area (acres)
Arizona/New Mexico Mountains	0
Arizona/New Mexico Plateau	7,500
Chihuahuan Desert	100
Madrean Archipelago	5,700
Mojave Basin and Range	76,700
Sonoran Basin and Range	127,900
Colorado Plateau	600

Source: EPA 2011b

Impacts from Alternative 3

Impacts from Load Offset REDA

The nature and type of impacts on vegetation likely to occur from Alternative 3 within the REDA would be similar to those described for Impacts Common to All Alternatives. Ecoregions that would be potentially impacted under Alternative 3 are presented in **Table 4-17**, Potential Ecoregion Impacts in the REDA for Alternative 3. Sonoran Basin and Range and Arizona/New Mexico Plateau are the ecoregions that would be most likely to be affected within the REDA planning area.

Table 4-17
Potential Ecoregion Impacts in the REDA for Alternative 3

Ecoregion	Planning Area (acres)
Arizona/New Mexico Mountains	200
Arizona/New Mexico Plateau	8,400
Chihuahuan Desert	0
Madrean Archipelago	5,600
Mojave Basin and Range	3,000
Sonoran Basin and Range	112,000
Colorado Plateau	600

Source: EPA 2011b

Impacts from Proposed Agua Caliente Solar Energy Zone

The nature and type of impacts on vegetation likely to occur from Alternative 3 within the proposed Agua Caliente SEZ would be the same as those described for Impacts Common to All Alternatives. Vegetation communities that would be potentially impacted under all alternatives in the proposed SEZ are presented in

Table 4-15. Sonora-Mojave Creosotebush-White Bursage Desert Scrub is the community that would be most likely to be affected in the SEZ. Other potentially affected communities include Invasive Southwest Riparian Woodland and Shrubland, Sonoran Paloverde-Mixed Cacti Desert Scrub, and Agricultural Lands.

Impacts from Alternative 4

Impacts from Water Conservation and Protection REDA

The nature and type of impacts on vegetation likely to occur from Alternative 4 would be similar to those described for Impacts Common to All Alternatives. Ecoregions that would be potentially impacted under Alternative 4 are presented in **Table 4-18**, Potential Ecoregion Impacts in the REDA for Alternative 4. The ecoregions most likely to be affected would be the same as those described for Alternative 1. The focus on protection of the groundwater supply in Alternative 3 would maintain water available to vegetation, which would thereby maintain the composition and structure of vegetation communities.

Table 4-18
Potential Ecoregion Impacts in the REDA for Alternative 4

Ecoregion	Planning Area (acres)
Arizona/New Mexico Mountains	3,500
Arizona/New Mexico Plateau	56,100
Chihuahuan Desert	100
Madrean Archipelago	7,300
Mojave Basin and Range	81,100
Sonoran Basin and Range	172,900
Colorado Plateau	600

Source: EPA 2011b

Impacts from Proposed Agua Caliente Solar Energy Zone

The nature and type of impacts on vegetation likely to occur from Alternative 4 within the proposed Agua Caliente SEZ would be the same as those described for Alternative 1.

Impacts from Alternative 5

Impacts from Land Tenure REDA

The nature and type of impacts on vegetation likely to occur from Alternative 5 would be similar to those described for Impacts Common to All Alternatives. Ecoregions that would be potentially impacted under Alternative 5 are presented in **Table 4-19**, Potential Ecoregion Impacts in the REDA for Alternative 5. Sonoran Basin and Range and Mojave Basin and Range are the communities that would be most likely to be affected within the REDA under Alternative 5.

Table 4-19
Potential Ecoregion Impacts in the REDA for Alternative 5

Ecoregion	Planning Area (acres)
Arizona/New Mexico Mountains	0
Arizona/New Mexico Plateau	0
Chihuahuan Desert	0
Madrean Archipelago	3,800
Mojave Basin and Range	11,100
Sonoran Basin and Range	28,200
Colorado Plateau	600

Source: EPA 2011b

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

The nature and type of impacts on vegetation likely to occur from Alternative 6 would be similar to those described for Impacts Common to All Alternatives. Ecoregions that would be potentially impacted under Alternative 6 are presented in **Table 4-20**, Potential Ecoregion Impacts in the REDA for Alternative 6. The ecoregions most likely to be affected would be the same as those described for Alternative 1. Alternative 6 reduces impacts on vegetation by combining the protective features of the other action alternatives. This would reduce new vegetation disturbance and removal.

Table 4-20
Potential Ecoregion Impacts in the REDA for Alternative 6

Ecoregion	Planning Area (acres)
Arizona/New Mexico Mountains	200
Arizona/New Mexico Plateau	12,400
Chihuahuan Desert	100
Madrean Archipelago	6,300
Mojave Basin and Range	76,700
Sonoran Basin and Range	140,700
Colorado Plateau	600

Source: EPA 2011b

Impacts from Proposed Agua Caliente Solar Energy Zone

The nature and type of impacts on vegetation likely to occur from Alternative 6 within the proposed Agua Caliente SEZ would be similar to those described for Impacts Common to All Alternatives. Vegetation communities that would be potentially impacted under all alternatives in the proposed SEZ are presented in **Table 4-15**. Sonora-Mojave Creosotebush-White Bursage Desert Scrub is the community that would be most likely to be affected in the SEZ. Other potentially affected communities include Invasive Southwest Riparian Woodland

and Shrubland, Sonoran Paloverde-Mixed Cacti Desert Scrub, and Agricultural Lands.

4.2.22 Visual Resources

This section analyzes impacts on visual resources as a result of identifying lands as the REDA and each proposed Agua Caliente SEZ, as well as indirect impacts from solar or wind development.

Project-specific analysis will be required to determine actual impacts on site-specific visual resource factors of scenic quality, sensitivity levels, and distance zones. Without site-specific project proposals, the proposed REDA lands for each alternative were overlaid with the four VRI components (i.e., scenic quality, sensitivity levels, distance zones, and VRI classification). Where proposed REDA lands overlap with C-ranked scenic quality lands, there would be no impact on scenic quality because the lands cannot move into a lower category. Similarly, where REDA lands overlap with low-sensitivity lands or VRI Class IV lands, there would be no impact on that component of visual resources because lands cannot move into a lower category.

For this analysis, it is assumed that lands within the foreground/middleground distance zone that overlap REDA would remain in that category, as new infrastructure, including roads, could be developed to access renewable energy projects. While there would not be an impact on the foreground/middleground distance zone in terms of changing distance zones, these lands are most seen by viewers because they are the closest to roads or trails. As such, changes to the landscape within this zone can be perceived has having more of an impact than changes in the background or seldom-seen distance zone.

While the discussion that follows focuses in quantitative terms on impacts on visual resources within the REDA footprint, impacts on visual resources could be experienced beyond the location of development. As such, representative sensitive areas within five miles (the distance amounting to the foreground/middleground distance zone) of REDA lands were selected to indicate the visual impact. The viewshed from the sensitive areas may be impacted by solar or wind energy development within the REDA. Structures and development in the foreground-middleground of the viewshed are the most prominent and are viewable to the greatest number of people. Special designation areas identified as sensitive receptors are those where visual resources: 1) have been identified as a value to be protected in that area; or 2) are inherent to their uniqueness. This analysis is qualitative and does not take into account topographic, vegetation, or other features that might shield REDA lands from view. It also does not take into account the number of potential viewers from each of the sensitive receptors. It is recognized that some areas might be heavily visited, while others may have few visitors. All development would be subject to site-specific NEPA analysis, and appropriate sensitive

receptors would be identified and evaluated at that time. Representative sensitive receptors on BLM-administered lands are:

- Wilderness areas;
- WSAs;
- ACECs;
- National monuments;
- National scenic and historic trails; and
- National conservation areas.

Special designation areas on non-BLM-administered land identified as sensitive receptors are:

- NPS lands (includes national parks, wilderness areas, national monuments, and NRAs);
- National scenic and historic trails;
- National monuments; and
- Byways.

Preliminary viewshed analyses were conducted to identify which lands surrounding each proposed Agua Caliente SEZ are visible from each SEZ. Two viewshed analyses were conducted, each with a different height representative of project elements associated with potential solar energy technologies, including solar dishes and power blocks for CSP technologies (38 feet) and tall solar power towers (650 feet). These heights were selected based on methodology from the Solar PEIS (BLM and DOE 2010).

The viewshed analysis did not account for the presence of vegetation or structures that might screen views of the landscape. However, in most cases, this introduced little error, because most of the land within the viewshed of each proposed SEZ is devoid of vegetation or structures of sufficient height to screen solar facilities from view.

One target point was used as a potential location of a solar structure. This target point was located in the center of each proposed Agua Caliente SEZ. In addition to its geographical location on the ground, the target point can represent its own height, as well as the height of a person viewing it. Heights representative of the potential solar energy technologies (see above) were used as target heights. This resulted in two separate viewshed analyses for each proposed SEZ, each representing a potential solar energy technology.

Each viewshed was then overlain on the data layers representing the different sensitive receptors, which include ACECs, BLM wilderness, NCAs, WSAs,

national scenic and historic trails, national monuments, NPS land, byways, and VRM Class I areas. The Juan Bautista de Anza National Historic Trail, Sears Point ACEC, and Eagletail Mountains Wilderness may be located within the viewshed of each proposed Agua Caliente SEZ.

Also included in this analysis are photographs from various key observation points (KOPs) around the proposed Agua Caliente SEZ analysis area. Some of the points chosen are on sensitive resource areas, such as on lands managed to maintain wilderness, along the Juan Bautista de Anza National Historic Trail, and on Sears Point. Photographs were taken from other KOPs, which were spread throughout the proposed Agua Caliente SEZ. **Figure 4-2**, Key Observation Points of Proposed Agua Caliente SEZ: Photographs of KOPs 001-005, and **Figure 4-3**, Key Observation Points of Proposed Agua Caliente SEZ: Photographs of KOPs 006-009, provide photos taken from KOPs of the proposed Agua Caliente SEZ analysis area.

Finally, the VRI class was compared to the VRM class of the proposed Agua Caliente SEZ in order to compare the current condition of area visual resources to the level of landscape modification allowed by the area's assigned VRM class. Note that this analysis could not be performed for REDA lands because VRI data are unavailable on a state-wide level.

