CHAPTER 4.
ENVIRONMENTAL CONSEQUENCES

4 ENVIRONMENTAL CONSEQUENCES

4.1 Introduction

This chapter presents the anticipated environmental consequences of the development actions proposed under each of the alternatives described in Chapter 2. The four alternatives, one sub-alternative, and two options addressed below are analyzed.

The **No Action alternative** forms the baseline against which the potential impacts of the Proposed Action and the other action alternatives are compared. Thus, it includes current actions and activities in the Project Area. Under the No Action alternative, the SSEP would not be developed, and existing land uses (i.e., livestock grazing, dispersed recreation, mining, and utilities) in the Project Area would continue.

The **Proposed Action** would consist of two independent, concentrated solar-powered electricity-generating facilities with nominal net electrical outputs of 125 MW and 250 MW. The Proposed Action would use a wet-cooling tower for power plant cooling.

Alternative A was developed to respond to concerns about consumptive water use by the SSEP that were expressed during public and agency scoping. Under Alternative A, the SSEP would be operated using a dry-cooling technology rather than the wet-cooling technology considered under the Proposed Action.

Sub-alternative A1 was developed in response to agency and public comments on the draft EIS as an alternative to Alternative A for reducing water consumption. Sub-alternative Al would use PV technology instead of solar thermal technology to reduce water use, as well as decrease the project footprint and avoid other sensitive resources raised by the public and agency cooperators. This sub-alternative was originally eliminated from further analysis in the draft EIS due to technological and economic infeasibility. However, advancements in technology and changing market conditions have allowed a reconsideration of PV technology in the final EIS.

Alternative B was developed to respond to issues identified during agency and public scoping, including impacts to wildlife linkages and travel corridors, impacts to residential areas, impacts to xeroriparian vegetation and washes, impacts to water use, and the overall level of surface disturbance resulting from the SSEP. Under Alternative B, the SSEP would consist of two independent, concentrated solar-powered electricity-generating facilities, each with nominal net electrical outputs of 125 MW (for a total of 250 MW), rather than 375 MW considered under the Proposed Action. This alternative would also use a wet-cooling tower for power plant cooling. The reduction of generating capacity would allow a reduced project footprint.

A **Brine Concentrator Option** was developed to further respond to concerns regarding consumptive water use by the SSEP. This optional component could be added to either of the alternatives utilizing a wet-cooling system (i.e., the Proposed Action or Alternative B). A brine concentrator would reduce the volume of wastewater exiting the facility, reduce evaporation pond sizes, and reduce plant water consumption about 7%.

A **Gen-tie Line Option** was developed as an alternate gen-tie line alignment, which could be applied to any of the action alternatives. The Gen-tie Line Option is a different means of routing produced electricity from the SSEP solar field to the Jojoba Switchyard. This option would address alternate methods and locations for crossing existing high-voltage transmission lines located west of the Project Area, as well as an alternate route through existing designated utility corridors that may be subject to future development.

For the analysis, BLM staff used existing data, appropriate scientific methodologies, and professional judgment. The analysis takes into account the applicant-committed measures described in Table 2.2, the applicable RMP stipulations and BMPs in Table 2.1, and the LORSs as described under each resource heading in Chapter 3. This analysis was done using the best-available information, including (but is not limited to) landscape-level data such as Gap Analysis Program (GAP) level vegetation data, Soil Survey Geographic Database soils data, and state agency information on wildlife habitat boundaries. Impacts from actions to be carried out under more than one alternative are discussed under the first applicable alternative. This discussion is then referenced under the other pertinent alternatives.

As discussed in Section 2.5.5.1, it is not possible to predict the conditions and management objectives that would exist at the time of decommissioning. Therefore, for the purposes of this analysis, decommissioning impacts are generally assumed to be the same as those for construction. The consideration of decommissioning impacts at a greater level of detail would be speculative; therefore, they are not considered in the EIS beyond this assumption regarding their similarity to construction impacts.

4.1.1 Types of Impacts to be Addressed

Only those resources and resource uses that would potentially be impacted by any of the alternatives are brought forward for detailed analysis and discussed in Chapter 4. Impacts are defined as modifications to the existing environment brought about by implementing an alternative. Impacts can be beneficial or adverse, result from the action directly or indirectly, and can be long term, short term, temporary, or cumulative in nature.

Direct impacts are attributable to implementation of an alternative that affects a specific resource, and generally occur at the same time and place. Indirect impacts can result from one resource affecting another (e.g., soil erosion and sedimentation affecting water quality) or can occur later in time or removed in location, but can be reasonably expected to occur. Long-term impacts are those that would substantially remain for many years or for the life of the project. Short-term impacts result in changes to the environment that are stabilized or mitigated rapidly and without long-term effects.

The analysis in this chapter provides a quantitative or qualitative comparison (dependant on available data and nature of the impact) between alternative impacts and establishes the severity of those impacts in the context of the existing environment. The discussion of each resource includes sections for specifically required disclosures under NEPA, including the disclosure of residual impacts, irreversible and irretrievable commitment of resources, and the impact of the project's short-term resource use on the long-term productivity of the Project Area. These required disclosures are explained in the sections below.

4.1.1.1 MITIGATION AND RESIDUAL IMPACTS

The mitigation measures identified in Chapter 4 consist of potential additional mitigation not included as applicant-committed measures under any of the alternatives (including measures outside the jurisdiction of the lead or cooperating agency) that could be implemented to address impacts that would result from

the project's implementation. The residual impacts section addresses impacts that cannot be avoided by the application of mitigation measures. This section therefore discloses the effectiveness of proposed mitigation measures for each resource, and helps the decision maker identify those mitigation measures to be included in the record of decision.

4.1.1.2 IRRETRIEVABLE AND IRREVERSIBLE COMMITMENTS OF RESOURCES

Irreversible and irretrievable commitments of resources (in other words, irreversible and irretrievable impacts) are disclosed in this chapter for each resource. Irreversible impacts are those impacts that would result in changes to the environment that cannot be reversed, reclaimed, or repaired. An example of an irreversible impact would be the removal of groundwater from a poorly recharged aquifer. Once groundwater reserves are removed, they cannot be replaced or reclaimed. Irretrievable impacts are those impacts that result in the temporary loss or degradation of the resource value until reclamation is successfully completed.

4.1.1.3 RELATIONSHIP OF SHORT-TERM USES TO LONG-TERM PRODUCTIVITY

This section describes how the short-term project use would affect the long-term productivity of a given resource.

4.1.2 Regulatory Requirements, Mitigation and Monitoring Measures

All SSEP operations would comply with pertinent state, federal, and local LORS. Because LORS are generally specific to a resource, they are presented in Chapter 3 (Affected Environment) of this EIS, which describes the current environment and its management. In addition, Section 1.6 (Relationship to Policies, Plans, and Programs) summarizes existing state, federal, and local requirements that would be required under any of the alternatives. Regulatory requirements, mitigation and monitoring measures, and applicant-committed environmental protection measures particular to each resource are also identified in specific resource sections.

4.1.3 General Analytical Assumptions, Guidelines, and Notes

The following are the general assumptions used for assessment under all alternatives. Assumptions associated with a given resource (e.g., wildlife habitat) are included within the impacts analysis for that resource.

- Short-term impacts are those that would last fewer than five years.
- Long-term impacts are those that would last five years or more.
- Acreages were calculated using GIS technology; there may be slight variations in total acres between resources. These variations are negligible and will not affect analysis.
- All acreages and percentages presented in this chapter pertain to all lands in the Project Area (rather than only BLM lands), unless otherwise specified.
- All alternatives incorporate applicable BMP and management stipulations from the *Lower Gila South Resource Management Plan* (BLM 1985), as amended (BLM 2005a; 2009a), by reference.

As discussed in Section 2.5.2.5.3, minor changes have been made to the design and alignment of the proposed gen-tie line since the publication of the draft EIS. These changes affect all action alternatives equally and would result in impacts of the same nature and general magnitude as discussed in the draft EIS.

Under the revised gen-tie alignment, 33.52 acres of surface disturbance would be required west of the solar field for roads and other gen-tie construction. This compares to a total of 33.25 acres under the original alignment discussed in the draft EIS, which is a difference of 0.27 acre or less than a 1% increase in surface disturbance. With a total surface disturbance of approximately 3,620 acres for the Proposed Action, this amounts to an overall increase in surface disturbance of approximately 0.01%. Surface disturbance acreages and resource impacts analyses for the alternatives have therefore not been updated in the final EIS.

All acres are approximate. Some acreage estimates refer to stand-alone components of the project (e.g., the solar field). Please see Chapter 2, Section 2.5.1.1, and Chapter 3, Section 3.1.1, for more information.

4.2 Air Quality

This section describes the impacts to air quality associated with the construction and operation of the SSEP. Impacts to air quality are discussed in terms of project emissions of criteria air pollutants, visibility of plumes, and compliance with air quality regulations and standards. The impacts described in this section are derived from the modeling and emissions analysis available in the *SSEP Air Quality Technical Report* (Farmer 2010).

Emissions common to all action alternatives would consist of CO, NO_2, PM_{10}, $PM_{2.5}$, SO_2, VOC, and hazardous air pollutants (HAP). Sources of emissions from the SSEP would include:

- fugitive dust from vehicle travel on unpaved surfaces, especially during construction,
- vehicle exhaust emissions during construction,
- windblown dust from disturbed areas, and
- stationary sources during operation consisting of the following:
    - gas-fired supplemental electrical generation components
    - cooling towers
    - emergency diesel generator and fire water pump engines

These impacts are described in terms of 1) total project emissions compared to current emissions for Maricopa County, 2) the probability of causing or contributing to existing exceedances of NAAQS, and 3) the likelihood of an emissions plume being visible at recreational sites in the area.

4.2.1 Regulatory Requirements, Mitigation and Monitoring Measures

The SSEP would fall under the air permitting and jurisdiction of the MCAQD. During both the construction and operational phases, the SSEP would be subject to several federal requirements derived from Title 40 of the CFR, and county requirements contained in Regulations II and III of the Maricopa County Air Pollution Control Regulations. The statutory provisions in the CAA and all subsequent amendments are implemented in 40 CFR §§ 50–97. The EPA delegates the authority to administer and enforce many of these regulations to individual states and agencies such as the MCAQD. In such cases, the delegated state agency may write equivalent or more stringent requirements into their own rules, or they can adopt the federal requirements by reference.

Table 4.1 addresses the various federal and county regulatory requirements that would apply to the project. Where appropriate, the rationale that justifies the inapplicability of certain air quality regulatory programs is stated. Because the Project Area is within the incorporated boundaries of the Town of Buckeye, there is one local ordinance pertaining to fugitive dust controls that would also be applicable to the project.

Prior to commencing construction, the SSEP facility would be required to obtain a Title V Air Quality Operating Permit (Title V permit) from the MCAQD (MCAQD 2010b). This permit would incorporate all of the applicable federal rules as specific conditions for compliance. During construction of the SSEP, any dust-generating activities would have to comply with Maricopa County Rule 310, which requires substantive dust mitigation and monitoring. Once the SSEP's natural gas-fired equipment is operational, federal NSPS are among the prominent requirements (also adopted by reference in Maricopa County Air Quality Regulations). Air pollutant emissions would be continuously monitored, in accordance with Federal Acid Rain Program rules.

In accordance with the requirements of the CAA, the MCAQD has prepared a state implementation plan (SIP) to address the specific methods and regulations that would lead to compliance with all NAAQS. In general, the rules contained in the SIP are equivalent to, or less stringent than, rules contained in the current MCAQD Air Pollution Control Regulations. In practice, SSEP operations would comply with applicable rules in MCAQD Regulations I, II, and III, and would comply with the SIP. The compliance status and methods to maintain compliance with these requirements are described in the following sections. All applicable SIP rules would be cited in the SSEP's requested Title V permit.

Another set of criteria that pertains to air quality significance is the Maricopa County thresholds for applicability of BACT. Several of these thresholds could be exceeded by the SSEP stationary sources on a maximum daily emission rate basis (Farmer 2010). Therefore, the SSEP would be required to apply suitable BACT measures, and would accept in its permit emission limitations that are consistent with a top-down BACT determination. Although the Title V permit has not been finalized, the following BACT limits are proposed in the permit application:

- 0.0120 pound NO_x/MMBtu for the natural gas co-fired units
- 0.0500 pound CO/MMBtu on a 3-hour average basis for the steam boiler and process heaters
- 0.0160 pound VOC/MMBtu for both steam boilers and process heaters on not less than a 3-hour basis
- 0.0100 pound PM_{10}/MMBtu, 0.0100 pound $PM_{2.5}$/MMBtu, and 0.0110 pound NO_x/MMBtu for small boilers
- 0.1000 pound NO_x/MMBtu for the HTF freeze-protection heaters
- 0.0190 pound CO/MMBtu for auxiliary boilers
- 0.0029 pound VOC/MMBtu for auxiliary boilers
- 0.1200 pound CO/MMBtu for HTF freeze-protection heaters
- 0.0029 pound VOC/MMBtu for HTF freeze-protection heaters
- 0.0050 pound PM_{10}/MMBtu for both the HTF freeze-protection heaters and the auxiliary boilers
- 0.0050 pound $PM_{2.5}$/MMBtu for both the HTF freeze-protection heaters and the auxiliary boilers

A complete analysis of the BACT measures that may apply to the gas-fired generation HTF process heaters, auxiliary boilers, and other fuel-fired sources is provided in the MCAQD Title V permit for the SSEP. The BACT measures that were identified in the permitting analysis are applied to the emission inventory for the SSEP, and reflect the mitigation measures described in this impacts analysis.

An SIP conformity analysis is another applicable process that would be prepared in accordance with the general conformity rule promulgated by the EPA on November 30, 1993 (58 *Federal Register* 63214). The purpose of the rule is to ensure that federal actions conform to the SIP applicable to the Project Area. The applicable regulations are provided in 40 CFR § 51 Subpart W, and Part 93. A *federal action* is defined as any activity engaged in by a federal agency, department, or other entity, or any activity licensed, permitted, funded, or otherwise supported by a federal entity. Because the SSEP would be developed on federal BLM land, which may also involve federal financial assistance, the construction and operation of the SSEP would be a federal action. In such cases, *Conformity to a SIP* is defined as adherence to a SIP's purpose of eliminating or reducing the severity and number of violations of the NAAQS and achieving expeditious attainment of such standards.

As a result of the general conformity rule, federal actions must be evaluated for conformity to the local SIP if the project 1) is located within an EPA-designated nonattainment or maintenance area; 2) would result in emissions above major source threshold quantities of a criteria pollutants; 3) is not a listed exempt action; and 4) has not been accounted for in an EPA-approved SIP.

In serious nonattainment areas, such as Maricopa County, the de minimis level for PM_{10} is 70 tpy. The de minimis level for ozone precursors (100 tpy of NOx and VOCs) also apply due to the location of the project in an 8-hour ozone nonattainment area. As shown in Table 4.5, the SSEP facility would not exceed any de minimis level during the operational phase. At the time of this writing, construction emissions have not been calculated on an annual basis for comparison with the de minimus level; however, as part of the Proposed Action (see Table 2.2), the proponent has committed to meeting de minimus levels of construction emissions. This would be a necessary step for the conformity analysis. Therefore, the SSEP would be a minor source of air emissions during both the construction and operational phases, and further analysis under the general conformity rule is not necessary.

Table 4.1 Air Quality Laws, Ordinances, Regulations, and Standards

LORS	Description	Applicability
Federal		
Federal New Source Review (NSR)/Prevention of Significant Deterioration (PSD) 40 CFR § 51, Subpart I and 40 CFR § 52.2(1), and for new major sources comparable requirements are incorporated in Regulation. II Rules 210 and 240	In general, the NSR/PSD rules define a ~~"~~major source" as any source with the potential to emit 250 tpy or more of a criteria pollutant. A more stringent threshold is defined for a limited number of *categorical sources*, source categories for which the PSD applicability threshold is 100 tpy of any criteria pollutant. Neither of these thresholds would be exceeded by the project during full operation.	Based on the estimated, maximum potential emissions for the proposed gas-fired generating options, considering the operational constraints on gas-fired generation, the project would not be a *major source*, and therefore the NSR/PSD programs do not apply to this project.
NSPS, 40 CFR § 60	The proposed facility and emissions units would be subject to several subparts of the federal NSPS, which are located in 40 CFR § 60: • Subpart A – General Provisions • Subpart Dc – Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units. The regulatory requirements in this subpart for units fired solely on natural gas are relatively minimal, compared to solid-fuel or oil-fired units. Primarily, the SSEP facility would have to document the boiler information, and certify that pipeline quality natural gas is the only fuel used. • Subpart IIII – Standards of Performance for Stationary Compression Ignition Internal Combustion Engines. Even though these units would see only occasional routine operation for readiness testing and maintenance, there are applicable requirements under NSPS Subpart IIII. The requirements include emissions standards for NO_X, CO, and hydrocarbons (depending on engine rating and model year); documentation of compliance with the emission standards through manufacturer data; and record keeping of engine maintenance activities and operating time.	The affected sources at the SSEP facility would be the separate gas-fired auxiliary boilers for the 125-MW and 250-MW plants, which have the preliminary design heat input rating of 30 million MMBtu per hour. The 125-MW and 250-MW plants would each have a diesel-engine driven emergency generator and an emergency fire-water pump.
40 CFR §§ 72 and 75, Acid Rain Program Emission Monitoring	Because the SSEP would be a new facility with a capacity greater than 25 MW, it would be subject to the federal Acid Rain Program that is administered by the EPA Clean Air Markets office, in cooperation with MCAQD. The co-fired boilers or HTF process heaters would be subject to a range of monitoring, quality assurance, record keeping, and reporting requirements under 40 CFR § 72, § 75, and attached appendices. These requirements are generally incorporated in MCAQD Air Pollution Control Regulations by reference (MCAQD Rule 371). Alternative monitoring options that may be available include fuel flow monitoring to provide SO_2 and CO_2 emissions estimates (40 CFR § 75, Appendices D and F). Further, the SSEP facility may exercise an option in 40 CFR § 75 Appendix E for estimation of NO_X emissions using a testing-based correlation. Additional details regarding the procedures for monitoring compliance are discussed in the Title V air permit application supplied to MCAQD.	The gas-fired generating operations of the SSEP facility would be required to obtain an Acid Rain Permit. In addition, the co-fired boilers or HTF process heaters would be subject to a range of monitoring, quality assurance, record keeping, and reporting requirements.

Table 4.1 Air Quality Laws, Ordinances, Regulations, and Standards

LORS	Description	Applicability
The National Emission Standards for Hazardous Air Pollutants (NESHAP) rules are codified at 40 CFR §§ 61 and 63, and are incorporated in the MCAQD Air Pollution Control Regulations in Rule 370	As part of the NESHAP program, federal maximum achievable control (MACT) standards are enacted to reduce the emissions of federally listed HAP from source categories. In general, the NESHAP regulations apply to affected sources that are located at (or are themselves) major sources of HAP emissions, as defined in 40 CFR § 63.2. That is, any stationary source that emits or has the potential to emit (considering controls in the aggregate) 10 tpy or more of any single HAP or 25 tpy or more of any combination of HAP.	Consideration of NESHAP Subparts in 40 CFR § 61 and 63 indicate that none of these regulations apply to the SSEP, primarily because the annual emissions of HAPs would be well below the applicability threshold for major sources.
40 CFR § 64 – Compliance Assurance Monitoring Program	The federal regulations implementing compliance-assurance monitoring (CAM) apply to major sources that must obtain a Title V operating permit pursuant to 40 CFR § 70. The CAM rules are primarily aimed at emission units that are individually above major source thresholds and that utilize control devices in order to comply with an emission limitation (40 CFR § 64.2). The emission units for the SSEP facility consisting primarily of gas-fired equipment would be subject to operational limitations under the requested permit that would avoid emissions above the major source thresholds.	The SSEP facility is not a major source of criteria pollutants; consequently, the facility would not be subject to CAM requirements.
40 CFR § 68 – Accidental Release Prevention Program/Risk Management Plans	The Accidental Release Prevention Program applies to facilities that may store quantities of toxic or flammable chemicals above listed thresholds. The requirements include process hazards analyses, implementation of work practices to prevent releases, and development of site-specific risk management plans.	Based on its process and facility design, the SSEP facility would not store on-site quantities of listed chemicals above the thresholds listed in 40 CFR § 68; therefore, this program would not be applicable to the facility.
40 CFR § 82, Subpart F – Stratospheric Ozone Protection Regulations	Processes at the planned SSEP facility would not involve the use of chlorofluorocarbon (CFC) compounds. Therefore, these operations would not be subject to CFC-related regulations. If facility personnel are to service air conditioning units of sufficient size to be covered under the rule, those personnel would be required to be certified and would have to use certified refrigerant capture equipment. At this time, there is no plan to have in-house servicing of CFC-containing equipment.	Facility operations would not be subject to CFC-related regulations.
40 CFR § 98 – Reporting of Greenhouse Gas Emissions	For the combustion processes at the SSEP facility, this very recent rule requires monitoring, recordkeeping, and reporting of greenhouse gas emissions on an annual basis. In addition to the CO_2 emissions that are tracked under the federal Acid Rain Program (40 CFR § 75), this rule requires calculation of N_2O and CH_4 releases.	The stack monitoring required under 40 CFR § 75, and natural gas fuel analysis and flow metering for 40 CFR § 75 Appendix D, would provide adequate information for the SSEP facility to comply with this rule.

Table 4.1 Air Quality Laws, Ordinances, Regulations, and Standards

LORS	Description	Applicability
40 CFR § 51, Subpart W and 40 CFR § 93 – General Conformity Analysis	Federal actions must be evaluated for conformity to the local SIP if the project 1) is located within an EPA-designated nonattainment or maintenance area; 2) would result in emissions above major source threshold quantities of a criteria pollutants; 3) is not a listed exempt action; and 4) has not been accounted for in an EPA-approved SIP.	The project is located in a nonattainment area for PM_{10} (24-hour and annual) and ozone. The BLM must demonstrate that the SSEP would 1) conform to an enforceable state, tribal or federal implementation plan; 2) not cause or contribute to new violations of an ambient standard; 3) not increase the severity or frequency of existing violations; and 4) not otherwise delay achieving attainment of the NAAQS. Because the SSEP would be a minor source of air emissions during both the construction and operational phases, further analysis under the general conformity rule is not necessary.
State of Arizona		
A.A.C. R18-2-604	Prohibits development of open areas without taking ~~-r~~easonable precautions" to limit excessive PM from becoming airborne. The rule requires the use of good modern practices, dust suppressants, and the minimization of visible fugitive dust from motor vehicle use on dry open areas.	Applies to permanent clearing of vegetation for the SSEP.
A.A.C. R18-2-605	Prohibits use of roads without taking ~~-r~~easonable precautions" to limit excessive PM from becoming airborne. The rule requires the use of wetting, dust suppressants, and covering loads.	Applies to all traffic associated with construction and operations of the project.
A.A.C. R18-2-606	Prohibits handling of materials without taking ~~-r~~easonable precautions" to limit excessive PM from becoming airborne. The rule requires the use of ~~-r~~easonable precautions" such as wetting and covering loads.	Applies to transport of materials to and from the site.
A.A.C. R18-2-607	Prohibits piles of dust-producing material without taking ~~-r~~easonable precautions" to limit excessive PM from becoming airborne. The rule requires the use of ~~-r~~easonable precautions" such as wetting and covering piles.	Applies to piles of soil and other material created during construction of the project.
A.A.C. R18-2-804	Requires that site clearing machinery not exceed an opacity of 40% for more than 10 consecutive seconds or 10 minutes if the equipment is cold. Also proh bits site clearing without taking ~~-r~~easonable precautions" to limit excessive PM from becoming airborne. The rule requires the use of ~~-r~~easonable precautions" such as dust suppressants and removal of dust and other materials from paved roads.	Applies to site clearance during construction of the project.

Table 4.1 Air Quality Laws, Ordinances, Regulations, and Standards

LORS	Description	Applicability
Maricopa County		
Title V Air Quality Operating Permit from the MCAQD	Prior to commencing construction, the SSEP facility would be required to obtain a Title V Air Quality Operating Permit from the MCAQD. This permit would incorporate all of the applicable federal rules as ~~"~~Specific Conditions" for compliance.	By rule, because the SSEP generating units would be ~~"~~Affected Units" subject to the requirements of the Federal Acid Rain Program (Title 4 of the CAA Amendments, the project would be required to obtain a Title V permit.
MCAQD Rule 100 – General Provisions and Definitions	Rule 100 contains general administrative procedures applicable to the SSEP facility as a permit holder under Maricopa County Air Pollution Control Regulations. This rule provides definitions, administrative requirements, as well as general record keeping and reporting requirements.	Among the general provisions are several that define specific compliance actions that would be implemented by the facility: • Retention of records related to air permit compliance for a five-year period after the date of the record (Section 504) • Submittal of an Annual Emissions Inventory to MCAQD in a specified timeframe and format (Section 505)
MCAQD Rule 200 – Permit Requirements	Rule 200 describes the categories of air quality-related permits issued by MCAQD. The designation of the SSEP facility as a Title V source, regardless of potential to emit levels, is contained in Section 302.3: ~~"~~A Title V permit...shall be required for a person to commence construction of...§ 302.3. Any affected source as defined in Rule 100 – General Provisions and Definitions..."	By submitting an application to MCAQD, the project would be requesting a Title V Air Quality Operating Permit.
MCAQD Rule 210 – Title V Permit Provisions	Rule 210 includes provisions for Title V permit application submittal, review, and permit issuance for facilities in Maricopa County deemed to be ~~"~~major sources." Requirements for changes allowed without a permit revision and requirements for permit modifications are also covered in Rule 210.	The estimated facility-wide emission levels would qualify the SSEP facility for Synthetic Minor Source status. However, the SSEP facility must be permitted as a Title V facility because of its status as an affected source under the Title IV – Acid Deposition Control in the CAA Amendments of 1990.

Table 4.1 Air Quality Laws, Ordinances, Regulations, and Standards

LORS	Description	Applicability
MCAQD Rule 241 – Permits for New Sources and Modifications to Existing Sources	Rule 241 provides control technology requirements for new sources and modifications to existing sources of air pollution requiring permits or permit revisions. This rule is applicable to all new and existing sources other than new major sources and major modifications to major sources. In its permit the SSEP facility would seek the flexibility to operate with gas-fired generation for up to 24 hours during a given day. In addition, up to 25% of the gross generation of the plant (in terms of MWh) would be supplied by gas-fired generation using co-fired boilers or HTF process heaters. Given these operating characteristics, the SSEP facility would have daily and annual emissions above the listed threshold levels (Rule 241, §301) for some criteria pollutants. As descr bed in a subsequent section, the aggregate 24-hour facility-wide emissions of NOx and CO would potentially be above the applicable thresholds for evaluation of BACT (e.g., 150 pounds per day emissions of NOx) under MCAQD Rule 241. Therefore, a ~~t~~op-down" BACT determination for NOx and CO was performed, and the results are discussed in the MCAQD air permit application. The analysis of BACT control options considered the economic, energy, and environmental factors for technically feas ble mitigation measures. Because of the high capital and operating costs for add-on controls on the limited schedule (maximum 25% of the time on an annual basis) for gas-fired operations, the annualized cost for all add-on emission controls (e.g., selective catalytic reduction) proved to be cost prohibitive on a dollars/tons-abated basis. Costs for add-on controls remain fixed despite the fact that they would only be necessary 25% of the year.	
MCAQD Rule 270 – Performance Tests	Rule 270 provides the administrative requirements and performance test criteria for stationary sources. The requested permit includes source emissions units that would be subject to testing requirements. Sufficient demonstration of performance would be required in the air quality permit in the form of periodic performance tests. These tests would be performed periodically by the facility, in conformance with an approved test protocol and in compliance with an approved operating and maintenance plan.	This requirement pertains to the co-fired boiler units, for which performance testing would be required under NSPS Subpart D.
MCAQD Rule 300 – Vis ble Emissions	Stipulates emission standards for visible emissions from sources for which no source-specific opacity requirements apply. • Section 301 – Limitations Opacity/General. This rule states that no person shall discharge into the ambient air from any single source of emissions any air contaminant, other than uncombined water, ~~in~~ excess of 20% opacity for a period aggregating more than three minutes in any 60-minute period." • Section 501 – Compliance Determination–Opacity. This rule requires that opacity observations be conducted in accordance with EPA Reference Method 9 as modified by EPA Reference Method 203B. This latter method addresses the appropriate averaging calculations when one or more of the individual readings are above the 20% opacity standard.	Based on the planned gas-fired equipment for the SSEP facility, the auxiliary boilers and the HTF heaters would be subject to this county opacity requirement. For these units, Rule 300 §301 stipulates the applicable opacity limit.

Table 4.1 Air Quality Laws, Ordinances, Regulations, and Standards

LORS	Description	Applicability
MCAQD Rule 310 – Fugitive Dust Sources	Establishes standards to limit the emissions of PM into the ambient air from any property, operation, or dust-generating operations that may serve as a fugitive dust source. This rule states that no person shall allow visible emissions that exceed 20% opacity from dust-generating activities (Rule 310, §301). Prior to construction, a dust control plan would be submitted to MCAQD to define how excess opacity emissions would be mitigated, including use of watering trucks, limitations on vehicle speed, and cessation of activity during wind events. Additional requirements pertain to soil stabilization for different types of disturbed areas and roadways (Rule 310, §302). Several field methods are specified in the rule (Section 2.1 in Appendix C to Regulation III), such as verification of surface crust and vegetation, and should be used to verify compliance with the soil surface stabilization requirements.	These standards would apply during the construction phase of the project.
MCAQD Rule 310.01 – Fugitive Dust from Open Areas, Vacant Lots, Unpaved Parking Lots, and Unpaved Roadways	Establishes standards to limit the emission of PM into the ambient air from open areas, vacant lots, unpaved parking lots, and unpaved roadways that are not regulated in Rule 310 and that are not required to have either a permit or a dust control plan. Section 301 requires surface stabilization and work practices to mitigate emissions of PM from certain types of roadway and unpaved surfaces. These measures include application of palliatives, maintenance of surface crust, maintaining adequate vegetation, and other measures. Section 501 requires that surface stabilization observations be conducted in accordance with suitable field methods (Section 2.1 of Appendix C of Regulation III). These include the drop ball test to verify surface crust, measurement of nonerod ble elements, and assessment of existing surface vegetative cover.	At the Project Area, there may be sections of plant roadways and parking areas that would not be paved. These areas would be subject to requirements of Rule 310.01.
MCAQD Rule 311 – Particulate Matter from Process Industries	Limits the discharge of PM into the atmosphere from process equipment by establishing emission rates based on process weight rate (defined in Rule 311, Section 206).	The gas-fired equipment emissions units at the SSEP facility, exhausting combustion emissions, are potentially subject to this rule. Should some or all of the gas-fired equipment be deemed subject to Rule 311, the PM limits would be met through the use of pipeline-quality natural gas fuel.

Table 4.1 Air Quality Laws, Ordinances, Regulations, and Standards

LORS	Description	Applicability
MCAQD Rule 320 – Odors and Gaseous Air Contaminants	Establishes limits for the emissions of odors and certain other gaseous air contaminants into the atmosphere. The facility would engage in appropriate work practices to comply with each of these requirements: • Section 302 – Material Containment Required. This rule requires that suitable work practices be in place for pollutant-containing materials including, but not limited to, solvents or other volatile compounds, paints, acids, a kalis, pesticides, fertilizer, and manure. These materials shall be stored, processed, used, and transported in such a manner and by such means that they will not unreasonably evaporate, leak, escape, or be otherwise discharged into the ambient air so as to cause or contr bute to air pollution. It is expected that such materials would be used at the SSEP facility for maintenance purposes. These provisions also generally apply to the level of control of VOC from the HTF ullage system, which are minimized by the use of carbon canisters to capture vapors. • Section 303 – Reasonable Stack Height Required. This rule states that where a stack, vent, or other outlet is at such a level that air contaminants are discharged to adjoining property, installation of abatement equipment or alteration of the stack may be required to adequately dilute, reduce, or eliminate the discharge to adjoining property. This general requirement is applicable to process vents and gas-fired equipment. The configurations of the planned stacks and vents would be designed to meet the Rule 320 requirements, and the position and arrangement of the stacks would be adequate to disperse the exhausted emissions.	Only the most generalized emission and work practice standards in this rule would be applicable to the SSEP facility, because other source specific standards are applied from other MCAQD rules.
MCAQD Rule 322 – Power Plant Operations	This rule was most recently revised in October 2007 and regulates the discharge of combustion-related pollutants from stationary fossil-fuel-fired equipment at existing power plants. Specifically, the rule is applicable to electric utility steam generating units with heat input capacity equal to or greater than 100 MMBtu/hour, and for which construction commenced prior to May 10, 1996.	By virtue of the commencement date, the SSEP facility would not be subject to this county rule.
MCAQD Rule 323 – Fuel Burning Equipment at Industrial, Commercial, and Institutional Sources	This rule, most recently revised in October 2007, addresses emission control standards and associated requirements for fuel burning equipment at industrial, commercial, and institutional facilities. This rule is potentially applicable to the gas-fired equipment that is not related to power generation. However, the exemptions in Section 103 apply directly to each category of SSEP facility equipment. These exemptions identify -combustion equipment used in power plant operations for the purpose of supplying greater than one-third of the electricity to any utility power distribution system ...” (Section 103.6). Further, an exemption for -direct-fired process heaters” applies to the HTF heater units used for natural-gas–fired generation (Section 103.3).	Based on the current design, there would be no equipment at the SSEP facility that would be subject to this rule.

Table 4.1 Air Quality Laws, Ordinances, Regulations, and Standards

LORS	Description	Applicability
MCAQD Rule 330 – Volatile Organic Compounds	Rule 330, Section 301 establishes limits for the emissions of VOCs into the atmosphere that may result from the use of ~~o~~rganic solvents" or processes that emit VOCs. The SSEP's HTF system and storage tanks would be considered processes with the potential to emit VOC. The HTF compounds would be considered, as Group II, noncomplying solvents. A key design feature of the ullage/flash system is that the reservoir of HTF would be continuously blanketed with nitrogen to avoid contamination and oxidization of the organic constituents. From Section 302 of Rule 330, a maximum emission limitation of 40 pounds (18 kg) per day is imposed on ~~a~~ny machine, equipment, device or other article for employing...any such noncomplying solvent, unless the entire amount of such discharge has been reduced in accordance with Section 304 of this rule." This limitation would apply to the remainder of the HTF storage and handling system. Based on engineering simulation calculations for the SSEP'S HTF storage tanks, and including the benefit of activated carbon canister controls on tank vents, the HTF would not be evaporated in an amount that could exceed 40 pounds per day.	The design of the HTF system makes Section 301 not applicable to the HTF ullage/flash process.
MCAQD Rule 372 – Hazardous Air Pollutants Program	This regulation applies to sources of HAP, with individual HAP emissions above 10 tpy, and combined HAP emissions of 25 tpy or more. The rule is applicable to facilities with specific Standard Industrial Classification (SIC) codes, and an electric generating facility (SIC 4911) is not one of the regulated SIC code categories identified in Rule 372, Section102.1.a.	The future status of the county program is uncertain, because the Arizona state program, after which the MCAQD program is patterned, has been subject to legal challenges.
Local – Town of Buckeye		
Ordinance No. 14-08 Dust Control	Because the SSEP site would be within the boundary of the Town of Buckeye, this town ordinance is also applicable to the project. This ordinance either matches or extends the MCAQD requirements for dust control measures. Included are measures for stabilization of unpaved areas, restrictions on leaf blowers, and speed limits for high traffic dirt roads.	MCAQD is primarily responsible for administration and enforcement of air quality controls. The planned measures for use of gravel and soil binder applications satisfy the applicable sections of this town ordinance for unpaved area stabilization.