Impacts Common to All Alternatives

Because of the experiential nature of visual resources, the human response to visual changes in the landscape cannot be quantified even though the visual changes associated with solar and wind development can be described (BLM and DOE 2010). There is, however, some commonality in individuals' experiences of visual resources, and while it may not be possible to quantify subjective experience and values, it is possible to systematically examine and characterize commonly held visual values and to reach consensus about visual impacts and their trade-offs. The BLM's VRM procedures, discussed in **Section 3.22**, Visual Resources, provide a means of describing visual impacts systematically and of evaluating their impact on the scenic qualities of affected landscapes, so that defensible decisions about the relative worth and disposition of visual resources relative to competing resource demands can be made (BLM 1984). A discussion of factors that influence an individual's perception of visual impacts can be found in the Draft Solar PEIS (BLM and DOE 2010, Chapter 5, pp. 5-160 to 5-161).

Visual impacts depend upon the type and degree of visual contrasts introduced to an existing landscape. Where modifications repeat the general forms, lines, colors, and textures of the existing landscape, the degree of visual contrast is lower, and the impacts are generally perceived less negatively. Where modification introduces pronounced changes in form, line, color, and texture, the degree of contrast is greater, and impacts are often perceived more negatively.

Visual impacts associated with wind and solar energy development can be produced through a range of direct and indirect actions or activities, including:

- Vegetation and landform alterations;
- Additions of structures, including solar collector/reflector arrays, buildings, and other ancillary facilities;
- Additions or upgrades to roads;
- Additions or upgrades to utilities and/or ROWs, such as expanding ROW width, adding electric transmission lines, which results in larger towers, or upgrading transmission voltage rating;
- Vehicular activity;
- Dust, water vapor plumes, and other visible emissions; and
- Light pollution.

A detailed discussion of visual changes likely to occur as a result of siting and design, construction, operation and maintenance, and reclamation and abandonment of utility-scale solar energy development, including technology-specific impacts, can be found in the Draft Solar PEIS (BLM and DOE 2010, Chapter 5, pp. 5-164 to 5-191). The nature and type of visual changes likely to occur from non-utility-scale solar energy development would be similar but of smaller magnitude.

A detailed discussion of visual changes likely to occur as a result of siting and design, construction, operation and maintenance, and reclamation and abandonment of wind energy development can be found in the Wind Energy Development PEIS (BLM 2005b, Chapter 5, pp. 5-90 to 5-96).

Solar and wind energy projects are being concentrated in VRM Class IV areas where land use plan visual objectives allow for major level of visual modifications and avoids VRM Class I, II, and III where VRM Class objectives are more restrictive and protective of visual values. There are exceptions, though, were pre-disturbed lands (nominated sites) happen to be located within VRM Class II and III areas. There are 8 nominated sites within VRM Class II that would cover 1,650 acres (less than 1 percent of the total VRM II acreage), and 21 nominated sites within VRM Class III that would cover 20,850 acres (less than 1 percent of the total VRM Class III acreage).

Impacts from the No Action Alternative

Under the No Action Alternative, solar and wind energy development would continue to be authorized on a case-by-case basis. In areas identified as ROW exclusions, solar and wind energy development would not be permitted, thereby maintaining the surrounding viewshed. In ROW avoidance areas, solar and wind energy development would only be authorized if it is compatible with the purpose for which the area was identified for avoidance, and the

development is not otherwise feasible on lands outside the avoidance area. Under such circumstances, development would still be required to meet the applicable VRM class assigned to the land on which the project would be developed. As such, visual resources would be protected to the extent required by the VRM class. VRM Class I areas would be protected more than VRM Class IV areas by allowing less landscape modification.

Impacts Common to All Action Alternatives

Impacts from REDA

The nature and type of impacts from solar and wind energy development are described above in Impacts Common to All Alternatives. VRM Class I, II, and III lands have been identified as 'Areas with Known Sensitive Resources' (Chapter 2, **Table 2-1**, Areas with Known Sensitive Resources [Eliminated from REDA Consideration]) and have been eliminated from consideration as a REDA. Solar and wind energy development would meet the objectives of VRM Class IV areas. However, all or portions of 8 nominated sites totaling 1,650 acres are in VRM Class II areas (less than 1 percent of the total BLM Arizona VRM II acreage), and all or portions of 21 nominated sites totaling 20,850 acres are in VRM Class III areas (less than 1 percent of the total BLM Arizona VRM Class III acreage). Solar and wind energy development is not generally compatible with VRM Class II or III objectives. Some low-profile solar development may be compatible with VRM Class III objectives if developed so that activities do not dominate the casual observer's view.

Even in VRM Class IV areas, every attempt should be made to minimize the impact of solar and wind development through careful location, minimal disturbance, and repetition of the basic landscape elements. To that end, some plans that may be required as part of project development, as discussed in **Section 2.3.2**, Elements Common to All Action Alternatives, could include elements that provide some visual resources mitigation. Plans include:

- Access Road Siting and Management Plan;
- Compensatory Mitigation and Monitoring Plan;
- Decommissioning and Site Reclamation Plan;
- Glint and Glare Assessment, Mitigation, and Monitoring Plan; and
- Lighting Plan.

In addition, the following management actions, also discussed in **Section 2.3.2**, Elements Common to All Action Alternatives, would provide some protection of visual resources by minimizing visual disturbance or concentrating development in already-disturbed areas:

- To protect sacred sites and portions of historic trails that are potentially eligible for listing on the NRHP from visual intrusion and to maintain the integrity of the historic cultural setting, the

BLM could require that surface disturbance be restricted or prohibited within the viewshed of a sacred site or within the viewshed of the trail along those portions of the trail for which eligibility is tied to the visual setting.

- Consolidation of access and other supporting infrastructure will be required for single projects and for cases in which more than one project is close to another to maximize efficient use of public land.

- Disturbed lands would be reallocated as preferred development areas for renewable energy development.

In any case, where REDA lands (including nominated sites) overlap VRI Class II or III lands, scenic quality B-ranked lands, lands with high or medium sensitivity to landscape changes, or lands within the background or seldom seen distance zone, there is a potential for change to that visual resources component. Under all action alternatives, none of the proposed REDA overlaps scenic quality A landscapes. There is also no overlap with VRI Class I lands because VRI Class I is only assigned to special areas, such as designated wilderness, which were identified as 'Areas with Known Sensitive Resources' (Chapter 2, **Table 2-1**, Areas with Known Sensitive Resources [Eliminated from REDA Consideration]) and eliminated from consideration as a REDA.

Impacts on Scenic Quality: Solar and wind energy development has the potential to add cultural modifications to an area, which can then change the elements of vegetation and color by removing vegetation or changing the predominant vegetation type over time. The size and type of facility would be the main factor in how cultural modifications affect vegetation and color and ultimately contribute to a scenic quality change.

Impacts on Sensitivity: Solar or wind energy development is unlikely to impact the sensitivity of the area. However, solar or wind energy development in high- or medium-sensitivity areas may be more highly scrutinized or opposed by the public, as these areas have been identified as places of higher public concern for scenic quality.

Impacts on Distance Zone: Solar and wind energy development have the potential to change the background and seldom-seen distance zones by building new access roads to the facility. If these roads become utilized by the public, there is more opportunity for the casual observer to view the facilities for a longer period of time. However, with the BLM trending towards designating routes for specific uses, roads created strictly for access purposes are not likely to be designated for public use. Because of this, it is assumed that areas within the background and seldom-seen distance zones would remain as such.

Impacts on VRI Classification: A change in any of the three visual resource inventory components could change the VRI classification. Because proposed

actions in this EIS are not expected to impact distance zones or sensitivity, changes to VRI classification would come from impacts on scenic quality, as previously discussed. Changing scenic quality B-ranked lands in the foreground/middleground distance zone could result in a change in VRI Class from either Class II to Class III in high-sensitivity areas, or from Class III to Class IV in medium-sensitivity areas.

The discussion under each alternative focuses on the potential direct impact on scenic quality B-ranked lands in the foreground/middleground distance zone where there is overlap with REDA. As previously discussed, VRI data for the Tucson Field Office were unavailable at the time of this analysis. Proposed REDA occurring in the Tucson Field Office is included in this analysis, but any potential visual conflicts are not included in the acreages. The nature and type of impacts would be the same as those previously discussed.

Impacts from Proposed Agua Caliente Solar Energy Zone

As noted in **Section 3.22.2**, Visual Resources, Agua Caliente SEZ Affected Environment, the current VRI for the proposed SEZ is Class III and has a scenic quality rating of B, has a sensitivity rating of medium, and is located in the foreground/middleground distance zone. Since the VRI was developed, however, First Solar has begun constructing a new 290-MW solar energy facility on adjacent private land (retired agricultural lands), which has added a new visual intrusion to the area in addition to the transmission line and railroad. Due to these existing and anticipated landscape modifications, the sensitivity rating for the area may have already been impacted by cultural modifications and contrast in form, line, color, and texture. It is unlikely that additional solar development in the proposed Agua Caliente SEZ would result in additional impacts on scenic quality beyond what exists and is anticipated on adjacent private lands.

The Juan Bautista de Anza National Historic Trail sits low in the valley, and vegetation blocks the view of the proposed Agua Caliente SEZ, particularly along the portion of the trail to the southwest of the proposed SEZ. While the viewshed analysis projects that the proposed Agua Caliente SEZ might be visible from the trail, it is unlikely to be seen along most, if not all, of the trail, due to tall vegetation blocking the view. Recreation in the area is generally dispersed; there are no developed recreation sites. It is a seasonally popular hunting area. As such, the casual observer is likely to be either a hunter or an employee of the existing solar energy facility.

Impacts from Alternative 1

Impacts from Maximum REDA

The nature and type of impact on visual resources would be the same as those described under Impacts Common to All Action Alternatives. Under Alternative 1, approximately 35,600 acres of scenic quality B-ranked lands in the foreground/middleground distance zone overlap REDA, which accounts for 11 percent of REDA lands under this alternative (BLM 2011a, 2011b).

Alternative 1 provides the most opportunity for sensitive receptors to be impacted by solar and wind energy development. **Table 4-21**, Number and Acres of Sensitive Receptors within Five Miles of the REDA, Alternatives 1 and 4, shows the total number of sensitive receptors and associated acreages within five miles of a REDA on BLM-administered land. Solar or wind energy development in the proposed REDA surrounding these areas would result in modifications to the landscape that, if visible from these areas, would impact the visual resource that is either: 1) identified as a value to be protected in that area; or 2) inherent to the uniqueness of the area.

Table 4-21
Number and Acres of Sensitive Receptors within Five Miles of the REDA, Alternatives 1 and 4

Sensitive Receptor	Number of Areas	Acres*
ACECs	19	41,600
BLM Wilderness	28	69,900
National Conservation Areas	2	100
Wilderness Study Areas	1	800
National Scenic and Historic Trails	3	22,000
National Monuments	5	31,200
NPS Land (includes National Parks, Wilderness, National Monuments, and NRAs)	5	16,200
Byways	2	40

Source: BLM 2011a, 2011b
*Acres may overlap one another if sensitive receptor is within five miles of another. The sum of the acres in this table is greater than the total acres of sensitive receptors within five miles of REDA on BLM lands.

Five percent or less of each of the special designation areas listed in Table 4-21 would be within five miles of the proposed REDA on BLM-administered land. The viewsheds of these special areas have the potential to be impacted by solar and wind energy development, as described under Impacts Common to All Alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone

Under Alternative 1, the Yuma Field Office RMP would be amended so that the proposed Agua Caliente SEZ would be managed as VRM Class IV instead of VRM Class III. This would result in a 21,030-acre (4-percent) reduction in VRM Class III areas, while increasing VRM Class IV areas by the same amount, over two times the original acreage (**Table 4-22**, Proposed Changes to Yuma Field Office VRM Classes).

Table 4-22
Proposed Changes to Yuma Field Office VRM Classes

VRM Class	Current		Proposed	
	Acres	Percent	Acres	Percent
I *(all alternatives)*	167,800	13	167,800	13
II *(all alternatives)*	618,600	47	618,600	47
III	512,400	39		
Alternatives 1, 3, & 4			*491,370*	*37*
Alternatives 2 & 6			*505,630*	*38*
Alternative 5			*509,640*	*39*
IV	19,200	1		
Alternatives 1, 3, & 4			*40,230*	*3*
Alternatives 2 & 6			*25,970*	*2*
Alternative 5			*21,960*	*2*
Total	**1,318,000**		**1,318,000**	

Source: BLM 2010g

Solar and wind energy development would be more compatible with VRM Class IV objectives than with VRM Class III objectives, as more modifications to the landscape would be allowed under VRM Class IV.

Viewshed analyses illustrate how CSP technology might be visible from areas with significant wilderness and cultural resources. Areas taken into account were the Juan Bautista de Anza National Historic Trail, Sears Point ACEC, Woolsey Peak Wilderness, Signal Mountain Wilderness, and Eagletail Mountains Wilderness. Analyses were conducted assuming CSP technology was placed at the center of the proposed Agua Caliente SEZ. The height of potential CSP technology could be anywhere between 650 feet and 25 feet. As such, 650 feet and 38 feet were selected as sample heights for analysis. **Figures 4-4** through **4-8** show the impact CSP technology 650 and 38 feet tall, respectively, would have on the viewshed of the above areas. The analyses assume ideal conditions (e.g., no haze, dust, vegetation, or other obstructions) are present, allowing visitors to be able to see clearly across the landscape. All analyses were conducted using the largest Agua Caliente SEZ footprint. As such, these analyses are relevant for all alternatives.

Figure 4-4, Viewshed Analysis of Proposed Agua Caliente SEZ Analysis Area: Potential Concentrated Solar Power Technology 650 Feet Tall, shows a viewshed analysis based on the presence of CSP technology 650 feet tall placed in the center of the proposed Agua Caliente SEZ. Within five miles of the viewpoint, there are no significant cultural or wilderness areas. Within 15 miles of the viewpoint, the CSP technology could be visible from many points along the Juan Bautista de Anza National Historic Trail, as well as from portions of the Sears Point ACEC. Within 25 miles, the viewpoint could be visible from portions of the Juan Bautista de Anza National Historic Trail and also from parts of the Eagletail Mountains Wilderness.

Visitors to areas outside of the 25-mile radius from the viewpoint are unlikely to see the potential CSP technology, though GIS calculations predict the viewpoint could possibly be visible from portions of the Woolsey Peak, Signal Mountain, and Eagletail Mountains Wilderness, were ideal conditions present. However, the visual simulations in **Figure 4-5**, Visual Simulation of Eagletail Mountain Wilderness: Potential Concentrated Solar Power Technology 650 Feet Tall, and **Figure 4-6**, Visual Simulation of Woolsey Peak and Signal Mountain Wilderness: Potential Concentrated Solar Power Technology 650 Feet Tall, demonstrate that even from the highest points in these wilderness areas, 650-foot-tall CSP technology would not be visible.

Figure 4-7, Viewshed Analysis of Proposed Agua Caliente SEZ Analysis Area: Potential Concentrated Solar Power Technology 38 Feet Tall, shows the visibility of a 38-foot CSP solar tower. Within 15 miles, the viewpoint might be visible from portions of the Juan Bautista de Anza National Historic Trail and portions of the Sears Point ACEC. Outside a 15-mile radius from the viewpoint, visibility is unlikely.

Visual simulations were also generated to illustrate the visibility of potential CSP technology 650 feet tall. The simulations generated an image from the highest point in the designated area looking towards the proposed Agua Caliente SEZ and potential 650-foot tower. As **Figure 4-8**, Visual Simulation of Sears Point and Juan Bautista de Anza National Historic Trail: Potential Concentrated Solar Power Technology 650 Feet Tall, shows, CSP technology 650-feet tall would likely be visible from the highest point in the Sears Point ACEC and Juan Bautista de Anza National Historic Trail. From a peak in the Eagletail Mountains Wilderness, potential CSP technology 650-feet tall would not be visible, as shown in **Figure 4-5**, nor would the 650-foot tower be visible from the Woolsey Peak and Signal Mountains Wilderness (**Figure 4-6**).

These analyses examined the impacts of a CSP solar tower system, which is most suitable for large utility-scale applications and is most likely to have the largest visual impact. However, the visual impacts of the solar development project would vary if other solar technologies were used. For example, PV systems, which are lower to the ground, would be less visible from afar than CSP technology. However, PV systems need to be scaled over a large area in order to be effective for utility-scale applications. If the PV field currently adjacent to the proposed Agua Caliente SEZ were expanded, the solar project would be less visible from a distance than CSP technology, but would likely need to extend over a larger footprint of land in order to harness the same amount of power. As such, the larger spread of a project on the proposed SEZ site could have a larger visual impact on the immediate surrounding areas.

An aerial viewshed analysis for a potential PV solar field six feet tall is provided in **Figure 4-9**, Viewshed Analysis of Proposed Agua Caliente SEZ Analysis Area: Potential Photovoltaic Solar Field 6 Feet Tall. This analysis suggests a potential

PV solar field, or the existing PV First Solar Agua Caliente Solar Field, may be visible from Sears Point ACEC or the Juan Bautista de Anza National Historic Trail. **Figure 4-10**, Visual Simulation of Sears Point and the Juan Bautista de Anza National Historic Trail: Potential Photovoltaic Solar Field 6 Feet Tall, provides a visual simulation of the view from Sears Point looking northwest towards the proposed Agua Caliente SEZ. According to this simulation, a potential PV solar field would likely be visible from nine miles away. From the same point nine miles from the proposed Agua Caliente SEZ, CSP technology would also likely be visible. A comparison of **Figures 4-8** and **4-10** provide an idea of how these visible impacts might vary. Additionally, **Figure 4-11**, Visual Simulations of Proposed Agua Caliente SEZ Analysis Area: Concentrated Solar Power Technology and Photovoltaic Solar Field, demonstrates the differing visual impacts of CSP and PV technology from both aerial and street views.

Other CSP technologies, such as linear concentrators and dish/engine systems, would also be lower to the ground than a CSP solar tower; the viewshed analysis for the 38-foot and 25-foot CSP solar tower would be analogous to these other CSP technologies. As their shorter height would be less intrusive, they would consequently be less visible from afar, although still visible.

All CSP technologies utilize mirrors to concentrate sunlight onto receivers. Concentrated PV systems also use lenses and mirrors to concentrate light onto solar cells. These technologies all have the potential to produce glare and light pollution that could impact the viewshed of surrounding areas. PV flat-plate systems do not use mirrors to concentrate sunlight and would be less likely to produce glare and light pollution that would impact surrounding viewsheds.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

The nature and type of impact on visual resources would be the same as those described under Impacts Common to All Action Alternatives. Under Alternative 2, approximately 20,400 acres of scenic quality B-ranked lands in the foreground/middleground distance zone overlap REDA, which accounts for 9 percent of REDA lands under this alternative (BLM 2011a, 2011b).

Table 4-23, Number and Acres of Sensitive Receptors within Five Miles of the REDA, Alternative 2, shows the total number of sensitive receptors and associated acreages within five miles of the REDA on BLM-administered land.

Four percent or less of each of the special designation areas listed in Table 4-23 would be within five miles of the proposed REDA on BLM-administered land. The viewsheds of these special areas have the potential to be impacted by solar and wind energy development, as described under Impacts Common to All Alternatives.

Table 4-23
Number and Acres of Sensitive Receptors within Five Miles of the REDA, Alternative 2

Sensitive Receptor	Number of Areas	Acres*
ACECs	18	32,900
BLM Wilderness	25	47,900
National Conservation Areas	2	100
Wilderness Study Areas	1	800
National Scenic and Historic Trails	3	17,500
National Monuments	4	30,700
NPS Land (includes National Parks, Wilderness, National Monuments, and NRAs)	2	10,000
Byways	2	40

Source: BLM 2011a, 2011b
*Acres may overlap one another if sensitive receptor is within five miles of another.
The sum of the acres in this table is greater than the total acres of sensitive receptors within five miles of REDA on BLM lands.

Impacts from Proposed Agua Caliente Solar Energy Zone
Under Alternative 2, the Yuma Field Office RMP would be amended to designate the proposed Agua Caliente SEZ as VRM Class IV instead of VRM Class III. This would result in a 6,770-acre (1-percent) reduction in VRM Class III acres and a corresponding 6,770-acre (35-percent) increase in VRM Class IV (see **Table 4-22**, Proposed Changes to Yuma Field Office VRM Classes).

The VRI and viewshed analyses would be the same as those described for Alternative 1.

Impacts from Alternative 3
Impacts from Load Offset REDA
The nature and type of impact on visual resources would be the same as those described under Impacts Common to All Action Alternatives. Under Alternative 3, approximately 13,500 acres of scenic quality B-ranked lands in the foreground/middleground distance zone overlap REDA, which accounts for 10 percent of REDA lands under this alternative (BLM 2011a, 2011b).

Table 4-24, Number and Acres of Sensitive Receptors within Five Miles of the REDA, Alternative 3, shows the number of sensitive receptors and associated acreages within five miles of the proposed REDA on BLM-administered land.