4.2.2 Analysis Area and Analysis Assumptions

4.2.2.1 PROJECT EMISSIONS CALCULATIONS

As described in Chapter 3, the analysis area for air quality is the Maricopa County serious nonattainment area for PM_{10}, which is the regulatory boundary used for air quality assessment in which the SSEP would reside. The area of analysis and the Project Area are shown in Map 8. Estimated emissions under each action alternative are provided in Sections 4.2.4.1, 4.2.5.1, 4.2.6.1, and 4.2.7.1.

4.2.2.1.1 Windblown and Fugitive Dust Emissions

The following assumptions were used in the calculation of dust emissions during construction of the SSEP project. The overall construction duration for the Proposed Action and Alternative A would be 39 months for the 125-MW and 250-MW generation plant sections (37 months for Alternative B and 25 months for Sub-alternative A1). For the Proposed Action, construction of the two plant sections may overlap in time, but the months of peak activity for both sections of the SSEP would not occur at the same time. Construction phase air emissions for the SSEP would vary on a monthly, and even a daily basis. The specific location and intensity of construction activities would evolve during construction, as earthmoving and construction activities move across the SSEP site. The construction phase emission inventory is based on the projected highest-activity months during the construction schedule. Peak construction activity for the 250-MW block (assumed for the Proposed Action and Alternative A) is slightly less than the peak construction activity for the 125-MW block (assumed for Alternative B); however, peak construction activity is least for Sub-alternative A1.

To quantify dust emissions from industrial and commercial facility construction, an emission factor of 0.19 ton PM_{10}/acre-month was multiplied by the total acres of land under active construction at a given time. This emission factor is based on recent recommendations for construction in western states (WRAP 2006) and does not assume a particular set of mitigation measures, other than the typical range of soil moisture and silt content in western soils. Over the course of construction, a large number of truck deliveries of roadway materials would be delivered to the site. Therefore the project includes the development of a network of improved-surface plant roads within the extensive parabolic trough solar field. This activity is within the type of operations considered in the development of the general construction PM_{10} emission factor that is representative of earthmoving projects in western states (WRAP 2006).

In Maricopa County, the status of the area as a serious nonattainment area for PM_{10} has prompted the MCAQD to adopt some of the most stringent dust control regulations in the nation (see Table 4.1). The construction and operational phases of the project would be subject to these requirements. MCAQD regulations related to fugitive dust sources are aimed at substantially reducing the mass emissions of particulates and the release of visible emissions. Emissions of particulate species due to earthmoving equipment would be limited by the stringent mitigation measures that are imposed by Maricopa County Rule 310 and A.A.C. R18-2. This rule requires that visible emissions associated with fugitive dust be limited to 20% opacity. The rule requires a dust control plan prior to construction that details mitigation measures that would be employed to ensure compliance with this standard. A copy of this plan would be maintained at the site and available for public or county inspector review. Subsequently, the construction contractors and project representatives would be required to monitor the adequacy of the dust mitigation measures by making opacity emission observations not less than daily. Records of these opacity observations must be maintained at the

construction site. The impacts analysis assumes that all of these regulations would be fully attained by the SSEP. Dust control measures prescribed by MCAQD Rule 310 include:

- Frequent application of water to active earthmoving areas
- Restriction in construction vehicle speeds on unpaved roadways (e.g., less than 15 miles per hour [mph])
- Application of gravel or other surface palliatives to unpaved areas and roadways
- Restriction or cessation of construction activities during ~~"~~high-wind" events
- Covering or otherwise shielding stock piles of soil or similar construction materials
- Installation of vehicle ~~"~~track-out" areas or wash-down areas to prevent fine dust from being tracked onto adjacent paved roads

Construction activities would also generate emissions of $PM_{2.5}$, which has more recently become regulated as a criteria air pollutant. Guidance from the EPA indicates that emissions of $PM_{2.5}$ are to be quantified as a fraction of the total PM_{10} emissions. The ratio of $PM_{2.5}$ to PM_{10} emissions for SSEP construction dust emissions was assumed to be 0.208, based on documentation in EPA Document AP-42 and in other publications (EPA 1995, SCAQMD 2006).

During operation of the SSEP, MCAQD Rule 310.01 requires that dust suppression measures be applied to all disturbed surface soils to reduce the likelihood of windblown dust. Measures such as watering/crusting, application of palliatives, or installation of a layer of gravel are required, as necessary, and the permanence and efficacy of the stabilization must be periodically evaluated by field measurements of soil surface condition (MCAQD Rule 310.01). Under Rule 310.01, open areas and vacant lots (Section 302.4) would not result in visible emissions of PM beyond the property line. Fugitive dust emissions associated with unpaved parking lots would not exceed 20% opacity (Section 302.5). The measure requires that control measures be implemented within 60 days. Control measures include establishment of vegetative ground cover, application of a dust suppressant or surface gravel, and/or restoration of disturbed surface areas to conditions similar to undisturbed native conditions (Section 302.1). Control measures are considered to be effectively implemented when the open area meets one of the following criteria (Section 302.2): a visible crust demonstrates soil stability, a friction velocity threshold is met, vegetative cover thresholds are attained, or an alternative method is approved by EPA.

Dust suppression measures are necessary for the operation of the solar collection array. Dust accumulation on the mirror surfaces reduces solar collection efficiency and must be washed off periodically. This has become an accepted practice for large solar-generation facilities, and the SSEP facility would maintain substantive dust abatement measures throughout the operational period of the project. Therefore, in addition to the measures required by MCAQD during construction, the proponent has committed to specific dust suppression measures. The main access road, selected areas around the gates, and parking lots would be paved. Other areas around the power block would be graveled. In addition, the maintenance roads between the collector assemblies and other high traffic areas would be treated with a dust palliative as appropriate for the duration of the plant's construction. Exposed vehicle pathways between the collector array rows would be firmly crusted by the penetration and binding action of the palliative solutions. Maintenance roads between the collector assemblies and other high traffic areas would be treated with a dust palliative, as appropriate, for the duration of the plant's operation. In all other disturbed areas, such as beneath the solar collectors, soil would be watered to form a durable surface crust. If dusting conditions at the site create an adverse effect on generation, the proponent would consider treating problem areas with dust palliative, including areas under the collectors that would not be regularly travelled by maintenance vehicles.

The measures required by MCAQD and additional measures committed to by the proponent would reduce overall construction emissions of PM_{10} by over 60% (based on MCAQD control effectiveness estimates) compared to uncontrolled emissions. To allow for a conservative assessment, the actual control effectiveness was assumed to be 50%, compared to uncontrolled levels, and is reflected in the final emissions calculations. The dust suppression measures would also reduce the potential for dust emissions during operations from both vehicle travel and windblown dust. Typical vendor estimates of dust control effectiveness are over 80%, compared to uncontrolled levels on roadways. On areas that are stabilized but not disturbed by vehicles, control effectiveness would be close to 100% after soils have recrusted (Farmer 2010).

4.2.2.1.2 Vehicle Exhaust Emissions of Criteria Pollutants during Construction

Operation during construction of diesel- and gasoline-fueled offroad vehicles and temporary stationary equipment generates emissions of gaseous pollutants including NO_X, CO, and VOC. To conservatively estimate the potential emissions of gaseous pollutants, these emissions factors were applied to the highest estimated number of vehicles and equipment expected to be present during the maximum activity month during construction (month 6 for both 125-MW and 250-MW sections). The estimates presented here assume that all equipment in each category would operate full time during the hours estimated for the most active month.

Emission factors associated with the average fleet make-up of construction equipment in 2010 were obtained from the *South Coast Air Quality Management District (SCAQMD) Emissions Handbook* (SCAQMD 1993, 2008) and were used to assemble the inventory of emission rates for equipment exhausts. For the current equipment, the SCAQMD factors are based on at least Tier II engine performance, and use of ultra-low sulfur diesel fuels that are now mandatory in California, Arizona, and elsewhere. The gaseous pollutant emission factors used in the emission inventory are based on this level of performance (SCAQMD, 1993, 2008). The SCAQMD factors are expressed in units of pounds of pollutant emissions per hour, at a given horsepower range, for different categories of equipment. The roster of planned construction equipment during the maximum activity month, and the associated SCAQMD emissions factors for on-site construction activities are available in the *SSEP Air Quality Technical Report* (Farmer 2010).

4.2.2.1.3 Emissions of Criteria Pollutants from Stationary Sources during Operations

The generation of electrical power using parabolic trough solar thermal technology does not result in criteria pollutant emissions. During the operational phase, SSEP emissions would be generated predominantly by combustion sources associated with either the co-firing boilers or the HTF heaters and would be emitted from several stationary, point-source stacks. As part of the project application for an air quality permit, an evaluation of BACT was conducted for NO_X, CO, and particulate emissions. The project design incorporates the proposed emission controls identified as BACT, and operation of these controls would be enforceable requirements in the Project Air Quality Operating Permit, issued by MCAQD.

Operational phase emission rates were evaluated on maximum hourly and total annual bases (Farmer 2010). For purposes of characterizing maximum hourly emissions, the SSEP facility equipment was assumed to be operating at maximum rated capacity. These hourly rates are used for the dispersion modeling analysis (SCREEN3) of operational phase impacts, and for the assessment of visible plumes.

Under Alternative A, the allowable gas-fired generation would be reduced by 9% from the Proposed Action, which was assumed to correspond to a 9% reduction in all emission associated with gas-fired generation. Under Alternative A, there were also no assumed emissions from cooling towers because they would not be employed under this alternative. Under Alternative B, emissions estimates assume two 125-MW HTF process heaters and two 1,000-kW generators. It was also assumed that plant vehicle travel on paved and unpaved roads would be reduced by 33% under Alternative B. All other components of the SSEP were assumed to be the same for Alternative B, compared to the Proposed Action. There are no operational emissions from point sources under Sub-alternative A1 because gas-fired generation, freeze protection heaters, and cooling towers would not be required under this alternative.

Gas-fired Supplemental Electrical Generation

The 125-MW and 250-MW generating plants would use natural gas-fueled equipment to improve operating flexibility and maximize output of the plant during periods of low solar thermal input. However, the electricity generation supplied by gas-firing would be limited to 25% of total facility output on an annual basis. Three components make up the gas-fueled generation of electricity:

1. **Gas Co-fired Electrical Generating Units:** Co-fired HTF process heaters would modulate and supplement steam production in response to load demand during each operating day. Heat input would be provided via a combustion system designed to reduce emissions of NOx and other pollutants. The system includes low-NOx burners (LNB) and advanced controls to promote complete and efficient combustion at all loads. One possible option for each solar-generating plant at the SSEP is the use of natural gas-fueled, co-fired steam generating boilers, sized to provide full plant nominal output capacity at night or during other times of low incoming solar radiation. The heat duty requirements and emission characteristics for each of the generation plants are comparable to the HTF process heater design. Emission controls would be included in the design (i.e., LNB with induced flue gas recirculation technology) to achieve specified NO_X emission levels at all loads.

2. **Auxiliary Boilers:** For each of the two generating plants, a 30-MMBtu/hour-rated auxiliary boiler would provide steam for the steam turbine gland seal steam system, deaerator start-up sparging steam, steam jet air ejector, and other minor steam consumers while the steam turbine generators are offline and during start-up.

3. **Heat Transfer Fluid Freeze-protection Heaters:** A 30-MMBtu/hour gas-fired, direct contact HTF heater in each generating plant block would be used as needed to keep the HTF at or above 100°F whenever the facility is offline. This would include periods of shutdown for routine events such as periodic maintenance primarily in the winter months. The HTF heater is similar to the auxiliary boiler except that it uses the organic HTF oil instead of water in the tube bundles. The gas-fired process heaters would be equipped with low-NOx burner technology and flue gas recirculation as pollution control measures. In addition, the annual operating schedule, or total heat input, would be limited by the facility‘s air quality permit to prevent gas-fired generation from exceeding 25% of the facility‘s annual production.

Annual emissions for the operational phase considers the gas-fired generation HTF process heaters and supporting ancillary equipment according to the maximum, annual schedule shown in Table 4.2. The equipment assumed in the air quality analysis differs slightly from the equipment identified in Chapter 2 of the Proposed Action; however, the capacity of the components and total fuel use assumptions are consistent with assumptions described in Chapter 2. Fuel usage is the most important assumption in calculating expected emissions from the SSEP because emissions are based on the amount of fuel used. Nonetheless, the difference in assumption slightly overestimates emissions associated with the HTF process heaters. Criteria pollutant emission rates for the combustion equipment for the SSEP operational

phase reflect the selections of BACT that would be required for compliance with MCAQD permitting requirements. The emission analysis is based on vendor-specified emission factors in combination with emission factors from EPA Document AP-42 (current sections can be obtained from the EPA TTN Website). More detailed tabulation of emission calculations and a description of the methodology are provided in the *SSEP Air Quality Technical Report* (Farmer 2010). The gas-fired supplemental generation would not be used in the SSEP under Sub-alternative A1.

Table 4.2 Operating Parameters for the 125-MW and 250-MW Gas-fired Supplemental Systems

Unit	Output Capacity (MMBtu/hour)	Annual Hours of Operation at 100% Load	Annual Thermal Energy Produced (MMBtu/year)[1]	Annual Thermal Input (MMBtu/year)[2]
125-MW Plant				
HTF process heater[3]	1,300	689	895,700	1,120,000
Auxiliary boiler[4]	30	1,000	30,000	37,500
HTF freeze-protection heater[4]	30	2,500	75,000	93,750
250-MW Plant				
HTF process heater	2,550	693	1,767,000	2,210,000
Auxiliary boiler[4]	30	1,000	30,000	37,500
HTF freeze-protection heater[4]	30	2,500	75,000	93,750

[1] Annual thermal energy produced is the output capacity for the equipment multiplied by the annual hours of operation.

[2] Annual natural gas thermal input is based on the assumption that the boilers/heaters have an 80% thermal efficiency.

[3] Annual operating hours for the HTF process heaters are the equivalent hours of full-load (375 MW) operation that equate to annual gas-fired generation output (equal to 25% of the total maximum capacity of the plant). Actual operating hours per year would be higher, with a substantial portion of the gas-fired generation at part-load conditions.

.[4] Annual operating hours for the auxiliary boilers and HTF freeze-protection heaters are based on project estimates for maximum design case.

Cooling Tower

The SSEP facility would use wet cooling towers for power plant cooling. Water for cooling tower makeup, process water makeup, and other on-site uses such as mirror washing, would be supplied from on-site groundwater wells. The cooling towers for the 250-MW and 125-MW plants would be emission sources of PM_{10} and $PM_{2.5}$. Aerosol droplets that are released as plume drift from the towers would evaporate in the atmosphere, and the dissolved salts would precipitate to form fine particles. The operational phase inventory includes these cooling tower emissions. The cooling towers would not be used in the SSEP under Alternative A or Sub-alternative A1.

Emergency Diesel Generator and Fire Water Pump Engines

Air pollutant emissions from the emergency diesel generators and fire water pump engines would be subject to emission limits under National Source Performance Standards (NSPS) Subpart IIII. One emergency generator and one fire water pump in each of the 125-MW and 250-MW blocks would be included in the facility design. For these units, the facility would adopt in its permit an operating limitation of no more than 50 hours per year, per engine for routine testing and maintenance of these components. These engines would be compliant with current EPA tier emission performance criteria.

4.2.2.2 CONTRIBUTIONS TO NAAQS

To characterize ambient concentrations due to emissions from SSEP stationary sources (described in the previous section), the EPA SCREEN3 model was used to perform dispersion modeling for criteria pollutants. The SCREEN3 model provides a very conservative analysis to determine whether operational-phase concentration impacts might cause or contribute to exceedances of NAAQS. The screening assessment addresses the large, stationary sources that have the potential for long-term and farther reaching impact.

For the purposes of the SCREEN-3 model, maximum hourly emissions from the following components were assumed: 250-MW process heaters, 125-MW process heaters, and the 1,000-kW generator hourly emissions. Emissions from auxiliary boilers were not included in the screening model because these would only be employed at start up and therefore would not run simultaneously with the other sources included in the model. Emissions from HTF freeze-protection heaters, the 1,500-kW generator, and the fire water pump were not included in the screening model because they would run intermittently and generally not simultaneously with the sources included in the model. The cooling towers were not included in the screening model because they do not have point-source characteristics compatible with the large, hot exhaust stack sources, and thus cannot be treated in the same SCREEN3 model. For this reason, the towers were addressed quantitatively in the plume visibility analysis. The model also does not include intermittent fugitive sources that would result in dust emissions for brief periods, such as operation of maintenance vehicles and windblown dust. Fugitive sources and smaller emission sources that are intermittent and of unpredictable duration were also not included in the screening modeled. Similarly, the air pollutant emissions from operation of in-plant maintenance vehicles are assumed to be small, compared to the modeled generation process sources and they are not included in the analysis. Commuting travel is assumed to result in a very small incremental change compared to existing local traffic, because an estimated 82 workers would be required to operate the facility on a full-time basis. Commuting travel was also not included in the screening-level model. Complete calculations and detailed modeling methodologies are available in the *SSEP Air Quality Technical Report* (Farmer 2010).

The SCREEN3 model assumes that a plume may be emitted in any direction from a single stack that combines similar project source emissions. The model calculates the maximum, 1-hour average, ground-level concentrations at specified distances and elevations from the aggregated SSEP stack. Using accepted scaling values, termed ―persistence factors" provided by EPA guidance, the 1-hour SCREEN3 results can be translated to longer averaging times. The model was used to predict ground-level concentrations in all direction, using the ―full meteorology" option. This option causes the model to predict concentrations based on an array of more than 50 separate sets of meteorological parameters that reflect a range of poor-dispersion conditions. The SCREEN3 model evaluates ground-level concentrations for each such meteorological condition, and indicates the highest value over a range of distances from the combined project emission sources. A summary of key model inputs for SCREEN3, and the ground-level impacts at the point of maximum concentration for each case, are available in the *SSEP Air Quality Technical Report* (Farmer 2010).

Increases in concentrations associated with project emissions were compared to NAAQS and background monitoring data at the Buckeye monitoring station, which are assumed to be most representative of air quality around the Project Area. Exceedances of the 24-hour and annual PM_{10} NAAQS occur regularly at this station. Although the project is located in an 8-hour ozone nonattainment area, there were no exceedances of the 8-hour ozone NAAQS at the Buckeye monitoring station between 2005 and 2008.

4.2.2.3 VISIBILITY OF EMISSION PLUMES FROM STATIONARY SOURCES

The VISCREEN model (EPA 1992; EPA 1988) was used to assess the potential for observers in recreational areas, parks, and wilderness areas located within 50 km of the SSEP to perceive visible plumes from emissions associated with combustion of natural gas (Table 4.3). The impact is modeled as a loss of visual clarity in the direction of the SSEP facility.

Table 4.3 Class II Wilderness Areas and Recreational Areas near the Project Area

Area Name (Managing Agency)	From Project Area to Nearest Boundary	
	Approximate Distance in Kilometers (miles)	Direction
Sonoran Desert National Monument (BLM)	2.2 (1.3)	Southeast to south
Signal Mountain Wilderness (BLM)	34.3 (21.3)	West-southwest to west
Woolsey Peak Wilderness (BLM)	22.7 (14.1)	Southwest to west
North Maricopa Mountains Wilderness (BLM)	4.9 (3.0)	Southeast
South Maricopa Mountains Wilderness (BLM)	28.2 (17.5)	Southeast
Sierra Estrella Wilderness (BLM)	22.5 (13.9)	East
Estrella Mountain Regional Park (Maricopa County)	13.8 (8.6)	Northeast to east-northeast
White Tank Mountain Regional Park (Maricopa County)	43.5 (27.0)	North
Buckeye Hills Regional Park (Maricopa County)	8.9 (5.5)	Northwest

VISCREEN is designed to evaluate, on a relative scale, the ability of an observer to see a visible plume from a range of vantage points due to distant emission sources of PM_{10} and NO_x. The VISCREEN model considers the transport and dispersion of the plume, and also the viewing position of the observer relative to the sun. The analysis accounts for both spatial and temporal factors that affect the visibility of a plume from the SSEP. These factors allow the model to account for occurrences when the wind is blowing in the necessary direction to convey the source plume(s) to a viewer in a given sensitive area while considering intervening topographic features. VISCREEN depicts the plume as having a parabolic shape that broadens uniformly and drifts toward the ground. The VISCREEN representation allows for lateral drift and dispersion of the plume to follow actual winds in the area.

The VISCREEN analysis provides two measures of potential plume visibility, based on contrast with sky and terrain backgrounds. The first is a plume –contrast index," which is the relative difference in light intensity between light scattered through the plume and light scattered from the background. The second index measures plume perceptibility, expressed as the total color contrast (ΔE), because plume perceptibility is a function of both brightness and color. The two indices are related to perception by the human eye. The VISCREEN model output for the SSEP was compared to a perceptibility threshold based on significance criteria that have been developed for federal Class I areas (Federal Land Managers' Air Quality Related Values Work Group [FLAG] 2000). These thresholds are a ΔE value over 2.0 and a contrast of more than 0.05. In general, the assessment procedures outlined in the FLAG guidelines are generally applicable to both Class I and Class II areas (FLAG 2000 and 2008). Note that Class II areas have no visibility protection under federal or state law.

The VISCREEN model is designed to consider the contributions from NO_X and PM_{10} emissions from point-source stacks that have the potential to create visible plumes. For this study, the emission units and pollutants that were used for the visible plume analysis are:

- Electrical generation HTF process heaters (NO_X and PM_{10})
- Auxiliary boilers and freeze-protection HTF heaters (NO_X and PM_{10})
- Plant cooling tower (PM_{10} only, excluding water vapor)

For these process point sources, the pollutants that could contribute to a visible plume have been quantified for the maximum, gas-fired supplemental generation scenario (see Section 4.2.2.1). Fugitive and windblown dust emissions associated were not included in the VISCREEN analysis. The emission rates used as inputs to VISCREEN simulations for the SSEP represent potential maximum daily operating conditions for the project stationary stack. The PM_{10} and NO_x emission rates used in the visibility analysis are 10.35 grams per second (g/s) (1,971 pounds per day) and 4.92 g/s (937 pounds per hour), respectively. These would be the combined emissions of the gas-fired SSEP sources, operating simultaneously, in combination with the cooling tower particulate emissions. The stack height assumed in the VISCREEN model was 150 feet.

For terrain viewing backgrounds, the terrain was assumed to be dark and located as close to the observer and the plume as possible. The analysis used representative meteorological data from Phoenix Sky Harbor Airport, which is near the Project Area.

The VISCREEN model was first used to quantify the highest likelihood of a visible plume (based on the perceptibility threshold described above) using the set of meteorological parameters (wind speed, stability class, and wind direction) that are unfavorable for dispersion and that occur with a cumulative probability of 1% (99th percentile worst dispersion conditions for a potential plume).

The VISCREEN model was also used to assess how frequently a plume is likely to be perceptible (based on the perceptibility threshold described above) at each of the areas of interest. The analysis focused on the meteorological conditions that would most likely contribute to visual impacts from project emissions. Five years of hourly meteorology data from Phoenix Sky Harbor Airport were used to characterize the range of conditions that occur with respect to the locations of an observer in each area compared to the SSEP. Because the impairment of visibility is unlikely during darkness, the analysis focused on conditions that were recorded during daylight hours.

Complete documentation of the VISCREEN analysis, including model inputs, assumptions, and results, is available in the *SSEP Air Quality Technical Report* (Farmer 2010).

4.2.3 No Action

Under the No Action alternative, BLM would continue to manage the land in the Project Area for livestock grazing and dispersed recreation use; and the lands adjacent to the Project Area for sand and gravel production, utility ROWs, livestock grazing, and dispersed recreation. Dust from the use of these lands would continue to contribute to the Maricopa County PM_{10} serious nonattainment area. Under the No Action alternative, the SSEP would not be developed, and existing air quality concerns in the Project Area would continue. The MCAQD would continue to work to bring emissions in the area into compliance with NAAQS. In the near future, the classification of the area as a serious nonattainment area for PM_{10} would continue.

4.2.4 Proposed Action

Direct impacts to air quality would result from vehicle exhaust emissions during construction, emissions from stationary sources (gas-fired supplemental electrical generation components, cooling towers, and emergency generator and fire water pumps) during operations, fugitive dust emissions associated with construction activities and travel on unpaved roads, and windblown dust associated with the removal of 3,400 acres of vegetation until such time as soils have recrusted and have returned to predisturbance stability levels.

4.2.4.1 PROJECT EMISSIONS

4.2.4.1.1 Summary of Emissions during Construction

Emissions of criteria pollutants during construction would result from fuel combustion by construction equipment and vehicles. In addition, fugitive dust emissions (PM_{10} and $PM_{2.5}$) during the construction of the SSEP would result from a variety of activities, including land clearing and excavation, road surface construction, and cut and fill operations (i.e., earth moving). Dust emissions can vary substantially from day-to-day depending on the level of activity, the specific operations, and the prevailing meteorological conditions. A portion of the total fugitive dust emissions and construction vehicle exhaust emissions would result from construction vehicle traffic over the extensive improved plant road surfaces within the Project Area. Given the nature of dust emissions that may be generated during construction, and the stringent control measures required under county rules described in this section, impacts due to dust emissions would be of short duration and would be localized. Dust emissions that may occur due to high winds are unpredictable.

Maximum monthly emissions from construction of the SSEP are summarized in Table 4.4 and compared to current emissions in the PM_{10} nonattainment area (for particulates) and to current emissions in Maricopa County for all other criteria pollutants. The proponent has committed to ensuring that construction emissions would not exceed major source thresholds for any criteria pollutant. At maximum construction levels, construction of the SSEP would increase current emissions of PM_{10} and $PM_{2.5}$ in the PM_{10} nonattainment area by 8.8 tons per month (tpm) (0.12%) and 2.3 tpm (0.15%), respectively. Emissions of NO_x, CO, and VOCs would be 14.7 tpm (0.14% increase over current county emissions), 6.1 tpm (0.01% increase), and 1.6 tpm (0.01% increase), respectively.

Table 4.4 Summary of Maximum Monthly Construction Emissions – Proposed Action and Alternative A*

Emission Source Category[1]	Maximum Construction Monthly Emissions (tpm)[2]				
	PM_{10}	$PM_{2.5}$	NO_X	CO	VOC
Proposed Action and Alternative A					
Earthmoving/construction operations[3]	8.20	1.70	0.0	0.0	0.0
Offroad construction equip. exhaust[4]	0.56	0.52	13.40	5.71	1.48
Construction mobile vehicle exhaust[5]	0.04	0.04	1.30	0.37	0.14
Total construction emissions	**8.8**	**2.3**	**14.7**	**6.1**	**1.6**
Current average emissions[6]	**7,063**	**1,460**	**10,475**	**109,950**	**19,712**
Estimated increase in current emissions	**0.12%**	**0.15%**	**0.14%**	**0.01%**	**0.01%**

Note: Maximum monthly construction emissions are based on the project construction schedule (Table 2.45) and include months when construction of Unit 1 and Unit 2 overlap.

[1] Listing of the emission sources and equipment within each category is from Farmer 2010.

[2] Emission factors primarily obtained from WRAP 2006; SCAQMD 1993.

[3] General nonresidential construction activity, 0.19 ton PM_{10}/acre month (WRAP 2006)

[4] Equipment category includes wheeled and tracked mobile construction equipment; roster of equipment is the highest estimated level over 24-month schedule.

[5] Equipment category includes sta ionary, temporary construction equipment; roster of equipment is the highest estimated level over 24-month schedule.

[6] Because the Project Area is in the PM_{10} nonattainment area, current PM_{10} and $PM_{2.5}$ are reported as he average monthly emissions in the PM_{10} nonattainment area (MCAQD 2005a); Because the Project Area is not in the ozone nonattainment area current NOx, CO and VOC emissions are average monthly emissions in all of Maricopa County (MCAQD 2005b).

4.2.4.1.2 Summary of Emissions during Operations

Emissions of criteria pollutants during operation of the SSEP would result from combustion sources associated with components of the gas-fired supplemental electrical generation, emergency generators, and fire water pumps. In addition, the cooling tower would emit PM that originates as suspended solids in the water used for evaporative cooling. Dust emissions (PM_{10} and $PM_{2.5}$) during the operation of the SSEP would result from windblown dust generated from disturbed areas and fugitive dust due to vehicle travel on unpaved roads and other surfaces.

Most dust generated from the site would be controlled through mitigation. However, incidents of windblown dust are unpredictable and typically occur several times per year, most often during the mid-summer monsoon pattern. At such times, short-duration, windblown dust plumes in the region significantly impair visibility. It is expected that the SSEP would not contribute more to this phenomena than other dry desert or agricultural areas. The combination of measures (see Section 4.2.2.1.1) such as soil binder application and repeated soil watering to promote crust formation would make the Project Area less susceptible to release of windblown dust than native bare soil or the agricultural/residential areas near the Project Area. Consequently, these emissions were not considered in the operational phase modeling.

An overall summary of the maximum operational phase emission sources is provided in Table 4.5. These emissions represent the maximum gas-fired generation scenario for the SSEP. Maximum annual emissions are below both PSD and Title V major source thresholds. Facility-wide emissions of HAPs are below the major source thresholds of 10 tpy for individual HAP and 25 tpy for total combined HAPs. Operating limits on fuel input proposed by the facility would result in emission levels below the 100 tpy major source thresholds for NO_x, CO, and VOCs and below the 70 tpy major source threshold for PM_{10}. Operational limits on gas-fired operations that are consistent with the parameters used in this analysis would be implemented in the air quality permit in the form of enforceable limits on the facility-wide, annual, natural gas heat input capacity. Complete calculations of emissions, including an overall facility summary, are available in the SSEP *Air Quality Technical Report* (Farmer 2010).

Expected maximum annual emissions during operation of the proposed SSEP are compared to current emissions in the PM_{10} nonattainment area (for particulates) and to current emissions in Maricopa County for all other criteria pollutants in Table 4.5. Operation of the SSEP at maximum levels would increase current emissions of PM_{10} and $PM_{2.5}$ in the PM_{10} nonattainment area by 40.9 tpy (0.05%) and 22.2 tpy (0.13%) respectively. Emissions of other criteria pollutants would result in an increase over current emission levels of less than 0.05%.

Table 4.5 Maximum Annual Operational Phase Emissions for the SSEP – the Proposed Action

Source or Activity	Annual Potential to Emit, with Controls (tpy)						
	PM_{10}	$PM_{2.5}$	NO_x	CO	SO_2	VOC	HAP
250-MW HTF process heater	5.5	5.5	12.0	55.2	0.1	9.2	2.1
125-MW HTF process heater	2.8	2.8	6.1	28.0	0.0	4.6	1.1
30 MMBtu/hour auxiliary boilers (2x)	0.2	0.2	0.4	0.7	0.0	0.1	0.1
30 MMBtu/hour HTF freeze-protection heaters (2x)	0.5	0.5	9.4	11.3	0.0	0.3	0.2
1,500-kW diesel powered emergency generator	0.0	0.0	0.5	0.3	0.0	0.0	0.1

Table 4.5 Maximum Annual Operational Phase Emissions for the SSEP – the Proposed Action

Source or Activity	Annual Potential to Emit, with Controls (tpy)						
	PM_{10}	$PM_{2.5}$	NO_x	CO	SO_2	VOC	HAP
1,000-kW diesel powered emergency generator	0.0	0.0	0.4	0.2	0.0	0.0	0.0
300-hp fire water pump diesel engine (2×)	0.0	0.0	0.1	0.1	0.0	0.0	0.0
Cooling towers (2×)	19.9	11.9	–	–	–	–	–
Plant vehicles on paved/unpaved roads	12.0	1.3	–	–	–	–	–
Proposed action total annual emissions	**40.9**	**22.2**	**28.9**	**95.8**	**0.1**	**14.2**	**3.5**
Current Maricopa County emissions[1]	**84,753**	**17,520**	**125,699**	**1,319,398**	**7,546**	**263,580**	**No data**
Estimated increase in current emissions	**0.05%**	**0.13%**	**0.02%**	**0.01%**	**0.00%**	**0.01%**	**n/a**

[1]Because the Project Area is in the PM_{10} nonattainment area, current PM_{10} and $PM_{2.5}$ are reported as the average monthly emissions in the PM_{10} nonattainment area (MCAQD 2005a); Because the Project Area is not in the ozone nonattainment Area current NOx, CO, and VOC emissions are average mon hly emissions in all of Maricopa County (MCAQD 2005b).

4.2.4.2 CONTRIBUTIONS TO NAAQS

The NAAQS provide an appropriate context to assess air quality impacts from the project because they represent thresholds identified by EPA to protect public health. The fraction of the NAAQS concentrations that would be contributed by a conservative representation (maximum output and unfavorable meteorological conditions) of the project emissions for pollutants is summarized in Table 4.6. The following criteria pollutants do not currently exceed NAAQS: NO_x, CO, and SO_2. The SSEP, therefore, would not contribute to existing exceedances, nor would it lead to new exceedances. However, it would incrementally increase overall current emissions of those constituents by <0.01% to 0.5% (Table 4.6).

Table 4.6 Predicted Project Source Ground Level Concentration Effects for Operational Phase – Proposed Action

	Predicted Maximum Ground Level Concentrations, NAAQS, and Background Concentrations (µg/m^3)[2]								
	PM_{10} 24-hour	**PM_{10} Annual**	**$PM_{2.5}$ 24-hour**	**$PM_{2.5}$ Annual**	**NO_X Annual**	**NO_X 8-hour**	**NO_x 1-hour**	**VOCs 8-hour**	**CO 8-hour**
Concentration associated with SSEP Emissions[1]	0.562	0.113	0.557	0.111	0.28	2.69	3.84	1.62	10.1
NAAQS	150	50	35	55	100	n/a	n/a	n/a	10,000
SSEP potential contribution to NAAQS	0.37%	0.23%	1.59%	0.20%	0.28%	n/a	n/a	n/a	0.10%
Buckeye background concentration[2,3]	158–192	53	No data	No data					
West Phoenix background concentration[3]	103–122	44.5–49.8	27.2–40.5	10.9–13.5					

[1]Project emission rates assessed for conserva ive maximum 8 hours of full-load gas-fired operation per day. Assumes 150 foot stack and flat terrain. Maximum distance to predicted concentration is 1.3 km from the project site.

[2]Buckeye monitoring sta ion data range from 2005 to 2007 (Source: Arizona Department of Environmental Quality [ADEQ], Air Quality Annual Reports 2008, 2007, 2006).

[3]Note that the Buckeye monitoring station, used for comparison to PM_{10} concentrations, is 10 km from the project site and the predicted concentrations are at 1 3 km from the project site. It was, however, assumed that the Buckeye monitoring station is representative of current air quality at and around the Project Area. Because there are no data for $PM_{2.5}$ at the Buckeye monitoring station, the west Phoenix monitoring station data were used to provide context to the analysis. However, the west Phoenix data underrepresent particulate concentrations near the Project Area as shown by the difference in PM_{10} concentrations between the Buckeye and west Phoenix stations. Therefore, the contribution of the project to existing exceedances in the area as reported in this table is a minimum.

The SSEP would be located in the Maricopa County PM_{10} nonattainment area. Exceedance of the 24-hour NAAQS occurs if two or more 24-hour PM_{10} readings exceed the standard of 150 micrograms per cubic meter (µg/m^3). Data from the Buckeye monitoring station, the closest monitoring station to the Project Area, indicate consistent exceedances of this standard. Between 2005 and 2007, the second maximum 24-hour PM_{10} concentration ranged from 158 to 192 µg/m^3 (see Table 4.6). The SSEP would contribute at most 0.562 µg/m^3 of PM_{10} during a 24-hour period. SSEP sources constitute a maximum of 0.37% of the 24-hour PM_{10} standard (see Table 4.6) and are predicted to occur close to the Project Area boundary. The SSEP would contribute no more than 0.113 µg/m^3 toward the annual PM_{10} NAAQS. The current annual average PM_{10} concentration at the Buckeye monitoring station is 53 µg/m^3 compared to the NAAQS of 50 µg/m^3. The data from the west Phoenix monitoring station are likely to underrepresent particulate concentrations near the Project Area as shown by the difference in PM_{10} concentrations between the Buckeye and west Phoenix monitoring stations (see Table 4.6). Similarly, the SSEP would contribute at most 0.557 µg/m^3 of $PM_{2.5}$ during a 24-hour period. SSEP sources constitute a maximum of 1.59% of the 24-hour $PM_{2.5}$ standard (see Table 4.6).