Four percent or less of each of the special designation areas listed in Table 4-24 would be within five miles of the proposed REDA on BLM-administered land. The viewsheds of these special areas have the potential to be impacted by solar

Table 4-24
Number and Acres of Sensitive Receptors within Five Miles of the REDA, Alternative 3

Sensitive Receptor	Number of Areas	Acres*
ACECs	13	13,400
BLM Wilderness	19	27,100
National Conservation Areas	2	100
Wilderness Study Areas	1	800
National Scenic and Historic Trails	3	17,800
National Monuments	4	30,400
NPS Land (includes National Parks, Wilderness, National Monuments, and NRAs)	4	1,200
Byways	1	<40

Source: BLM 2011a, 2011b
*Acres may overlap one another if sensitive receptor is within five miles of another. The sum of the acres in this table is greater than the total acres of sensitive receptors within five miles of REDA on BLM lands.

and wind energy development, as described under Impacts Common to all Alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone
Under Alternative 3, the Yuma Field Office RMP would be amended to designate the proposed Agua Caliente SEZ as VRM Class IV instead of VRM Class III. This would result in a 2,760-acre (less than 1-percent) reduction in VRM Class III acres and a corresponding 2,760-acre (14-percent) increase in VRM Class IV (see **Table 4-22**, Proposed Changes to Yuma Field Office VRM Classes). The VRI and viewshed analyses would be the same as those described under Alternative 1.

Impacts from Alternative 4
Impacts from Water Conservation and Protection REDA
Impacts would be similar to those described under Alternative 1. However, because more restrictions would be imposed to protect water resources under Alternative 4, development is more likely to be in the form of PV versus CSP, particularly in Zone 3 areas, due to the amount of water required for CSP technology. As discussed under Impacts Common to All Alternatives, PV development would generally be less visually obtrusive than CSP development, resulting in less visual impacts.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts would be similar to those described under Alternative 1. However, because the proposed Agua Caliente SEZ is within the WPZ 2 area, more restrictions would be imposed to protect water resources under Alternative 4.

As such, development is more likely to be in the form of PV versus CSP technology due to the amount of water required for CSP technology. As discussed under Impacts Common to All Alternatives, PV development would generally be less visually obtrusive than CSP technology, resulting in less visual impacts.

Impacts from Alternative 5

Impacts from Land Tenure REDA

The nature and type of impact on visual resources would be the same as those described under Impacts Common to All Action Alternatives. Under Alternative 5, approximately 200 acres of scenic quality B-ranked lands in the foreground/middleground distance zone overlap REDA, which accounts for less than 1 percent of REDA lands under this alternative (BLM 2011a, 2011b).

Table 4-25, Number and Acres of Sensitive Receptors within Five Miles of BLM REDA and All REDA Lands, Alternative 5, shows the total number of sensitive receptors and associated acreages within five miles of a the proposed REDA on BLM-administered land.

Table 4-25
Number and Acres of Sensitive Receptors within Five Miles of the REDA, Alternative 5

Sensitive Receptor	Number of Areas	Acres
ACECs	8	2,800
BLM Wilderness	14	11,600
National Conservation Areas	2	100
Wilderness Study Areas	1	200
National Scenic and Historic Trails	3	4,700
National Monuments	4	6,400
NPS Land (includes National Parks, Wilderness, National Monuments, and NRAs)	4	400
Byways	2	40

Source: BLM 2011a, 2011b
*Acres may overlap one another if sensitive receptor is within five miles of another.
The sum of the acres in this table is greater than the total acres of sensitive receptors within five miles of REDA on BLM lands.

One percent or less of each of the special designation areas listed in Table 4-25 would be within five miles of the proposed REDA on BLM-administered land. The viewsheds of these special areas have the potential to be impacted by solar and wind energy development, as described under Impacts Common to all Alternatives.

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

The nature and type of impact on visual resources would be the same as those described under Impacts Common to All Action Alternatives. Under Alternative 6, approximately 25,900 acres of scenic quality B-ranked lands in the foreground/middleground distance zone overlap REDA, which accounts for 11 percent of REDA lands under this alternative (BLM 2011a, 2011b).

Table 4-26, Number and Acres of Sensitive Receptors within Five Miles of the REDA, Alternative 6, shows the number of sensitive receptors and associated acreages within five miles of the proposed REDA on BLM-administered land.

Table 4-26
Number and Acres of Sensitive Receptors within Five Miles of the REDA, Alternative 6

Sensitive Receptor	Number of Areas	Acres
ACECs	18	37,300
BLM Wilderness	25	52,000
National Conservation Areas	2	100
Wilderness Study Areas	1	800
National Scenic and Historic Trails	3	21,800
National Monuments	4	31,200
NPS Land (includes National Parks, Wilderness, National Monuments, and NRAs)	4	10,800
Byways	2	40

Source: BLM 2011a, 2011b
*Acres may overlap one another if sensitive receptor is within five miles of another. The sum of the acres in this table is greater than the total acres of sensitive receptors within five miles of REDA on BLM lands.

Five percent or less of each of the special designation areas listed in **Table 4-26** would be within five miles of the proposed REDA on BLM-administered land. The viewsheds of these special areas have the potential to be impacted by solar and wind energy development, as described under Impacts Common to all Alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts would be the same as those discussed for Alternative 2.

4.2.23 Water Resources

Evaluation Methodology, Resource Indicators, and Assumptions

This section discusses potential impacts on water resources from the proposed allocation decisions, management actions, design features, and BMPs in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable

Development Scenario, and **Appendix B**, Design Features and Best Management Practices.

The methods to determine potential impacts on water resources included a review of relevant GIS data for the planning area. The GIS data were overlain with the actions found under each alternative, and conclusions were drawn based on an understanding that these types of actions may affect known surface and groundwater resources (**Section 3.23**, Water Resources). Impacts on water resources are evaluated only from the perspective of changes to water availability and quality. Impacts from the perspective of other values (e.g., impacts of water quality on livestock) are discussed in sections for the other resources. Effects are quantified where possible; in the absence of quantitative data, best professional judgment was used.

The following GIS data were used to conduct the analysis:

- National hydrography dataset;
- National Wetland Inventory;
- Groundwater basins;
- Active Management Areas;
- Irrigation Non-expansion Areas;
- BLM priority watersheds;
- EPA sole source aquifers; and
- Federal Emergency Management Act 100-year floodplains.

Potential impacts on water resources could occur if anticipated actions consistent with implementing the alternatives described in Chapter 2 were to:

- Alter surface water drainage patterns, which could result in increased sediment and turbidity in surface water drainages where renewable energy developments would be constructed;
- Release pollutants other than sediment into the environment during construction, operation, and maintenance of proposed facilities;
- Deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level;
- Result in flash flooding effects on proposed facilities;
- Create potential water pollution from leaks and spills of chemicals;
- Change ground cover that could decrease infiltration or increase surface runoff;

- Use facilities that would degrade surface or groundwater quality; or
- Concentrate and divert surface waters (such as dams, pipelines, or ditches, or those for other beneficial uses).

Water quality and quantity is also relevant to other resources. Biological resources, cultural resources, and recreation may be impacted by changes to water quantity and quality. While the development of renewable energy resources would be intricately linked with groundwater and surface water rights, those rights are specific to individual locations, aquifers, landowners, and local jurisdictions.

This analysis assumes the following:

- Land disturbance associated with construction activities varies between solar and wind energy technologies. Solar energy technologies would disturb 100 percent of the lands associated with solar projects. Wind energy projects typically disturb 10 percent of acres per GW of capacity; and
- Water use associated with siting/design, construction, operations, and decommissioning would vary between solar energy and wind energy technologies.

Impacts Common to All Alternatives

During the project siting and design phase of renewable energy development, water use would be negligible because activities would be limited to planning actions that would occur in an office environment.

During construction, water is needed primarily for fugitive dust control and for the workforce potable water supply. Water requirements for dust suppression would vary depending on the scale of the project. Water use related to dust suppression during construction activities would be estimated by applicants on a site-specific basis using the formulas and tables in the Draft Solar PEIS Sections 8.1.9 through 8.3.9 and Appendix M (pp. M-14 to M-16) (BLM and DOE 2010).

Solar project development would impact 100 percent of the lands associated with site grading, access road construction and ancillary facilities. Wind energy projects result in little ground disturbance outside of the actual turbine foundations, access roads, and ancillary facilities, which is estimated to be about 10 percent of the acres per GW of capacity.

The availability of groundwater and the impacts of groundwater withdrawal would need to be assessed during the siting/design phase of a renewable energy development project. Groundwater quality would need to be tested to verify that the quality would comply with drinking water standards; if water is not of

drinking water quality, then potable drinking water would be brought to the site.

The grading of renewable energy project sites could impact surface water quality and quantity. Potential impacts on water quality and quantity associated with sedimentation and erosion would be offset through the implementation of BMPs and design features in **Appendix B**.

For solar energy projects, water may be required for mirror/panel washing, workforce potable water supply, and cooling during operations. Water needs for cooling are a function of the energy technology and size of the energy development site. For wind energy projects, only a workforce potable water supply would be needed.

The availability of water rights and the impacts associated with groundwater withdrawals or surface water diversions would need to be assessed during the site characterization phase.

The operational phase of solar and wind energy projects involves inspections and maintenance activities. These activities include driving in vehicles, welding, painting, and lubricating, and could result in spills of petroleum, oils, and lubricants. Potential impacts on water quality associated with spills would be offset through the implementation of design features and BMPs in **Appendix B**.

During decommissioning and abandonment, all surface structures associated with the solar and wind projects would be dismantled and reclaimed to their pre-construction state. Activities and water needs during this phase would be similar to those during the construction phase with the addition of possible water needs for reestablishing vegetation in some areas. The total volume of water needed for decommissioning and reclamation is expected to be less than for the construction phase since this phase takes less time.

During the decommissioning and abandonment phase of solar and wind energy projects to support sustainable reuse of the developed lands, the BLM could opt to retain the construction conditions on the site in order to reuse the location for another purpose. Disturbed soils could impact downstream water quality. The implementation of a storm water pollution prevention plan would offset potential impacts on water resources and quality.

The decommissioning and reclamation phase of solar and wind energy projects involves the use of heavy construction equipment and personnel vehicles. These activities could result in spills of petroleum, oils, and lubricants. Potential impacts on water quality associated with spills would be offset through the implementation of design features and BMPs in **Appendix B**.

The specific impacts of solar and wind energy facilities development would depend on project location, technology and scale employed, development size,

and proximity to existing roads and transmission lines. On the basis of the assumptions given in the RFDS report (**Appendix A**, Reasonably Foreseeable Development Scenario for Renewable Energy in Arizona), land disturbance for solar facilities would be about 8 acres per MW, while land disturbance for wind facilities would be about 10 percent of the acres per GW capacity. However, due to the uncertainty of specific solar and wind development that would occur as a result of identifying lands within the REDA as available for solar and wind energy, it is not possible to quantify the total acreage affected on lands within the planning area, other than to identify the acreage of land that could be affected by maximum build-out. Implementation-level actions (development of specific solar and wind facilities) would be subject to further environmental review and would include quantifying the total acreage affected by site-specific development.

Impacts from the No Action Alternative

Under the No Action Alternative, renewable energy applications would continue to be processed on a case-by-case basis and would not include the required design features and BMPs noted in **Appendix B**. Without the REDA and the proposed SEZ being identified, applications are likely to occur on areas with sensitive water resources, and impacts similar to those noted above are likely to occur on surface and groundwater resources. Water would be used for each phase of development, as described in Impacts Common to All Alternatives; however, the volume of such water use is unknown because it is unknown whether the RFDS would be achieved in Arizona without the identification of areas of low resource sensitivity. As no comprehensive list of design features and BMPs would be distributed to BLM districts, there would be no consistent guidance for future renewable energy development.

Risks of contamination during all phases of development would be as described in Impacts Common to All Alternatives. Potential impacts on water quality associated with spills would be offset through the implementation of design features and BMPs identified in **Appendix B** on a case-by-case basis.

Impacts from Alternative 1

Impacts from Maximum REDA

While there would be no direct impacts from Alternative 1, indirect impacts associated with its implementation (i.e., project development) on water resources of the type noted in Impacts Common to All Alternatives could occur due to land disturbance and water use requirements associated with the possible future renewable energy development phases (construction, operations, decommissioning). These potential impacts would be reduced or avoided by applying the required design features and BMPs in **Appendix B**. Additionally, should future projects be proposed within the REDA, the site-specific analysis required for the project could suggest additional mitigation and protection measures that would be included in the ROW grant.

Specific to water resources, Alternative 1 was developed to guide renewable energy developers to areas where there are fewer resource conflicts (see **Section 2.2**, Alternative Development Process, and **Figure 2-1**, Proposed Agua Caliente SEZ), including eliminating surface waters, wetlands, streams, and floodplains from consideration as REDA. As a result, this alternative would have negligible impacts on surface water resources.

Alternative 1 has a suite of generalized design features and BMPs listed in **Appendix B** that would establish the minimum specifications for management of individual renewable energy projects and mitigate adverse impacts on water resources. However, these design features do not specify how much additional mitigation may be required. These design features would not restrict or indicate a preference for one type of technology over another. In general, implementing the management actions, design features, and BMPs in **Section 2.3.2**, Elements Common to All Action Alternatives, and **Appendix B**, Design Features and Best Management Practices, would mitigate impacts on water resources, but would not provide specific measures to protect designated areas including , INAs, BLM priority watersheds, or EPA sole source aquifers.

Any proposed groundwater-supply extraction wells, including proposed wells in AMAs, INAs, BLM priority watersheds, and sole source aquifers would be subject to review and approval by the ADWR. The sole source aquifer program allows for EPA environmental review of any project that is financially assisted by federal grants or federal loan guarantees. **Table 4-27** identifies the Maximum REDA acreages of BLM-administered Lands by Designated Water Resource Area for Alternative 1.

Table 4-27
Alternative 1: Maximum REDA – BLM-administered Land Acres by Designated Water Resource Area

Location	Active Management Areas	Irrigation Non-expansion Areas	BLM Priority Watersheds	EPA Sole Source Aquifers
REDA	29,600	0	34,000	0
SEZ	0	0	0	0

Source: BLM 2011a, 2011b

Impacts from Proposed Agua Caliente Solar Energy Zone

The proposed Aqua Caliente SEZ is 20,600 acres. Aerial photographs and GIS data show approximately 300 acres of surface waters consisting of ephemeral washes in the SEZ. As noted in **Chapter 3**, Affected Environment, data on the Lower Gila Basin suggest there could be issues related to recharge and groundwater levels in the SEZ. Water resources in the proposed SEZ would be impacted by construction, operations, and reclamation activities as described in

Impacts Common to All Alternatives. Implementing the management actions, design features, and BMPs in **Section 2.3.2**, Elements Common to All Action Alternatives, and **Appendix B**, Design Features and Best Management Practices, would effectively avoid or reduce impacts on water resources within the proposed SEZ, but would not provide specific measures to protect water resources found in the proposed SEZ.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

Indirect impacts associated with Alternative 2 would be the same as those described in Impacts Common to All Alternatives and Alternative 1 for surface and groundwater; however, there are 29,000 less acres of designated areas (BLM priority watersheds) under this alternative, as shown in **Table 4-28**, Alternative 2: Transmission REDA—BLM-administered Land Acres by Designated Water Resource Area. Alternative 2 has the same amount of AMAs, INAs, and sole source aquifers as Alternative 1.

Table 4-28
Alternative 2: Transmission REDA—BLM-administered Land Acres by Designated Water Resource Area

Location	Active Management Areas	Irrigation Non-expansion Areas	BLM Priority Watersheds	EPA Sole Source Aquifers
REDA	29,600	0	6,100	0
SEZ	0	0	0	0

Source: BLM 2011a, 2011b

Any proposed groundwater-supply extraction wells, including proposed wells in AMAs, INAs, BLM priority watersheds, and sole source aquifers, would be subject to review and approval by the ADWR. The sole source aquifer program allows for EPA environmental review of any project that is financially assisted by federal grants or federal loan guarantees.

Alternative 2 has the same suite of generalized design features and BMPs listed in **Appendix B** as Alternative 1, which would establish the minimum specifications for management of individual renewable energy projects and would mitigate adverse impacts on water resources. The nature and types of impacts from these measures would be the same as those described under Alternative 1.

Impacts from Proposed Agua Caliente Solar Energy Zone

The proposed Aqua Caliente SEZ is 6,770 acres. Aerial photographs and GIS data identify approximately 30 acres of surface waters consisting of ephemeral washes. As noted in **Chapter 3**, Affected Environment, data on the Lower Gila

Basin suggest there could be issues related to recharge and groundwater levels in the SEZ. Impacts would be similar to those described in Impacts Common to All Alternatives and Alternative 1. Implementing the management actions, design features, and BMPs in **Section 2.3.2**, Elements Common to All Action Alternatives, and **Appendix B**, Design Features and Best Management Practices, would effectively avoid or reduce impacts on water resources within the proposed SEZ, but would not provide specific measures to protect water resources found in the proposed SEZ.

Impacts from Alternative 3

Impacts from Load Offset REDA

Indirect impacts from Alternative 3 would be the same as those described in Impacts Common to All Alternatives and Alternative 1 for surface and groundwater; however, there are 30,200 acres less of BLM priority watersheds, and 900 acres less of AMAs under this alternative, as shown in **Table 4-29**, Alternative 3: Load Offset REDA—BLM-administered Land Acres by Designated Water Resource Area.

Table 4-29
Alternative 3: Load Offset REDA—BLM-administered Land Acres by Designated Water Resource Area

Location	Active Management Areas	Irrigation Non-expansion Areas	BLM Priority Watersheds	EPA Sole Source Aquifers
REDA	28,700	0	3,800	0
SEZ	0	0	0	0

Source: BLM 2011a, 2011b

Alternative 3 has the same suite of generalized design features and BMPs listed in **Appendix B** as Alternative 1, which would establish the minimum specifications for management of individual renewable energy projects and would mitigate adverse impacts on water resources. The nature and types of impacts from these measures would be the same as those described under Alternative 1.

Any proposed groundwater-supply extraction wells, including proposed wells in AMAs, INAs, BLM priority watersheds, and sole source aquifers would be subject to review and approval by the ADWR. The sole source aquifer program allows for EPA environmental review of any project that is financially assisted by federal grants or federal loan guarantees.

Impacts from Proposed Agua Caliente Solar Energy Zone

The proposed Aqua Caliente SEZ is 2,760 acres. Aerial photographs and GIS data identify approximately 20 acres of surface waters consisting of ephemeral

washes. As noted in **Chapter 3**, Affected Environment, data on the Lower Gila Basin suggest there could be issues related to recharge and groundwater levels in the SEZ. Impacts would be similar to those described in Impacts Common to All Alternatives and Alternative 1. Implementing the management actions, design features, and BMPs in **Section 2.3.2**, Elements Common to All Action Alternatives, and **Appendix B**, Design Features and Best Management Practices, in the proposed SEZ would effectively avoid or reduce impacts on water resources, but would not provide specific measures to protect water resources found in the proposed SEZ.

Impacts from Alternative 4

Impacts from Water Conservation and Protection REDA

Indirect impacts associated with implementation of decisions in Alternative 4 would be the same as those noted in Impacts Common to All Alternatives and Alternative 1 for surface and groundwater; however, there are 100 acres less designated areas (BLM priority watersheds) under this alternative, as shown in **Table 4-30**, Alternative 4: Water Conservation and Protection REDA—BLM-administered Land Acres by Designated Water Resource Area.

Table 4-30
Alternative 4: Water Conservation and Protection REDA—BLM-administered Land Acres by Designated Water Resource Area

Location	Active Management Areas	Irrigation Non-expansion Areas	BLM Priority Watersheds	EPA Sole Source Aquifers
REDA	29,600	0	33,900	0
SEZ	0	0	0	0

Source: BLM 2011a, 2011b

Alternative 4 has the same suite of generalized design features and BMPs listed in **Appendix B** as Alternative 1, which would establish the minimum specifications for management of individual renewable energy projects and would mitigate adverse impacts on water resources. The nature and types of impacts from these measures would be the same as those described under Alternative 1. In addition, Alternative 4 includes additional water resource protection design features that identify additional protections in Water Resource Protection Zones 2 and 3, as shown in **Table 4-31**, Alternative 4: Water Conservation and Protection REDA—BLM-administered Land Acres in Each Water Protection Zone.

Any proposed groundwater-supply extraction wells, including proposed wells in AMAs, INAs, BLM priority watersheds, and sole source aquifers would be subject to review and approval by the ADWR. The sole source aquifer program

allows for EPA environmental review of any project that is financially assisted by federal grants or federal loan guarantees.