Concentrations associated with construction emissions could not be estimated with the use of the SCREEN-3 model, which is designed to evaluate point-source emissions. However, these emissions would not exceed the major source threshold (see Table 2.2) and therefore, are unlikely to contribute to the existing exceedances of NAAQS.

The project would also be located in an 8-hour ozone nonattainment area, and therefore emissions of ozone precursors were also considered in this analysis. The SSEP would contribute, at most, an additional 2.69 µg/m^3 and 1.62 µg/m^3 to existing concentrations of NO_x and VOCs over an 8-hour period, respectively. However, 8-hour ozone background data at the Buckeye monitoring station are well below the NAAQS (see Chapter 3) and do not indicate any exceedances of ozone NAAQS between 2005 and 2008. Ozone exceedances occur in the more urbanized areas of Maricopa County. Therefore, emissions of ozone precursors from the SSEP are unlikely to cause or contribute to exceedances of the 8-hour ozone NAAQS.

4.2.4.3 VISIBILITY OF EMISSION PLUMES FROM STATIONARY SOURCES

The VISCREEN model was used to evaluate the maximum potential impact over a single hour. The analysis conservatively assumed the most unfavorable meteorological conditions and that a low sun angle occurred simultaneously for each observer location. Complete VISCREEN model results are available in the *SSEP Air Quality Technical Report* (Farmer 2010). Table 4.7 summarizes the outputs for the VISCREEN modeling for the most adverse dispersion conditions and illustrates how these impacts are distance dependent. However, these conditions frequently occur at night when the visibility of plumes is not a concern.

Perception of a visible plume by a distant observer is more likely during early morning or late afternoon hours, when the sun is lowest in the sky. The closer the area of interest is to the SSEP, the higher the potential plume visibility is to an observer. Under the most adverse meteorological conditions, including nighttime hours, the model predicted that a plume could be visible at the Sonoran Desert National Monument, Signal Mountain Wilderness, Woolsey Peak Wilderness, North Maricopa Mountains Wilderness, Sierra Estrella Wilderness, Estrella Mountain Regional Park, and Buckeye Hills Regional Park. This analysis is based on significance thresholds identified for Class I areas (see Section 4.2.2.3). Under no conditions would a plume be visible from the South Maricopa Mountains Wilderness or the White Tank Mountain Regional Park. Plume visibility is a function of distance, wind patterns, and topography. To better evaluate the likelihood of significant plume visibility during daylight conditions, the VISCREEN model was operated with a data filter to predict the number of daylight hours per year, on average, when observers might see visible plumes.

Table 4.7 VISCREEN Analysis Results under most Unfavorable Meteorological Conditions

Class II Wilderness and Recreation Areas	Distance to SSEP (km)	Wind Vector	Sky Plume Visibility		Terrain Plume Visibility	
			ΔE	Contrast	ΔE	Contrast
Sonoran Desert National Monument	2.2	SE	**11.8–18.2**	**-0.2–0.25**	**6.2–49.3**	0.03–**0.18**
Signal Mountain Wilderness	34.3	WSW	0.6–1.6	-0.02–0.02	0.2–**2.2**	0.01–0.02
Woolsey Peak Wilderness	22.7	W	0.8–**2.8**	-0.03–0.03	0.9–**4.2**	0.03–0.05
North Maricopa Mountains Wilderness	4.9	SE	**5.9–16.5**	**-0.18–0.20**	**2.8–29.0**	0.02–**0.12**
South Maricopa Mountains Wilderness	28.2	SE	0.5–1.5	-0.02–0.02	0.2–1.9	0.00–0.02
Sierra Estrella Wilderness	22.5	E	1.0–**2.3**	-0.02–0.02	0.2–**3.6**	0.00–0.02
Estrella Mountain Regional Park	13.8	ENE	1.9–**4.6**	-0.05–0.05	1.8–**9.8**	0.04–**0.09**
White Tank Mountain Regional Park	43.5	N	0.1–0.3	0.00	0.0–0.3	0.00
Buckeye Hills Regional Park	8.9	NW	1.3–**2.4**	-0.03–0.03	0.5–**6.2**	0.00–0.03

Note: **Bolded** values exceed the perceptibility threshold (ΔE greater than 2.0 or contrast parameter greater than 0.05) and therefore indicate a likelihood of visibility from he recreation area.

Table 4.8 summarizes the frequency that the perceptibility threshold is likely to be exceeded during daylight hours only for each of the nine wilderness and recreation areas. The likelihood of seeing a visible plume from the SSEP would occur for 43 hours per year (0.5% of the time) at the Sonoran Desert National Monument and North Maricopa Mountains Wilderness, and for 73 hours per year (0.8% of the time) at the Buckeye Hills Regional Park. Note that the visibility of plumes would not necessarily extend for full days. Plumes would not be visible at any of the other wilderness or recreation areas. Note that Class II areas have no visibility protection under federal or state law.

Table 4.8 Frequency of Plume Visibility at Class II Wilderness and Recreation Areas

Class II Wilderness and Recreation Areas	Distance from SSEP	Percent of Values over Perceptibility Threshold[1]	Average No. of Hours/Year[2]
Sonoran Desert National Monument	2.2	0.49%	42.8
Signal Mountain Wilderness	34.3	None	None
Woolsey Peak Wilderness	22.7	None	None
North Maricopa Mountains Wilderness	4.9	0.49%	42.8
South Maricopa Mountains Wilderness	28.2	None	None
Sierra Estrella Wilderness	22.5	None	None
Estrella Mountain Regional Park (County)	13.8	None	None
White Tank Mountain Regional Park (County)	43.5	None	None
Buckeye Hills Regional Park (County)	8.9	0.83%	73

[1] From five years of Phoenix meteorological data, highest annual percentage of daylight hours when perceptibility threshold would be exceeded, specifically ΔE parameter above 2.0 and contrast parameter higher than 0.05.

[2] Calculated based on six hours per day of low-sun angle hours analyzed by VISCREEN. This information assumes only this 6-hour period per day would be affected.

4.2.5 Alternative A: Reduced Water Use (dry-cooled CST)

4.2.5.1 PROJECT EMISSIONS

4.2.5.1.1 Summary of Emissions during Construction

The nature and quantity of construction emissions would be the same under Alternative A compared to the Proposed Action (see Table 4.4) because the area of disturbance and peak construction plan would be the same.

4.2.5.1.2 Summary of Emissions during Operations

The nature of emissions during operations would be very similar under Alternative A compared to the Proposed Action. The elimination of cooling towers, however, would result in a 51% reduction of PM_{10} emissions and a 57% reduction in $PM_{2.5}$ emissions under Alternative A compared to the Proposed Action. In addition, emissions from all gas-fired electrical generation components would be reduced by 9% due to the reduced amount of fuel consumption under Alternative A compared to the Proposed Action (Table 4.9).

Maximum annual emissions during operations of Alternative A would result in an increase to current emissions of PM_{10} and $PM_{2.5}$ in the PM_{10} nonattainment area by 20.2 tpy (0.02%) and 9.5 tpy (0.05%) respectively. Emissions of other criteria pollutants would result in an increase over current emission levels of less than 0.02%.

Table 4.9 Maximum Annual Operational Phase Emissions for the SSEP – Alternative A

Source or Activity	Annual Potential to Emit, with Controls (tpy)						
	PM_{10}	$PM_{2.5}$	NO_X	CO	SO_2	VOC	HAP
250-MW HTF process heater	5.0	5.0	10.9	50.2	0.0	8.4	1.9
125-MW HTF process heater	2.5	2.5	5.6	25.5	0.0	4.2	1.0
30-MMBtu/hour auxiliary boilers (2×)	0.2	0.2	0.4	0.7	0.0	0.1	0.1
30-MMBtu/hour HTF freeze-protection heaters (2×)	0.4	0.4	8.5	10.3	0.0	0.3	0.2
1,500-kW Diesel powered emergency generator	0.017	0.016	0.53	0.29	0.001	0.01	0.054
1,000-kW Diesel powered emergency generator	0.01	0.01	0.35	0.19	0.0004	0.001	0.037
300-hp fire water pump diesel engine (2x)	0.005	0.005	0.1	0.088	0.0002	0.002	0.038
Plant vehicles on paved/unpaved roads	12	1.3	–	–	–	–	–
Alternative A Total emissions annual emissions	**20.2**	**9.5**	**26.4**	**87.2**	**0.1**	**12.9**	**3.2**
Current Maricopa County emissions[1]	**84,753**	**17,520**	**125,699**	**1,319,398**	**7,546**	**263,580**	**No data**
Estimated increase in current emissions	**0.02%**	**0.05%**	**0.02%**	**0.01%**	**0.001%**	**0.00%**	**n/a**

[1]Because the Project Area is in the PM_{10} nonattainment area, current PM_{10} and $PM_{2.5}$ are reported as the average monthly emissions in the PM_{10} nonattainment area (MCAQD 2005a); Because the Project Area is not in the ozone nonattainment area current NOx, CO, and VOC emissions are average monthly emissions in all of Maricopa County (MCAQD 2005b).

4.2.5.2 CONTRIBUTIONS TO NAAQS

The nature of impacts on the current attainment status of NAAQS emissions during operations would be very similar under Alternative A compared to the Proposed Action. Due to the elimination of cooling towers, there would be a reduction in the contribution of the SSEP toward NAAQS for PM_{10} and $PM_{2.5}$. In addition, the concentrations of all other criteria pollutants would be reduced by 9% and would therefore be smaller contributors toward NAAQS. Under Alternative A, the SSEP would contribute at most 0.28 $\mu g/m^3$ of PM_{10} during a 24-hour period (compared to 0.562 $\mu g/m^3$ under the Proposed Action). SSEP sources would constitute a maximum of 0.2% of the 24-hour PM_{10} standard (Table 4.10), and would occur close to the Project Area boundary.

Concentrations associated with construction emissions could not be estimated with the use of the SCREEN-3 model, which is designed to evaluate point-source emissions. However, these emissions would not exceed the major source threshold (see Table 2.2) and therefore, are unlikely to contribute to the existing exceedances of NAAQS. The SSEP would contribute, at most, an additional 2.46 $\mu g/m^3$ and 1.48 $\mu g/m^3$ to existing concentrations of NO_x and VOCs in the area, respectively (9% less than the Proposed Action). As described under the Proposed Action, these emissions of ozone precursors from the SSEP are unlikely to cause or contribute to exceedances of the 8-hour ozone NAAQS.

Table 4.10 Predicted Project Source Ground Level Concentration Effects for Operational Phase – Alternative A

	Predicted Maximum Ground Level Concentrations, NAAQS, and Background Concentrations (µg/m³)[2]								
	PM_{10} 24-hour	**PM_{10} Annual**	**$PM_{2.5}$ 24-hour**	**$PM_{2.5}$ Annual**	**NO_X Annual**	**NO_X 8-hour**	**NOx 1-hour**	**VOCs 8-hour**	**CO 8-hour**
Scaling factor compared to Proposed Action	51%	51%	57%	57%	9%	9%	9%	9%	9%
Concentration associated with SSEP Emissions[1]	0.28	0.06	0.24	0.05	0.25	2.46	3.51	1.48	9.20
NAAQS	150	50	35	55	100	n/a	n/a	n/a	10,000
SSEP potential contribution to NAAQS	0.2%	0.1%	0.7%	0.1%	0.3%	n/a	n/a	n/a	0.1%
Buckeye background concentration[2,3]	158–192	53	No data	No data	–	–	–	–	–
West Phoenix background concentration[3]	103–122	44.5–49.8	27.2–40.5	10.9–13.5	–	–	–	–	–

[1] Project emission rates assessed for conservative maximum 8 hours of full-load gas-fired operation per day. Assumes 150 foot stack and flat terrain. Maximum distance to predicted concentration is 1 3 km from the project site.

[2] Buckeye monitoring station data range from 2005 to 2007 (Source: ADEQ, Air Quality Annual Reports 2008, 2007, 2006.)

[3] Note that the Buckeye monitoring station, used for comparison to PM_{10} concentrations, is 10 km from the project site and the predicted concentrations are at 1.3 km from the project site. It was, however, assumed that the Buckeye monitoring station is representative of current air quality at and around the Project Area. Because there are no data for $PM_{2.5}$ at the Buckeye monitoring station, the west Phoenix monitoring station data were used to provide context to the analysis. However, the west Phoenix data underrepresent particulate concentrations near the Project Area as shown by the difference in PM_{10} concentrations between the Buckeye and west Phoenix stations. Therefore, the contribution of the project to existing exceedances in the area as reported in this table is a minimum.

4.2.5.3 VISIBILITY OF EMISSION PLUMES FROM STATIONARY SOURCES

Plume visibility associated with Alternative A would be the same or less than the impact described for the Proposed Action because combustion related emissions would be 9% less under Alternative A compared to the Proposed Action. The Proposed Action would result in a visible plume less than 1% of the time at three recreational areas in the vicinity. Under Alternative A, there would not be any vapor plumes associated with the cooling towers.

4.2.6 Sub-alternative A1: Photovoltaic

4.2.6.1 PROJECT EMISSIONS

4.2.6.1.1 Summary of Emissions during Construction

The nature of construction emissions would be the same under Sub-alternative A1 as under the Proposed Action (see Table 4.11) because the nature of construction (e.g., methods) would be the same. Maximum monthly emissions from construction of the SSEP under Sub-alternative A1 are summarized in Table 4.11 and compared to current emissions in the PM_{10} nonattainment area (for particulates) and to current emissions in Maricopa County for all other criteria pollutants. At maximum construction levels, construction of the SSEP under Sub-alternative A1 would increase current emissions of PM_{10} and $PM_{2.5}$ in the PM_{10} nonattainment area by 6.1 tpm (0.09%) and 1.4 tpm (0.1%), respectively. Emissions of NO_x, CO, and VOCs would result in less than 0.07% increases over current emission (Table 4.11).

Table 4.11 Summary of Maximum Monthly Construction Emissions – Sub-alternative A1

Emission Source Category[1]	Maximum Construction Monthly Emissions (tpm)[2]				
	PM_{10}	$PM_{2.5}$	NO_X	CO	VOC
Earthmoving/construction operations[3]	4.8	1.1	–	–	–
Offroad construction equipment exhaust[4]	0.035	0.32	5.5	1.44	0.36
Construction mobile vehicle exhaust[5]	0.005	0.005	1.7	0.13	0.04
Total construction emissions	**6.1**	**1.4**	**7.2**	**1.57**	**0.40**
Current average emissions[6]	**7,063**	**1,460**	**10,475**	**109,950**	**19,712**
Estimated increase in current emissions	**0.09%**	**0.10%**	**0.07%**	**0.001%**	**0.002%**

[1] Listing of the emission sources and equipment within each category is from Farmer 2010.

[2] Emission factors primarily obtained from WRAP 2006 and SCAQMD 1993.

[3] General nonresidential construction activity, 0.19 ton PM_{10}/acre month (WRAP 2006)

[4] Equipment category includes wheeled and tracked mobile construction equipment; roster of equipment is the highest estimated level over 24-month schedule.

[5] Equipment category includes stationary, temporary construction equipment; roster of equipment is the highest estimated level over 24-month schedule.

[6] Because the Project Area is in the PM_{10} nonattainment area, current PM_{10} and $PM_{2.5}$ are reported as he average monthly emissions in the PM_{10} nonattainment area (MCAQD 2005a); because the Project Area is not in the ozone nonattainment area, current NO_x, CO, and VOC emissions are average monthly emissions in all of Maricopa County (MCAQD 2005b).

4.2.6.1.2 Summary of Emissions during Operations

Under Sub-alternative A1, there would not be any emissions of criteria pollutants resulting from direct operation of the plant. Dust emissions (PM_{10} and $PM_{2.5}$) during the operation of the SSEP would result from windblown dust generated from disturbed areas and fugitive dust due to vehicle travel on unpaved roads and other surfaces. Dust suppression would be achieved using the same measures described for the Proposed Action.

An overall summary of the maximum operational phase emission sources under Sub-alternative A1 is provided in Table 4.12. Complete calculations of emissions, including an overall facility summary, are available in the SSEP *Air Quality Technical Report* (Farmer 2010). Expected maximum annual emissions during operation of the SSEP are compared to current emissions in the PM_{10} nonattainment area (for particulates) and to current emissions in Maricopa County for all other criteria pollutants in Table 4.12. Operation of the SSEP at maximum levels would increase current emissions of PM_{10} and $PM_{2.5}$ in the PM_{10} nonattainment area by 15.8 tpy (0.009%) and 1.6 tpy (0.009%), respectively. There would be no emissions of other criteria pollutants.

Table 4.12 Maximum Annual Operational Phase Emissions for the SSEP – Sub-alternative A1

Source or Activity	Annual Potential to Emit, with Controls (tpy)						
	PM_{10}	$PM_{2.5}$	NO_X	CO	SO_2	VOC	HAP
Plant vehicles on paved/unpaved roads	15.8	1.6	–	–	–	–	–
Sub-alternative A1 Total emissions annual emissions	**15.8**	**1.6**	**–**	**–**	**–**	**–**	**–**
Current Maricopa County emissions[1]	**84,753**	**17,520**	**125,699**	**1,319,398**	**7,546**	**263,580**	**No data**
Estimated increase in current emissions	**0.02%**	**0.009%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**

[1] Because the Project Area is in the PM_{10} nonattainment area, current PM_{10} and $PM_{2.5}$ are reported as the average monthly emissions in the PM_{10} nonattainment area (MCAQD 2005a); Because the Project Area is not in the ozone nonattainment area, current NO_X, CO, and VOC emissions are average monthly emissions in all of Maricopa County (MCAQD 2005b).

4.2.6.2 CONTRIBUTIONS TO NAAQS

There are no point sources of emissions under Sub-alternative A1; therefore, the SSEP would not result in any substantive contribution to NAAQS under this sub-alternative.

4.2.6.3 VISIBILITY OF EMISSION PLUMES FROM STATIONARY SOURCES

There are no point sources of emissions under Sub-alternative A1, including no visible plumes of water vapor. As a result, the SSEP would not result in any visible plumes at any of the recreation areas evaluated under the other alternatives.

4.2.7 Alternative B: Reduced Footprint

4.2.7.1 PROJECT EMISSIONS

4.2.7.1.1 Summary of Emissions during Construction

The nature of construction emissions would be the same under Alternative B compared to the Proposed Action. However, construction emissions would persist for a shorter period of time (two fewer months) compared to the Proposed Action.

Maximum monthly emissions of construction-related criteria pollutants would be lower than under the Proposed Action (Table 4.13). These reductions are associated with less intensive construction activities during construction of a 125-MW power block compared to a 250-MW power block including less emission generating equipment. Compared to the Proposed Action, Alternative B would result in 3% fewer emissions of PM_{10}, 9% fewer emissions of $PM_{2.5}$, 34% fewer emissions of NOx, 39% fewer emissions of CO, and 34% fewer emissions of VOCs at maximum construction levels. Alternative B would still result in an increase over current emissions of PM_{10} and $PM_{2.5}$ in the PM_{10} nonattainment area by 8.6 tpm (0.12%) and 2.1 tpm (0.14%) respectively. Emissions of NO_x would result in an increase over current emissions of 9.7 tpm (0.09%).

Table 4.13 Summary of Maximum Monthly Construction Emissions – Alternative B

Emission Source Category [1]	Maximum Construction Monthly Emissions (tpm)[2]				
	PM_{10}	$PM_{2.5}$	NO_X	CO	VOC
Earthmoving/construction operations [3]	8.20	1.70	0.0	0.0	0.0
Offroad construction equipment exhaust [4]	0.31	0.31	8.40	3.37	0.94
Construction mobile vehicle exhaust [5]	0.05	0.04	1.30	0.35	0.13
Total construction emissions	**8.6**	**2.1**	**9.7**	**3.7**	**1.1**
Current average emissions[6]	**7,063**	**1,460**	**10,475**	**109,950**	**19,712**
Estimated increase in current emissions	**0.12%**	**0.14%**	**0.09%**	**0.00%**	**0.01%**

[1] Listing of the emission sources and equipment within each category is from Farmer 2010.

[2] Emission factors primarily obtained from WRAP 2006; SCAQMD 1993

[3] General nonresidential construction activity, 0.19 ton PM_{10}/acre month (WRAP 2006)

[4] Equipment category includes wheeled and tracked mobile construction equipment; roster of equipment is the highest estimated level over 24-month schedule.

[5] Equipment category includes stationary, temporary construction equipment; roster of equipment is he highest estimated level over 24-month schedule.

[6] Because the Project Area is in the PM^{10} nonattainment area, current PM_{10} and $PM_{2.5}$ are reported as he average monthly emissions in the PM_{10} nonattainment area (MCAQD 2005a); Because the Project Area is not in the ozone nonattainment area current NOx, CO and VOC emissions are average monthly emissions in all of Maricopa County (MCAQD 2005b).

4.2.7.1.2 Summary of Emissions during Operations

The nature of emissions during operations would be very similar under Alternative B compared to the Proposed Action. The reduced capacity of the SSEP under Alternative B, however, would result in approximately 1/3 fewer operating emissions compared to the Proposed Action (Table 4.14). Maximum annual emissions during operations of Alternative B would result in an increase to current emissions of PM_{10} and $PM_{2.5}$ in the PM_{10} nonattainment area by 27.6 tpy (0.03%) and 15.1 tpy (0.09%) respectively. Emissions of other criteria pollutants would result in an increase over current emission levels of less than 0.02%.

Table 4.14 Maximum Annual Operational Phase Emissions for the SSEP – Alternative B

Source or Activity	Annual Potential to Emit, with Controls (tons/year)						
	PM_{10}	$PM_{2.5}$	NO_X	CO	SO_2	VOC	HAPs
125-MW HTF process heaters	5.6	5.6	12.2	56	0.06	9.2	2.12
30 MMBtu/hour auxiliary boilers (2×)	0.18	0.18	0.42	0.72	0.02	0.11	0.07
30 MMBtu/hour HTF freeze-protection heaters (2×)	0.46	0.46	9.38	11.3	0.02	0.28	0.17
1,000-kW diesel powered emergency generator (2×)	0.02	0.02	0.7	0.38	0.0008	0.002	0.074
300-hp fire water pump diesel engine (2×)	0.005	0.005	0.1	0.088	0.0002	0.002	0.038
Cooling towers (2×)	13.3	8.0	–	–	–	–	–
Plant vehicles on paved/unpaved roads	8.0	0.9	–	–	–	–	–
Alternative B total emissions annual emissions	**27.6**	**15.1**	**22.8**	**68.5**	**0.1**	**9.6**	**2.5**
Current Maricopa County emissions[1]	**84,753**	**17,520**	**125,699**	**1,319,398**	**7,546**	**263,580**	**No data**
Estimated increase in current emissions	**0.03%**	**0.09%**	**0.02%**	**0.01%**	**0.00%**	**0.00%**	**n/a**

[1]Because the Project Area is in the PM_{10} nonattainment area, current PM_{10} and $PM_{2.5}$ are reported as the average monthly emissions in the PM_{10} nonattainment area (MCAQD 2005a); Because the Project Area is not in the ozone nonattainment area current NOx, CO and VOC emissions are average monthly emissions in all of Maricopa County (MCAQD 2005b).

4.2.7.2 CONTRIBUTIONS TO NAAQS

The nature of impacts on the current attainment status of NAAQS emissions during operations would be very similar under Alternative B compared to the Proposed Action. The reduced capacity of the SSEP under Alternative B would result in a reduction in concentrations associated with project emissions of approximately 1/3 (Table 4.15). Under Alternative B, the SSEP would contribute, at most, 0.38 µg/m^3 PM_{10} during a 24-hour period (compared to 0.562 µg/m^3 under the Proposed Action). SSEP sources constitute a maximum of 0.3% of the 24-hour PM_{10} standard (Table 4.15) and are predicted to occur close to the Project Area boundary.

Table 4.15 Predicted Project Source Ground Level Concentration Effects for Operational Phase – Alternative B

	Predicted Maximum Ground Level Concentrations, NAAQS, and Background Concentrations (µg/m³)[2]								
	PM_{10} 24-hour	**PM_{10} Annual**	**$PM_{2.5}$ 24-hour**	**$PM_{2.5}$ Annual**	**NO_X Annual**	**NO_X 8-hour**	**NOx 1-hour**	**VOCs 8-hour**	**CO 8-hour**
Scaling factor compared to Proposed Action	32%	32%	32%	32%	21%	21%	21%	32%	29%
Concentration associated with SSEP Emissions[1]	0.38	0.08	0.38	0.08	0.22	2.12	3.03	1.09	7.22
NAAQS	150	50	35	55	100	n/a	n/a	n/a	10,000
SSEP potential contribution to NAAQS	0.3%	0.2%	1.1%	0.1%	0.2%	n/a	n/a	n/a	0.1%
Buckeye background concentration[2,3]	158–192	53	No data	No data					
West Phoenix background concentration[3]	103–122	44.5–49.8	27.2–40.5	10.9–13.5					

[1] Project emission rates assessed for conservative maximum 8 hours of full-load gas-fired operation per day. Assumes 150 foot stack and flat terrain. Maximum distance to predicted concentra ion is 1.3 km from the project site.

[2] Buckeye monitoring station data range from 2005 to 2007 (Source: ADEQ, Air Quality Annual Reports 2008, 2007, 2006).

[3] Note that the Buckeye monitoring station, used for comparison to PM_{10} concentrations, is 10 km from the project site and the predicted concentrations are at 1.3 km from the project site. It was, however, assumed that the Buckeye monitoring station is representative of current air quality at and around the Project Area. Because there are no data for $PM_{2.5}$ at the Buckeye monitoring station, the west Phoenix monitoring station data were used to provide context to the analysis. However, the west Phoenix data underrepresent particulate concentrations near the Project Area as shown by the difference in PM_{10} concentrations between the Buckeye and west Phoenix stations. Therefore, the contribution of the project to exis ing exceedances in the area as reported in this table is a minimum.

Concentrations associated with construction emissions could not be estimated with the use of the SCREEN-3 model, which is designed to evaluate point-source emissions. However, these emissions would not exceed the major source threshold (see Table 2.2) and therefore are unlikely to contribute to the existing exceedances of NAAQS.

The SSEP would contribute, at most, 2.12 $\mu g/m^3$ and 1.09 $\mu g/m^3$ over an 8-hour period toward NAAQS for NO_x and VOCs in the area, respectively. As described under the Proposed Action, these emissions of ozone precursors from the SSEP are unlikely to cause or contribute to exceedances of the 8-hour ozone NAAQS.

4.2.7.3 VISIBILITY OF EMISSION PLUMES FROM STATIONARY SOURCES

Plume visibility associated with Alternative B would be the same or less than the impact described for the Proposed Action because combustion related emissions would be less under Alternative B compared to the Proposed Action. The Proposed Action would result in a visible plume less than 1% of the time at three recreational areas in the vicinity: Sonoran Desert National Monument, North Maricopa Mountains Wilderness, and Buckeye Hills Regional Park. There would also be a smaller likelihood of vapor plumes as compared to the Proposed Action.

4.2.8 Reduced Water Use Option–Brine Concentrator

The brine concentrator option would not result in any changes in air quality impacts under the Proposed Action or Alternative B because it would not require any additional area of construction disturbance nor a change in operation of equipment to run the brine concentrator.

4.2.9 Generation Tie Line Option

The implementation of the Gen-tie Line Option would not increase vehicle exhaust emissions during construction because no additional vehicles would be required compared to the proposed gen-tie line; nor would it affect emissions or emission plumes from stationary sources during operations because no equipment changes to the solar energy plant would occur. Therefore, there would be no additional emissions of criteria pollutants or HAPs from these sources if this option were selected.

The application of the Gen-tie Line Option would result in additional surface disturbance, which has the potential to increase fugitive and windblown dust emissions (PM_{10} and $PM_{2.5}$). If the Gen-tie Line Option were added to the Proposed Action, Alternative A, or Alternative B, there would be an increase of 8.3 acres of disturbed land under each alternative. Using a total of 3,620 and 3,609 acres of disturbance area for the Proposed Action and Alternative A, respectively, this represents a 0.23% increase in total surface disturbance under these alternatives. Using a total of 2,394 acres of disturbance area for Alternative B, this represents a 0.35% increase in total surface disturbance for this alternative. If the Gen-tie Line Option were added to Sub-alternative A1, an additional 11.4 acres of land would be disturbed. Using a total of 2,013 acres of disturbance area for Sub-alternative A1, this represents a 0.56% increase in total surface disturbance. Conservatively assuming that an increase in surface disturbance would be proportional to an increase in dust emissions, the application of the Gen-tie Line Option would increase emissions of PM_{10} and $PM_{2.5}$ no more than 0.56%, depending on the alternative. These emissions would be for the construction period only.

4.2.10 Potential Mitigation Measures

Mitigation of PM_{10} and $PM_{2.5}$ emissions during the construction phase may be warranted because the project is in a serious nonattainment area, and background data at the Buckeye monitoring station indicate exceedances of the NAAQS. These measures are in addition to those required by MCAQD 310 and A.A.C. R18-02 (see Table 4.1 and Section 4.2.2.1.1) and could include the following:

- Cease emission-producing construction activities during periods of NAAQS exceedances, which could include high wind events and inversions.
- Treat actively disturbed areas on the Project Area prior to foreseeable and/or predictable high wind events with a water or a dust palliative to reduce dust emissions.
- Pave, gravel, and/or apply dust palliative to all road surfaces on the Project Area.
- Treat actively disturbed areas on the Project Area as soon as practicable (as discrete phases of construction on each area are completed) with a dust palliative to reduce windblown dust emissions.
- Minimize land disturbance as much as practicable to accommodate project design and construction.
- Cover cargo area of trucks when hauling soil.
- Revegetate any disturbed land not used for the SSEP.
- Implement dust-suppression mitigation measures as practicable on off-site roads within approximately 2 miles of the Project Area to offset all or a portion of remaining construction emissions.
- Create and use a mandatory carpool and/or vanpool system for construction employees to reduce travel on roads and vehicle emissions.

The following potential mitigation measures could be implemented during operation of the SSEP:

- Create and use a mandatory carpool and/or vanpool system for employees to reduce travel on roads and vehicle emissions.

Emissions of NO_x and VOCs, ozone precursors, are unlikely to contribute to exceedances of the 8-hour ozone NAAQS because exceedances of this standard occur in the more urbanized areas of Maricopa County. Therefore, potential mitigation has not been identified for these pollutants.

4.2.11 Residual Impacts

If the mitigation described in Section 4.2.10 were implemented in full, the project would contribute fewer emissions from fugitive and windblown dust sources. These reductions cannot be quantified because they depend on site-specific conditions and event-specific level of application.

4.2.12 Short-term Uses versus Long-term Productivity

Construction of the SSEP would result in emissions that are below the major source thresholds for all criteria pollutants. Construction emissions would result in a short-term increase in emissions of criteria pollutants; however, these emissions would be less than 0.2% of current monthly emissions in Maricopa County. The pollutants of greatest concern are PM_{10} and $PM_{2.5}$ due to the location of the SSEP in the Maricopa County PM_{10} serious nonattainment area.

Operation of the SSEP under the Proposed Action and Alternative A would result in long-term emissions of criteria pollutants and an associated increase in concentration of these pollutants surrounding the Project Area for the 30-year life of the project, but at a lower level than during the construction phase. These emissions are less than 0.1% of the annual total for Maricopa County and would not exceed major source thresholds. Operation would also lead to visible plumes from several recreational and wilderness areas within 50 km of the SSEP during no more than 1% of daylight hours. These impacts would also persist for the life of the project. Operational emissions under Sub-alternative A1 would be substantially fewer because there are no point-source emissions under this alternative. As a result, there would be no visibility impacts associated with this alternative, including no visual plumes.

4.2.13 Irreversible and Irretrievable Commitments of Resources

Air quality impacts would persist during operation of the SSEP, but would cease relatively quickly following the closure of the project and final reclamation. Therefore, there would be no irreversible impacts on air quality in the area. However, the impacts to air quality during the operation of SSEP would constitute an irretrievable impact.

4.3 Climate Change

The State of Arizona is committed to the reduction of GHG emissions as a means of limiting the influence of human activities on climate change. In September 2006, the governor enacted EO 2006-13, which set the goal of reducing statewide GHG emissions to year 2000 levels by the year 2020, and to 50% below the 2000 level by 2040. Further, the state is a member of the Board of Directors for the Climate Registry, a nonprofit collaboration among North American states, provinces, territories, and Native Sovereign Nations that sets consistent and transparent standards to calculate, verify, and publicly report GHG emissions into a single registry—supporting both voluntary and mandatory reporting programs and providing comprehensive, accurate data to reduce GHG emissions. Arizona, along with California and most western states, is also a member of the Western Climate Initiative, a multistate and international program promoting a regional cap-and-trade market to reduce North American GHG emissions, with a particular focus on the western region of North America.

As a renewable power-generation facility, the SSEP would help the State of Arizona achieve these GHG reduction goals and help the state prepare for any future regional or federal GHG emissions regulations or legislation. This section provides a review of the SSEP GHG emissions for both construction and operational phases.

Combustion sources utilizing carbon-based fuel are the single largest anthropogenic source of CO_2 emissions (EPA 2002). Within the general category of combustion sources, however, different methods of electricity generation can have widely differing GHG emissions per unit of power generation. Direct and avoided GHG emissions (expressed as metric tons of CO_2 equivalents, Mt CO_2e[1]) are considered in this analysis.

4.3.1 Regulatory Requirements, Mitigation and Monitoring Measures

The Project Area is located in an area that falls under the air permitting and jurisdiction of the MCAQD. During both the construction and operational phases, the SSEP would be subject to several federal regulatory requirements under the Clean Air Act derived from Title 40 of the CFR and from county requirements contained in Regulations II and III of the Maricopa County Air Pollution Control Regulations. The statutory provisions in the CAA and all subsequent amendments are implemented in 40 CFR §§ 50–97. The CAA provides for the regulation of certain pollutants, including the GHG CO_2. For more information on these regulations and how they apply to the SSEP, please see Section 3.2 (Air Quality). The EPA delegates the authority to administer and enforce many of these regulations to individual states and agencies such as the MCAQD. In such cases, the delegated state agency may write equivalent or more stringent requirements into their own rules, or they can adopt the federal requirements by reference.

One such agency rule, MCAQD Rule 241 Permits for New Sources and Modifications to Existing Sources, provides control technology requirements for new sources and modifications to existing sources of air pollution requiring permits or permit revisions. This rule is applicable to all new and existing sources other than new major sources and major modifications to major sources. Although this rule only applies to criteria pollutants, the new source technology controls associated with the rule also affect the total GHG emissions associated with the project because efficiencies designed for criteria pollutants also result in reduced GHG emissions.

[1] Individual GHGs have different warming effects, and by convention each is compared to the warming effect of CO_2 through its global warming potential (GWP). For example, methane has a GWP of 21, which means that one metric ton of methane has the same global warming impact as twenty-one metric tons of CO^2. In this way, each greenhouse gas can be translated into metric tons of CO^2 equivalents (Mt CO_2e). Thus, one metric ton of methane is equal to 21 Mt CO_2e.

Under all action alternatives, the SSEP facility would have the flexibility to supply an amount of electricity not exceeding 25% of the gross generation of the plant (in terms of MWh) by gas-fired generation using co-fired boilers or HTF process heaters (see Section 2.5.2.2.5 for regulatory details concerning gas-fired generation).