Table 4-31
Alternative 4: Water Conservation and Protection REDA—BLM-administered Land Acres in Each Water Protection Zone

Water Protection Zone	Acres
1	0
2	30,200
3	33,300

Source: BLM 2011a, 2011b

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts would be similar to those described in Impacts Common to All Alternatives and Alternative 1. Implementing the management actions, design features, and BMPs in **Section 2.3.2**, Elements Common to All Action Alternatives, and **Appendix B**, Design Features and Best Management Practices, as well as the additional water resource design features for Water Protection Zone 2, in the proposed SEZ would effectively avoid or reduce impacts on water resources.

Impacts from Alternative 5
Impacts from Land Tenure REDA
Indirect impacts associated with Alternative 5 would be the same as those described in Impacts Common to All Alternatives and Alternative 1 for surface and groundwater. However, there are 27,300 less acres of AMAs and 33,900 less acres of BLM priority watersheds under this alternative, as shown in **Table 4-32**, Alternative 5: Land Tenure REDA—BLM-administered Lands Acres by Designated Water Resource Area.

Table 4-32
Alternative 5: Land Tenure REDA—BLM-administered Land Acres by Designated Water Resource Area

Location	Active Management Areas	Irrigation Non-expansion Areas	BLM Priority Watersheds	EPA Sole Source Aquifers
REDA	2,300	0	100	0
SEZ	0	0	0	0

Source: BLM 2011a, 2011b

Alternative 5 includes the same suite of generalized design features and BMPs listed in **Appendix B** as Alternative 1, which would establish the minimum specifications for management of individual renewable energy projects and

would mitigate adverse impacts on water resources. The nature and types of impacts from these measures would be the same as those described under Alternative 1.

Any proposed groundwater-supply extraction wells, including proposed wells in AMAs, INAs, BLM priority watersheds, and sole source aquifers, would be subject to review and approval by the ADWR. The sole source aquifer program allows for EPA environmental review of any project that is financially assisted by federal grants or federal loan guarantees.

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

Indirect impacts associated with Alternative 6 would be the same as those discussed in Impacts Common to All Alternatives and in Alternatives 1 and 4 for surface and groundwater. However, there are 27,800 less acres of designated areas (BLM priority watersheds) associated with Alternative 6, as shown in **Table 4-33**, Alternative 6: Collaborative-based REDA—BLM-administered Lands Acres by Designated Water Resource Area.

Table 4-33
Alternative 6: Collaborative-based REDA—BLM-administered Land Acres by Designated Water Resource Area

Location	Active Management Areas	Irrigation Non-expansion Areas	BLM Priority Watersheds	EPA Sole Source Aquifers
REDA	29,600	0	6,200	0
SEZ	0	0	0	0

Source: BLM 2011a, 2011b

The proposed mitigation measures are the same as those described in Alternative 4. These identify additional protections in Water Resource Protection Zones 2 and 3, as shown in **Table 4-34**, Alternative 6: Collaborative-based REDA—BLM-administered Land Acres in Each Water Protection Zone.

Any proposed groundwater-supply extraction wells, including proposed wells in AMAs, INAs, BLM priority watersheds, and sole source aquifers, would be subject to review and approval by the ADWR. The sole source aquifer program allows for EPA environmental review of any project that is financially assisted by federal grants or federal loan guarantees.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts and proposed mitigation measures would be the same as those described in Alternative 4.

Table 4-34
Alternative 6: Collaborative-based REDA—BLM-administered Land Acres in Each Water Protection Zone

Water Protection Zone	Acres
1	0
2	2,400
3	33,400

Source: BLM 2011a, 2011b

4.2.24 Wild Horses and Burros

Evaluation Methodology, Resource Indicators, and Assumptions

This analysis addresses potential impacts on wild horses and burros from implementing the management actions under the alternatives described in **Chapter 2**, Description of Alternatives and the Reasonably Foreseeable Development Scenario. Existing conditions concerning wild horses and burros are described in **Section 3.24**, Wild Horses and Burros. This analysis focuses on solar and wind energy development that has the potential for disturbance of wild horses and burros or alterations to HMAs, either by reducing the area available for HMAs or changing the availability of forage, water, or other critical habitat components in HMAs. It should be noted that HMAs are composed of public and private lands, and negotiations with private landowners allow for federally supervised protection of wild horses on private lands. In order to analyze the potential for impacts of development on lands adjacent to HMAs, acres of HMAs on private and BLM-administered lands within a 5-mile buffer of the REDA were identified.

Site-specific impacts would be influenced by location, magnitude, technology, type of development, and soil and vegetation conditions of developed sites.

The following indicators/significance criteria were used to determine impacts in the analysis:

- Levels of changes in available forage and water; and
- Levels of changes in permitted appropriate management level (the maximum number of animals sustainable on a yearlong basis).

The following assumptions were made:

- The wild horse and burro population would continue to increase in the absence of active management.

- Wild horse and burro herds would be managed within the appropriate management level range through gathers and the selected application of additional population control practices.
- Management actions on HAs would not impact wild horses and burros, as BLM does not manage HAs for wild horses and burros.

Impacts Common to All Alternatives

Wild horses and burros would be impacted by renewable energy development. The degree of impact would depend on the location of the development relative to wild horse and burro populations. Potential impacts include but are not limited to the following:

- Direct displacement from area of development.
- Reduction of available forage due to loss of acres available for use in HMAs. This reduction in forage may necessitate a reduction in appropriate management levels in HMAs to match forage availability on the remaining portion(s) of HMAs.
- Disturbance due to construction noise and, to a lesser extent, operations noise from some technologies, including wind farms.
- Habitat fragmentation and blockage of movement, primarily associated with fencing of utility-scale solar farms. Once constructed, wind farms and transmission line facilities would not prevent use of the land by horses or burros other than in the areas physically occupied by the facilities such as the support towers and substations. However, wild horses and burros could be subject to disturbance or harassment.
- Potential for vehicular collisions due to additional roads and increased traffic near facilities.
- Disturbance from human activity during construction and plant operations and maintenance. This impact would generally be greatest for utility-scale solar development due to the larger acreage impacted, and may be lesser in scale for community-scale solar or wind, for which some use of wind farms by horse and burros may be compatible during operation. Human disturbance would have secondary impacts, including the increased potential for wildfire and spread of noxious weeds.

Impacts from the No Action Alternative

Under the No Action Alternative, solar and wind development applications would continue to be processed on a case-by-case basis. Areas excluded from solar and wind development by statute, regulation, or proclamation would remain excluded, and administratively excluded areas would be assessed based on management in local land use plans. Impacts on wild horses and burros would be assessed on a project-specific level. In the absence of identifying the

REDA, solar and wind project development would likely result in patchy, fragmented development with an increased likelihood of fragmentation of wild horse or burro ranges. In addition, no standard set of design features or BMPs would be developed for protection of wild horses and burros.

Impacts from Alternative 1

Impacts from Maximum REDA

All HMAs have been eliminated from the REDA; therefore, impacts on wild horse and burros would be negligible. There is limited potential for impacts to occur should development occur in a REDA adjacent to a HMA. Under Alternative 1, approximately 64,400 acres of HMAs on BLM-administered lands are within five miles of the REDA. In particular, actions that reduced available water in the surrounding area may impact wild horse and burro herds. Water is a limited resource throughout much of the planning area and may partially dictate the capacity of a habitat to support wild horses and burros.

Impacts from Proposed Agua Caliente Solar Energy Zone

The proposed SEZ would have negligible impacts on wild horses and burros as it is not within or adjacent to any HMAs.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

The nature and types of impacts would be the same as those described for Alternative 1. However, under this alternative, approximately 43,400 acres of HMAs on BLM-administered lands are within 5 miles of the REDA; therefore, the scale of impacts would be reduced.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts would be the same as described for Alternative 1.

Impacts from Alternative 3

Impacts from Load Offset REDA

The nature and types of impacts would be the same as those described for Alternative 1. Under this alternative, approximately 2,600 acres of HMAs on BLM-administered lands are within 5 miles of the REDA; therefore, the scale of impacts would be reduced.

Impacts from Proposed Agua Caliente Solar Energy Zone

Impacts would be the same as described for Alternative 1.

Impacts from Alternative 4

Impacts from Water Conservation and Protection REDA

The nature and type and of impacts would be similar to those described for Alternative 1. Design features that limit the withdrawal of groundwater under this alternative, however, may reduce the potential for impacts on water availability for wild horses and burros in HMAs adjacent to the REDA. Total acres of HMAs within five miles of the REDA are the same as Alternative 1.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts would be the same as described for Alternative 1.

Impacts from Alternative 5
Impacts from Land Tenure REDA
The nature and type and of impacts would be the same as those described for Alternative 1. Under this alternative, approximately 8,300 acres of HMAs on BLM-administered lands are within 5 miles of the REDA; therefore, the scale of impacts would be reduced.

Impacts from Alternative 6
Impacts from Collaborative-Based REDA
The nature and type of impacts would be similar in nature to those described in Alternative 1. As in Alternative 4, however, design features that limit the withdrawal of groundwater under may reduce the potential for impacts on water availability for wild horses and burros in HMAs adjacent to the REDA. Total acres of HMAs within five miles of the REDA are the same as in Alternative 2.

Impacts from Proposed Agua Caliente Solar Energy Zone
Impacts would be the same as described for Alternative 1.

4.2.25 Wilderness Characteristics

Evaluation Methodology, Resource Indicators, and Assumptions
Impacts on lands with wilderness characteristics were assessed by considering the potential for degradation of wilderness characteristics to a level at which the characteristic would no longer be present within the specific area. The primary concern regarding impacts on wilderness characteristics is the loss of opportunities for solitude, naturalness, and primitive and unconfined recreation, to the point where the area no longer has wilderness characteristics. There would be no direct impacts from the identification of a REDA. Indirect impacts on wilderness characteristics would result from implementing the planning decisions and possible future ground-disturbing activities associated with construction of renewable energy facilities, as well as from proximity to such activities.

While permitting solar and wind energy development on lands with wilderness characteristics managed for other uses would be in compliance with RMP decisions, such development would impact wilderness characteristics and, as such, are included in this discussion.

Impacts Common to All Alternatives
Lands with wilderness characteristics may be impacted by solar and wind energy development on BLM-administered lands adjacent to or within the viewshed of the areas. These impacts could include effects on opportunities for solitude, naturalness, and scenic values.

The most significant impacts on lands with wilderness characteristics are likely to occur during the construction, operation and maintenance, and reclamation/abandonment stages of the project. The siting/design phase is likely to have a negligible impact.

The construction or upgrading of roads may be necessary to transport workers to the site. This would result in an increase in traffic and associated dust from vehicles, which could impact wilderness characteristics if located in the viewshed of areas with wilderness characteristics. Trenching to bury cables and equipment used in construction may create noise that would limit an experience of solitude and may be visible from areas with wilderness characteristics. During operation and maintenance, plumes of steam or dust may be visible as well. Additionally, the presence of workers during the construction, operation, and reclamation phases of the project would likely contribute to increased vehicle presence around the site, impacting the solitude and naturalness of the area.

These impacts could limit the wilderness characteristics of a parcel of land through proximity and increased evidence of human activity. Other possible effects on wilderness characteristics would be light pollution and impacts on the viewing experience, if any portion of the site and its associated effects is within the viewshed of an area with wilderness characteristics. Light pollution and the portion of site in the viewshed could vary based on the type of solar technology used. For example, a CSP system might be more visible (i.e., power tower systems) from an area with wilderness characteristics and might produce more glare than a PV system.

Impacts from the No Action Alternative

Under the No Action Alternative, solar and wind energy development would continue to be authorized through the lands and realty program via a ROW grant. Because solar and wind energy development would diminish wilderness characteristics, it is assumed that such actions would not be permitted on lands managed to maintain these characteristics. As such, wilderness characteristics of these lands would be provided some direct protection from impacts associated with solar and wind energy development.

On lands with wilderness characteristics but not managed to maintain these characteristics, solar or wind development could occur unless the proposed project site has been identified as a ROW exclusion area (based upon the presence of some other sensitive resources). ROW exclusion areas would protect lands with wilderness characteristics by prohibiting all new ROW authorizations, including solar and wind energy development. Outside of ROW exclusion areas, if solar or wind energy development were to occur on lands with wilderness characteristics not managed to maintain these characteristics, the nature and type of impact would be the same as described under Impacts Common to All Alternatives.

For all lands with wilderness characteristics, potential impacts from solar and wind development adjacent to or within the viewshed of the lands with wilderness characteristics would be the same as those described under Impacts Common to All Alternatives. The magnitude of impact would vary by field office and would depend upon RMP decisions, including ROW allocations (e.g., exclusion and avoidance), VRM class, and existing land uses.

Impacts from Alternative 1

Impacts from Maximum REDA

All lands with wilderness characteristics have been identified as 'Areas with Known Sensitive Resources' (Chapter 2, **Table 2-1**, Areas with Known Sensitive Resources [Eliminated from REDA Consideration]). As such, these lands have been eliminated from consideration as a REDA. Therefore, negligible direct impacts on wilderness characteristics are anticipated. However, wilderness characteristics may experience indirect impacts from solar and wind energy development on BLM-administered lands adjacent to or within the viewshed of the eliminated areas similar to those described in Impacts Common to All Alternatives.

The analysis also considered lands with wilderness characteristics within five miles of the REDA. Under Alternative 1, 2,300 acres of lands managed to maintain wilderness characteristics are within five miles of the REDA and could be indirectly impacted by solar and wind energy development as described under Impacts Common to All Alternatives. Similarly, 79,700 acres of lands with wilderness characteristics but not managed to maintain these characteristics under the applicable RMP are within five miles of the REDA and could also be indirectly impacted as described under Impacts Common to All Alternatives.

Implementing the management actions, design features, and BMPs noted in **Section 2.3.2**, Elements Common to All Action Alternatives, and **Appendix B**, Design Features and Best Management Practices, are anticipated to reduce impacts on lands with wilderness characteristics.

Impacts from Proposed Agua Caliente Solar Energy Zone

Under Alternative 1, the lands with wilderness characteristics currently managed to maintain these characteristics would continue to be managed to maintain these characteristics (BLM 2010g).

A total of 9,660 acres of land with wilderness characteristics were identified within the proposed Agua Caliente SEZ, none of which are being managed to maintain these characteristics. As discussed under Impacts Common to All Alternatives, impacts from solar development on these lands would diminish the naturalness of the area as well as opportunities for solitude and primitive or unconfined recreation to the degree that these characteristics may cease to exist in the area, resulting in a reduction in total acres of lands with wilderness characteristics. However, the 210 acres that best contained the required

opportunities for solitude, naturalness, and primitive and unconfined recreation would continue to be managed to maintain wilderness characteristics.

Implementing the management actions, design features, and BMPs noted in **Section 2.3.2**, Elements Common to All Action Alternatives, and **Appendix B**, Design Features and Best Management Practices, are anticipated to reduce impacts on lands with wilderness characteristics.

Impacts from Alternative 2

Impacts from Transmission Line and Utility Corridor REDA

Under Alternative 2, 2,300 acres of lands managed to maintain wilderness characteristics are within five miles of the REDA and could be indirectly impacted as described under Impacts Common to All Alternatives. Similarly, 49,400 acres of lands with wilderness characteristics but not managed to maintain these characteristics are within five miles of the REDA and could be indirectly impacted as described under Impacts Common to All Alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone

Under Alternative 2, 1,700 acres of land with wilderness characteristics but not managed to maintain wilderness characteristics would be within the proposed Agua Caliente SEZ. As discussed under Impacts Common to All Alternatives, impacts from solar development on these lands would diminish the naturalness of the area as well as opportunities for solitude and primitive or unconfined recreation to the degree that these characteristics may cease to exist in the area, resulting in a reduction in total acres of lands with wilderness characteristics.

Impacts from Alternative 3

Impacts from Load Offset REDA

Under Alternative 3, 2,300 acres of lands managed to maintain wilderness characteristics are within five miles of the REDA and could be indirectly impacted as described under Impacts Common to All Alternatives. Similarly, 44,600 acres of lands with wilderness characteristics but not managed to maintain these characteristics are within five miles of the REDA and could be indirectly impacted as described under Impacts Common to All Alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone

Under Alternative 3, 370 acres of land with wilderness characteristics but not managed to maintain wilderness characteristics would be within the proposed SEZ. As discussed under Impacts Common to All Alternatives, impacts from solar development on these lands would diminish the naturalness of the area as well as opportunities for solitude and primitive or unconfined recreation to the degree that these characteristics may cease to exist in the area, resulting in a reduction in total acres of lands with wilderness characteristics.

Impacts from Alternative 4

Impacts from Water Conservation and Protection REDA

Impacts would be the same as those described under Alternative 1.

Impacts from Proposed Agua Caliente Solar Energy Zone

The proposed Agua Caliente SEZ analysis area is the same as described in Alternative 1. As such, impacts would be the same as those described under Alternative 1.

Impacts from Alternative 5

Impacts from Land Tenure REDA

Under Alternative 5, 1,100 acres of lands managed to maintain wilderness characteristics are within five miles of the REDA and could be indirectly impacted as described under Impacts Common to All Alternatives. Similarly, 3,400 acres of lands with wilderness characteristics but not managed to maintain these characteristics are within five miles of the REDA and could be indirectly impacted as described under Impacts Common to All Alternatives.

Impacts from Alternative 6

Impacts from Collaborative-Based REDA

Under Alternative 6, 2,300 acres of lands managed to maintain wilderness characteristics are within five miles of the REDA and could be indirectly impacted as described under Impacts Common to All Alternatives. Similarly, 61,500 acres of lands with wilderness characteristics but not managed to maintain these characteristics are within five miles of the REDA and could be indirectly impacted as described under Impacts Common to All Alternatives.

Impacts from Proposed Agua Caliente Solar Energy Zone

The proposed Agua Caliente SEZ analysis area is the same as described in Alternative 2. As such, impacts would be the same as those described under Alternative 2.

4.3 ADDITIONAL MITIGATION MEASURES, UNAVOIDABLE ADVERSE IMPACTS, IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES, AND RELATIONSHIP OF SHORT-TERM USES OF THE ENVIRONMENT TO LONG-TERM PRODUCTIVITY

This section includes a summary table of the additional mitigation measures noted in individual sections of the impact analysis and describes the unavoidable adverse environmental impacts, irreversible and irretrievable commitments of resources, and the relationship between short-term uses of the environment and long-term productivity as required in 40 CFR 1502.16.

4.3.1 Additional Mitigation Measures

Table 4-35, Additional Mitigation Measures, includes a summary of the additional mitigation measures noted in individual sections of the impact analysis.

Table 4-35
Additional Mitigation Measures

Resource	Additional Mitigation Measures
Land Use and Realty	Consolidation of access and other supporting infrastructure should be required for single projects and for cases in which there is more than one project in close proximity to another to maximize the efficient use of public land.
	Coordination with federal, state, and county agencies; tribes; property owners; and other stakeholders should be accomplished as early as possible in the planning process to identify potentially significant land use conflicts and issues and state and local rules that govern solar energy development. Significant issues that are raised, and potential modifications to proposed projects to eliminate or mitigate these issues, should be considered in the environmental analysis of a project application.
	Where there are existing BLM ROW authorizations within development areas, pursuant to Title 43, Part 2807.14 of the CFR (43 CFR 2807.14), the BLM would notify ROW holders that an application that might affect their existing ROW has been filed and would request their comments. Early discussion with existing ROW holders should occur to ensure their rights are protected and any issues are resolved.
Paleontology	If avoidance is chosen as the preferred mitigation measure, projects should be located, designed, or modified to avoid impacts on significant resources.
	Use of management practices such as training/education programs to reduce the amount of inadvertent destruction to paleontological sites could reduce the occurrences of human-related disturbances to nearby sites. The specifics of these management practices would be established in project-specific coordination between the project developer and the managing agency.

4.3.2 Unavoidable Adverse Impacts

Unavoidable adverse environmental impacts are impacts that would occur after implementation of all feasible mitigation measures. The environmental impacts of the proposed project are described in this chapter, while cumulative impacts are described in **Chapter 5**, Cumulative Impacts. The analysis has identified impacts that are unavoidable adverse environmental impacts, as summarized below in **Table 4-36**, Unavoidable Adverse Impacts. These impacts, while adverse, are not considered substantial after implementing environmental protection measures described in **Appendix B**, Design Features and Best Management Practices, and in **Table 4-35**, Additional Mitigation Measures.