40 CFR § 98 (Reporting of GHGs) requires annual monitoring, recordkeeping, and reporting of GHG emissions for the combustion processes at the SSEP facility. In addition to the CO_2 emissions that are tracked under 40 CFR § 75 (federal Acid Rain Program) this rule requires the calculation of nitrous oxide (N_2O) and methane (CH_4) GHG emissions. The stack monitoring required under 40 CFR § 75, and natural gas fuel analysis and flow metering for 40 CFR § 75 Appendix D, would provide adequate information for the SSEP facility to comply with this rule.

4.3.2 Analysis Area and Analysis Assumptions

The climate change analysis for the SSEP focuses on a two-tiered analysis area. The first tier relates to emissions from construction, vegetation loss, and SSEP operations. The study of these emissions is limited to the Project Area because that is where the vegetation would be lost and where construction and operational activities would take place (although emissions from vegetation that is removed from the Project Area and decomposes in local landfills are included). The second tier relates to an analysis of the emissions intensity of the SSEP versus area grid electricity and its comparison to the relevant portion of the national electrical grid—an area spanning multiple states (Figure 3.2).

Three key assumptions are made in this analysis. The first assumption, applicable to emissions from vegetation decomposition, is that area landfills where the vegetation would be disposed of are not fitted with CH_4 recovery systems. These systems typically capture approximately 75% of methane coming off of the landfill and combust it for use in energy generation or other applications. Because it is not known in which landfill the removed vegetation would be disposed, the existence of a methane recovery system to capture vegetation methane emissions cannot be assumed. The second assumption, also applicable to emissions from vegetation decomposition, is that Project Area vegetation is largely creosotebush and that a negligible percentage of its vegetative biomass would be subject to protection under the Arizona Native Plant Law (see Sections 4.1.1 and 4.16 of this document). Thus, it is conservatively assumed for the purposes of this analysis that all Project Area vegetation would be cleared and sent to area landfills. The third assumption, applicable to emissions from SSEP operations, is based on the Internal Revenue Service regulations related to the ITC available to solar projects, which states that if the unit generates more than 25% of its output using natural gas, the facility is no longer considered eligible for the ITC. Therefore, it is assumed that a maximum of 25% of the SSEP's annual electricity generation would come from gas-fired sources.

In this analysis, net project contribution to or mitigation of a changed climate is evaluated using a proxy measure of net project lifetime net GHG emissions, measured in Mt CO_2e. Net positive project lifetime emissions are considered a net contribution to a changed climate, whereas net negative project lifetime emissions are considered a net mitigation of a changed climate. The rationale for this approach is outlined below.

The causes of climate change are global in nature, with human and natural contributions that are global in scale. In addition, the effects of climate change are also global in nature; although modeling work has been conducted in an attempt to understand the potential effects of global climate change on a particular region. This is because emissions of GHGs do not generally remain localized, but become well mixed with the general composition of the earth's atmosphere. Therefore, this analysis cannot separate the particular contribution of SSEP emissions or emissions reductions to global climate change (and its regional implications) from the multitude of other past, present, and reasonably foreseeable projects that

would produce or mitigate GHG emissions. The implication is that the SSEP cannot be said to contribute or mitigate a certain ~~"a~~mount" of climate change. However, as described above, the analysis of project net lifetime emissions is used to disclose the SSEP's net mitigation of a changed climate.

The following GHG emissions are considered in the SSEP lifetime emissions analysis:

- Methane emissions from the decay of removed vegetation in area landfills
- The lost capacity of removed vegetation to sequester carbon in the future
- CO_2, methane, and N_2O emissions from diesel and gasoline fuel combustion in construction vehicles and equipment during SSEP construction activities
- CO_2, methane, and N_2O emissions from diesel, gasoline, and natural gas fuel combustion in SSEP vehicles and equipment during SSEP operations
- Emissions avoided from the generation of renewable electricity versus emissions from an equivalent amount of existing grid electricity

These GHG emissions, considered over the 30-year lifetime of the SSEP, are summed to yield a total value for net lifetime SSEP GHG emissions.

GHG emissions sources in this study are limited to emissions sources that are located within the confines of the Project Area. This limit was drawn to maintain the relevancy of this analysis to the SSEP. For example, one could include any number of indirect GHG emissions sources, such as the GHG emissions resulting from transportation to the Project Area or from the manufacture and transportation of construction equipment to the Project Area; however, such an approach would include a multitude of sources with an ever further degree of removal from the SSEP. The limitation of this analysis to emissions occurring in the Project Area maintains its relevancy to the SSEP as a decision-making tool.

The only exception to the Project Area limitation described above is the inclusion of GHG emissions from the landfill decay of Project Area vegetation. Although these emissions occur at the landfill in which the vegetation is placed, and not in the Project Area, they are a result of the clearing of vegetation that is itself located in the Project Area. Sufficient data were available to conclude that the relationship between the clearing of Project Area vegetation and GHG emissions from the decay of this vegetation was sufficiently close as to warrant the inclusion of this emissions source in the GHG analysis. Another potential exception would be increased employee travel to the Project Area; however, the relationship in this case is less direct because factors such as commuting distance, vehicle type, fuel type, and carpooling practices are not known and are not under the control of the SSEP and its operators.

Unless noted otherwise, all data in this section are drawn from the *SSEP Air Quality Technical Report* (Farmer 2010).

4.3.3 No Action

Under the No Action alternative, the SSEP would not be developed and existing land uses in the Project Area would continue. No acres of vegetation would be cleared, Project Area vegetation would continue to sequester CO_2, there would be no project construction or operational phase GHG emissions, and no renewable energy would be generated.

Livestock grazing in the Project Area would continue in two allotments (one authorized and one ephemeral) that are grazed infrequently. Limited vehicle use in the Project Area would also continue. The Project Area includes approximately 13.1 miles of roads, and it is currently used infrequently by hikers, hunters, and birders. Motor vehicle use of this road system is also infrequent. Although livestock grazing

and motor vehicle activities do involve GHG emissions, emissions levels are likely small and data are not available to accurately quantify them. Therefore emissions from these sources are not considered in this analysis.

Project Area vegetation would continue to sequester CO_2, and over the 30-year lifetime of the SSEP, this vegetation would sequester an estimated 23,554 Mt CO_2e. Because this biosequestration of CO_2 is a naturally occurring feature of the Project Area, it is not considered a net mitigation of climate change. However, loss of this biosequestration capacity is considered as an impact area under the Proposed Action and the subsequent action alternatives and options. GHG emissions under the No Action alternative are summarized in Table 4.16.

Table 4.16 GHG Emissions – No Action Alternative

Activity Name	GHG Emissions (Mt CO_2e)
Landfill of vegetation	0
Lost biosequestration capacity of vegetation (30 year)	0
Construction activities	0
SSEP operations	0
Emissions savings from renewable energy	0
Total No Action emissions	**0**

4.3.4 Proposed Action

4.3.4.1 EMISSIONS FROM CONSTRUCTION, VEGETATION LOSS, AND SSEP OPERATIONS

The Proposed Action would result in GHG emissions from SSEP construction, Project Area vegetation loss, and SSEP operations.

Construction activities under the Proposed Action would consist of clearing the Project Area of vegetation and operating earthmoving construction equipment and other construction vehicles and stationary equipment. This construction equipment would be operated to grade the Project Area, prepare drainage features, lay foundations for SSEP structures, construct the structures, and install major SSEP equipment. During construction, vegetation would be permanently removed from approximately 3,569 acres, and would be temporarily removed from (or disturbed on) an additional 31 acres. Construction equipment for both the 125-MW and 250-MW units would be operated for 25 months over the 39-month construction and commissioning timeframe (Farmer 2010, Appendix A). As construction equipment is operated, it produces GHG emissions through the combustion of gasoline and diesel fuels.

Once the Project Area vegetation has been cleared, it would be sent to area landfills where its decay would result in methane GHG emissions that would not otherwise occur. Finally, because Project Area vegetation would be suppressed during the SSEP's 30-year lifetime, its capacity to sequester CO_2 would be lost. This lost biosequestration capacity would result in a lost capture of CO_2 that is treated as the equivalent of a new emission of GHGs relative to the No Action alternative. Construction, vegetation landfill, and lost biosequestration GHG emissions for the 125-MW and 250-MW units are summarized in Tables 4.17 and 4.18, respectively.

Table 4.17 125-MW Construction GHG Emissions – Proposed Action

Activity Name	Source Data	GHG Emissions (Mt CO_2e)
Landfill of vegetation	1,206 acres	2,139
Lost biosequestration capacity of vegetation (30 years)	1,196 acres	7,893
Construction: earthmoving equipment	98,550 hours	2,424
Construction: vehicles and stationary equipment	93,425 hours	2,084
Total 125-MW construction emissions		**14,540**

Table 4.18 250-MW Construction GHG Emissions – Proposed Action

Activity Name	Source Data	GHG Emissions (Mt CO_2e)
Landfill of vegetation	2,394 acres	4,245
Lost biosequestration capacity of vegetation (30 years)	2,373 acres	15,662
Construction: earthmoving equipment	114,875 hours	2,967
Construction: vehicles and stationary equipment	68,450 hours	1,674
Total 250-MW Construction Emissions		**24,547**

Operational GHG emissions under the Proposed Action would consist of 1) emissions from natural gas combustion for SSEP co-fired HTF process heaters or steam boilers, auxiliary boilers, and HTF freeze-protection heaters; 2) emissions from diesel and gasoline fuel combustion for SSEP vehicles and emergency equipment; and 3) emissions from the leakage of the switchgear inert gas sulfur hexafluoride[2] (SF_6) (a GHG 23,900 times more potent than CO_2).

SSEP operational GHG emissions for the 125-MW and 250-MW units are summarized in Tables 4.19 and 4.20, respectively. These emissions have been evaluated for the 30-year lifetime of the SSEP. Operational GHG emissions over the life of the project for both the 125-MW and 250-MW block would range from 485,502 Mt CO_2e to 6,845,955 Mt CO_2e. The maximum emissions assume that the SSEP would generate 25% of the total electricity output from combustion of natural gas. The minimum emissions required to operate the SSEP would consist of those associated with the auxiliary boiler, the HTF freeze protection heater, the leakage of SF_6, and plant vehicles.

[2] Because the decision of whether to use SF_6 at the SSEP has not yet been finalized, the conservative assumption was made that the gas would be used. Leakage rates were estimated based on a similar project (Farmer 2010).

Table 4.19 125-MW Operational GHG Emissions (30-year) – Proposed Action

Activity Name	Source Data[1]	GHG Emissions (Mt CO_2e)
Natural gas augmented power production	Up to 1,327,000 MMBtu/year	2,118,210
Auxiliary boiler and HTF freeze-protection heater*	60 MMBtu/hour	239,400
SF_6 switchgear inert gas leakage*	125-MW scale	303
Diesel emergency generator	1,341 hp	1,173
Diesel emergency water pump (fire prevention)	300 hp	528
Plant vehicles*	113,555 miles/year	2,706
Maximum total 125-MW operational emissions		**2,362,320**
Minimum total 125-MW operational emissions[1]		**242,409**

[1]Operational emissions included in the minimum emissions estimate are indicated by an asterisk (*)

Table 4.20 250-MW Operational GHG Emissions (30-year) – Proposed Action

Activity Name	Source Data[1]	GHG Emissions (Mt CO_2e)
Natural gas augmented power production	Up to 2,655,000 MMBtu/year	4,238,010
Auxiliary boiler and HTF freeze-protection heater*	60 MMBtu/hour	239,400
SF_6 switchgear inert gas leakage*	250-MW scale	606
Diesel emergency generator	2,012 hp	2,004
Diesel emergency water pump (fire prevention)	300 hp	528
Plant vehicles*	122,680 miles/year	3,087
Maximum total 250-MW operational emissions		**4,483,635**
Minimum total 250-MW operational emissions[1]		**243,093**

[1]Operational emissions included in the minimum emissions estimate are indicated by an asterisk (*)

SSEP construction and vegetation loss GHG emissions can be added to the 30-year operational GHG emissions, yielding the total lifetime SSEP GHG emissions under the Proposed Action (Table 4.21).

Table 4.21 Summary of SSEP Lifetime GHG Emissions – Proposed Action

Activity Name	GHG Emissions (Mt CO_2e)
125-MW unit construction (including vegetation loss)	14,540
250-MW unit construction (including vegetation loss)	24,556
Maximum 125-MW unit operation	2,362,320
Minimum 125-MW unit operation	242,409
Maximum 250-MW unit operation	4,483,635
Minimum 250-MW unit operation	243,093
Maximum total SSEP 30-year GHG emissions	**6,885,050**
Minimum total SSEP 30-year GHG emissions	**524,598**

Note: Individual values may not sum to the total due to rounding error.

The SSEP's net mitigation of climate change under the Proposed Action was determined by comparing the SSEP lifetime GHG emissions given in Table 4.21 to GHG emissions from grid electricity. GHG emissions from grid electricity, and how they relate to SSEP electricity under the Proposed Action, are discussed below.

4.3.4.2 ELECTRICITY GHG EMISSIONS INTENSITY: SSEP VERSUS THE REGIONAL GRID

Under the Proposed Action, the SSEP is expected to produce 1,155,000 MWh of electricity per year, assuming 25% generation from gas co-firing (see Chapter 2, Table 2.15), or 34,650,000 MWh over its 30-year lifetime. When comparing GHG emissions intensity[3] to other sources of electricity, by EPA convention, only GHG emissions from plant fuel combustion for energy generation are considered (EPA 2008). Therefore, for the SSEP GHG emissions intensity, only GHG emissions from the combustion of natural gas in the co-fired HTF heaters or co-fired boilers (–Natural gas augmented power production" in Tables 4.19 and 4.20) are considered: 6,356,220 Mt CO_2e over the 30-year lifetime of the SSEP. This gives an emissions intensity of 404.4 pounds of CO_2e/MWh for the SSEP.

The GHG emissions intensity of the existing local grid electricity was assessed using the appropriate EPA eGRID subregion. EPA defined these subregions to represent portions of the power grid that have similar emissions and generation-resource mix characteristics, and that may be partially isolated by transmission constraints. However, these subregions also reflect the interconnected nature of the electrical grid, which spans county, state, and other geopolitical boundaries.

The Project Area and its associated analysis area are located in the Arizona New Mexico Western Electricity Coordinating Council (AZNM WECC) southwest subregion (see Figure 3.2). GHG emissions intensities of electricity for the SSEP and the existing AZNM WECC southwest eGrid subregion are given in Table 4.22.

Table 4.22 EPA AZNM WECC Southwest eGRID Subregion and SSEP GHG Emissions Intensities[1] of Electricity – Proposed Action

	Carbon Dioxide Equivalents (pounds/MWh)
SSEP	404.4
AZNM WECC southwest eGrid subregion (grid electricity)	1,317.98

Resources that generate electricity in AZNM WECC southwest subregion consist primarily of coal (46% of total generation), natural gas (32%), nuclear (16%), hydro (4%), and geothermal (2%) (EPA 2008). Renewable energy sources such as hydro, geothermal, wind, and solar make up 6% of the total subregion generation mix, with solar in particular contributing 0.0086% of total generation. Total annual electricity generation in this subregion is 157,546 GWh.

Existing generation levels of renewable energy within the AZNM WECC southwest eGrid subregion and the changes that would occur under the Proposed Action are summarized in Table 4.23.

[3] When discussing the GHG emissions of electricity, the term "emissions intensity" refers to the amount of GHGs emitted per unit of electricity generated. By convention, the only GHGs used to calculate this figure are GHGs emitted from the combustion of fuel directly involved in the generation of the electricity. For example, a coal-fired power plant would include emissions from the burning of coal in its GHG emissions intensity calculation, but it would not include emissions from equipment used to move the coal within the site.

Table 4.23 AZNM WECC Renewable Energy Mix With and Without the SSEP – Proposed Action

	Existing AZNM WECC Subregion	AZNM WECC Subregion + SSEP	Percentage Change due to SSEP
All renewables (GWh/year)	9,450	10,608	12.2%
Solar energy (GWh/year)	13.5	1,169	8,524.6%

Given the emissions intensity of AZNM WECC southwest grid electricity of 1,317.98 pounds of CO_2e/MWh (see Table 4.22) and assuming the consumption of an amount of grid electricity equal to the SSEP's annual energy output of 1,155,000 MWh over its 30-year lifetime, the GHG emissions from the consumption of an equivalent amount of AZNM WECC southwest grid electricity over 30 years would total 20,714,872 Mt CO_2e. This value assumes that if the SSEP were not built, its electricity output would not be available and grid electricity would be consumed instead. By building the SSEP under the Proposed Action, 20,714,872 Mt CO_2e of GHG emissions from grid electricity would be avoided.

In contrast, construction of the SSEP under the Proposed Action would result in 6,896,657 Mt CO_2e of GHG emissions for the lifetime of the SSEP. SSEP net lifetime GHG emissions are calculated as the sum of SSEP lifetime GHG emissions and the avoided GHG emissions from 30 years of grid electricity at 1,155,000 MWh per year (Table 4.24).

Table 4.24 SSEP Net Lifetime GHG Emissions – Proposed Action

SSEP lifetime GHG emissions (Mt CO_2e)	6,885,050
Avoided GHG emissions from AZNM WECC Grid Electricity (Mt CO_2e)	-20,714,872
Proposed Action SSEP net lifetime GHG emissions (Mt CO_2e)	**-13,829,822**

4.3.5 Alternative A: Reduced Water Use (dry-cooled CST)

Alternative A was developed to respond to concerns about consumptive water use by the SSEP that were expressed during public and agency scoping. Under Alternative A, the SSEP would be constructed using a dry-cooling technology rather than the wet-cooling considered under the Proposed Action. Because no water would be used for cooling, consumptive evaporative losses would be considerably lower under this alternative than under the other action alternatives.

4.3.5.1 EMISSIONS FROM CONSTRUCTION, VEGETATION LOSS, AND SSEP OPERATIONS

Under Alternative A, GHG emissions from construction would not change; however, long-term and short-term vegetation loss would be reduced by approximately 9 acres and 2 acres, respectively, due to the need for fewer groundwater well sites. SSEP total construction and vegetation loss GHG emissions under Alternative A are shown in Tables 4.25 and 4.26, below.

Table 4.25 125-MW Construction GHG Emissions – Alternative A

Activity Name	Source Data	GHG Emissions (Mt CO_2e)
Landfill of vegetation	1,204 acres	2,135
Lost biosequestration capacity of vegetation (30 years)	1,194 acres	7,881
Construction: earthmoving equipment	98,550 hours	2,424
Construction: vehicles and stationary equipment	93,425 hours	2,084
Total 125-MW construction emissions		**14,524**

Table 4.26 250-MW Construction GHG Emissions – Alternative A

Activity Name	Source Data	GHG Emissions (Mt CO_2e)
Landfill of vegetation	2,386 acres	4,232
Lost biosequestration capacity of vegetation (30 years)	2,367 acres	15,623
Construction: earthmoving equipment	114,875 hours	2,976
Construction: vehicles and stationary equipment	68,450 hours	1,674
Total 250-MW construction emissions		**24,505**

Additionally, less efficient dry cooling would allow less energy production from the (same sized) solar field than under the wet-cooled Proposed Action. Total solar generation would be approximately 9% less than the anticipated generation under the Proposed Action, or approximately 1,051,050 MWh per year. Because total electricity generation would be reduced, the maximum level of natural gas allowed for electricity generation under the SSEP air permit would also be reduced to 3,623,620 MMBtu. This reduction in the maximum level of allowed natural gas means a reduction in maximum SSEP-operational GHG emissions to 6,273,885 Mt CO_2e under Alternative A relative to the Proposed Action (see Tables 4.19 and 4.20), as shown in Tables 4.27 and 4.28 below. The minimum GHG emissions from the SSEP under Alternative A would be the same as the Proposed Action at 485,502 Mt CO_2.

Table 4.27 125-MW Operational GHG Emissions (30-year) – Alternative A

Activity Name	Source Data[1]	GHG Emissions (Mt CO_2e)
Natural gas augmented power production	Up to 1,207,570 MMBtu/year	1,927,560
Auxiliary boiler and HTF freeze-protection heater*	60 MMBtu/hour	239,400
SF_6 switchgear inert gas leakage*	125-MW scale	303
Diesel emergency generator	1,341 hp	1,173
Diesel emergency water pump (fire prevention)	300 hp	528
Plant vehicles*	113,555 miles/year	2,706
Maximum total 125-MW operational emissions		**2,171,670**
Minimum total 125-MW operational emissions[1]		**242,409**

[1]Operational emissions included in the minimum emissions estimate are indicated by an asterisk (*)

Table 4.28 250-MW Operational GHG Emissions (30-year) – Alternative A

Activity Name	Source Data[1]	GHG Emissions (Mt CO_2e)
Natural gas augmented power production	Up to 2,416,050 MMBtu/year	3,856,590
Auxiliary boiler and HTF freeze-protection heater	60 MMBtu/hour	239,400
SF_6 switchgear inert gas leakage	250-MW scale	606
Diesel emergency generator	2,012 hp	2,004
Diesel emergency water pump (fire prevention)	300 hp	528
Plant vehicles	122,680 miles/year	3,087
Maximum total 250-MW operational emissions		**4,102,215**
Minimum total 250-MW operational emissions[1]		**243,093**

[1]Operational emissions included in the minimum emissions estimate are indicated by an asterisk (*)

Adding SSEP GHG emissions from construction and vegetation loss to the 30-year operational GHG emissions yields the total lifetime SSEP GHG emissions under Alternative A (Table 4.29).

Table 4.29 Summary of SSEP Lifetime GHG Emissions – Alternative A

Activity Name	GHG Emissions (Mt CO_2e)
125-MW unit construction (including vegetation loss)	14,524
250-MW unit construction (including vegetation loss)	24,505
125-MW unit operation	2,171,670
250-MW unit operation	4,102,215
Maximum total SSEP 30-year GHG emissions	**6,312,914**
Minimum total SSEP 30-year GHG emissions	**524,531**

4.3.5.2 ELECTRICITY GHG EMISSIONS INTENSITY: SSEP VERSUS THE REGIONAL GRID – ALTERNATIVE A

The changes to the SSEP's electrical output and GHG emissions described above would influence the SSEP's contribution of renewable energy to the local grid, relative to the Proposed Action (see Table 4.23). However, because the SSEP's electrical output and GHG emissions from natural gas-augmented power production would both be reduced by 9% under Alternative A, the SSEP's emissions intensity (see Section 4.3.4.2) of electricity would be unchanged relative to the Proposed Action (see Table 4.22). The SSEP's contribution of renewable energy to the local grid under Alternative A is described in Table 4.30.

Table 4.30 AZNM WECC Renewable Energy Mix with and without the SSEP – Alternative A

	Existing AZNM WECC Subregion	AZNM WECC Subregion + SSEP	Percentage Change due to SSEP
All renewables (GWh/year)	9,450	10,504	11.1%
Solar energy (GWh/year)	13.5	1,065	7,757.4%

Finally, SSEP net lifetime GHG emissions—the difference between SSEP lifetime GHG emissions and the GHG emissions from an equivalent amount of grid electricity (see the discussion preceding Table 4.24)—would be changed relative to the Proposed Action (see Table 4.27) for two reasons. First, reductions to SSEP operational emissions under Alternative A (Tables 4.27 and 4.28) would reduce SSEP lifetime GHG emissions. Second, reductions to SSEP electrical output would reduce the equivalent amount of grid electricity considered over 30 years. SSEP net lifetime GHG emissions under Alternative A are presented in Table 4.31.

Table 4.31 SSEP Net Lifetime GHG Emissions – Alternative A

SSEP lifetime GHG emissions (Mt CO_2e)	6,312,914
Avoided GHG emissions from AZNM WECC grid electricity (Mt CO_2e)	-18,850,534
Alternative A SSEP net lifetime GHG emissions (Mt CO_2e)	**-12,537,620**

4.3.6 Sub-alternative A1: Photovoltaic

Sub-alternative A1 was developed primarily in response to comments on the draft EIS concerning consumptive water use; however, this alternative also reduces the level of impacts to other resources due to its smaller footprint. Under this sub-alternative, the SSEP would use PV technology to generate electricity. This technology only requires incidental water use and does not require the use of natural gas. For a detailed explanation of Sub-alternative A1, refer to Section 2.7.

4.3.6.1 EMISSIONS FROM CONSTRUCTION, VEGETATION LOSS, AND SSEP OPERATIONS

The nature of construction under this sub-alternative would be similar to the Proposed Action and would result in GHG emissions from construction. The area cleared during construction under Sub-alternative A1 would be 1,933 acres, 46% less than the 3,600 acres that would be cleared under the Proposed Action (Table 4.32). This would result in the emissions of 16,152 Mt CO2e over the life of the project due to the removal of vegetation and the loss of vegetative biosequestration capacity, 47% less emissions than under the Proposed Action. There would be 260,680 fewer construction hours under Sub-alternative A1 than under the Proposed Action, resulting in 6,139 Mt CO2e GHG emissions, 67% less than the emissions associated with vehicles and equipment under the Proposed Action.

Table 4.32 Construction GHG Emissions – Sub-alternative A1

Activity Name	Source Data	GHG Emissions (Mt CO_2e)
Landfill of vegetation	1,933 acres	3,427
Lost biosequestration capacity of vegetation (30 years)	1,928 acres	12,724
Construction: earthmoving equipment	75,460 hours	2,231
Construction: vehicles and stationary equipment	39,160 hours	788
Total construction emissions		**19,171**

Additionally, there would be fewer GHG emissions during operation under Sub-alternative A1 than under the Proposed Action due to the sub-alternative's lack of natural gas supplemental power, auxiliary boiler and HTF freeze-protection heaters, diesel emergency generators, and water pumps. The operational GHG emissions would result from plant vehicle emissions and leakage of SF6 associated with switchgears. Total operational emissions for the life of the project would be 6,033 Mt CO2e, approximately 99.9% less than operational emissions associated with the Proposed Action (Table 4.33).

Table 4.33 Operational GHG Emissions (30-year) – Sub-alternative A1

Activity Name	Source Data	GHG Emissions (Mt CO_2e)
SF_6 switchgear inert gas leakage	300 MW Generation Capacity	729
Plant vehicles	140,190 miles/year	5,304
Total 125-MW operational emissions		**6,033**

Total construction and operation emissions over the life of the project would be 25,204 Mt CO2e under Sub-alternative A1, which is less than 1% of the total emissions (construction and operations) that would result from the project under the Proposed Action (Table 4.34).

Table 4.34 Summary of SSEP Lifetime GHG Emissions – Sub-alternative A1

Activity Name	GHG Emissions (Mt CO_2e)
Construction (including vegetation loss)	19,171
Operation	6,033
Total SSEP 30-year GHG emissions	**25,204**

4.3.6.2 ELECTRICITY GHG EMISSIONS INTENSITY: SSEP VERSUS THE REGIONAL GRID – SUB-ALTERNATIVE A1

Under Sub-alternative A1, the SSEP would produce at least 775,000 MWh of electricity per year. Using the EPA criteria for calculating carbon intensity associated with electrical generation (see Section 4.3.4.2 for details), the SSEP under Sub-alternative A1 would have a carbon intensity of 0 pound of CO2e/MWh of production, compared to 1,318 pounds of CO2e/MWh for the AZNM WECC southwest eGrid subregion (i.e., the grid to which the SSEP would feed).

Existing generation levels of renewable energy within the AZNM WECC southwest eGrid subregion and the changes that would occur under Sub-alternative A1 are summarized in Table 4.35. The SSEP under Sub-alternative A1 would result in an 8.2% increase in all renewable energy and a 5,720% increase in solar energy contributing to the AZNM WECC subregion grid.

Table 4.35 AZNM WECC Renewable Energy Mix with and without the SSEP – Sub-alternative A1

	Existing AZNM WECC Subregion	AZNM WECC Subregion + SSEP	Percentage Change due to SSEP
All renewables (GWh/year)	9,450	10,225	8.2%
Solar energy (GWh/year)	13.5	789	5,720%

Construction and operation of the SSEP under Sub-alternative A1 would result in 25,203 Mt CO2e over the life of the project. In contrast, an equivalent amount of electrical production from the AZNM WECC southwest grid would result in 13,899,589 Mt CO2e over 30 years. These emissions are avoided through the construction of the SSEP, assuming that if the SSEP were not built, its electricity output would not be available and grid electricity would be consumed instead. Including these avoided GHG emissions, the net lifetime emissions of the SSEP under Sub-alternative A1 would be –13,874,386 Mt CO2e, which is less than 1% fewer emissions than the emissions associated with the Proposed Action (Table 4.36).

Table 4.36 SSEP Net Lifetime GHG Emissions – Sub-alternative A1

SSEP lifetime GHG emissions (Mt CO_2e)	25,203
Avoided GHG emissions from AZNM WECC grid electricity (Mt CO_2e)	–13,899,589
Sub-alternative A1 SSEP net lifetime GHG emissions (Mt CO_2e)	**–13,874,386**

4.3.7 Alternative B: Reduced Footprint

Under Alternative B, the SSEP would consist of two independent, concentrated solar electric generating facilities, each with nominal net electrical outputs of 125 MW (for a total of 250 MW), rather than 375 MW considered under the Proposed Action.

The main project footprint under Alternative B would require the permanent removal of vegetation on approximately 2,343 acres, versus approximately 3,568 acres under the Proposed Action. An additional 30 acres of vegetation would be removed or disturbed on a temporary basis, versus approximately 31 acres under the Proposed Action. Total solar generation would be approximately 33% less than the anticipated generation under the Proposed Action, or 770,000 MWh.

4.3.7.1 EMISSIONS FROM CONSTRUCTION, VEGETATION LOSS, AND SSEP OPERATIONS

Because Alternative B would involve a smaller project footprint with less electricity generation capacity, there would be a number of differences in the construction, vegetation loss, and SSEP operational GHG emissions between this alternative and the Proposed Action. These differences are:

- a reduction in the acres of vegetation cleared, which would result in less vegetation being sent to area landfills (and therefore reduced GHG emissions from the decay of this vegetation) and less lost biosequestration capacity;
- a reduction in the SSEP construction time, due to less construction activity needed to build two 125-MW units instead of one 125-MW and one 250-MW unit, which would result in less GHG emissions from construction activities;
- a reduction in SSEP operational emissions from natural gas used to augment power production, due to the reduced electricity output and SSEP air permit restrictions, which would result in a reduction of GHG emissions from natural gas combustion; and
- a smaller amount of required operational support equipment and vehicles due to the reduced unit size from 250-MW to 125-MW, which would result in a reduction of SSEP operational emissions.

SSEP construction GHG emissions (including vegetation-related emissions) under Alternative B are shown in Table 4.37. Alternative B construction activities and emissions for the second 125-MW unit were scaled based on the Proposed Action‘s construction vehicle operation time of 25 months, versus 16 months of construction under Alternative B. A construction time of 16 months for the second 125-MW unit under Alternative B was assumed based on the 2 month reduction in construction time on the parabolic troughs and a 7 month reduction in construction time on the power blocks.

Table 4.37 Construction GHG Emissions – Alternative B

Activity Name	Source Data	GHG Emissions (Mt CO_2e)
Landfill of vegetation	1,167 acres	2,070
Lost biosequestration capacity of vegetation (30 years)	1,148 acres	7,574
Construction: earthmoving equipment	68,296 hours	1,728
Construction: vehicles and stationary equipment	51,800 hours	1,203
125-MW unit 2 total construction emissions	n/a	12,575
125-MW unit 1 construction (unchanged from the proposed action)	n/a	14,540
Total construction emissions – Alternative B	**n/a**	**27,114**

SSEP operational GHG emissions under Alternative B are shown in Table 4.38. Minimum GHG emissions would be 7.5% less than the Proposed Action at 484,818 Mt CO2e; however, maximum GHG emissions would be 31% less than the Proposed Action at 4,724,640 Mt CO2e.

Table 4.38 125-MW Operational GHG Emissions (30-year) – Alternative B

Activity Name	Source Data[1]	GHG Emissions (Mt CO_2e)
Natural gas augmented power production	Up to 1,327,500 MMBtu/year	2,118,210
Auxiliary boiler and HTF freeze-protection heater*	60 MMBtu/hour	239,400
SF_6 switchgear inert gas leakage*	250-MW scale	303
Diesel emergency generator	2,012 hp	1,173
Diesel emergency water pump (fire prevention)	300 hp	528
Plant vehicles*	122,680 miles/year	2,706
Single 125-MW unit operational emissions		2,362,320
Maximum total operational emissions – Alternative B		**4,724,640**
Minimum total operational emissions – Alternative B		**484,818**

[1]Operational emissions included in the minimum emissions estimate are indicated by an asterisk (*)

Adding SSEP GHG emissions from construction and vegetation loss to the 30-year operational GHG emissions yields the total lifetime SSEP GHG emissions under Alternative B, as shown in Table 4.39.

Table 4.39 Summary of SSEP Lifetime GHG Emissions – Alternative B

Activity Name	GHG Emissions (Mt CO_2e)
125-MW Unit 1 construction (including vegetation loss)	14,540
125-MW Unit 2 construction (including vegetation loss)	12,575
Maximum 125-MW Unit 1 operation	2,362,320
Minimum 125-MW Unit 1 operation	242,409
Maximum 125-MW Unit 2 operation	2,362,320
Minimum 125-MW Unit 2 operation	242,409
Maximum total SSEP 30-year GHG emissions	**4,751,754**
Minimum total SSEP 30-year GHG emissions	**511,933**

Note: Individual values may not sum to the total due to rounding error.

4.3.7.2 ELECTRICITY GHG EMISSIONS INTENSITY: SSEP VERSUS THE REGIONAL GRID

The changes to the SSEP's electrical output and GHG emissions described above would influence the SSEP's contribution of renewable energy to the local grid, relative to the Proposed Action (see Table 4.23). However, because the SSEP's electrical output and GHG emissions from natural gas-augmented power production would both be reduced by 33% under Alternative B, the SSEP's emissions intensity (see Section 4.3.4.2) of electricity would be unchanged relative to the Proposed Action (see Table 4.22). The SSEP's contribution of renewable energy to the local grid under Alternative B is described in Table 4.40.

Table 4.40 AZNM WECC Renewable Energy Mix with and without the SSEP – Alternative B

	Existing AZNM WECC Subregion	AZNM WECC Subregion + SSEP	Percentage Change due to SSEP
All renewables (GWh/year)	9,450	10,223	8.1%
Solar energy (GWh/year)	13.5	784	5,683.1%

Finally, net lifetime GHG emissions for SSEP —the difference between SSEP lifetime GHG emissions and the GHG emissions from an equivalent amount of grid electricity (see the discussion preceding Table 4.24)—would change relative to the Proposed Action (see Table 4.24) for two reasons. First, reductions to SSEP construction emissions (Table 4.37) and operational emissions (Table 4.38) under Alternative B result in a reduction in SSEP lifetime GHG emissions. Second, reductions to SSEP annual electrical output would result in a reduction in the equivalent amount of grid electricity considered over 30 years. SSEP net lifetime GHG emissions under Alternative B are presented in Table 4.41.

Table 4.41 SSEP Net Lifetime GHG Emissions – Alternative B

SSEP lifetime GHG emissions (Mt CO_2e)	4,751,754
Avoided GHG emissions from AZNM WECC grid electricity (Mt CO_2e)	-13,809,915
Alternative A SSEP net lifetime GHG emissions (Mt CO_2e)	**-9,058,160**

4.3.8 Reduced Water Use Option–Brine Concentrator

The use of a brine concentrator would not affect SSEP construction or operational GHG emissions, and it would not affect SSEP electricity production. As such, the brine concentrator option would not affect the climate change contribution of any of the SSEP alternatives.

4.3.9 Generation Tie Line Option

The application of the Gen-tie Line Option would not affect SSEP electricity production, operational GHG emissions, or construction GHG emissions under any action alternative. Potential GHG emissions from this option would consist of short-term and long-term vegetation loss caused by additional surface disturbance.

If the Gen-tie Line Option were added to the Proposed Action, Alternative A, or Alternative B, there would be an increase of 8.3 acres of disturbed land under each alternative. Using a total of approximately 3,620 and 3,609 acres of disturbance area for the Proposed Action and Alternative A, respectively, this represents a 0.23% increase in total surface disturbance under these alternatives. Using a total of 2,394 acres of disturbance area for Alternative B, this represents a 0.35% increase in total surface disturbance

for this alternative. If the Gen-tie Line Option were added to Sub-alternative A1, an additional 11.4 acres of land would be disturbed. Using a total of 2,013 acres of disturbance area for Sub-alternative A1, this represents a 0.56% increase in total surface disturbance. Conservatively assuming that an increase in surface disturbance would be proportional to an increase in GHG emissions, the application of the Gen-tie Option would increase total emissions of GHGs no more than 0.56% depending on the alternative.

4.3.10 Potential Mitigation Measures

Under all action alternatives, the SSEP would have a net lifetime GHG emissions level of less than zero (see Table 4.40), meaning that over its lifetime, the SSEP would act to reduce GHG emissions levels. Thus, because the SSEP would displace grid electricity with renewable electricity, the SSEP would mitigate future climate change relative to the No Action alternative.

Because climate change is a relatively new and evolving field, no BMPs have been identified with respect to this resource. However, some mitigation measures that could be applied to further reduce GHG emissions are discussed below.

4.3.10.1 COMPOST CLEARED VEGETATION TO REDUCE METHANE EMISSIONS IN LANDFILL

Some or all vegetation (as practicable) cleared from the site could be composted or used onsite as mulch rather than taken to a landfill. This would reduce or eliminate (depending on the practicable portion mulched) the methane emissions associated with anaerobic decomposition of plant material at a landfill and would also result in a net uptake of carbon because compost results in carbon storage in soils during application and therefore would not result in full decomposition. As a result, composting vegetation cleared from the site would result in net emissions of up to approximately -0.18 Mt CO_2e per wet ton of compost (EPA 2006b).

4.3.10.2 REDUCE ENGINE IDLING DURING CONSTRUCTION

An idling engine generally wastes fuel and contributes to air pollution. Although it is not known how much engine idling might occur during SSEP construction, reduction of engine idling or implementation of a ―no idling" policy, where practicable, would conserve fuel, save money, and reduce construction-related GHG emissions.

4.3.10.3 USE BIODIESEL FUEL IN CONSTRUCTION EQUIPMENT

Biodiesel is a form of diesel fuel derived from biological sources instead of petroleum sources. The biological sources (such as vegetable oil) used to make biodiesel fuels sequester CO_2 as they grow. It is this sequestered CO_2 that is released upon fuel combustion that makes biodiesel a GHG-neutral fuel.

Typically, blends of biodiesel and petroleum fuels can be used in diesel engines without any need for engine modifications. When biodiesel is used, blends of 5% biodiesel and 95% petroleum diesel (B5) and 20% biodiesel and 80% petroleum diesel (B20) are common. The use of B5 biodiesel would reduce SSEP construction emissions from construction equipment and vehicles by 5%; the use of B20 biodiesel would reduce SSEP construction emissions from construction equipment and vehicles by 20%. The use of B5 or B20 biodiesel is encouraged wherever practicable.

4.3.10.4 USE BIODIESEL FUEL IN SSEP OPERATIONS EQUIPMENT AND VEHICLES

Biodiesel fuel could also be used, where practicable, in diesel-fueled SSEP operations vehicles. The same B5 and B20 biodiesel blends could be employed, and their use would result in respective GHG reductions in diesel fueled operations vehicles of 5% and 20%. Annual diesel equipment and vehicle GHG emissions at the 125-MW and 250-MW units under the Proposed Action are 113 Mt CO_2e and 73 Mt CO_2e per year, respectively (Farmer 2010, Appendix C).

4.3.10.5 INVESTIGATE PARTICIPATING IN THE EPA'S SF_6 EMISSION REDUCTION PARTNERSHIP FOR ELECTRIC POWER SYSTEMS

Boulevard would investigate joining EPA's SF_6 Emission Reduction Partnership for Electric Power Systems, and, at a minimum, consider

- annual inspection and estimation of SF_6 emissions using an emissions inventory protocol;
- for equipment that will contain SF_6, purchase only new equipment that meets International Council on Large Electric Systems (CIGRE) standards for leak rates;
- implement SF_6 recovery and recycling; and
- ensure that only knowledgeable personnel handle SF_6.

4.3.11 Residual Impacts

After implementation of the mitigation measures described above, the lifecycle GHG emissions of each alternative are shown in Table 4.42. Note that the measure ~~"~~purchase carbon offsets" is not included due to its potential cost-prohibitive nature, and the measure ~~"~~reduce engine idling during construction" is not included due to a lack of ability to quantify associated GHG emissions reductions. The brine concentrator option for the Proposed Action and Alternative B is not included because this option does not affect the climate change analysis (see Section 4.3.7).

Table 4.42 SSEP Residual Impacts – All Alternatives

	No Action	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Sub-alternative A1: Photovoltaic	Alternative B: Reduced Footprint
Lifetime Net GHG emissions before mitigation (Mt CO_2e)	0	-13,829,822	-12,537,620	-13,874,386	-9,058,160
Eliminate methane emissions from landfill	0	-8262	-8240	-4435	-2679
Use B20 fuel during SSEP construction (Mt CO_2e)	0	-1,832	-1,832	-604	-1,758
Use B20 fuel during SSEP 30-year operation (Mt CO_2e)	0	-1,117	-1,117	0	-872
Lifetime net GHG emissions after mitigation (Mt CO_2e)	0	-13,841,033	-12,548,809	-13,879,425	-9,063,469

Note: Individual values may not sum to the total due to rounding error.

After mitigation measures, all action alternatives would maintain a net lifetime GHG emissions level of less than zero and would therefore act to reduce GHG emissions levels.

4.3.12 Short-term Uses versus Long-term Productivity

The clearing of Project Area vegetation and construction activities associated with the SSEP would contribute to climate change through the short-term generation of GHG emissions. However, the long-term GHG emissions saved by the SSEP's renewable energy generation (versus grid electricity) would more than offset the short-term vegetation and construction-related GHG emissions, giving the SSEP a net negative lifetime GHG emissions level and making it a net mitigation of climate change in the long term. The implications of climate change for the region surrounding the SSEP are described below.

4.3.13 Irreversible and Irretrievable Commitments of Resources

The SSEP would result in irreversible emissions of GHGs during construction and operation activities. In addition, the SSEP would result in the irretrievable loss of carbon sequestration by Project Area vegetation until full site reclamation following termination of the project. However, the SSEP would also generate electricity with a lower GHG emissions intensity than the existing grid, which would offset its GHG emissions and result in an overall net decrease in GHG emissions relative to the No Action alternative.

4.4 Cultural Resources

4.4.1 Analysis Area and Analysis Assumptions

Impacts to cultural resources eligible for the NRHP must be considered under Section 106 of the NHPA. Federal agencies are required to identify any historic properties in the project APE and evaluate their eligibility status for the NRHP in consultation with the SHPO. If the resources are NRHP-eligible, agencies must assess whether or not the undertaking would have an adverse effect on those resources, and if necessary, avoid, minimize, or mitigate any adverse effects to those resources. Federal agencies must consult with the SHPO, the Advisory Council on Historic Preservation, and others (including Indian tribes and consulting parties) regarding adverse effect determinations and the resolution of adverse effects.

As discussed in Section 3.4, the cultural resources analysis area for the SSEP consists of 8,646 acres, which includes the approximately 3,620-acre footprint of the Proposed Action. In consultation with the SHPO, the BLM defined the APE as the cultural resource analysis area, which encompasses the entire 8,646 acres that received intensive archaeological survey. No agencies or tribes identified any specific locations of cultural or archaeological significance beyond the analysis area that could be affected by visual impacts of the proposed project.

Nine archaeological sites are present in the analysis area; of the nine sites, three prehistoric sites have been determined eligible for the NRHP, as follows:

- AZ T:10:238 (ASM) consists of an artifact scatter in a 105 × 20–m area (2,100 m^2). The scatter is dominated by plainware and buffware ceramics, but also includes a core tool or chopper.
- AZ T:14:165 (ASM) is an artifact scatter and two rock pile features in a 110 × 60–m (6,600 m^2) area. The artifacts include plainware and buffware ceramic sherds as well as lithic flakes, a hammer stone, and a ground stone fragment.
- AZ T:14:167 (ASM) consists of an artifact scatter and two rock concentrations in a 57 × 34–m (1,938 m^2) area. The artifacts include plainware, buffware, and red-on-buffware sherds and one piece of worked marine shell.

Existing information indicates that there were places and natural landmarks of traditional importance to the O'odham and Maricopa along the Gila River and in the Estrella Mountains. Archaeological evidence indicates that the Project Area was likely used as a travel corridor between villages along the river and hunting or gathering areas in nearby mountain ranges. The archaeological sites indicate temporary activities such as travel or camping.

In developing any plans to mitigate adverse effects through scientific data recovery, BLM will require that the data recovery plan include a discussion of the site's role within the context of prehistoric and tribal use of the surrounding landscape. Tribes have been consulted and offered the opportunity to comment and offer additional information relevant to this mitigation and to contribute to the analyses outlined in the data recovery plan.

The following analysis assumes that all ground-disturbing activities would be confined to the analysis area for each action alternative and that only the three sites identified above (AZ T:10:238 [ASM], T:14:165 [ASM], and T:14:167 [ASM]) within the analysis area are eligible for the NRHP. For the purposes of this analysis, an impact is considered adverse only if the site is eligible for the NRHP. Thus only impacts to these three sites are discussed.

An adverse impact exists when a project would alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for the NRHP in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association (36 CFR § 800.5(A)(1). Adverse impacts are generally evaluated in regard to the qualities of integrity and the specific criteria that make a site eligible for the NRHP. Adverse impacts result from physical destruction, damage, or alteration of all or part of the site; or from alterations to the site‘s setting when the character of setting contributes to its eligibility. Additionally, there is no difference between temporary or permanent disturbance. All disturbances to the surface or subsurface deposits of archaeological sites are considered permanent. Disturbance of artifacts and features would affect a site‘s NRHP eligibility status, which is based on a site‘s potential to provide important information about the past. It is important to note that the implementation of mitigation measures would reduce adverse impacts to cultural resources.

4.4.2 No Action

Under the No Action alternative, Boulevard‘s ROW application for the SSEP under the Proposed Action, Alternative A, Sub-alternative A1, or Alternative B would not be approved. Livestock grazing and dispersed recreation in the Project Area would continue. Both of these activities would affect, in a limited manner, the three eligible historic properties. Livestock grazing would have a limited effect (loss of integrity) on site integrity because livestock grazing only occurs when infrequent rainfall allows for vegetation growth, and may not occur every year. Recreational use, such as hiking and hunting, would also have a minimal effect on site integrity due to the relatively limited use of the Project Area by these recreationists, the remoteness of the area, and the low visibility of the sites due to the fragmentary nature of the artifacts present. These factors, considered together, would deter discovery and most looting and vandalism. Motorized travel on designated routes would not affect any of the sites because the sites are off route and motorized recreationists would therefore not have access to them.

4.4.3 Proposed Action

Under the Proposed Action, approximately 3,620 acres would be disturbed by the construction of the SSEP facility; these 3,620 acres are considered the project footprint. Of the three NRHP-eligible archaeological sites, AZ T:10:238 (ASM) would be directly impacted by construction of the proposed facility and could not be avoided by project design. This site would be subjected to 100% ground disturbance resulting in the permanent elimination of the physical presence of the site. Therefore, the Proposed Action would result in short- and long-term direct adverse effects to AZ T:10:238 (ASM); however, through a program of data recovery, this adverse effect could be mitigated. Due to the permanent removal of the site, mitigation measures would be required prior to construction.

To address adverse effects, the BLM has consulted with the SHPO, Indian tribes, and other parties to develop an MOA to mitigate and resolve the adverse effects. The MOA addresses adverse effects through development of a treatment plan that includes provisions for scientific data recovery, monitoring, long-term protection, worker education, and treatment of unanticipated discoveries. The MOA defines the roles and responsibilities of the consulting parties. The Advisory Council on Historic Preservation was notified of the adverse effect determination in July 2011, but at this time, they have declined to participate as a signatory to the agreement. The MOA would be attached to the ROD for this project.

Intentional or unintentional disturbance of archaeological sites by SSEP workers and construction crews would be mitigated by requiring a program of worker education emphasizing site avoidance, reporting of unanticipated discoveries, and minimal disruption of permitted archaeological investigations. Workers would be informed that unauthorized collection of artifacts or disturbance of sites is illegal.

Sites AZ T:14:165 and 167 (ASM) are eligible for the NRHP and are situated in the analysis area (near the proposed transmission line and access road corridor); however, project design has been developed to avoid direct disturbance of these sites during construction and operation of the facility. Under the Proposed Action, the main access road would be paved, and a new transmission line would be installed along the road. The new transmission line would have an adverse visual effect on these sites by changing the view from and to the sites and therefore changing their setting; however, because the sites' NRHP eligibility is based on their potential to supply important information about the past, any effects to setting would not change their NRHP eligibility. Although road paving would make access to the sites easier and may increase the risk of looting and vandalism, the fragmentary nature of the artifacts would deter most looting and vandalism. In addition, the presence of the facility and associated workers would deter most looting by hikers, hunters, and other casual or recreational visitors. A program of long-term monitoring for these two sites would be necessary to ensure their continued avoidance during construction and operation of the facility and future maintenance of the transmission line and access road. Thus the MOA and treatment plan for the project would also include a monitoring and discovery plan that details the process of long-term monitoring at AZ T:14:165 and 167 (ASM), including reporting and treatment of discoveries during monitoring.

4.4.4 Alternative A: Reduced Water Use (dry-cooled CST)

Under Alternative A, the project footprint would remain the same as under the Proposed Action. Because the project footprint under Alternative A would be the same as the Proposed Action, the impacts would be the same as the Proposed Action.

4.4.5 Sub-alternative A1: Photovoltaic

Under Sub-alternative A1, the project footprint would be approximately 44% smaller than that of the Proposed Action. However, due to the location of proposed facilities, direct adverse effects to AZ T:10:238 (ASM) and indirect effects to AZ T:14:165 and 167 (ASM) would be the same as those of the Proposed Action.

4.4.6 Alternative B: Reduced Footprint

Under Alternative B, the power plant footprint would be approximately 34% smaller than that of the Proposed Action. However, due to the location of proposed facilities, direct adverse effects to AZ T:10:238 (ASM) and indirect effects to AZ T:14:165 and 167 (ASM) would be the same as those of the Proposed Action

4.4.7 Reduced Water Use Option–Brine Concentrator

An optional brine concentrator in the power block area could be applied to either of the water-cooled action alternatives (the Proposed Action or Alternative B). There would be no changes to the project footprint of the Proposed Action or Alternative B under this option therefore the impact to cultural resources of including a brine concentrator under either alternative would be the same as described above.

4.4.8 Generation Tie Line Option

The Gen-tie Line Option could be added to any action alternative in place of the proposed gen-tie line alignment. If used, this option would be located within the existing cultural resources analysis area/APE, and impacts to cultural resources under this option would be the same as previously described (i.e., no effects to cultural resources from the gen-tie alignment and associated roads).

4.4.9 Potential Mitigation Measures

No potential mitigation measures outside of those described above are recommended. As described above, the BLM has consulted to develop an MOA that addresses adverse effects through development of a treatment plan that includes provisions for scientific data recovery, monitoring, long-term protection, worker education, and treatment of unanticipated discoveries. The treatment plan for the project would also include a monitoring and discovery plan detailing the process of long-term monitoring at AZ T:14:165 and 167 (ASM), including reporting and treatment of discoveries during monitoring. The MOA and treatment plan would be part of the ROD for this project.

4.4.10 Residual Impacts

There would be no potential mitigation measures for cultural resources; therefore impacts are the same as the direct and indirect impacts described under the alternatives.

4.4.11 Short-term Uses versus Long-term Productivity

The short-term use of the Project Area for renewable energy development would result in the physical removal of Site AZ T:10:238 (ASM) from the area. This would adversely affect the long-term productivity of cultural resources in the Project Area because this site and the scientific data associated with it would no longer be located in situ. Though this effect would be mitigated through data recovery, the removal of this site from the Project Area would mean that the site could no longer provide important information about the past.

4.4.12 Irreversible and Irretrievable Commitments of Resources

Because the Proposed Action, Alternative A, Sub-alternative A1, and Alternative B would remove NRHP-eligible Site AZ T:10:238 (ASM), the disturbance to the site would represent an irreversible commitment of resources because the site would be permanently removed from the landscape. There would not be any irretrievable impacts on cultural resources as a result of the project.

4.5 Geology and Minerals

4.5.1 Analysis Area and Analysis Assumptions

The analysis area for geological and mineral resources consists of the Project Area. Areas of subsidence outside of the Project Area are addressed in the groundwater section of this EIS (see Section 4.18.2). Earthquakes or active faults have not been recorded in the Project Area (Kirby 2009a) therefore unlikely to impact or be impacted by the project. Further, the SSEP power plant would be designed in conformance with the 2006 International Building Code and with applicable wind and seismic criteria for the site location. For these reasons earthquakes, active faults, and landslides are not discussed further in this section.

Impacts to geology and minerals are discussed below in terms of 1) acres of disturbance within each geologic unit and 2) the availability of salable sand and gravel deposits. The availability of salable sand and gravel deposits assumes that noncompatible actions would not be authorized, and what would be precluded from development would be the well field, external linear facilities, and power plants (the main project footprint), as described for each alternative in Chapter 2.

4.5.2 No Action

Under the No Action alternative, the SSEP would not be developed and existing land uses in and adjacent to the Project Area would continue. These uses include livestock grazing and dispersed recreation in the Project Area, utility ROWs, and salable material production adjacent to the Project Area. Salable sand and gravel deposits in the area would remain available, though there are no current plans to develop these resources in the Project Area.

4.5.3 Proposed Action

4.5.3.1 LOCAL GEOLOGY

Under the Proposed Action, construction-related impacts to local geology would be from terrain modification (e.g., cuts, fills, drainage diversion channels, and protective berms) and dust generation (e.g., excavation and grading). These terrain modifications would result in a more consistent landform including a uniform slope across the Project Area and mixing of surface and subsurface materials. Dust generation and the potential for soil erosion associated with the SSEP are discussed further in Section 4.13 (Soils). Acres of disturbance within the two geologic units identified in the Project Area under the Proposed Action are detailed in Table 4.43.

Table 4.43 Acres of Disturbance within Geologic Units – All Action Alternatives

Long-term Disturbance	Proposed Action (acres)	Alternative A: Reduced Water Use (dry-cooled CST) (acres)	Sub-alternative A1: Photovoltaic (acres)	Alternative B: Reduced Footprint (acres)
Undivided Quaternary alluvium (Q)	3,587.0	3,578.3	1,982.1	2,361.7
Younger Quaternary alluvium (Qy)	1.7	1.7	1.6	1.6
Total long-term disturbance	***3,588.7***	***3,580.0***	***1,983.7***	***2,363.3***
Temporary Disturbance	**Proposed Action (acres)**	**Alternative A: Reduced Water Use (dry-cooled CST) (acres)**	**Sub-alternative A1: Photovoltaic (acres)**	**Alternative B: Reduced Footprint(acres)**
Undivided Quaternary alluvium (Q)	29.2	27.2	27.5	28.4
Younger Quaternary alluvium (Qy)	1.8	1.8	1.8	1.8
Total temporary disturbance	***31.0***	***29.0***	***29.3***	***30.2***
Total disturbance	**3,619.7**	**3,609.0**	**2,013.0**	**2,393.5**

4.5.3.2 MINERALS RESOURCES

Salable sand and gravel deposits are present in the Project Area. Construction and operation of the SSEP under the Proposed Action would preclude these deposits from being used in the approximately 3,620-acre Project Area for the life of the project (30 years). At the end of the useful life of the facility and termination of the ROW grant, salable deposits would again become available. However, during the life of the ROW grant these resources would remain within the Project Area.

The alluvium occurring within the Project Area tends to have surface deposits consisting of coarse material and subsurface deposits that are characterized by well-sorted silt, sand, and gravel to cobbles. The alluvium could become more uniform and less sorted as a result of surface-disturbing activities (cut, fill, drainage diversion, protective berms) necessary for project construction. This potential mixing could impact how future mineral extraction is performed (i.e., mixing of sand and gravel resources could require additional sorting). However, most surface-disturbing activities would come from site grading and would disturb an approximate average of 4 feet, with the maximum depth of 8 feet. Available materials under this maximum 8 foot depth would not be mixed.

4.5.4 Alternative A: Reduced Water Use (dry-cooled CST)

4.5.4.1 LOCAL GEOLOGY

Impacts to geology under Alternative A would be the same in nature as the impacts described under the Proposed Action. However, because of differences in the design and layout of the well field, slightly different acreages of the geologic units would be impacted. These acreages are shown in Table 4.43. Impacts to geologic units would be reduced by 8.7 acres (0.2%) for long-term disturbance and 2.0 acres (6.5%) for short-term disturbance when compared to the Proposed Action.

4.5.4.2 MINERALS RESOURCES

Impacts to the availability and potential mixing of salable sand and gravel deposits would be of the same nature under Alternative A and the Proposed Action. Under Alternative A, approximately 3,609 acres would be precluded from development for the life of the SSEP and could be mixed by project disturbance, which is a reduction of 10.7 acres (0.3%) when compared to the Proposed Action.

4.5.5 Sub-alternative A1: Photovoltaic

4.5.5.1 LOCAL GEOLOGY

Impacts to geology under Sub-alternative A1 would be the same in nature as the impacts described under the Proposed Action. However, because of the decrease in the project footprint under Sub-alternative A1, impacts to geologic units would be reduced by 1,605 acres (44.7%) for long-term disturbance and 1.7 acres (5.5%) for short-term disturbance when compared to the Proposed Action. These acreages are shown in Table 4.43.

4.5.5.2 MINERALS RESOURCES

Impacts to the availability and potential mixing of salable sand and gravel deposits under Sub-alternative A1 would be the same in nature as the impacts described under the Proposed Action. Under Sub-alternative A1, 2,013 acres would be precluded from development for the life of the SSEP and could have sand and gravel mixed by project disturbance, which is a reduction of 1,606.7 acres (44.4%) when compared to the Proposed Action.

4.5.6 Alternative B: Reduced Footprint

4.5.6.1 LOCAL GEOLOGY

Impacts to geology under Alternative B would be of the same nature as under the Proposed Action. However, due to the reduced footprint, smaller acreages of the geologic units would be impacted. These acreages are shown in Table 4.43. Impacts to geologic units would be reduced by approximately 1,225.4 (34.2%) acres for long-term disturbance and less than 1.0 acre (2.6%) for short-term disturbance, when compared to the Proposed Action.

4.5.6.2 MINERAL RESOURCES

Impacts to the availability and potential mixing of salable sand and gravel deposits would be of the same nature under Alternative B and the Proposed Action. Under Alternative B, approximately 2,394 acres would be precluded from development for the life of the SSEP and could be mixed by project disturbance, which is a reduction of approximately 1,226 acres (33.9%) when compared to the Proposed Action.

4.5.7 Reduced Water Use Option–Brine Concentrator

The brine concentrator could be added to either of the action alternatives that would use a wet-cooling system (the Proposed Action and Alternative B) and would not change the long-term or short-term acres of disturbance or the project boundary.

4.5.8 Generation Tie Line Option

4.5.8.1 LOCAL GEOLOGY

Impacts to geology under the Gen-tie Line Option would be similar in nature to the impacts described under the Proposed Action, except that only the Undivided Quaternary alluvium (Q) geologic unit would be disturbed by this gen-tie line alignment. As detailed in Table 4.44, impacts to Undivided Quaternary alluvium would increase by 8.3 acres if the Gen-tie Line Option were added to the Proposed Action, Alternative A, or Alternative B. If the Gen-tie Line Option were added to Sub-alternative A1, impacts to Undivided Quaternary alluvium would be increased by 11.4 acres. Total surface disturbance in Undivided Quaternary alluvium would increase to no more than 0.56% depending on the alternative to which the Gen-tie Option is applied.

Table 4.44 Additional Acres Disturbed with the Gen-tie Line Option – All Action Alternatives

Geologic Resource	Proposed Action, Alternative A: Reduced Water Use (dry-cooled CST), and Alternative B: Reduced Footprint	Sub-alternative A1: Photovoltaic
Undivided Quaternary alluvium (Q)		
Temporary disturbance	5.1	6.8
Long-term disturbance	3.3	4.6
Total disturbance	**8.3**	**11.4**

4.5.8.2 MINERAL RESOURCES

An increase of 8.3 acres of disturbed land would occur if the Gen-tie Line Option were selected in combination with the Proposed Action, Alternative A, or Alternative B. Using a total of approximately 3,620 and 3,609 acres of disturbance area for the Proposed Action and Alternative A, respectively, this represents a 0.23% increase in total surface disturbance under these alternatives. Using a total of 2,394 acres of disturbance area for Alternative B, this represents a 0.35% increase in total surface disturbance for this alternative. If the Gen-tie Line Option were added to Sub-alternative A1, an additional 11.4 acres of land would be disturbed. Using a total of 2,013 acres of disturbance area for Sub-alternative A1, this represents a 0.56% increase in total surface disturbance when compared to the original gen-tie line alignment. Assuming that an increase in surface disturbance would be proportional to a decrease in the availability (and an increase in potential mixing) of salable sand and gravel deposits, the application of the Gen-tie Line Option would result in no more than 0.56% of additional impact to mineral resources.

4.5.9 Potential Mitigation Measures

No potential mitigation measures would be required beyond the applicant-committed environmental protection measures identified in Chapter 2 and the Proposed Action.

4.5.10 Residual Impacts

No potential mitigation measures would be required; therefore, impacts would be the same as discussed under the alternatives.

4.5.11 Short-term Uses versus Long-term Productivity

Construction and operation of the SSEP would preclude salable sand and gravel resources from being used in the Project Area for the life of the project (30 years) and have the potential to mix surface layers with subsurface layers, but it would not impact the amount or availability of these resources after project decommissioning. Mixing of surface and subsurface layers would not remove the mineral resource, only potentially change the way the sand and gravel could be extracted. Therefore, long-term impacts to the productivity of mineral resources would be minor.

4.5.12 Irreversible and Irretrievable Commitments of Resources

Salable sand and gravel resources in the Project Area would be unavailable for the life of the project (30 years), resulting in an irretrievable impact to the availability and production of mineral materials within the Project Area. The sand and gravel could become more uniform and less sorted as a result of surface-disturbing activities (cut, fill, drainage diversion, protective berms). This potential mixing could impact how future mineral extraction is performed (i.e., mixing of sand and gravel resources could require additional sorting). However, there would be no irreversible impact because construction and operation of the SSEP would not preclude these resources from being used after decommissioning of the SSEP, nor would they change the deposits in a way that would change the potential for extraction.

Irreversible impacts would occur from terrain modifications that would result in a more consistent landform. This change would include a more uniform slope across the Project Area and mixing of surface and subsurface materials. During reclamation, all practical means would be made to restore the land to its original natural patterns; however, the mixing of surface and subsurface materials could not be reversed.

4.6 Hazardous Materials and Hazardous and Solid Waste

4.6.1 Analysis Area and Analysis Assumptions

The area of analysis for hazardous materials and hazardous and solid waste consists of the Project Area (where these materials would be generated and used) and proposed transportation routes to existing disposal sites in Maricopa County.

Because the primary impact from hazardous materials and hazardous and solid waste would be from potential leaks and spills and potential contamination of surrounding soils, surface waters, and groundwater, these materials are discussed in terms of 1) the type and amount of material that would occur on-site for construction and operation of the SSEP, 2) their relative risk, and 3) how these materials and wastes would be managed for the SSEP to prevent these impacts. Certain chemicals and materials that would be used during the construction and operation of the SSEP are characterized as hazardous materials. Improperly handled chemicals and other hazardous materials have the potential to cause health issues in humans. SSEP construction and operation activities would generate certain hazardous and nonhazardous solid waste streams. Hazardous materials, wastes, and regulated, nonhazardous solid wastes are governed by the LORS discussed in Chapter 3, Section 3.6.2.1 and 3.6.2.2. Additional discussion of each of the LORS identified in Chapter 3 can be found in the *Hazardous Materials and Wastes Technical Report* (Parke 2009). A full SPP would be developed and implemented prior to construction of the SSEP. With adherence to these LORS as well as the applicant-committed environmental protection measures described in Chapter 2, Section 2.3.2, and implementation of the SPP, there would be no impacts to surrounding soils, surface water, or groundwater.

A variety of safety-related plans and programs would be developed and implemented to ensure safe handling, storage, and use of hazardous materials (e.g., hazardous material business plan). Plant personnel would be supplied with appropriate PPE and would be properly trained in the use of PPE, the handling, use, and clean-up of hazardous materials used at the facility, as well as procedures to be followed in the event of a leak or spill. Adequate supplies of appropriate clean-up materials would be stored on-site.

4.6.2 No Action

Current activities in the area, livestock grazing and dispersed recreation use, would not result in the generation, use, or disposal of hazardous materials and hazardous and solid waste within the Project Area.

4.6.3 Impacts Common to all Action Alternatives

All action alternatives would involve the use and generation of hazardous materials and hazardous and solid waste during construction and operation of the SSEP. A list of identified hazardous materials and relative toxicity and hazard class is provided in Table 4.45. In general, the types, quantities of materials, and management of these materials would not change under each alternative. If any quantities or types would change under the alternatives, they are discussed in the action alternatives‘ respective sections.

The primary direct impacts from hazardous materials and hazardous and solid waste would come from the potential for contamination of soils from spills and leaks during construction and operation of the SSEP. Potential impacts from hazardous materials, wastes, and regulated, nonhazardous solid wastes would be mitigated by adherence to the LORS listed in Chapter 3, Section 3.6.2.1; site-specific plans listed in each of the following detailed sections; as well as the applicant-committed environmental protection measures listed in Chapter 2, Section 2.3.2.

Table 4.45 Chemical Inventory and Estimated Usage Rates

Hazardous Material	Relative Toxicity[1] and Hazard Class
Natural gas (methane)	Low toxicity; Hazard class – Flammable gas
Hydrogen	Low toxicity; Hazard class – Flammable gas
Sodium hydroxide, 50% solution	High toxicity; Hazard class – Corrosive
Sodium hypochlorite, 12.5% solution	High toxicity; Hazard class – Poison-B, Corrosive
Sulfuric acid, 29.5% solution	High toxicity; Hazard class – Corrosive, water reactive
Sulfuric acid, 93% solution	High toxicity; Hazard class – Corrosive, water reactive
CO[2]	Low toxicity; Hazard class – Nonflammable gas
Therminol VP-1 Diphenyl ether (73.5%) Biphenyl (26.5%)	Moderate toxicity; Hazard class – Irritant; Combustible Liquid (Class III-B)
Lube Oil	Low toxicity; Hazard class – n/a
Mineral insulating oil	Low toxicity; Hazard class – n/a
Diesel fuel	Low toxicity; Hazard class – Combustible liquid
Nitrogen (liquid)	Low toxicity; Hazard class – Non flammable gas
Hydraulic fluid	Low to moderate toxicity; Hazard class – Class IIIB combustible liquid
Water treatment chemical NALCO Tri-Act 1800 Cyclohexlyamine (5%–10%) Monoehtanolamine (10%–30%) Methoxyproplyamine (10%–30%)	High toxicity; Hazard class – Corrosive, Class II Combustible liquid
Water treatment chemical NALCO Elimin-Ox Carbohydazide (5%–10%)	Moderate toxicity; Hazard class – Sensitizer
Water treatment chemical NALCO 3D Trasar 3DT185 Phosphoric Acid (60%–100%)	High toxicity; Hazard class – Corrosive
Water treatment chemical NALCO 3D Trasar 3DT177 Phosphoric acid (30%)	Moderate toxicity; Hazard class – Irritant
Water treatment chemical NALCO 3D Trasar 3DT190	Low toxicity; Hazard class – Irritant
Water treatment chemical NALCO Acti-Brom (R) 7342 Sodium bromide	Low toxicity; Hazard class – Irritant
Water treatment chemical NALCO pHreedom® 5200M Sodium salt of phosphonomethylated diamine	Low to moderate toxicity; Hazard class – Irritant

Table 4.45 Chemical Inventory and Estimated Usage Rates

Hazardous Material	Relative Toxicity[1] and Hazard Class
Water treatment chemical NALCO PCL-1346	Low toxicity; Hazard class – Irritant
Water treatment chemical NALCO Permacare (R) PC-7408 Sodium bisulfite	Low toxicity; Hazard class – Irritant
Water treatment chemical NALCO BT-3000 Sodium hydroxide Sodium tripolyphosphate	High toxicity; Hazard class – Corrosive
Water treatment chemical NALCO 8338 Sodium nitrite Sodium tolytriazole Sodium hydroxide	Moderate toxicity; Hazard class – Toxic
Welding gas Acetylene	Moderate toxicity; Hazard class – Toxic
Welding gas Oxygen	Low toxicity; Hazard class – Oxidizer
Welding gas Argon	Low toxicity; Hazard class – Nonflammable gas
Fertilizer Urea	Low toxicity; Hazard class – n/a
Fertilizer Monopotassium phosphate	Low toxicity; Hazard class – Irritant
Activated Carbon	Nontoxic (when unsaturated), low to moderate toxicity when saturated, depending on the adsorbed material; Hazard class – combustible solid
Herbicide Roundup® or equivalent	Low toxicity; Hazard class – Irritant
Soil stabilizer Active ingredient: acrylic or vinyl acetate polymer or equivalent	Nontoxic; Hazard class – n/a

[1] Low toxicity is used to describe materials with a Na ional Fire Protection Association (NFPA) health rating of 0 or 1. Moderate toxicity is used describe materials with an NFPA rating of 2. High toxicity is used to describe materials with an NFPA ra ing of 3. Extreme toxicity is used to describe materials with an NFPA rating of 4.

[2] n/a denotes materials that do not meet the criteria for any hazard class defined in the 1997 Uniform Fire Code.

4.6.3.1 COMPRESSED GAS STORAGE

All action alternatives would result in other compressed gases stored and used at the SSEP. These gases would consist of acetylene, argon, and oxygen, which are typical for maintenance activities such as shop welding. Acetylene is a flammable gas and a narcotic. It is highly reactive and is not toxic. Oxygen is an oxidizer with low toxicity. Argon has low toxicity but may cause asphyxiation if released in a confined area. It is anticipated that the SSEP would have 800 cubic feet of each of these gases stored on-site at any given time. The potential for any of these materials to cause a fire at the SSEP would be managed by the following site-specific plans:

- Compressed gases would be stored in standard compressed gas cylinders at the facility (typically 200 cubic feet per cylinder), and the total quantity would be kept to the minimum required for operation and maintenance.

- The compressed gases would be delivered and stored in U.S. Department of Transportation (USDOT)-approved safety cylinders, and secured to a solid support (such as a building or rack) to prevent tipping and physical damage.
- The compressed gases would be stored in an isolated storage area surrounded by crash posts to minimize potential for accidents or upset.
- Incompatible gases (e.g., flammable gases and oxidizers) would be stored in separate, isolated areas.
- Operators would be trained in the proper use of equipment and materials.

4.6.3.2 PETROLEUM PRODUCTS

All action alternatives would result in the storage and use of lube oil, diesel fuel, and insulating oils at the SSEP. Lube oil has low toxicity and does not meet the criteria for any hazard class defined by the Uniform Fire Code (UFC). Diesel is a combustible liquid with low toxicity. Insulating oil has low toxicity and is not classified as a hazardous material. Surface water and/or groundwater quality could be impacted by an accidental release of one or more of these materials from a vehicle or motorized piece of equipment. The amounts of these materials anticipated to be on-site are detailed in Table 4.46.