Table 4-36
Unavoidable Adverse Impacts

Resource	Unavoidable Adverse Impacts
Air Quality	Unavoidable air quality impacts due to dust generated during site preparation and construction.
Energy and Minerals	Solar and wind energy facilities would be incompatible with most types of mineral production because of the intensive land coverage required.
	Issuance of ROWs establishes a superior right as to other subsequent actions, (i.e., location of mining claims). In areas of high mineral potential, the establishment of solar and wind energy facilities would constrain the exploration for and development of locatable minerals on lands encumbered by these facilities.
	There would be a short-term reduction in available salable minerals within the REDA and/or SEZ; however, additional saleable minerals would be available elsewhere outside the REDA and/or SEZ, mitigating this impact.
Fish and Wildlife	Construction activities, heavy equipment, and vehicle use on site during construction could potentially cause mortality or injury to a variety of wildlife species, especially slower-moving species, small animals, species that have subsurface burrows, or ground- or shrub-nesting birds. Noise from construction could also cause short-term disturbance to wildlife, which may disrupt behavior.
Livestock Grazing	Land developed for renewable energy use, including that occupied by solar panels, wind tower pads, and associated infrastructure, would not be available for livestock grazing.
Noise	There could be unavoidable noise impacts from the use of heavy construction equipment, depending on the scale and location of individual projects.
Recreation	Solar and wind energy development within the REDAs and adjacent important recreation areas could impact experiences by altering physical setting characteristics. Development would most likely impact those users seeking middle- or backcountry experiences in a less-developed setting. The extent of potential impacts would depend on the project's location and extent, timing, technology, and topography between the proposed site and the potentially affected recreation area.
Socioeconomics	Potential for short-term (during construction) and long-term impacts on current land uses and associated impacts on social and economic resources.
Soils	Construction of solar or wind energy development projects would cause the disturbance of soils where facilities are placed. In addition, it would take at least several years to successfully reestablish soil conditions in temporarily impacted areas. Grading, construction, maintenance, and other surface-disturbing activities on sensitive, protective soil surface layers such as biotic crusts and desert pavement, which take very long periods to form, are effectively irretrievable. Increases in erosion due to disturbance of these surfaces will persist for lengthy, unknown periods. Implementation of design criteria and BMPs will reduce erosion in these and other areas, assuming that channel head-cutting or other severe erosion does not become established. The total acres of soil disturbance cannot be determined at this time due to uncertainty in project locations.

Table 4-36 *(continued)*
Unavoidable Adverse Impacts

Resource	Unavoidable Adverse Impacts
Special Status Species	There is limited potential for death or injury to special status species during project construction, operation, and reclamation. Construction of solar or wind energy development projects would cause the permanent removal of native vegetation where facilities are placed, thus eliminating this area as potentially suitable habitat for the life of the project. Project areas disturbed during construction would be unavailable for at least several years as vegetation was reestablished. The total acres of habitat loss cannot be determined at this time.
Vegetation	Construction of solar or wind energy development projects would cause the permanent removal of native vegetation where facilities are placed. In addition, it would take at least several years to successfully reestablish vegetation in temporarily impacted areas. The total acres of vegetation removal cannot be determined at this time.
Visual Resources	Solar and wind development under the action alternatives and under the No Action Alternative would result in unavoidable, long-term adverse impacts, impacts on residents of communities near solar facilities, users of roads passing near solar facilities, and patrons of specially designated areas within the viewshed of solar facilities. The magnitude of these adverse impacts would to some degree depend on a specific project and would be decreased by implementing the programmatic design features required under the action alternatives (e.g., siting facilities away from the most sensitive resources), although the extent to which these impacts could be mitigated cannot be assessed, except at the project level, and it is possible these impacts could not be completely avoided.
Wilderness Characteristics	Sights, sounds, and evidence of nearby human activity resulting from solar and wind energy development are unavoidable and would adversely affect the experience of solitude and naturalness in areas with wilderness characteristics. Some of these impacts can be mitigated through measures such as designing equipment and structures in a manner that mimics the geography of the area, directing vehicles traveling to the solar energy site to follow a path avoiding as much land with wilderness characteristics as possible, and implementing measures to limit light pollution. However, to a large degree many of the signs of human presence, like smoke and dust from the operation of the solar energy plant, are unavoidable impacts.

4.3.3 Irreversible and Irretrievable Commitment of Resources

A resource commitment is considered irreversible when direct and indirect impacts from its use limit future use options. Irreversible commitments apply primarily to nonrenewable resources, such as cultural resources, and also to those resources that are renewable only over long periods of time, such as soil productivity. A resource commitment is considered irretrievable when the use or consumption of the resource is neither renewable nor recoverable for future use. Irretrievable commitment applies to the loss of production, harvest, or natural resources. **Table 4-37**, Irreversible and Irretrievable Commitment of

Resources summarizes the findings. The management actions, design features, BMPs, and additional mitigation measures described above would be implemented to ensure that all natural resources are conserved to the maximum extent practicable.

Table 4-37
Irreversible and Irretrievable Commitment of Resources

Resource	Irreversible and Irretrievable Commitment of Resources
Cultural Resources	Cultural resources are nonrenewable and, once damaged or destroyed, are not recoverable. Therefore, if a cultural resource is damaged or destroyed during solar or wind energy development, this particular cultural location, resource, or object would be irretrievable.
Energy and Minerals	Solar and wind energy development would result in the consumption of salable minerals such as sand and gravel.
Livestock Grazing	Land would be disturbed during construction and during the life of a project and would be unavailable for livestock grazing. Land not needed for operation and maintenance of the facilities would be reclaimed immediately after construction. At the end of the useful life of a proposed project, developed lands could be reclaimed for livestock grazing use as well.
Paleontological Resources	Paleontological resources are nonrenewable and, once damaged or destroyed, cannot be recovered. Therefore, if a paleontological resource (specimen, assemblage, or site) is damaged or destroyed during renewable energy development, this scientific resource would become irretrievable.
Soils	Grading, construction, maintenance, and other surface-disturbing activities on sensitive, protective soil surface layers such as biotic crusts and desert pavement, which take very long periods to form, are effectively irretrievable. Increases in erosion due to disturbance of these surfaces will persist for lengthy, unknown periods. Implementation of design criteria and BMPs will reduce erosion in these and other areas, assuming that channel head-cutting or other severe erosion does not become established.
Special Status Species	Most solar energy development projects would cause the irreversible loss of habitat that would otherwise have been available for wildlife to use. While every effort would be made to recover native vegetation and habitat, full restoration of preexisting conditions is not assured.
Vegetation	Most solar energy development projects would cause the irreversible loss of vegetation that would otherwise have been available for wildlife to use. While every effort would be made to recover native vegetation and habitat, full restoration of preexisting conditions is not assured.
Visual Resources	The introduction of any new manmade line, form, color, or texture into an existing landscape will cause a change, however slight or great, in the existing visual resource inventory conditions (even if the VRM objectives are met), and for the most part, is generally irreversible because few manmade footprints upon the landscape that result from the spread of a growing civilization are ultimately removed completely.

Table 4-37 *(continued)*
Irreversible and Irretrievable Commitment of Resources

Resource	Irreversible and Irretrievable Commitment of Resources
Wilderness Characteristics	The solitude, naturalness, and opportunities for primitive and unconfined recreation of the areas with wilderness characteristics can be retrieved if the project were abandoned and the surrounding area restored. It is possible that through reclamation, areas could return to a state of apparent naturalness, a state appearing natural to the average visitor who is not familiar with the biological composition of natural verses human-affected ecosystems, but would be unable to return to a state of natural integrity, that is, the state of an ecosystem being relatively unaffected by human activities.

4.3.4 Relationship of Short-term Uses of the Environment to Long-term Productivity

This section compares the potential temporary effects of the actions analyzed in this EIS on the environment with the potential effects on its long-term productivity. The BLM must consider the degree to which the proposed action or alternatives would sacrifice a resource value that might benefit the environment in the long term, for some temporary value to a project proponent or the public. **Table 4-38**, Relationship of Short-term Uses of the Environment to Long-term Productivity summarizes the findings.

Environmental protection measures described in the management actions, design features, BMPs, and additional mitigation measures would be employed to reduce disturbances and reclaim or improve vegetation cover, soil, and wildlife habitat on these lands. While the degree of reclamation is unknown, to the extent that disturbances can be reclaimed, other productive use of these lands would not be precluded in the long term.

Table 4-38
Relationship of Short-term Uses of the Environment to Long-term Productivity

Resource	Relationship of Short-term Uses of the Environment to Long-term Productivity
Air Quality	Short-term construction activities would impact air quality, while the long-term productivity of the renewable energy facilities would result in reductions of combustion-related emissions, assuming these facilities offset electricity generated by fossil fuel power plants.
Greenhouse Gases	Short-term construction activities would emit GHGs, while the long-term productivity of the renewable energy facilities would result in reductions of GHG emissions, assuming these facilities offset electricity generated by fossil fuel power plants.
Fish and Wildlife	There may be some loss of existing vegetation, soil, and habitat available for wildlife, but the REDA has been selected to avoid most high quality wildlife habitat, so wind and solar energy development within the REDA would not result in the loss of rare resources. Full recovery of these lands and restoration of any lost habitat or associated wildlife is not assured.

Table 4-38 *(continued)*
Relationship of Short-term Uses of the Environment to Long-term Productivity

Resource	Relationship of Short-term Uses of the Environment to Long-term Productivity
Livestock Grazing	Where undeveloped land is used for facilities, some grazing uses could continue within a project site. A project's use of the environment has very little adverse impact on the maintenance and enhancement of long-term productivity as the development of renewable energy facilities is unlikely to physically preclude livestock grazing if the facility is decommissioned in the future.
Soils	Most renewable energy development projects would cause removal of vegetation and disturbance of soil resources. While every effort would be made to restore soil conditions, full restoration of preexisting conditions is not assured and would take many years. In particular, grading, construction, maintenance, and other surface-disturbing activities on sensitive, protective soil surface layers such as biotic crusts and desert pavement, which take very long periods to form, are effectively irretrievable. Increases in erosion due to disturbance of these surfaces will persist for lengthy, unknown periods. Implementing design criteria and BMPs would reduce erosion in these and other areas, assuming that channel head-cutting or other severe erosion does not become established.
Special Status Species	There would be some loss of habitat under the proposed action, but the REDA has been designed to avoid habitat important to special status species; therefore, the project should not significantly contribute to the population decline in special status species, lead to federal listing of species, or lead to species extinction.
Vegetation	There would be some loss of existing vegetation, but most of the planning area has vegetation cover that is common to the region, so a project would not result in the loss of rare resources.
Wilderness Characteristics	Identifying the proposed Agua Caliente SEZ and developing utility-scale solar energy on lands with wilderness characteristics would result in a loss of those wilderness characteristics.

This page intentionally left blank.