Table 4.46 Petroleum Products Used at the SSEP

Petroleum Product	Estimated Quantity
Lube oil	10,000 gallons in equipment and piping, additional maintenance inventory of up to 550 gallons in 55-gallon steel drums.
Mineral insulating oil	32,000 gallons
Diesel fuel	300 gallons

The potential impacts presented by the use of these petroleum products at the SSEP would be managed by the following site-specific plans:

- Lube oil would be stored in a 10,000-gallon carbon steel tank associated with the steam turbine. The turbine enclosure would provide secondary containment sufficient to hold the full contents of the tank.
- The carbon steel tank would be inspected daily to ensure that it is not leaking.
- Diesel fuel would be stored in the fire water pump engine in a carbon steel tank. The fire water pump would be contained within the equipment skid to provide secondary containment.
- Insulating oil would be used in the electrical transformers. Each of these transformers would be installed in a secondary containment structure that would contain 100% of the transformer capacity plus an allowance for precipitation.
- An SPP would be prepared to describe the storage of oil, the spill prevention measures employed by the facility, the potential consequences of a spill, and spill response measures developed by the facility to respond to an oil spill. The SPP would also describe the inspection and monitoring performed by the facility associated with oil storage.

4.6.3.3 USED HYDRAULIC FLUIDS, OILS, GREASES

All action alternatives would generate hazardous waste streams (i.e., spent hydraulic fluids and oils, oily rags, greases, and oily effluent from the water treatment separator system during operation of the SSEP), which would have the potential to contaminate surrounding soils, surface, and groundwater. In addition, several uses of lubricant oils in the operation and maintenance of the SSEP facility and equipment would generate used oil that would not be deemed a hazardous waste.

Under all action alternatives, the SSEP would be expected to generate 70,000 gallons per year or less of spent hydraulic fluids and oils, 5,000 gallons per year or less of oily effluent from the water treatment separator system, and six 55-gallon drums or less per month of oily rags and filters. The potential impacts from used hydraulic fluids, oils, and greases would be managed by the following site-specific plans:

- These materials would be accumulated and maintained on-site for less than 90 days in a secure hazardous waste accumulation area within secondary containment.
- These materials would be shipped off-site within 90 days of entering the accumulation area under manifest, via a licensed hazardous waste transporter.
- These wastes would be recycled to the extent practicable. For example, oils, hydraulic fluids and oil/water separator effluent may be recovered and recycled.
- Oily rags and oil adsorbent material (to capture spills) would be generated as a normal aspect of plant maintenance. These materials would be shipped off-site for energy recovery or disposal in a licensed waste management facility.
- Nonhazardous used oils would be captured in leak-free containers, accumulated in properly labeled containers in a designated accumulation area, and periodically shipped off-site for energy recovery or disposal in a licensed waste management facility.

4.6.3.4 HAZARDOUS SOLVENTS/CLEANING SOLUTIONS

Waste cleaning solutions and solvents, some of which may be classified as hazardous, would be generated during normal equipment maintenance and repair and would have the potential to contaminate surrounding soils, groundwater, and surface water. Less than 500 gallons per year would be generated by the SSEP. The potential impacts from used solvents and cleaning solutions would be managed by the following site-specific plans:

- These waste solutions would be accumulated in suitable, labeled containers within a secure hazardous waste accumulation area within secondary containment. These materials would be shipped off-site for energy recovery or recycled at a licensed waste management facility.

4.6.3.5 SOIL STABILIZER

All action alternatives would require a periodic application of a polymer dust suppressant/soil stabilizer to reduce fugitive dust emissions in the solar field. Potential dust coatings include magnesium chloride (MgCl) and commercially available polymers. These soil stabilizers consist of water emulsions of acrylic or vinyl acetate polymers. These products are nontoxic and do not meet the definition of any hazard classification. These soil stabilizers would not be stored on-site at the SSEP, but supplied in 55-gallon drums or 400-gallon totes to be used immediately.

4.6.3.6 UNIVERSAL WASTES

Under all action alternatives, spent batteries, fluorescent bulbs, and excess/unused pesticides would be expected to be present at the SSEP. Less than 75 of these items per month would be generated at the facility. Spent batteries from trucks and automobiles would be generated intermittently with less than 20 per two years. The potential impacts from universal wastes would come from contamination of surrounding soils, surface water, or groundwater. These impacts would be managed by the following site-specific plans:

- The SSEP facility would comply with universal waste rules by properly labeling, handling, and storing universal wastes. Materials would be accumulated for less than one year (less than 90 days for spent batteries).
- After collection in labeled accumulation containers, the SSEP facility would ensure that the transport of these wastes off-site for recycling or disposal is performed by licensed universal waste disposal companies.
- The facility would maintain the required records related to generation and disposal of universal wastes.
- SSEP employees would receive training regarding the collection and disposal of universal waste materials, and they would implement applicable regulatory requirements.

4.6.3.7 CONSTRUCTION WASTES

During construction of the SSEP, several wastes streams would be generated that would require management and appropriate disposal to prevent contamination to soils, surface water, and groundwater. These materials and the anticipated quantities are listed Table 4.47. The potential impacts from these construction wastes would be mitigated by the on-site handling and management method and disposal (Table 4.47).

Table 4.47 Construction Waste Streams

Waste Stream and Classification	Origin/ Composition	Estimated Quantity	Frequency of Generation	On-site Handling	Management Method and Disposal
Construction wastes– hazardous	Empty or partially empty containers of hazardous materials	<2 cubic yard per week of construction	Intermittent	Accumulate in designated area for less than 90 days	Return containers to vendor or transport under manifest to permitted treatment/disposal facility
Construction wastes– hazardous	Solvents, waste oils, paints, oily rags	< 200 gallons per 90 days	Intermittent	Accumulate in designated area for less than 90 days	Return containers to vendor or transport under manifest to permitted treatment/disposal facility
Heat exchanger/boiler cleaning waste fluid– hazardous[1]	Chelant type solutions, dissolved metals	< 1,000 gallons	One-time event during commissioning of 125-MW and 250-MW plants	Capture in suitable tanks and containers	Transport under manifest to permitted hazardous waste treatment/disposal facility
Spent Batteries, excess pesticides and containers– universal waste	Lead acid batteries, alkaline batteries, pesticides	20 batteries during construction; < 50 gallons of waste pesticides	Intermittent	Accumulate in designated labeled containers for less than 180 days	Recycle to extent practical, otherwise transport to local landfill qualified to receive universal wastes

Table 4.47 Construction Waste Streams

Waste Stream and Classification	Origin/ Composition	Estimated Quantity	Frequency of Generation	On-site Handling	Management Method and Disposal
Construction waste– nonhazardous	Scrap wood, concrete, steel, glass, plastic, paper	<40 cubic yards per week	Intermittent	Accumulate in suitable on-site containers	Recycle to extent practicable, otherwise dispose to local municipal waste landfill
Office and other conventional facility wastes	Paper, aluminum, plastics, waste food	< 200 gallons per day	Intermittent	Accumulate in suitable on-site containers	Recycle to extent practicable, otherwise dispose to local municipal waste landfill

[1] Would not be produced as part of Sub-alternative A1.

4.6.3.8 DISPOSAL OF WASTES AND TRANSPORTATION ROUTES

4.6.3.8.1 Waste Disposal Sites

Under all action alternatives, wastes generated during the construction and operation of the SSEP would be managed in a manner that suits the type and category of waste. Many nonhazardous waste streams can be recycled. Hazardous wastes generated during the construction and operation of the SSEP would be accumulated and contained on-site, in accordance with applicable LORS discussed in Chapter 2, Section 3.6.2 and as discussed in this section. Under suitable manifest, such materials would be taken off-site by a licensed shipper to a permitted treatment, storage, and disposal facility. Qualified waste disposal sites in Maricopa County are listed in Chapter 3, Section 3.6.4. Sufficient capacity is present at these facilities so that the additional waste materials generated by the SSEP would be accommodated (Parke 2009)

4.6.3.8.2 Transportation of Wastes

The Hazardous Materials Transportation Act (HMTA) regulates the transportation of hazardous materials and is implemented by the USDOT under 49 CFR §§ 171–179. The EPA has similar requirements in place for hazardous wastes (40 CFR § 263). The HMTA requires chemical manufacturers and hazardous waste generators and transporters to follow certain preparation, packaging, handling, loading/off-loading, routing, emergency planning, notification, and insurance requirements.

The HMTA requirements supplement the Resource Conservation and Recovery Act requirements regarding hazardous wastes. To comply with these requirements, SSEP employees who would be involved in the shipping or receiving of chemicals, or shipping parts, products, or subassemblies that could be contaminated with hazardous substances, wastes (or residue) would follow the specified procedures for packaging, labeling, and shipping of these regulated materials. Further, SSEP employees involved in these activities would receive training in the required procedures.

Transportation of wastes and contaminated containers from the SSEP site would be contracted to a qualified waste transporter, and the wastes would be taken, under manifest, to a permitted local landfill or treatment and disposal facility. Transportation of wastes from the SSEP site would use roadway routes that are suitable for hazardous waste transport. The roads and disposal sites in relation to the Project Area can be found on Map 12. These roads are established routes for commercial highway trucks. They offer no particular hazard for accidental release because they adhere to the LORS for hazardous material transportation (see Chapter 3, Section 3.6.2).

4.6.3.9 ELECTRICAL MAGNETIC FIELDS

Under all action alternatives, generation of EMFs through electrical generation, transmission, or distribution could result in human health and safety-related impacts. Average residential exposure to magnetic fields ranges from 0.055 to 0.110 microtesla (µT) in the United States; although, magnetic fields can approach 20 µT near power lines (World Health Organization [WHO] 2007). Studies of the potential effects of EMF exposure on animal behavior, physiology, endocrine systems, reproduction, and immune functions have typically examined exposures much higher and longer than would be encountered by wildlife or humans under actual field conditions. WHO (2007) reports that ~~"~~power-frequency fields of much less than the geomagnetic field of around 50 µT are unlikely to be of much biological significance." Several large-scale, long-term studies in rodents do not show any consistent increase in any type of cancer, including haematopoietic, mammary, brain, and skin tumors. There is no evidence that EMF exposure alone causes cancer in animals. In addition, the evidence that EMF exposure in combination with known carcinogens can enhance cancer development cannot be interpreted as supporting or opposing the relationship between EMF and cancer, due to major research design or analysis limitations and limited data (WHO 2007).

4.6.4 Proposed Action

4.6.4.1 ACTIVATED AND SPENT CARBON

Under the Proposed Action, the HTF expansion tank(s) would be vented through a two-stage, activated carbon system for the control of air emissions from the tank(s). Each stage of the system would comprise a 2,000-pound capacity carbon canister for a total of 4,000 pounds of inventory. However, the facility would not maintain an inventory of additional carbon. New activated carbon has low toxicity, but once it is in use, it can absorb VOCs and HAPs, including benzene, phenol, and biphenyl. This absorption can cause the toxicity to increase. Activated carbon is difficult to ignite, but smolders once ignited. When nearly saturated, the spent carbon must be removed from service and the canisters must be replaced. Activated carbon containing above-threshold amounts of toxic organic compounds is classified as a hazardous waste. Based on projected emissions levels, it is estimated that up to 400,000 pounds per year of spent carbon may be generated. The potential for fire or increased toxicity would be managed by the following site-specific plans:

- The emissions control system would be monitored periodically (with a frequency specified in the air operating permit) to determine the saturation level of the carbon.
- Spent carbon would be contained in the canister units, and it would be shipped off-site via a licensed waste transporter to a licensed management facility for regeneration.

4.6.4.2 HYDROGEN

Under the Proposed Action, a maximum of 63,000 standard cubic feet (335 pounds) of hydrogen would be stored on-site at any one time within the equipment cooling loop and ~~"~~tube trailer." The potential for risk of fire or explosion would be managed by the following site-specific plans:

- The hydrogen tanks on the tube trailer would be to USDOT specifications and capable of withstanding the normal abuse of highway travel.
- The tube trailer would be located outside, remote from the steam turbine generator, and away from electrical lines and other potential ignition sources, as required by applicable building and fire codes.
- Standard industry practices would be employed to safeguard the hydrogen tanks, including leak detection systems, pressure/temperature monitoring, automatic generator shutdown, fire detection/suppression systems, placement of tanks in areas away from most vehicular traffic, and the installation of crash posts to protect the tanks from vehicular impact.

4.6.4.3 WASTE MIRROR GLASS

Under the Proposed Action, exposure to wind and other elements could cause cracks and breakage of parabolic concentrator mirror glass. During maintenance events, a section of broken mirror would be replaced. It is not possible to quantify the broken mirror glass that would need to be replaced. Broken glass would be handled in the method described below:

- Broken mirror glass would be recycled.
- If a recycling facility is not available to take the broken mirrors, waste mirror glass may be classified as a hazardous waste, due to the Pb content of the glass. Glass wastes would be accumulated in suitable containers on-site for up to 90 days. The glass would be shipped off-site under manifest for treatment and/or disposal in a permitted landfill.

4.6.4.4 HERBICIDES

Under the Proposed Action, SSEP would contract the weed control program to an outside contractor to minimize fire potential. Based on historical use at Boulevard's Solar Energy Generating Systems (SEGS) facilities in California, annual usage of herbicide is approximately 10 pounds per acre. For the SSEP, this corresponds to approximately 37,000 pounds annually for the Proposed Action.

BLM-approved herbicides would be used in the solar field to control vegetation. At Boulevard's SEGS facilities, herbicides typically used for this purpose include Griffin Direx 80DF, Dupont Karmex DF, and Dupont Oust. The SSEP would employ similar herbicides. Impacts from herbicide would be the potential for runoff into surface water and seepage into groundwater (see Section 4.18). This potential impact would be managed by the following site-specific plans:

- Herbicide would not be stored on-site.
- The contractor would be required to hold the appropriate licenses and have a robust safety program for its employees. Industry-standard safety practices would be followed while using herbicides, including a) the use of personal protective equipment (for both contractor and SSEP employees) such as long-sleeved shirts and pants, coveralls, and chemically resistant gloves; b) thorough hand washing with soap and water after herbicide handling and before eating or drinking; c) the removal and proper disposal of any clothing or absorbent materials that have been contaminated with herbicide; and d) the use of herbicides only where there is adequate ventilation.

4.6.4.5 HEAT TRANSFER FLUID

Under the Proposed Action, approximately 1,500,000 gallons of HTF would be in process within the solar fields and power blocks; however, no reserve HTF would be stored on-site. The heat transfer system is a closed loop, and the system pressure would be monitored continuously. During operation of the SSEP, leaks of HTF could occur and have the potential to contaminate surrounding soils. The potential for HTF leaks and any impacts from those leaks would be managed by the following site-specific plans:

- The solar field would be regularly monitored by the operations staff using sight, sound, and smell to detect system leaks.
- Isolation valves would be installed throughout the solar field to minimize the HTF fluid loss in the event of a system leak.
- The isolation valves would be designed for automated operation triggered by a pressure drop in the system, or manual operation if a leak is detected by other means.

- In order to identify and react to larger leaks quickly, the SSEP would incorporate pressure sensing equipment and automatic controls that would allow for isolation of large areas of the field.
- Leaks would be repaired immediately.
- In the event of a leak, soils would be excavated, sampled, and analyzed for total petroleum hydrocarbon content (TPH).
- Soils found to have TPH concentrations in excess of 5,000 mg/kg, (considered hazardous petroleum contaminated soil [PCS] under ADEQ) would be disposed of off-site utilizing the services of a licensed special waste shipper as detailed in Chapter 2, Section 2.5.4.2.3.
- Soils found to have TPH concentrations less than 5,000 mg/kg would be spread in the land treatment area and treated as detailed in Chapter 2, Section 2.5.4.2.3.

Based on available operation data from other sites, it is anticipated that approximately 30 cubic yards (on average) of HTF-affected soil with greater than 5,000 mg/kg HTF may be generated per year and managed as hazardous waste, as described above. The generation of approximately 2,250 cubic yards of HTF-affected soil with less than 5,000 mg/kg HTF is anticipated (personal communication, Brandon Stankiewicz 2010). Larger or smaller quantities could be generated during some years, depending on the frequency and size of leaks and spills.

4.6.4.6 NATURAL GAS AND GAS DELIVERY

The Proposed Action would result in approximately 140 pounds of natural gas present on-site in the pipelines and equipment. There would be no on-site storage of natural gas. Natural gas consists mainly of methane (approximately 95%). Methane is a flammable gas with a NFPA hazard rating of four with low toxicity. The maximum, annual natural gas usage for the SSEP would be 3,900 million standard cubic feet per year for a maximum of 3,982,000 MMBtu/year. The potential risk of a natural gas pipeline rupture would be managed through the following site-specific plans:

- After construction, the gas pipeline would undergo hydrostatic testing that involves filling the line with water, venting all air, increasing the pressure to the specified code requirements, and holding the pressure for a period of time to ensure the integrity of the pipe.
- The design of the pipeline would adhere to USDOT specifications.
- On-site facilities (gas metering) would be designed and operated to industry standards.
- Applicable codes would be adhered to and the appropriate operational procedures standard in the industry would be developed and implemented.

4.6.4.7 WATER TREATMENT

The Proposed Action would result in the storage of large quantities of sulfuric acid, sodium hydroxide, and sodium hypochlorite. These chemicals would be used for water treatment. Sulfuric acid is corrosive (capable of eating away by chemical action) and water reactive (undergoes a chemical reaction with water). Sulfuric acid is typically hazardous only by direct physical contact (where it can cause severe burns). Sodium hydroxide is corrosive (has the power to corrode) though it is typically hazardous only by direct physical contact. Sodium hypochlorite is poisonous and corrosive.

Table 4.48 details the water treatment chemicals and the quantities that would be on hand under each action alternative.

Table 4.48 Water Treatment Chemicals and Estimated Usage Rates – All Action Alternatives

Water Treatment Chemical	Proposed Action Estimated Usage Rate	Alternative A: Reduced Water Use Estimated Usage Rate	Sub-alternative A1: Photovoltaic Estimated Usage Rate	Alternative B: Reduced Footprint Estimated Usage Rate
Sodium hydroxide, 50% solution	8,500 gallons	8,500 gallons Remains the same as under the Proposed Action	None	8,500 gallons Remains the same as under the Proposed Action
Sodium hypochlorite, 12.5% solution	17,000 gallons	Would reduce to 8,500 gallons	None	17,000 gallons Remains the same as under the Proposed Action
Sulfuric acid, 93% solution	16,000 gallons	Would reduce to 8,000 gallons	None	16,000 gallons Remains the same as under the Proposed Action

In addition to the above chemicals, corrosion inhibitors, oxygen scavengers, pH buffers, and anti-scaling agents would be required on-site under all action alternatives. Eleven water treatment products would be used in the boiler feedwater and cooling tower applications. Approximately 800 gallons of all these treatment products would be on-site.

The potential impacts to surrounding soils, surface water, and groundwater presented by the use of these chemicals at the SSEP would be managed by the following site-specific plans:

- Each of the chemicals would be stored in tanks constructed of a chemically compatible material to minimize the potential for catastrophic failure of the tank.
- A spill containment structure surrounding each storage tank would be provided to contain spills and leaks. Concrete spill containment structures would be coated with a corrosion-resistant material such as epoxy.
- The water treatment products would be stored in the same 400-gallon (nominal) plastic totes that they are shipped in. Shipping and storing the products in the same container minimizes chemical transfers, and thus minimizes the chances of a spill. The totes would be provided with secondary containment sufficient to hold the full stored contents with an allowance for precipitation.
- Solid wastes that would be generated in the form of spent demineralizer and softener resins, wastewater treatment plant filter cake and dewatering sludge, and cooling tower basin sludge would be characterized on a periodic basis, in accordance with applicable laws and regulations. These wastes would be sent off-site for disposal to a waste management facility.
- Water treatment-related wastes would be accumulated in appropriate containers or process vessels at the SSEP facility. Materials would be picked up by a qualified waste shipper and disposed of at a waste management facility.

4.6.5 Alternative A: Reduced Water Use (dry-cooled CST)

4.6.5.1 ACTIVATED AND SPENT CARBON

Under Alternative A, activated and spent carbon volumes would remain the same as outlined in the Proposed Action.

4.6.5.2 HYDROGEN

Under Alternative A, hydrogen volumes would remain the same as outlined in the Proposed Action.

4.6.5.3 WASTE MIRROR GLASS

Under Alternative A, waste mirror glass and replacement methods would remain the same as outlined in the Proposed Action.

4.6.5.4 HERBICIDES

Under Alternative A, herbicide use would remain the same as outlined in the Proposed Action.

4.6.5.5 HEAT TRANSFER FLUID

Under Alternative A, HTF volumes would remain the same as outlined in the Proposed Action.

4.6.5.6 NATURAL GAS AND GAS DELIVERY

Under Alternative A, less efficient dry cooling would allow less energy production from the (same sized) solar field than under the wet-cooled Proposed Action. Total solar generation would be approximately 9% less than the anticipated generation under the Proposed Action. The allowable gas-fired generation (no more than 25%) would drop proportionally (about 9%) to an approximate maximum of 3,623,620 MMBtu/year, or 3,549 million standard cubic feet per year. Site-specific plans would remain the same as under the Proposed Action.

4.6.5.7 WATER TREATMENT

Under Alternative A, there would be a 50% reduction in the amount of hypochlorite and sulfuric acid used at the SSEP. All other water treatment chemicals usage rates would remain the same. Site-specific plans would remain the same as under the Proposed Action. Table 4.48 details other changes from the Proposed Action.

Although there would be a reduction in the use of water treatment products under Alternative A, there would be no change to the amount stored at the SSEP due to minimum tank volumes that would be held on-site because of storage trunk sizes.

4.6.6 Sub-alternative A1: Photovoltaic

4.6.6.1 ACTIVATED AND SPENT CARBON

Under Sub-alternative A1, no activated and spent carbon volumes would be required.

4.6.6.2 HYDROGEN

Under Sub-alternative A1, no hydrogen volumes would be required.

4.6.6.3 WASTE MIRROR GLASS

Under Sub-alternative A1, no waste mirror glass would be generated.

4.6.6.4 HERBICIDES

Under Sub-alternative A1, herbicide use would be approximately 45% (20,350 pounds) less than the Proposed Action. Most solar field vegetation would be allowed to grow up to 18–24 inches in height and would be controlled with periodic mowing. Herbicides would primarily be used to control noxious weeds in disturbed areas and on unimproved roads in the solar field.

4.6.6.5 HEAT TRANSFER FLUID

Under Sub-alternative A1, no HTF volumes would be required.

4.6.6.6 NATURAL GAS AND GAS DELIVERY

Under Sub-alternative A1, no natural gas pipeline would be required.

4.6.6.7 WATER TREATMENT

Under Sub-alternative A1, no sodium hydroxide, hypochlorite, or sulfuric acid would be required. Daily water treatment chemicals would include one 55-gallon tote of bisulfite and one 15-gallon tote of anti-scalant.

4.6.6.8 HAZARDOUS MATERIALS ASSOCIATED WITH PV PANELS

PV cells convert sunlight into electricity through the use of thin layers of materials known as semiconductors. Semiconductors can be constructed of single crystals, semicrystals, polycrystals, or amorphous materials and thin films. The exact type of PV solar panel that would be used at the SSEP has not been determined, but is likely to be a crystalline silicon panel or thin film panel. Crystalline silicon cells have been the most commonly used PV cells and are expected to continue as the dominant type through approximately 2008–2013 (Public Interest Energy Research Program and Electric Power Research Institute 2003). Silicon semiconductor material is considered nonhazardous (BLM and DOE 2010).

Materials used in thin-film solar cells include amorphous silicon, polycrystalline silicon, and compound semiconductors such as cadmium telluride, cadmium sulfide, copper sulfide, copper indium deselenide, copper indium gallium diselenide, copper gallium diselenide, germanium, and gallium arsenide (Public Interest Energy Research Program and Electric Power Research Institute 2003). Cadmium is the primary metal of concern and has a high toxicity (BLM and DOE 2010).

The potential for chemical releases from PV panels is small because chemicals are present within the sealed PV modules (Public Interest Energy Research Program and Electric Power Research Institute 2003). Leaching from cracked or broken modules could occur while panels are in service, during decommissioning, or after disposal. Researchers have concluded that releases due to leaching would result in a negligible potential for human exposures (BLM and DOE 2010). At the SSEP, panels broken during installation and operations, as well as panels removed during decommissioning, would be sent to an approved recycling facility for disposal.

4.6.7 Alternative B: Reduced Footprint

4.6.7.1 ACTIVATED AND SPENT CARBON

Under Alternative B, activated and spent carbon volumes would remain the same as under the Proposed Action.

4.6.7.2 HYDROGEN

Under Alternative B, hydrogen volumes would remain the same as under the Proposed Action.

4.6.7.3 WASTE MIRROR GLASS

Under Alternative B, waste mirror glass and replacement methods would remain the same as under the Proposed Action.

4.6.7.4 HERBICIDES

Under Alternative B, herbicide use would be 35% (24,050 pounds) less than under the Proposed Action.

4.6.7.5 HEAT TRANSFER FLUID

Alternative B would result in a 25% to 30% reduction in the volume of HTF present at the SSEP. Approximately 1,125,000 to 1,050,000 gallons of HTF would be in process within the solar fields and power blocks, a reduction of 375,000 to 450,000 gallons when compared to the Proposed Action. Site-specific plans would remain the same as under the Proposed Action.

4.6.7.6 NATURAL GAS AND GAS DELIVERY

Under Alternative B, the SSEP would use 33% less natural gas than under the Proposed Action, for an annual natural gas usage of approximately 2,600 million standard cubic feet or a maximum of 2,655,000 MMBtu/year. Site-specific plans would remain the same as under the Proposed Action.

4.6.7.7 WATER TREATMENT

Under Alternative B, there would be no change in the amount of water treatment chemicals stored and used at the SSEP as described under the Proposed Action.

4.6.8 Reduced Water Use Option–Brine Concentrator

The brine concentrator could be added to either of the action alternatives that would use a wet cooling system (the Proposed Action and Alternative B). No additional hazardous materials would be generated or used at the SSEP under this option.

4.6.9 Generation Tie Line Option

The application of the Gen-tie Line Option to any of the action alternatives would not result in the additional generation or use of hazardous materials at the SSEP because the generation or use of additional hazardous materials would not be necessary to implement this option compared to the proposed gen-tie alignment.

4.6.10 Potential Mitigation Measures

Measures should be considered to reduce occupational EMF exposures, such as backing electrical generators with iron where practicable to block the EMF, shutting down generators when work is being done near them, and otherwise limiting exposure time and proximity while generators are running.

4.6.11 Residual Impacts

No potential mitigation measures are recommended; therefore impacts would be the same as discussed under the alternatives.

4.6.12 Irreversible and Irretrievable Commitments of Resources

There would be no irreversible or irretrievable commitments of resources.

4.7 Land Use and Access

4.7.1 Analysis Area and Analysis Assumptions

Impacts to land use resulting from the SSEP are analyzed within a 2-mile radius surrounding the Project Area. This distance was selected to account for potential indirect impacts from increased vehicle traffic and impediments to access that would extend beyond the project footprint. The 2-mile radius incorporates the area that would be affected by construction of new roads and utility corridors and by increased traffic. It is assumed that there would be no other use of the Project Area except for renewable energy during the lifetime of the project (30 years). Impacts to land uses in the area of analysis from implementation of the SSEP are discussed in terms of changes to the existing use. Impacts to land uses in the analysis area also consider the degree to which the SSEP would affect proposed future land uses.

4.7.2 No Action

Under the No Action alternative, the BLM land on which the project is proposed would continue to be managed within 1) BLM's framework of a program of multiple use and sustained yield and 2) the maintenance of environmental quality [43 U.S.C. § 1781 (b)] in conformance with applicable statues, regulations, and BLM's land-use plan. Current land uses in the area of analysis would continue under the No Action alternative, and the Project Area would become available to other uses that are consistent with BLM's land-use plan, potentially including another solar project. Current land uses in the area of analysis include cattle grazing, mining, utilities, dispersed recreation, low-density residential, transportation, a regional landfill, and a state prison complex. Land in the immediate vicinity of the Project Area would remain primarily open desert with pockets of agriculture, utilities, and widely dispersed, low-density residential uses on private parcels.

4.7.3 Proposed Action

Under the Proposed Action, all existing land uses would be precluded and replaced with renewable energy production. All uses in the analysis area, but outside the Project Area, would continue in their current manner, except that access to those uses could be interrupted by increased traffic during construction of the SSEP.

The SSEP's primary access would be from SR-85 via Komatke Road and a new access road from the west. Traffic would increase by approximately 1,000 vehicles at the peak of construction, which would last 39 months, and by 82 vehicles during operation, which would last at least 30 years. Commute times would increase for workers and others accessing the mining area and the Jojoba switchyard because they would use the same access roads.

After the Project Area is graded and construction begins, chain-link security fencing would be installed around the site perimeter (approximately 10 miles), switchyard, and other areas requiring controlled access during construction and operation. This would preclude grazing and recreational land uses because there would be no access or use of the Project Area for the life of the project. Construction of the SSEP would result in the conversion of approximately 3,500 acres of land to industrial uses and the closure of 7.4 miles of primitive roads across the Project Area. Construction of the SSEP and closure of some existing roads would reduce motorized and nonmotorized access to adjacent public lands. Other existing roads and public lands adjacent to the Project Area would remain open and continue to provide access to other public lands and the Sonoran Desert National Monument. Visitors would continue to have access to the Sonoran Desert National Monument via Komatke Road and its associated spur roads currently available to public use. Visitors would also continue to have access to Riggs Road to access other public lands and the Sonoran Desert National Monument.

New opportunities to access the public lands would become available with the addition of the well field road and gen-tie access roads. These roads would not be gated, enabling access for the public. The BLM would be encumbered with the enforcement of these new access points.

Under the Proposed Action, the BLM would issue a ROW grant to allow the SSEP on federally managed lands. Because the SSEP ROW must conform to the terms and conditions of previously issued ROWs in the Project Area, there would be no direct impacts to these rights. Direct or indirect impacts of the Proposed Action on pending or conceptual ROW and potential impacts to access and other future proposed land uses are described in Section 4.20.4.6 (Cumulative Impacts).

Approximately 69 acres of the project footprint overlap the Wesco Mining Claim. Because the mining plan of operations and the claim pre-date the SSEP application, and Wesco has maintained a validly filed mining claim, the existing mining operation would be an encumbrance on subsequent land uses, including the SSEP. BLM can authorize a ROW overlapping the claim if the plans of operation are not in conflict. The 69 acres would represent an impact only if the BLM authorizes a ROW that would overlap the mining plan of operations for the next 30 years, thereby precluding mining activities (assuming the mining claimant would agree). Table 4.49 summarizes the impacts to land uses for the project.

Table 4.49 Impacts to Land Uses from the SSEP

Affected Land Use	Impact
Grazing	Loss of approximately 3,500 acres due to project facility occupation and loss of plant productivity and access to forage
Recreation (hunting, hiking, equestrian use, motorized travel)	Loss of approximately 3,500 acres and 7.4 miles of primitive roads due to project facility occupation and loss of access to recreational opportunities
Utility corridors (electrical transmission, natural gas pipeline)	No anticipated impacts from the addition of new utilities to the existing corridors
Mining (sand and gravel)	Loss of 69 acres for mining if BLM authorizes a ROW that overlaps the mining plan of operation
Residential	Adverse impacts from 30–60 trucks per day during construction to the local residents and visitors to the area who are seeking a rural residential community or a semiprimitive view or recreation experience.(see Section 4.12 for more information)
Commercial and industrial	No impact
Airport/public/quasi-public	No impact

4.7.3.1 CONSISTENCY WITH OTHER APPLICABLE LAND-USE PLANS

According to Arizona statute, the Arizona Corporation Commission requires review of the general land-use plans within 2 miles of the proposed power plant site (Arizona Department of State 1975). In its review of siting factors, the Power Plant and Transmission Line Siting Committee must consider potential impacts to the existing plans of the state, local government, and private entities for other developments.

Table 4.50 outlines the plans that are applicable within the area of analysis, their goals and objectives, and the consistency of those plans with implementation of the Proposed Action (Also refer to Chapter 1 Section 1.6).

Table 4.50 Consistency of the Proposed Action with Applicable Federal and Local Plans

Plan	Goals/Objectives/Policy	Consistency Determination
BLM Lower Gila South Resource Management Plan	Directs BLM to consider renewable resources—specifically solar energy development—when undertaking the land-use planning process.	Consistent because the RMP provides opportunities for multiple land uses in the Project Area, including renewable energy projects.
City of Goodyear General Plan	~~"~~Attempts to strike the necessary balance between suburban and urban development while retaining the elements of the City's agricultural and natural character. Environmental and Energy Conservation projects would be considered even if baseline densities were exceeded" (City of Goodyear 2003).	Consistent because the plan encourages energy conservation and a balance between suburban and urban development, which would allow consideration of a solar facility.
Maricopa County Comprehensive Plan	Supports innovative technological operations and facilities to ~~"~~encourage … energy efficiency and the use of renewable resources" (Maricopa County 2002).	Consistent because it encourages the use of renewable resources.
Town of Buckeye General Plan	Goal 10.0 Use Energy Efficiently and Maximize Sustainability states ~~"~~Utilize renewable resources over nonrenewable resources" and ~~"~~Encourage renewable energy sources, such as solar and wind."	Consistent because it encourages the use of renewable resources; inconsistent because the Project Area is zoned by the Town of Buckeye as ~~"~~rural-residential." However, the land in question is federally owned and managed by the BLM. Therefore, Buckeye's ~~"~~rural residential" zoning classification is not applicable to this area.

4.7.4 Alternative A: Reduced Water Use (dry-cooled CST)

Impacts under Alternative A would be the same as under the Proposed Action, because Alternative A would occupy the same footprint as the Proposed Action (with the exception of two well sites). The number of acres that would be fenced and converted to an industrial land use to accommodate the project footprint would be the same, as would the number of miles (7.4 miles) of primitive roads closed to motorized travel in the Project Area. The loss of access (7.4 miles) and the conversion of land use (3,500 acres) would be the same under Alternative A as under the Proposed Action.

4.7.5 Sub-alternative A1: Photovoltaic

Impacts to land use and access under Sub-alternative A1 would be less than under the Proposed Action, primarily due to the sub-alternative's smaller solar-field footprint (approximately 1,907 acres, or 51% smaller than the Proposed Action). All other land uses in the Project Area would be precluded by the SSEP. Land uses in the analysis area but outside the Project Area would not be precluded by the SSEP and would continue; however, access would be temporarily impacted during construction due to the increase in traffic (see Section 4.15).

Under Sub-alternative A1, primary access would be the same as under the Proposed Action. Traffic would increase by approximately 267 vehicles at the peak of construction, which would last 39 months, and by 16 vehicles during operation, which would last at least 30 years. Commute times during construction would increase for workers and others accessing the mining area and the Jojoba Switchyard, because they would use the same access roads as those used for project construction. Due to the expected increase of 267 weekday construction trips, the LOS of the Riggs Road/SR-85 would be reduced from LOS B to LOS C.

There would be no impact to the commute time for workers and others accessing the mining area and the Jojoba Switchyard during operation and maintenance because the 16 weekday operation trips would not decrease the LOS of the Riggs Road/SR-85 intersection.

After the Project Area is graded and construction begins, chain-link security fencing would be installed around the site perimeter (approximately 6 miles), switchyard, and other areas requiring controlled access during construction and operation. This would preclude grazing and recreational land uses because there would be no access or use of the Project Area for the life of the project. Construction of the SSEP under Sub-alternative A1 would result in the conversion of approximately 1,907 acres of land to industrial uses and the closure of approximately 3 miles of primitive roads across the Project Area. This would reduce motorized and nonmotorized access to adjacent public lands (including Sonoran Desert National Monument). Other existing roads and public lands adjacent to the Project Area would remain open and continue to provide access to other public lands (including Sonoran Desert National Monument).

Table 4.51 summarizes the impacts to land uses for Sub-alternative A1.

Table 4.51 Impacts to Land Uses from the SSEP – Sub-alternative A1

Affected Land Use	Impact
Grazing	Loss of approximately 1,800 acres due to project facility occupation and loss of plant productivity and access to forage.
Recreation (hunting, hiking, equestrian use, motorized travel)	Loss of approximately 1,800 acres and approximately 3 miles of primitive roads due to project facility occupation and loss of access to recreational opportunities.
Utility corridors (electrical transmission, natural gas pipeline)	No anticipated impacts from the addition of new utilities to the existing corridors.
Mining (sand and gravel)	No impact.
Residential	Adverse impacts to the local residents and visitors to the area who are seeking a rural residential community or a semiprimitive view or recreation experience (see Section 4.12 for more information).
Commercial and industrial	No impact.
Airport/public/quasi-public	No impact.

Consistency with other relevant plans under Sub-alternative A1 would be the same as under the Proposed Action.

4.7.6 Alternative B: Reduced Footprint

Impacts under Alternative B would be of the same nature as those described under the Proposed Action; however, 2,300 acres (instead of 3,500 acres) would be fenced and converted from the existing land uses to an industrial land use for renewable energy production and 3.7 miles of road would be closed to motorized travel in the Project Area (instead of 7.4 miles). Alternative B would therefore result in a 37% smaller conversion of land use than the Proposed Action. Access would be impeded for two fewer months than under the Proposed Action, because the construction period under this alternative would be two months shorter. Fifteen acres of the Wesco Mining Claim would be precluded from use for the life of the project under Alternative B if the BLM issues an overlapping ROW for the SSEP; 54 fewer acres than under the Proposed Action.

4.7.7 Reduced Water Use Option–Brine Concentrator

The reduced water use option would not change the affect of the Proposed Action or Alternative B on other land uses or access, because the brine concentrator component of the facility would be constructed within the proposed facility footprint under both alternatives. No additional land would be needed to add this option to the alternative.

4.7.8 Generation Tie Line Option

If the Gen-tie Line Option were selected in combination with the Proposed Action, Alternative A, or Alternative B, an additional 8.3 acres would be converted from existing land uses to an industrial land use for renewable energy production. If the Gen-tie Line Option were selected in combination with Sub-alternative A1, an additional 11.4 acres of land would be disturbed and converted to an industrial land use. Total surface disturbance and conversion of land to an industrial use would increase by no more than 0.56% if the Gen-tie Line Option were selected, depending on the alternative it is combined with. Land use and access impacts would otherwise be the same as those described above.

When compared to the proposed gen-tie line alignment, the Gen-tie Line Option would disturb approximately 1.1 more acres of the Wesco Mining Claim if it were applied to any of the action alternatives. For the Proposed Action and Alternative A, this is a 1.6% increase in surface disturbance in the Wesco Mining Claim (70.1 acres of total disturbance with the Gen-tie Line Option applied to these alternatives). For Alternative B and Sub-alternative A1, this is a 7.3% increase in surface disturbance in the Wesco Mining Claim (16.1 acres of total disturbance with the Gen-tie Line Option applied to these alternatives).

4.7.9 Potential Mitigation Measures

No potential mitigation measures are suggested.

4.7.10 Residual Impacts

Because no potential mitigation measures are suggested, the residual impacts to land use and access would be the same as discussed under all action alternatives.

4.7.11 Short-term Uses versus Long-term Productivity

Under all action alternatives, project lands would be converted from their existing land uses to renewable energy production. The current productivity of the land within the SSEP footprint for grazing and dispersed recreation would be unavailable for as long as the SSEP is in operation. Although there would be a loss in the capability of the Project Area to provide for (produce) grazing and recreation, the new industrial land use would produce renewable energy.

4.7.12 Irreversible and Irretrievable Commitments of Resources

There would be an irretrievable loss of grazing and recreational uses from the SSEP, because the Project Area would be graded and fenced, and those uses would be precluded for the life of the project. There would also be an irretrievable loss of mining land if the BLM issues an overlapping ROW for the SSEP. There would be no irreversible commitments of resources, because the area would be reclaimed after termination of the project and these uses could then be reestablished.

4.8 Livestock Grazing

4.8.1 Analysis Area and Analysis Assumptions

The analysis area for livestock grazing, as described in Chapter 3, is the project footprint, consisting of approximately 3,620 acres of land. Impacts to grazing would consist of acres of forage lost as a result of implementation of the project, which would result in a loss of animal unit months (AUMs). Loss of access to forage due to fencing and potential livestock mortality from vehicle strikes due to increased traffic is also discussed.

4.8.2 No Action

Under the No Action alternative, the SSEP would not be developed and existing land uses (grazing, dispersed recreation, and utility ROWs) would continue. The portion of the Arnold grazing allotment (1,053 acres) in the Project Area would continue to be used for ephemeral grazing. Authorized grazing would continue on the 2,649 acres of the Beloat grazing allotment in the Project Area. The stock pond would remain, allowing cattle to travel farther to reach forage.

4.8.3 Proposed Action

Under the Proposed Action, site preparation would include the removal of all vegetation from the Project Area for the duration of the project. Vegetation removal would be maintained through the application of approved herbicides and, where needed, mechanical removal. Because the vegetation would be removed and the area would be fenced, livestock would no longer be able to graze from vegetation communities associated with the site. Fencing and grading the area would remove 971acres of the Arnold allotment (4.2% of the total allotment acreage of 23,390 acres) from livestock grazing use for the life of the SSEP. Fencing and grading would also remove 2,649 acres (2.6% of the total allotment acreage of 103,508 acres) of the Beloat allotment from livestock grazing use for the life of the SSEP.

Because the public land in the Project Area is used for two grazing allotments, implementation of the Proposed Action would reduce the amount of forage available for livestock grazing. BLM estimates that the total number of AUMs associated with the approximately 3,620-acre Project Area is 122; 44 AUMs for the Arnold allotment and 78 AUMs for the Beloat allotment. Implementation of the Proposed Action would include fencing of the entire project footprint and removal of vegetation, eliminating any potential use of the 122 AUMs on the Project Area for livestock grazing during the life of the project.

A stock pond (the CCC stock tank) is located in the eastern portion of the Project Area. Construction and operation of the SSEP would result in the loss of that water source due to vegetation clearing and leveling for construction of solar troughs. Because the stock pond allows the cattle to travel farther to reach forage in the area, this would have an adverse impact to grazing.

Increased traffic associated with the construction and operation of the SSEP would increase the risk of injury or death to individual cattle through vehicle strikes if cattle are grazing in the area. A variety of safety-related plans and programs would be implemented to ensure human health and safety (see Section 2.3.2). These measures would also help reduce the likelihood that livestock would be threatened by injury or death during the construction and operation of the SSEP. Also, fugitive dust control would decrease the amount of dust on vegetation adjacent to the Project Area, which has been shown to render forage unpalatable in some cases.

4.8.4 Alternative A: Reduced Water Use (dry-cooled CST)

Impacts to livestock grazing under Alternative A would be the same as under the Proposed Action because the project footprint would be of identical size, resulting in an equal loss of forage. As with the Proposed Action, the project site would be fenced and the stock pond destroyed, thereby limiting access to forage.

4.8.5 Sub-alternative A1: Photovoltaic

Impacts to livestock grazing under Sub-alternative A1 would be less than under the Proposed Action because the project footprint would be 2,013 acres (approximately 44%) less than the Proposed Action. This represents a permanent reduction (compared to the No Action alternative) in acres available for grazing of 1,051 acres (1.0% of the total allotment acreage) and 932 acres (4.0% of the total allotment acreage) in the Beloat allotment and Arnold allotment, respectively. Further, this represents a reduction (compared to the No Action alternative) in forage of 31 AUMs and 39 AUMs in the Beloat and Arnold allotments, respectively. Unlike the Proposed Action, under Sub-alternative A1 the CCC stock tank described above would fall outside the Project Area and would be available for livestock use.

4.8.6 Alternative B: Reduced Footprint

Impacts to livestock grazing under Alternative B would be largely the same as under the Proposed Action, except the project footprint would be 2,394 acres, which is 34% less than under the Proposed Action. This represents a reduction (compared to the No Action alternative) in acres available for grazing of 1,397 acres (1.3 % of the total allotment acreage) and 966 acres (4.2% of the total allotment acreage) in the Beloat allotment and Arnold allotment, respectively. Further, this represents a reduction (compared to the No Action alternative) in forage of 38 AUMs and 41 AUMs in the Beloat and Arnold allotments, respectively.

Unlike under the Proposed Action, under Alternative B, the CCC stock tank described above would fall outside the Project Area and would be available for livestock use.

4.8.7 Reduced Water Use Option–Brine Concentrator

Impacts to livestock grazing under this option would be the same as under the Proposed Action and Alternative A, because the project footprint under these alternatives would not change if a brine concentrator were employed to reduce water use.

4.8.8 Generation Tie Line Option

The nature of impacts to livestock grazing under the Gen-tie Line Option would be the same as previously described for the action alternatives. An additional reduction of grazing availability on the Arnold allotment of 8.3 acres would occur if the Gen-tie Line Option were selected in combination with the Proposed Action, Alternative A, or Alternative B. This represents less than a 1% change in grazing availability on this allotment under any of these alternatives. If the Gen-tie Line Option were selected in combination with Sub-alternative A1, a reduction of 11.4 acres of grazing availability in the Arnold allotment would occur (Table 4.52). This also represents less than a 1% change in grazing availability on this allotment under this alternative. Impacts to the Beloat allotment would not change if the Gen-tie Line Option were selected in combination with any action alternative because no part of the Gen-tie Line Option would be constructed on the Beloat allotment.

Table 4.52 Additional Acres Disturbed with the Gen-tie Line Option – All Action Alternatives

Livestock Grazing	Proposed Action, Alternative A: Reduced Water Use (dry-cooled CST), and Alternative B: Reduced Footprint	Sub-alternative A1: Photovoltaic
Arnold allotment		
Temporary disturbance	5.1	6.8
Long-term disturbance	3.3	4.6
Total disturbance	**8.3**	**11.4**

4.8.9 Potential Mitigation Measures

The additional protective measures described here would minimize or eliminate impacts to livestock from direct and indirect disturbances associated with the Proposed Action and action alternatives. These mitigation measures would help to reduce or eliminate impacts to livestock from access roads and increased traffic.

- The stock pond that would be removed during construction and operation of the SSEP under the Proposed Action and Alternative A would be rebuilt in a nearby location outside of the Project Area if one of these alternatives were selected by the BLM. A rebuilt stock pond would allow cattle to continue accessing the forage in the area. The stock pond would be appropriately sited in an area similar to the original stock pond location and would be constructed according to BLM standards. Range improvements such as stock ponds may be authorized under the terms and conditions of existing grazing permits or leases, but can also be authorized through a BLM Cooperative Range Improvement Agreement or a Range Improvement Permit. Impacts from the rebuilt stock pond would be addressed through such an agreement or permit with the BLM.
- Speed limits would be posted along access roads and strict adherence to posted speed limits would be enforced.

4.8.10 Residual Impacts

Rebuilding the stock pond would allow cattle to continue to forage in the area. Residual impacts would include the temporary loss of access to local forage and a change in cattle foraging habits during the interval between the removal of the existing stock pond and the construction of a new pond (because water is a limiting factor on cattle movement). In addition, cattle foraging habits may be permanently altered by the new stock pond location. This is because the grazing process is influenced by livestock's diet selection and the animals' physiological needs such as water or thermal regulation (e.g. shade) (Heitschmidt and Stuth 1991). The localized impact of grazing on vegetation and soils (i.e., livestock foraging) tends to dissipate with distance from points of concentration such as water (Washington-Allen et al. 2004). Livestock would likely forage outward from the new stock pond location, which would change the pattern of previous foraging around the old stock pond.

Posted speed limits along access roads and strict adherence to speed limits would reduce impacts to livestock from vehicle strikes. Fencing of access roads would further reduce impacts to cattle from vehicle strikes. However, approximately 25% of the forage in the Arnold allotment would be lost if the area were fenced, and would reduce livestock access to those forage resources as a result.

4.8.11 Short-term Uses versus Long-term Productivity

Construction and operation of the SSEP (the short-term use) would affect the long-term vegetation productivity of the Project Area because of vegetation removal. During construction of the SSEP vegetation removal would occur to facilitate placement of project facilities on the landscape. During project operations vegetation would not be allowed to reestablish within the bulk of the Project Area. At project decommissioning the Project Area would be reclaimed. However, the loss of the vegetation communities and forage productivity that occurred during project operations would persist for a time (approximately 10 years) until vegetation is reestablished and again available for forage.

4.8.12 Irreversible and Irretrievable Commitments of Resources

Long-term surface-disturbing activities and complete removal of forage associated with construction and operation of the SSEP would result in irretrievable commitments of livestock grazing resources for the life of the project and a period of approximately 10 years following project decommissioning because vegetation would be physically removed from the area to facilitate project construction and operations. There would be no irreversible impacts to livestock grazing resources because the area would be reclaimed and revegetated after the project and ephemeral grazing could be reinstated.

4.9 Noise

4.9.1 Analysis Area and Analysis Assumptions

The area of analysis for noise is approximately 14,750 acres and consists of the Project Area, vacant BLM-managed desert land (see Map 15), adjacent residential areas, the Buckeye Hills Regional Park, portions of the Sonoran Desert National Monument, and portions of the North Maricopa Mountains Wilderness. The relative direct and indirect impacts of each alternative to noise receptors were assessed by comparing changes in ambient noise levels from the construction and operation of the SSEP. Four different alternatives and one sub-alternative are analyzed in this section, including the No Action and Proposed Action. Each alternative presents a varying degree of impacts to noise receptors in the area of analysis.

For conservatism, and as is standard practice in the description of environmental noise, the noise modeling assumed stable atmospheric conditions (suitable for reproducible measurements) that are favorable for propagation. In addition, other sound attenuation factors, such as source directivity, air absorption, ground effects, and barrier/shielding, are commonly ignored for construction noise and commonly yield a conservative result. These factors in the modeling process tend to predict higher values than would be expected in the real-world environment around the site.

Several of the noise receptors are more than 1 mile from the site; at these distances, ground attenuation would be substantial. However, ground attenuation was excluded from construction noise propagation analyses for conservatism. Furthermore, the sound levels presented in the analysis are those that would be experienced by people outdoors. A building provides significant attenuation for those who are indoors. Sound levels can be expected to be as much as 27 dBA lower indoors, with windows closed. Even in homes with the windows open, indoor sound levels can be reduced by up to 17 dBA (EPA 1974).

For reference, a 1-dBA increase or decrease is a nonperceptible change in an environmental sound level (American Society of Heating, Refrigerating and Air Conditioning Engineers [ASHRAE] 1989). An increase of 3 dBA in environmental sound levels outdoors may or may not be distinguishable to the average person (ASHRAE 1989). A 5-dBA increase or decrease is a clearly discernible sound level change in an outdoor environment (ASHRAE 1989). Noise level increases below 3 dBA are commonly held as being inaudible for general environmental noise assessments. As noted in Section 3.9.3 (Fundamentals of Acoustics), intrusive noise is defined as noise that intrudes over and above the existing ambient condition at a given location. Finally, it is assumed that all noise from the operation and construction of SSEP would dissipate within 1.75 miles of the source[4] depending on topography and vegetation, intensity of construction activities, and the range of ambient conditions.

Noise emissions are regulated by Maricopa County, the State of Arizona, EPA, and OSHA. It is assumed that the Proposed Action and alternatives would comply with all federal, state, and local noise regulations, requirements, and ordinances during both the construction and operation phases of the SSEP. However, as described in Section 3.9.2.3.1, the following are exempt from County Ordinance P-23: 1) noise emanating from power plant equipment during normal operations; and 2) noise emanating from construction and repair equipment when used in compliance with existing Maricopa County rules and regulations. It is assumed that a hearing protection plan for workers and visitors would be part of the health and safety plan and would comply with Arizona OSHA and United States OSHA requirements. The analysis of noise to

[4] The assumption that noise usually dissipates to background levels was calculated using the Standard Attenuation Calculation: 20 log 10 = [(d2/d1)] where d1 = 50 feet and d2 = 9,240 feet (1.75 miles), executed as 20 log 10 [(9,240]/50 feet = 45.3 dBA. Noise from construction is attenuated from 90 dBA to 45.3 dBA at 1.75 miles. The subjec ive impression of 45 dBA falls between quiet (40 dBA) and light traffic at 100 feet (50 dBA) and is the assumed distance for dissipation of noise to background levels for this analysis.

biological resources addresses potential impacts of the presence and noise of construction and operation of the SSEP on wildlife and their lifecycles. Additional information concerning the effects of noise on biological resources may be found in Section 4.19.

4.9.2 No Action

Existing noise sources in the area of analysis consist of sporadic vehicle traffic, small machinery, distant aircraft, and natural sounds from wind, rustling vegetation, birds, and insects. Under the No Action alternative, current ambient noise levels in the area of analysis would continue to be influenced by these factors, and the sound conditions would remain quiet. The 24-hour L_{eq} levels recorded at Hayes Road, Baseline Road, and the Sonoran Desert National Monument were 47.6, 46.4, and 39.7 L_{eq}, respectively, and sound conditions in the area of analysis under the No Action alternative would not exceed this level.

4.9.3 Proposed Action

4.9.3.1 CONSTRUCTION

Project construction would occur in a phased schedule over a 39-month period. The main sources of noise and, potentially, vibration would be the large equipment pieces used during the primary phases of construction (i.e., site clearing/grading, excavation, foundations, building and erection, and finishing). Heavy equipment used during construction would typically include dozers, loaders, graders, power shovels, cranes, haul trucks, and generators. The noise and vibration levels from construction activities would vary during the different activity periods, depending on the activity location(s) and the number and types of equipment in operation. To analyze the construction noise impacts of the SSEP, the combined noise emissions of activities associated with site grading, power block construction, and solar field build-out were defined based on standard noise emission ratings. Additionally, because the construction zone is widely spaced, several areas of activity were defined as representative locations for construction noise evaluations (Mantee 2009). The following actions would be implemented as part of the construction phase of the Proposed Action and would result in increased ambient noise levels at some receptor locations in the area of analysis.

- Construction vehicle traffic
- Construction equipment operation
- Soil compaction
- Venting during site commissioning

Construction vehicle traffic would consist of workers traveling to and from the Project Area and haul trucks carrying equipment, supplies, and materials in and out of the Project Area. At the peak of construction, 1,000 vehicles would access the Project Area on a daily basis. Primary access for construction would be via SR-85. Some traffic would use the Rainbow Valley Road/Riggs Road, but this would be light when compared to SR-85 traffic flows. Noise from worker vehicles would be similar to the sound of existing traffic on SR-85. Haul trucks have the potential to generate noise levels as high as 80 dBA at a distance of 50 feet from the roadway. Assuming an hourly haul truck volume of 25 vehicle trips (12 to 13 trucks entering the site and then leaving again) and a vehicle speed of 25 mph, the hourly average noise level (L_{eq}) generated by haul trucks for the SSEP during construction would be approximately 62 dBA at a distance of 50 feet from the source (Mantee 2009).

Table 4.53 presents standard noise levels from common construction equipment at various distances. These typical noise levels do not account for attenuation from air absorption, ground effects, and shielding from intervening topography or structures.

Table 4.53 Noise Levels from Common Construction Equipment

Construction Equipment	Typical Sound Pressure Level (dBA)				
	50 feet	100 feet	500 feet	1,500 feet	3,000 feet
Dozer (250–700 hp)	88	82	68	58	52
Front end loader (6–15 cubic yards)	88	82	68	58	52
Trucks (200–400 hp)	86	80	66	56	50
Grader (13 to 16 feet blade)	85	79	65	55	49
Shovels (2–5 cubic yards)	84	78	64	54	48
Portable generators (50–200 kW)	84	78	64	54	48
Derrick crane (11–20 tons)	83	77	63	53	47
Mobile crane (11–20 tons)	83	77	63	53	47
Concrete pumps (30–150 cubic yards)	81	75	61	51	45
Tractor (0.75 to 2.00 cubic yards.)	80	74	60	50	44
Un-quieted paving breaker	80	74	60	50	44
Quieted paving breaker	73	67	53	43	36

Source: EPA (1971); Barnes et al. (1976).

Notes: These typical noise levels at distances away from the equipment item (beyond 50 feet) are conservative because the only attenuating mechanism considered was divergence of the sound waves in open air. In general, this mechanism results in a 6-dBA decrease in the sound level with every doubling of distance from the source. For example, the 84-dBA average sound level associated with generators would be attenuated to 78 dBA at 100 feet, 72 dBA at 200 feet, 66 dBA at 400 feet, and so forth. Attenuation from air absorption, ground effects, and shielding from intervening topography or structures are not included in these nominal values. Further, use of hese data is considered to be conservative because the evolution of construction equipment has been toward quieter designs to protect both operators from exposure to high noise levels and the community from undue noise intrusion.

Noise levels that would occur from construction activities associated with the Proposed Action are described in Table 4.54. Short-term noise receptors (ST) consist of institutional, residential, and recreational sites. Long-term noise receptors (LT) consist of both residential and recreational sites (see Map 15). Construction-related noise would range between 34 dBA and 54 dBA during the busiest periods of activity at each of the receptor locations. As noted in Chapter 3, any sound level 40 dBA and below gives the subjective impression of quiet.

Table 4.54 Predicted Construction Noise Levels (dBA) Compared to Ambient Noise Levels – Proposed Action

Noise Receptor Site Type and Name		Noise Levels	Construction Activity Phase				
			Site Clearing/ Grading	Excavation	Foundation	Building and Erection	Finishing
Aggregate construction noise level at 50 Feet (dBA)			91	90	93	93	90
Institutional	ST-1	Ambient	63	63	63	63	63
		Construction	38	34	37	37	37
Residential	ST-2	Ambient	34	34	34	34	34
		Construction	54	51	54	54	53
	LT-2	Ambient	46	46	46	46	46
		Construction	43	39	42	42	42
	LT-1	Ambient	48	48	48	48	48
		Construction	53	47	50	50	52
Recreational	ST-3	Ambient	28	28	28	28	28
		Construction	40	35	38	38	39
	LT-3	Ambient	40	40	40	40	40
		Construction	44	39	42	42	43
	RBWA	Ambient	–	–	–	–	–
		Construction	37	33	36	36	36
	BHRP	Ambient	–	–	–	–	–
		Construction	39	35	38	38	38

Source: EPA (1971); Mantee (2009).

Notes: The aggregated noise levels, using the EPA methodology, were propagated over the various distances to each receptor using only spreading loss attenuation (6 dBA/DD [doubling of distance]). These typical noise levels do not account for attenua ion from air absorption, ground effects, and shielding from topography or structures.

The choice of representative subareas for any given construction phase would result in different distances to each receptor, thus different summed noise levels. All ambient noise levels were rounded to zero decimals.

There are no ambient data for RBWA and BHRP.

RBWA = Robbins Butte Wildlife Area (NW of Project Area).

BHRP = Buckeye Hills Regional Park (WNW of Project Area).

The noise levels presented in Table 4.54 are those that would be experienced by people outdoors. Sound levels can be as much as 27 dBA lower indoors, with windows closed. Even in homes with the windows open, indoor sound levels can be reduced by up to 17 dBA (EPA 1974).

In addition to the areas of activity defined for construction noise evaluation (Mantee 2009), construction equipment would operate intermittently outside those areas of activity at sites close to noise receptors. The residence at ST-2 is approximately 1,630 feet from the Project Area boundary. Because a solar collector field would be located near the Proposed Action's Project Area boundary, it is assumed that one or more graders and/or dozers would operate within 0.5 mile of this representative residential structure. Exterior noise levels in the range of 60 to 63 dBA would be experienced at this residence for those periods when construction activities are occurring in that area.

Construction activities associated with the Proposed Action would result in ground vibration. These activities would include truck movements and soil compaction during grading activities. These sources would not result in a measurable increase in vibration levels at any receptor.

Intermittent increases in noise during the SSEP start-up and commissioning would result from air and steam venting. Ventings are necessary as part of the line-cleaning process prior to start-up. During venting, high-pressure steam (or air) is allowed to escape through an outlet in the piping. Commissioning and initial start-up would last two to three weeks between the end of construction and the beginning of commercial operations. A series of short steam blows, lasting two or three minutes each, may be performed several times daily over that two- to three-week period. Ventings can be as loud as 130 dBA at a distance of 100 feet. Temporary vent silencers would be used during this period to reduce the noise levels by 20 to 30 dBA. In addition to the planned and controlled line-cleaning discharges, the commissioning and initial start-up phase could also include steam releases during a system trip or during shutdown. Shutdowns occur as a result of an undesirable configuration or condition of the steam turbine or other pressurized system. The frequency, duration, and magnitude of these events are variable, depending on the particular plant conditions at the time.

Construction activities associated with the Proposed Action would generate measurable, short-term increases in ambient noise levels. Construction noise levels would be comparable to or above the existing ambient noise levels at the receptor locations. Some construction phases would not be audible during the typical daytime hours as a result of distances involved (e.g., all receptors would be over 2 miles away from the activities at the 250-MW power block). The noise level from a silenced steam blow venting would be 100 dBA at 100 feet from the outlet. As a result of 1) distance attenuation, 2) air absorption and ground effects, and 3) noise attenuation related to being indoors, the closest receptor (ST-2) would experience noise levels of approximately 35 dBA indoors.

4.9.3.2 OPERATIONS

To analyze the operational noise impacts of the SSEP, a proprietary, computerized noise prediction program was used to simulate and model the noise propagation from the SSEP (Mantee 2009). The following actions that would occur during operations of the Proposed Action were analyzed:

- Operations traffic
- Equipment vibration
- Operation of power blocks
- Transmission line
- Switchyard

Operations traffic would be intermittent and would be primarily from workers‘ vehicles and delivery trucks traveling to and from the SSEP. The SSEP is expected to have approximately 80 full-time employees. As with the construction phase, operations traffic is expected to access the site from the west, via SR-85. Given the distance (1 to 3 miles or more) to the nearest noise-sensitive receptors, operations traffic would not result in an increase in ambient noise levels at noise-sensitive receptors.

Rotating machinery within the power block would contribute to ground vibration in the immediate vicinity of the equipment. Vibration-monitoring systems installed in the equipment are designed to ensure that the equipment remains balanced and reduces ground vibration. The nearest noise-sensitive receptors are 0.9 mile or more from the proposed SSEP power block. At these distances, SSEP generated vibration energy would be undetectable.

There are two planned power blocks for the SSEP plus associated solar fields enabling the generation of 250 MW (west block) and 125 MW (east block) of electricity. Outdoor noise levels throughout the power blocks would range from 90 dBA near certain groups of equipment to 65 dBA in areas farther away from noise sources. Because there would be minimal noise sources operating in the solar arrays, outdoor noise levels in the arrays of solar troughs would be similar to existing ambient levels and would not exceed 50 dBA. For daytime operations, either with the boiler option or the fired heater option, noise levels would be at or below existing conditions at the following locations: LT-1, LT-2, LT-3, ST-1, ST-3, Buckeye Hills Regional Park, and Robbins Butte Wildlife Area. At ST-2 (the closest receptor to a proposed power block), SSEP daytime contributions would be 5–7 dBA above hourly average noise levels (L_{eq}) (Table 4.55). There is additional residential land between the Project Area and noise receptor ST-2, and a 5–7 dBA increase in ambient noise could be an irritant on this residential land depending on the noise characteristics given the very low existing ambient noise levels. However, ground attenuation could reduce the SSEP's contributions to 1–3 dBA above daytime ambient noise levels depending on environmental conditions such as wind speed and direction. Please see Tables 3.23 and 3.24 for details on ambient noise levels. For nighttime operations, noise contributions from the SSEP would not be expected to exceed the existing conditions at any receptor analysis locations. Table 4.55 lists the day and nighttime noise levels for project operations[6].

Table 4.55 Predicted Operations Noise Levels (dBA) Compared to Ambient Noise Levels – Proposed Action

Site Type and Noise Receptor		Noise Levels	Predicted Daytime Project Noise Level, (dBA); Boiler Option	Predicted Daytime Project Noise Level, (dBA); Fired Heater Option	Predicted Nighttime Project Noise Level, (dBA); Either Option
Institutional	ST-1	Ambient	63	63	63
		Operations	16	16	0
Residential	ST-2	Ambient	34	34	34
		Operations	41	42	28
	LT-2	Ambient	46	46	46
		Operations	25	26	6
	LT-1	Ambient	48	48	48
		Operations	35	35	23

[6] Ambient and construction/operations noise levels are not additive.

Table 4.55 Predicted Operations Noise Levels (dBA) Compared to Ambient Noise Levels – Proposed Action

Site Type and Noise Receptor		Noise Levels	Predicted Daytime Project Noise Level, (dBA); Boiler Option	Predicted Daytime Project Noise Level, (dBA); Fired Heater Option	Predicted Nighttime Project Noise Level, (dBA); Either Option
Recreational	ST-3	Ambient	28	28	28
		Operations	21	21	4
	LT-3	Ambient	40	40	40
		Operations	27	27	11
	RBWA	Ambient	–	–	–
		Operations	11	11	0
	BHRP	Ambient	–	–	–
		Operations	18	19	0

Source: Mantee (2009).
Notes:
SDNM = Sonoran Desert National Monument.
NMMW = North Maricopa Mountains Wilderness.
RBWA = Robbins Butte Wildlife Area (NW of Project Area).
BHRP = Buckeye Hills Regional Park (WNW of Project Area).
There are no ambient data for RBWA and BHRP.

During operations, steam releases can occur as a result of emergency pressure safety valve discharges. Steam by-pass systems are designed into modern power plants, like the SSEP, so that emergency pressure overages can be successfully managed with process control systems, making discharges a rare event. When a pressure safety valve discharge does occur, it can produce high noise levels at the discharge point. Outdoor receptors within approximately 3,000 feet of the plant would experience clearly audible noise levels of short duration.

During plant operations, the on-site switchyard electrical equipment would emit an audible hum from transformer and switching equipment. Additionally, the transmission line would also emit an audible hum. The switchyard would be located within the power block, more than 1 mile from noise-sensitive receptors and would not generate sufficient noise levels to contribute to the other SSEP noise sources. No increase in ambient noise levels at noise-sensitive receptors would occur from the operation of the SSEP transmission line and switchyard.

4.9.4 Alternative A: Reduced Water Use (dry-cooled CST)

4.9.4.1 CONSTRUCTION

Because construction activities would remain the same as the Proposed Action under Alternative A, changes in ambient noise levels from construction activities associated with Alternative A would be the same as those described for the Proposed Action.

4.9.4.2 OPERATIONS

Changes in ambient noise levels from operations associated with Alternative A would be the same as those described for the Proposed Action because the operational components and activities of the SSEP

that generate sound under this alternative would be essentially the same as those described under the Proposed Action.

4.9.5 Sub-alternative A1: Photovoltaic

Under this sub-alternative, the project footprint would only occupy the footprint of the 250-MW power block. As such, the distance between power plant equipment and potential receptors to the northeast, east, and southeast would be less than under the Proposed Action. Unlike the other alternatives, which propose using thermal transfer technology to drive a steam turbine generator to produce power, Sub-alternative A1 would have no rotating machinery and would need no cooling systems. Without rotating machinery for electricity generation, the major noise sources from Sub-alternative A1 would be the various transformers throughout the collection field and the main transformer within the Sub-alternative A1 substation. Noise reduction features for these transformers, if needed, would primarily involve enclosures and/or localized barriers or noise emissions limits from the equipment suppliers. During the detailed engineering phase of Sub-alternative A1, the electrical equipment would be evaluated to determine and update the noise control strategies necessary to support the overall acoustical design of Sub-alternative A1.

4.9.5.1 CONSTRUCTION

The construction process under Sub-alternative A1 would be the largely the same as under the Proposed Action and would be conducted over approximately 39 months. The primary difference between the construction process under Sub-alternative A1 compared to the other action alternatives is that the use of vibratory pile driving methods may be needed for a portion of post foundations for the PV panels[7].

Noise levels that would occur from construction activities associated with Sub-alternative A1 are shown in Table 4.56. Receptor locations are shown on Map 15. Construction-related noise would range from 34 dBA to 46 dBA during the busiest periods of activity at each receptor location.

Table 4.56 Predicted Construction Noise Levels (dBA) Compared to Ambient Noise Levels – Sub-alternative A1

Noise Receptor Site Type and Name		Noise Levels	Construction Activity Phase				
			Site Clearing/ Grading	Excavation	Foundation	Building and Erection	Finishing
Aggregate construction noise level at 50 feet (dBA)			91	90	93	93	90
Institutional	ST-1	Ambient	63	63	63	63	63
		Construction	36	36	39	39	35
Residential	ST-2	Ambient	34	34	34	34	34
		Construction	46	38	41	41	45
	LT-2	Ambient	46	46	46	46	46
		Construction	39	34	37	37	38
	LT-1	Ambient	48	48	48	48	48
		Construction	46	38	41	41	45

[7] These post foundations, similar to guard rail post installations, would entail vibratory pile driving to embed piers to a depth of 10–15 feet, depending on soil conditions and geotechnical engineering recommendations.

Table 4.56 Predicted Construction Noise Levels (dBA) Compared to Ambient Noise Levels – Sub-alternative A1

Noise Receptor Site Type and Name		Noise Levels	Construction Activity Phase				
			Site Clearing/ Grading	Excavation	Foundation	Building and Erection	Finishing
Recreational	ST-3	Ambient	28	28	28	28	28
		Construction	36	35	36	36	35
	LT-3	Ambient	40	40	40	40	40
		Construction	41	39	42	42	40
	RBWA	Ambient	–	–	–	–	–
		Construction	35	34	37	37	34
	BHRP	Ambient	–	–	–	–	–
		Construction	37	37	40	40	36

Source: EPA (1971); Mantee (2009).

Notes: The aggregated noise levels, using the EPA methodology, were propagated over the various distances to each receptor using only spreading loss attenuation (6 dBA/DD).

The choice of representative subareas for any given construction phase would result in different distances to each receptor, thus different summed noise levels.

RBWA = Robbins Butte Wildlife Area (NW of Project Area).

BHRP = Buckeye Hills Regional Park (WNW of Project Area).

There are no ambient data for RBWA and BHRP.

As shown in Table 4.56, some of the noise receptors would be expected to have construction-related noise levels that may be above ambient noise levels during the busiest periods of construction activity. In general, these results are roughly comparable, but typically lower than the predictions for the Proposed Action.

The residence at ST-2 is approximately 8,000 feet from the nearest PV panel and 9,000 feet from the subarea noise center. Because one or more graders and/or dozers may be moving dirt at the edge of the solar field closest to ST-2, exterior noise levels that are 1–2 dB higher than the tabled values may be experienced at this residence when these types of machines are working in this area. As they finish, the equipment would be moved further away to other parts of the solar field, and their noise contributions would reduce to levels more represented by the spatially averaged results given in Table 4.56.

Construction traffic noise for Sub-alternative A1 would not differ from the Proposed Action. Please refer to Section 4.9.3.1 (Construction) for a complete discussion of construction traffic noise impacts.

Construction activities associated with Sub-alternative A1 would result in ground vibration. These activities would include truck movements and soil compaction during grading activities. These sources would not result in a measurable increase in vibration levels at any receptor.

Once Sub-alternative A1 construction is completed, the start-up and commissioning phase would begin in preparation for commercial operations. Unlike the Proposed Action, which would use steam production, condensation processes, and would involve air and steam venting during commissioning, there would be no such venting occurrences during the start-up of Sub-alternative A1. Likewise, without the steam turbine generator system in the Proposed Action, there would be no _tripping'[8] steam releases either during the start-up phase or during ongoing operations of Sub-alternative A1.

[8] A _trip' is the shut-down of a system due to an undesirable configuration or condition.

4.9.5.2 OPERATIONS

Sub-alternative A1 would have one large solar field with 150 sub-units, each with its own power inverter. The major components of Sub-alternative A1 would include the following:

- Electrical switchyard/operations and maintenance building with the main step-up transformer and auxiliary transformers
- Solar field with panel trackers and power inverters
- Water well pumping systems

The pertinent noise sources from these components were used in the predictive noise modeling analysis following the methodology discussed above in Section 4.9.1. The predictive modeling results for future noise levels as a result of implementation of Sub-alternative A1 are shown in Table 4.57. Receptor locations are shown on Map 15.

After completion of construction, future Sub-alternative A1 noise levels would reflect the operations of a typical PV-based power-generation facility. The only notable noise sources from Sub-alternative A1 would be electrical transformers, which would only be operating during daylight hours. Because electricity generation from a PV system stops after the sun has set, operational noise levels at night would not be above 16 dBA and would not be audible at any of the noise receptors (Table 4.57).

Table 4.57 Predicted Operations Noise Levels Compared to Ambient Noise Levels – Sub-alternative A1

Receptor Site Type and Name		Noise Levels	Noise Levels (dBA)
Institutional	ST-1	Ambient	63
		Operations	7
Residential	ST-2	Ambient	34
		Operations	15
	LT-2	Ambient	46
		Operations	14
	LT-1	Ambient	48
		Operations	16
Recreational	ST-3	Ambient	28
		Operations	2
	LT-3	Ambient	40
		Operations	13
	RBWA	Ambient	No data
		Operations	3
	BHRP	Ambient	No data
		Operations	9

Source: Mantee (2011).
SDNM = Sonoran Desert National Monument.
NMMW = North Maricopa Mountains Wilderness.
RBWA = Robbins Butte Wildlife Area (NW of Project Area).
BHRP = Buckeye Hills Regional Park (WNW of Project Area).

There are no large rotating equipment items at a PV plant; therefore, there is no likelihood of Sub-alternative A1 generating discernable vibrational energy. Likewise, an insignificant amount of noise and vibration is anticipated from the PV panel tracking systems as these systems gradually rotate the panel arrays during the day.

Sub-alternative A1 would require approximately 16 full-time employees. As with the construction phase, operations traffic is expected to access the site from the west, via SR-85. Given the distance (1–3 miles or more) to the nearest noise receptors, operations traffic would not result in an increase in ambient noise levels at noise receptors.

4.9.6 Alternative B: Reduced Footprint

4.9.6.1 CONSTRUCTION

Changes in ambient noise levels from construction activities associated with Alternative B would be similar to those described for the Proposed Action, but would occur over a 37-month period. Additionally, there would be fewer employees and fewer daily vehicle trips to the SSEP. Peak daily vehicle trips to the SSEP under Alternative B (deliveries and commuters) would be approximately 950 trips per day. The average daily construction travel to the site would be approximately 600 trips per day. Increased ambient noise levels from employee traffic and haul trucks would be similar to that described under the Proposed Action, but would occur over a shorter duration.

The residence at ST-2 is approximately 1,650 feet from the boundary of the Project Area. As a result of the reduced footprint in this alternative, construction activities associated with the solar arrays would occur further from residential areas represented by ST-2. The increased distance between noise receptors and solar field construction activities can be expected to result in reduced audible construction noise at nearby residences, as compared to the Proposed Action construction scenario. Alternative B construction activities may still be audible at receptor locations such as ST-2 during periods of heavy activity, but these construction noise levels would be short term and would dissipate as the activities move farther away from the residences.

4.9.6.2 OPERATIONS

Because operations noise levels are primarily controlled by the power block equipment and not the solar field equipment, changes in the size of the solar field for this alternative would not change the SSEP noise environment relative to the Proposed Action.

4.9.7 Reduced Water Use Option–Brine Concentrator

4.9.7.1 CONSTRUCTION

The brine concentrator would be located in the power block site of the Proposed Action and Alternative B. The application of a brine concentrator option would not change the noise-related impacts of constructing under either the Proposed Action or Alternative B.

4.9.7.2 OPERATIONS

The application of a brine concentrator option would not change the noise-related impacts of operating under either the Proposed Action or Alternative B.

4.9.8 Generation Tie Line Option

4.9.8.1 CONSTRUCTION

If the Gen-tie Line Option were selected in combination with any action alternative, there would be no change to construction activities, methods, or timing. Because construction activities would remain the same, there would be no change in noise emissions with the selection of this option.

4.9.8.2 OPERATIONS

There would be no change to operational noise levels from the selection of the Gen-tie Line Option in combination with any of the action alternatives, because this option would not generate any new or additional sound above the overall operational noise of the entire SSEP facility.

4.9.9 Potential Mitigation Measures

No potential mitigation measures are recommended.

4.9.10 Residual Impacts

There would be no potential mitigation measures for noise; therefore, impacts are described under each alternative.

4.9.11 Short-term Uses versus Long-term Productivity

Construction of the SSEP would result in an increase in ambient noise levels at noise receptors surrounding the Project Area from construction activities occurring in the short term over the 39-month construction phase. Operation of the SSEP would result in long-term, intermittent increases in daytime ambient noise levels of 7–8 dBA at noise-sensitive receptors located in the Goodyear Planning Area, east of the Project Area. This change in the current sound environment would continue during the lifetime of the SSEP.

4.9.12 Irreversible and Irretrievable Commitments of Resources

There would be no irreversible impacts on the sound environment of the area because the plant has a design life and would be decommissioned after 30 years. There would be, however, irretrievable impacts associated with the operation of the SSEP. The increase in ambient noise levels of 7–8 dBA that would result at ST-2 would be an irretrievable loss of the existing sound environment until the SSEP operation is closed and reclamation activities have been completed.

4.10 Paleontology

4.10.1 Analysis Area and Analysis Assumptions

The analysis area for paleontological resources lies in the Project Area boundary, because surface-disturbing activities that could affect fossils are limited to the Project Area. The analysis assumes that the BLM's PFYC system is an appropriate tool to assess the presence of paleontological potential in the Project Area.

4.10.2 No Action

Under the No Action alternative the SSEP would not be built and existing land uses would continue. Livestock grazing and dispersed recreation would not be expected to impact paleontological resources as no fossil sites are known to exist in the Project Area, and the potential for fossils is low (PFYC 2).

4.10.3 Common to All Action Alternatives and Options

As stated in Section 3.10.2, the entire Project Area has a PFYC of 2. This rating suggests that the geologic unit is not likely to contain vertebrate fossils or scientifically significant nonvertebrate fossils. A PFYC 2 does not require construction monitoring due to the low probability of encountering fossils. The low potential rating within the Project Area suggests that the presence of paleontological resources is unlikely. As such, there would be no anticipated short or long-term adverse impacts to paleontological resources associated with construction and operation of the SSEP.

4.10.4 Potential Mitigation Measures

Construction workers responsible for surface-disturbing activities could be instructed to recognize paleontological resources and the protocol to enact upon discovery during vegetation clearing, site leveling, trenching, excavation of foundations and other surface-disturbing action.

Additionally, any discoveries would be treated in accordance with federal policy implementing the Paleontological Resources Protection Act of 2009. If paleontological resources are discovered inadvertently during construction or operation, the BLM would require the issuance of a paleontological resource use permit to a qualified paleontologist for the scientific collection and study of any vertebrate fossils or occurrences of noteworthy invertebrate or plant fossils.

4.10.5 Residual Impacts

Residual impacts resulting from potential mitigation measures would be beneficial as the specialized training of the construction workforce would result in recognition and protection of fossils, should they be discovered during surface-disturbing construction activities.

4.10.6 Short-term Uses versus Long-term Productivity

The SSEP would not result in adverse impacts to the long-term productivity of the paleontological resources because the geologic formations within the SSEP footprint are not likely to contain paleontological resources.

4.10.7 Irreversible and Irretrievable Commitments of Resources

There would be no irreversible or irretrievable commitments of paleontological resources as the presence of such resources within the Project Area is unlikely.

4.11 Recreation and Wilderness Characteristics

4.11.1 Analysis Area and Analysis Assumptions

This section discusses impacts to recreation and wilderness characteristics from the construction and operation of the SSEP. Impacts to recreation will be determined by changes to the type of recreational activities, the settings needed to support those activities, and desired recreational experience, brought on by the implementation of the Proposed Action and the alternatives. Impacts to the areas with wilderness characteristics will be determined by changes to the size and naturalness of each area, and changes to the opportunities for solitude and/or primitive recreation provided by these areas.

As explained in Chapter 3, the analysis area is any topographic point located in the adjacent recreation areas and in areas with wilderness characteristics where sights or sounds from the Project Area would be experienced by the visitor. To assess changes to recreation opportunities resulting from the implementation of the SSEP, this analysis uses information from the Noise and Visual Resources sections of this chapter.

The analysis considers the projected increase in sound at select noise receptors within and surrounding the recreation areas. Given the wide variation in individual thresholds of annoyance, habituation to noise, and situational reactions to noisy environments, there is no common standard for assessing the subjective effects of noise, or to measure the corresponding reactions of annoyance and dissatisfaction. One way of assessing a person's subjective reaction to a new noise is to compare it to the existing or ambient environment familiar to that person. An increase of 1–2 dBA in sound levels is a nonperceptible change to the human ear. An increase of 3–4 dBA may or may not be distinguishable in an outdoor environment. A 5-dBA increase or greater is a perceptible change and is clearly discernible in an outdoor environment (ASHRAE 1989). This analysis assumes that a certain portion of visitors to recreational and wilderness areas are seeking opportunities for quiet and that any noise level increase of 5 dBA or greater would perceptibly diminish one‘s experience of quietness. It should be noted that 40 dBA gives the subjective impression of ―quiet” (Beranek 1988).

Visual simulations used in conjunction with the visual resource contrast analysis are used to estimate changes to the viewshed from select KOPs throughout the analysis area. It is assumed that the greater the degree of contrast, the more visible the SSEP would be on the landscape, and the greater the effect to the recreational activities, settings, and experiences. Based on the definition of existing landscape character (see Section 3.1.1 [General Setting of Project Area]), the visual elements associated with the construction and operation of the SSEP facilities where compared to existing landscape character result in a measure of visual contrast ranging from strong to weak. Measures of visual contrast are defined as follows:

- Strong: visual change demands attention and strongly dominates the landscape.
- Strong/moderate: visual change begins to demand attention and is still moderately dominant in the landscape.
- Moderate: visual change attracts attention but is co-dominant in the landscape.
- Moderate/weak: visual change begins to attract attention and is moderately subordinate in the landscape.
- Weak: visual change can be seen but is subordinate in the landscape.

See Sections 4.9 (Noise) and 4.17 (Visual Resource) for more detailed information on visual resources and noise analysis methodologies and results.

An area in the northwest corner of Sonoran Desert National Monument, north of Margie's Peak, has been submitted to BLM for consideration of its wilderness characteristics in the current RMP revision. Management of the area is being analyzed under alternatives in the draft RMP, and has yet to be decided. The BLM has independently confirmed that this area has wilderness characteristics, as defined in the Wilderness Act of 1964 (Public Law [P.L.] 88-577 (BLM 2011). However, the Project Area does not possess wilderness characteristics. BLM lands of sufficient size to meet the wilderness characteristics size criteria are not present due to roads that cross the BLM lands in and surrounding the Project Area.

Further, this analysis assumes that direct impacts would not occur in the area with wilderness characteristics, the Sonoran Desert National Monument, the North Maricopa Mountains or Sierra Estrella wilderness areas, or the Buckeye Hills Regional Park because they are all located outside of the Project Area footprint where physical disturbances to the character of the landscape and recreation opportunities would occur. However, the indirect effects of the presence (sight) of the construction and operation of the SSEP would degrade the desired recreation activity, setting, and experience in each recreation area, wilderness, area with wilderness characteristics, or the national monument in varying degrees, depending on recreation activity, distance, topography, and preferences of individual visitors. Specific potential indirect impacts to these areas are discussed further in Sections 4.11.3, 4.11.4, 4.11.5, and 4.11.6.

4.11.2 No Action

Under the No Action alternative, the SSEP would not be constructed or operated, and existing recreational uses would continue in the Project Area and adjacent wilderness, lands with wilderness characteristics, national monument, and recreation areas. The landscape and existing roads and trails within the Project Area would not be altered, and there would be no changes to the scene or levels of noise. Therefore, the existing recreation activities, settings, and experiences would remain the same (no change from current conditions) under this alternative.

4.11.3 Proposed Action

Under the Proposed Action, approximately 3,500 acres would be graded to accommodate the project components and fenced for safety and security purposes. This would reduce the size of the ERMA by less than 1% and also reduce the total number of acres managed in the semiprimitive motorized ROS category by less than 1%. This would result in a direct loss of recreational opportunities in the Project Area, including backcountry driving, hiking, hunting, mountain biking, and horseback riding. These activities would be replaced by the single use of renewable energy production with restricted access. Recreational use of the land in the Project Area during the life of the SSEP would be precluded.

The removal of vegetation and construction of the SSEP in the Project Area would have an indirect impact on adjacent recreational users in the analysis area by altering the quality of the recreational setting. Although the sight of a large-scale solar-power facility may attract some recreational users (sightseers), those seeking the features of a primitive or semiprimitive, motorized setting in the Project Area would see the existing landscape change to an area characterized by industrial development and substantial modification of the landscape.

Opportunities for dispersed recreation in the adjacent analysis area would be interrupted during construction of the SSEP due to changes in patterns of access caused by construction traffic. Increases in vehicular traffic on the roads and along utility corridors would deter or delay some recreationists from the area due to safety concerns, noise, and traffic congestion. Conversely, the new road from SR-85 to the SSEP area would provide additional access to public lands for both motorized and nonmotorized recreation activities.

Eight noise receptor locations are identified in Section 4.9 (Noise); six of these are near or within the recreation areas or areas with wilderness characteristics (see Map 15): 1) ST-1 located approximately 3 miles south of the Buckeye Hills Regional Park; 2) ST-3 located in the northern portion of the Northern Maricopa Mountains Wilderness; 3) LT-2 located approximately 10 miles west of the Sierra Estrella Wilderness; 4) LT-3 located in the northern portion of the Sonoran Desert National Monument and 340 feet from the area with wilderness characteristics; 5) Buckeye Hills Regional Park located approximately 6 miles west-northwest of the Project Area and; 6) Robbins Butte Wildlife Area. All noise from operation and construction would dissipate within approximately 1.75 miles of the source[9] depending on topography and vegetation, intensity of construction activities, and the range of ambient conditions. Table 4.58 summarizes the existing baseline noise levels and the anticipated construction and operation noise levels at these receptors.

Based on the information in Table 4.58, ambient noise levels would increase by 5–12 dBA at recreational noise receptors during the 39-month construction period. The increases in noise levels could affect the recreational experience for some visitors in the North Maricopa Mountains Wilderness and the Sonoran Desert National Monument. Noise levels would be no more than 44 dBA. As visitors venture deeper into the recreation areas and further from the Project Area, this intrusion would lessen and eventually cease. The effect of this increase in noise on individual visitors would vary, depending on their desired recreation activity and experience and tolerance to the intrusion. Noise levels would not be above ambient sound levels during operations; therefore, there would be no effect on the recreational experience in North Maricopa Mountains Wilderness and the Sonoran Desert National Monument after the construction period.

Because there are no ambient noise level data for Buckeye Hills Regional Park and Robbins Butte Wildlife Area, this analysis cannot determine if there would be increases in the ambient environment noise levels. However, construction noise levels would not be above 39 dBA; therefore, it is unlikely that there would be impacts to the recreational experience except for highly sensitive individuals. Operational noise levels would not be above ambient sound levels at the monitoring locations; therefore, there would be no effects on the recreational experience in Buckeye Hills Regional Park and Robbins Butte Wildlife Area.

Table 4.58 Ambient, Construction, and Operational Noise Levels at Select Noise Receptors

Name/Location of Receptor	Ambient Noise Levels	Construction Noise Levels	Operational Noise Levels
ST-1/Prison/Frontage Road	62.7	38	16
ST-3/NMMW	28.2	40	21
LT-2/Hayes Road	46.4	43	26
LT-3/SDNM	39.7	44	27
BHRP	No ambient data	39	19
RBWA	No ambient data	37	11

Notes:
Only the six noise-monitoring stations that are relevant to recreation and wilderness are included in this table.
SDNM = Sonoran Desert National Monument.
NMMW = North Maricopa Mountains Wilderness.
RBWA = Robbins Butte Wildlife Area (NW of Project Area).
BHRP = Buckeye Hills Regional Park (WNW of Project Area).

[9] Noise attenua ion to background levels was calculated using the Standard Attenuation Calculation: 20 log 10 = [(d2/d1)] where d1 =50 feet and d2 = 9,240 feet (1.75 miles), executed as 20 log 10 [(9,240]/50 feet = 45.3 dBA. Noise from construction is attenuated from 90 dBA to 45.3 dBA at 1.75 miles. The subjective impression of 45 dBA falls between quiet (40 dBA) and light traffic at 100 feet (50 dBA).

The Project Area would be visible to recreationists in all of the recreation areas and the area with wilderness characteristics, except for the Buckeye Hills Regional Park, which would be completely screened from the SSEP when viewed at lower elevations. At higher elevations, recreation users could have superior or unobstructed views of the entire SSEP. When looking south from areas north of the Project Area (such as Highway 85), vertical structures associated with the project could be visible against the backdrop of the Sonoran Desert National Monument to the southeast. Due to the superior views from the Sonoran Desert National Monument (KOPs 2 and 6, see Section 4.17 for further details), high-sensitivity viewers would experience adverse impacts from the strong contrast presented by the project facility. From the North Maricopa Mountains Wilderness (KOP 1, see Section 4.17 for further details) and the area with wilderness characteristics, a viewer would expect a moderate contrast, meaning the contrast begins to attract attention and begins to dominate the landscape. However, there would be some topographic screening of the project facility. The entire Project Area would be visible from the Sierra Estrella Wilderness (KOP 18, see Section 4.17 for further details) and would have a moderate contrast rating; however, at a distance of 10 miles from the Project Area, the project would be viewed in the context of existing regional modifications. The presence of the SSEP in the viewshed in these areas would diminish the recreational experience, depending on the individual visitor‘s desired recreation experience and tolerance to the presence of the SSEP. See the Recreation Areas section of Section 4.17 (Visual Resources) for details on visual resource impacts.

4.11.3.1 WILDERNESS CHARACTERISTICS

The size of the area with wilderness characteristics would not be affected because the unit is outside of the Project Area and it would not be affected by any surface disturbance resulting from construction of the SSEP. For the same reason, there would be no impacts to naturalness because no component of the project would be constructed in the area with wilderness characteristics. However, opportunities for primitive and unconfined recreation would be adversely impacted in some locations (KOP 6, see Section 4.17 for further details) for sensitive viewers (such as photographers) by the sights from construction and operation of the SSEP. As described in the Recreation analysis above, the experience (solitude, isolation) and the undisturbed setting needed to support recreation activities like hiking, camping, and other primitive outdoor activities in the area with wilderness characteristics would be diminished for sensitive users (such as photographers) by the presence (sight) of the SSEP for some distance into the area. As visitors venture deeper into the core of the area, the view and its effects on the desired setting and experience would lessen and eventually disappear. See the recreational experience discussion above for a detailed description of the impacts from the sights of the SSEP. The impacts to the solitude and primitive recreation for the area with wilderness characteristics would be the same.

4.11.4 Alternative A: Reduced Water Use (dry-cooled CST)

Impacts to recreation and wilderness characteristics under Alternative A would be the same as the Proposed Action because the number of acres of surface disturbance for the project footprint would remain the same as under the Proposed Action. The components of a dry-cooled facility are similar to the Proposed Action, as are construction methods. Further, there would be no change in the number of vehicles used for construction and operation or any differences in access between the two alternatives.

4.11.5 Sub-alternative A1: Photovoltaic

Impacts to recreation and wilderness characteristics under Sub-alternative A1 would be less than under the Proposed Action because of the sub-alternative's smaller project footprint. The number of acres of surface disturbance for the project footprint would be approximately 2,013 acres, which is 44% less than under the Proposed Action.

The components of the facility and the construction phases under Sub-alternative A1 differ from the Proposed Action. Construction under Sub-alternative A1 would take the same amount of time as under the Proposed Action but would be staged in a 100-MW-per-year manner.

The number of vehicle trips during peak construction and regular operations would be reduced by 733 trips (73%); however, there would be no differences in access roads and transportation corridors between Sub-alternative A1 and the Proposed Action.

Noise from construction of the SSEP under this sub-alternative would be roughly comparable to the predictions for the Proposed Action. For the Proposed Action, there are instances of noise levels in the low to mid-40s dBA for construction. Under Sub-alternative A1, noise levels would not exceed 46 dBA. As visitors venture deeper into the recreation areas and further from the Project Area, this intrusion would lessen and eventually cease. The effect on individual visitors would vary, depending on their desired recreation activity and experience and tolerance to the intrusion. Operational noise levels under this alternative would not exceed ambient conditions; therefore, there would be no effects to the recreational experience during operations.

4.11.6 Alternative B: Reduced Footprint

Alternative B, like the Proposed Action, is a wet-cooled solar-powered electricity-generating facility, but occupies a smaller footprint (2,300 acres). The nature of impacts under Alternative B, to recreation opportunities in the Project Area and to recreation opportunities and wilderness characteristics adjacent to the Project Area, would be the same as under the Proposed Action, because the construction and operation of the SSEP would be executed in the same manner. However, under this alternative, only 2,300 acres within the ERMA, and managed for semiprimitive motorized recreation opportunities, would be converted to a solar-powered electricity-generating facility. This represents a 34% decrease in the Project Area footprint as compared to the Proposed Action.

4.11.7 Reduced Water Use Option–Brine Concentrator

The Reduced Water Use Option would not affect recreation and wilderness characteristics outside of those impacts already discussed under the Proposed Action and Alternative B. This is because the number of acres of surface disturbance for the Project Area footprint would remain the same under each action alternative, irrespective of the installation and use of a brine concentrator. Further, there would be no change in the number of vehicles used for construction and operation, nor would there be any differences in access if a brine concentrator were employed.

4.11.8 Generation Tie Line Option

The Gen-tie Line Option would not have direct impacts in recreation areas or the areas with wilderness characteristics because they are all located outside of the Project Area where physical disturbances to the character of the landscape and recreation opportunities would occur. As with the proposed gen-tie line, indirect impacts from the Gen-tie Line Option would include the presence (sight) of the line, which would degrade the desired recreation activity, setting, and experience. The Gen-tie Line Option would not impact noise levels from the construction and operation of the SSEP because it would not generate any new or additional sound.

If the Gen-tie Line Option were selected in combination with the Proposed Action, Alternative A, or Alternative B, there would be an increase of 8.3 acres of disturbed land (Table 4.59) when compared to the total acres of disturbance of these alternatives in combination with the proposed gen-tie line. Using a total of approximately 3,620 and 3,609 acres of disturbance area for the Proposed Action and Alternative

A, respectively, this represents a 0.23% increase in total surface disturbance under these alternatives. If the Gen-tie Line Option were added to Sub-alternative A1, an additional 11.4 acres of land would be disturbed. Using a total of 2,013 acres of disturbance area for Sub-alternative A1, this represents a 0.56% increase in total surface disturbance. Additional acres of surface disturbance under the Gen-tie Line Option are outlined in Table 4.59.

Table 4.59 Additional Acres Disturbed with the Gen-tie Line Option – All Action Alternatives

	Proposed Action, Alternative A: Reduced Water Use (dry-cooled CST), and Alternative B: Reduced Footprint	Sub-alternative A1: Photovoltaic
Temporary disturbance	5.1	6.8
Long-term disturbance	3.3	4.6
Total disturbance	**8.3**	**11.4**

4.11.9 Potential Mitigation Measures

Potential mitigation measures for visual impacts are described in Section 4.17.8.

The following mitigation measures could be implemented to maintain worker and visitor safety during construction of the SSEP and to provide continued recreational access to public lands:

- Use of traffic control measures (such as passive control and/or personnel) would reduce the risk of vehicle accidents and congestion and ensure continued access to adjacent public and private lands during construction of the SSEP.
- Maintenance of access roads would ensure continued availability of public lands for recreation uses.

4.11.10 Residual Impacts

Use of traffic control personnel would minimize but not completely prevent the risk of vehicle accidents and congestion during construction of the SSEP. Accidents or traffic congestion may still occur.

4.11.11 Short-term Uses versus Long-term Productivity

Construction and operation of the SSEP would result in use of land and other resources for renewable energy rather than recreation. Implementation of the project would eliminate recreational access and activities in the Project Area for the life of the SSEP (30 years). Specifically there would be long-term changes in hunting, hiking, and motorized vehicle use patterns because construction of the SSEP would limit access to the Project Area. Implementation of the SSEP would create long-term disruptions of the visual quality because of the soil and vegetation disturbances and changes of the land use to an industrial setting, affecting the availability of adjacent lands for recreational purposes. There would be no maintenance or enhancement of recreational resources, thereby precluding any long-term use of the Project Area for recreation during the lifetime of the project.

4.11.12 Irreversible and Irretrievable Commitments of Resources

The reclamation measures outlined in Chapter 2 require reclamation of the disturbed areas after the 30-year life of the project. Site reclamation would require completion of a decommissioning and site reclamation plan to define the specific reclamation, revegetation, restoration, and soil stabilization requirements for the Project Area. Details of the reclamation requirements are discussed in Chapter 2.

Because the Project Area would be reclaimed, there would be no irreversible loss of recreation opportunities associated with the Proposed Action or other alternatives. However, it could take years before the project footprint is no longer visible. Even when vegetation is established during reclamation efforts the composition of plant species in the recovery area is often different than the original vegetation community. Typically, grasses establish early on, whereas shrubs take much longer to reestablish. The project footprint could visibly persist for years beyond reclamation. This would be an irretrievable change to the recreation setting and could result in displacement of recreation users or alteration of their experiences or activities.

There would also be irretrievable impacts to recreation and areas with wilderness characteristics because construction and operation of the SSEP would alter the adjacent scenery to a more industrial setting, as viewed from within the adjacent recreation areas and/or area with wilderness characteristics. As described above, the existing landscape setting would be restored upon reclamation. Thus, the effects on recreation opportunities and wilderness characteristics are not irreversible.

4.12 Socioeconomics

4.12.1 Analysis Area and Analysis Assumptions

The impacts analysis for socioeconomics evaluates how the social and economic effects, both positive and negative, of the construction and operations phases of the SSEP would be distributed among the communities in the SESA. The analysis considers impacts to Maricopa and Pinal counties with specific detail given to communities closest to the SSEP site.

This section contains an analysis of the potential socioeconomic impacts associated with the two phases of the proposed SSEP: construction and operation. Short-term impacts are considered to be five years or less (generally, the construction phase). Long-term impacts are considered to be greater than five years for the life of the project (the operations phase).

The social and economic impacts are quantified where possible. However, where quantification of impacts is not possible, the analysis includes a qualitative discussion of possible effects. The analysis includes separate but integrated approaches to addressing social, economic, fiscal, and EJ impacts of the SSEP.

It is assumed that the Brine Concentrator and Gen-tie Line options would not contribute to additional social or economic impacts under the action alternatives because the workforce, duration, and maximum MWh output would be the same as the action alternatives without the implementation of these options. Therefore, the Brine Concentrator and Gen-tie Line options will not be discussed further in the socioeconomic analysis.

4.12.2 Social Impacts

4.12.2.1 NO ACTION

Under the No Action alternative, the SSEP would not be built, and impacts to local social conditions would remain similar to current conditions. The area would maintain the undeveloped, rural character that contributes to the overall sense of place for those living near the area.

4.12.2.2 PROPOSED ACTION

4.12.2.2.1 Project Workforce and Skills

Construction

Project construction would occur over a total of 39 months on a phased schedule. Construction would begin in December 2011 starting with the 125-MW unit. Construction of the 250-MW unit would follow such that the total 375-MW facility would be complete by the summer of 2014. All associated linear facilities would be constructed concurrently with the power-generation units.

SSEP construction operations, including linear facility construction, would require an average of 874 full-time skilled and unskilled employees per month over the entire 39-month construction period, with manpower requirements peaking at approximately 1,538 workers in month 24 of construction (Table 4.60. The peak of employment may vary slightly depending on the exact overlapping of the phased development and construction of the two units.

The primary trades required for construction of the SSEP include carpenters, electricians, insulators, ironworkers, cement masons, mill wrights, operating engineers, painters, pipefitters, and skilled and unskilled laborers. Solar field craft workers are primarily laborers and equipment operators who would be directly associated with the installation and assembly of the solar field. Construction employees would be expected to work 22 days per month, approximately 10 hours per day. It is expected that approximately 10% of the construction workforce would require specialty skills that could not be filled by the local workforce. These workers would either relocate temporarily or move to the area permanently. Construction payroll is estimated to be approximately $215 million over the life of the construction phase of this project (personal communication, Jared Foster 2009).

Table 4.60 Construction Workforce by Month

Month of Construction	Carpenter	Electrician	Insulators	Ironworker (civil and structural)	Laborers (civil, concrete, structural, electrical, and mechanical)	Cement Masons	Millwrights	Operating Engineers (civil, concrete, structural, electrical, and mechanical)	Painters	Pipefitters	Teamsters (civil, concrete, structural, electrical, and mechanical)	**Total Power Block Craft**	Solar Field Craft	**Total Craft**	Construction Staff	Construction Management Staff (NextEra)	Subcontractors	Technical Advisors	**Total Staff**	**Total Craft and Staff**
1	4	6	0	3	14	0	0	30	0	0	9	**66**	0	**66**	28	10	6	0	**44**	**110**
2	8	10	0	6	18	0	0	30	0	0	9	**81**	0	**81**	38	10	6	0	**54**	**135**
3	8	10	0	6	32	0	0	42	0	10	18	**126**	0	**126**	40	10	6	0	**56**	**182**
4	8	35	0	6	36	0	0	35	0	20	17	**157**	33	**190**	40	10	6	0	**56**	**246**
5	8	35	0	12	38	0	0	35	0	40	17	**185**	60	**245**	40	10	6	0	**56**	**301**
6	13	40	0	26	44	4	0	38	0	70	17	**252**	106	**358**	40	10	6	0	**56**	**414**
7	23	53	0	29	65	4	0	75	0	100	28	**377**	150	**527**	94	23	10	0	**127**	**654**
8	23	68	0	40	74	4	0	77	0	100	28	**414**	200	**614**	94	23	9	2	**128**	**742**
9	29	93	0	48	87	6	3	77	0	133	30	**506**	225	**731**	94	23	9	4	**130**	**861**
10	35	85	0	48	85	6	3	75	0	157	41	**535**	240	**775**	94	23	8	4	**129**	**904**
11	43	95	0	61	87	4	3	75	0	174	41	**583**	420	**1,003**	94	23	8	4	**129**	**1,132**
12	44	95	0	64	91	4	16	76	0	176	41	**607**	420	**1,027**	94	23	8	4	**129**	**1,156**
13	50	95	0	71	93	4	16	76	0	176	41	**622**	420	**1,042**	94	23	8	4	**129**	**1,171**
14	58	97	0	82	94	4	16	76	0	176	45	**648**	420	**1,068**	94	23	8	4	**129**	**1,197**
15	59	97	0	88	110	4	16	91	0	188	45	**698**	420	**1,118**	94	23	8	4	**129**	**1,247**
16	59	95	0	92	115	4	16	89	0	192	43	**705**	154	**859**	110	23	8	4	**145**	**1,004**
17	49	102	0	92	115	4	16	83	0	199	45	**705**	154	**859**	130	23	14	4	**171**	**1,030**
18	40	89	8	86	115	9	14	83	0	199	45	**688**	154	**842**	130	23	14	6	**173**	**1,015**
19	40	101	8	84	110	9	14	75	0	202	41	**684**	353	**1,037**	138	23	14	6	**181**	**1,218**
20	36	97	16	77	98	9	14	65	5	223	39	**679**	382	**1061**	147	23	14	9	**193**	**1,254**

Table 4.60 Construction Workforce by Month

Month of Construction	Carpenter	Electrician	Insulators	Ironworker (civil and structural)	Laborers (civil, concrete, structural, electrical, and mechanical)	Cement Masons	Millwrights	Operating Engineers (civil, concrete, structural, electrical, and mechanical)	Painters	Pipefitters	Teamsters (civil, concrete, structural, electrical, and mechanical)	**Total Power Block Craft**	Solar Field Craft	**Total Craft**	Construction Staff	Construction Management Staff (NextEra)	Subcontractors	Technical Advisors	**Total Staff**	**Total Craft and Staff**
21	42	124	24	72	98	8	22	59	8	232	39	**728**	464	**1192**	147	23	14	13	**197**	**1389**
22	40	128	24	67	98	8	22	59	12	222	39	**719**	553	**1272**	152	23	10	13	**198**	**1470**
23	48	130	24	73	96	5	22	59	15	202	27	**701**	587	**1288**	152	23	10	15	**200**	**1488**
24	57	129	24	79	101	5	28	59	15	218	33	**748**	587	**1335**	157	23	10	13	**203**	**1538**
25	64	129	12	82	101	5	28	57	10	178	46	**712**	553	**1265**	137	23	10	13	**183**	**1448**
26	66	105	0	81	89	5	20	37	0	158	39	**600**	487	**1087**	77	13	6	7	**103**	**1190**
27	66	105	0	93	91	5	20	37	0	171	39	**627**	487	**1114**	77	13	6	7	**103**	**1217**
28	66	99	0	97	94	5	20	37	0	171	36	**625**	97	**722**	104	13	7	7	**131**	**853**
29	53	99	0	94	94	5	20	37	0	180	38	**620**	97	**717**	139	13	7	7	**166**	**883**
30	39	78	11	86	88	5	19	37	0	180	38	**581**	97	**678**	139	13	7	10	**169**	**847**
31	31	78	11	80	85	5	19	44	0	180	33	**566**	97	**663**	139	13	7	10	**169**	**832**
32	16	60	20	63	61	5	19	36	6	171	31	**488**	97	**585**	139	17	7	10	**173**	**758**
33	16	60	31	56	61	0	25	30	11	132	31	**453**	97	**550**	139	17	7	10	**173**	**723**
34	11	46	31	41	49	0	25	30	16	118	31	**398**	97	**495**	139	17	7	10	**173**	**668**
35	11	33	31	33	44	0	25	30	20	93	16	**336**	146	**482**	139	17	7	14	**177**	**659**
36	11	31	31	28	36	0	11	30	20	78	14	**290**	146	**436**	139	17	7	10	**173**	**609**
37	11	31	27	0	36	0	11	30	20	66	14	**246**	146	**392**	139	17	7	10	**173**	**565**
38	11	31	20	0	36	0	11	30	13	53	14	**219**	146	**365**	139	17	7	10	**173**	**538**
39	11	31	16	16	36	0	11	27	13	27	14	**202**	97	**299**	104	17	7	10	**138**	**437**

The staffing for the construction phase of the SSEP would be expected to draw from the existing construction workforce in the region, including the Phoenix metropolitan statistical area (MSA). The construction industry in the Phoenix MSA has been particularly affected by the nation's recent economic downturn and the weak housing market in the region (Arizona Department of Commerce 2009c). As a result, a plentiful workforce is available in this region to accommodate the construction needs of the SSEP. For example, construction employment in the Phoenix MSA is projected to fall 23% between 2008 and 2010, from 140,700 to 108,200; a loss of approximately 32,500 jobs (Arizona Department of Commerce 2009c). Table 4.61 summarizes these figures for the construction industry. Similarly, the Phoenix MSA unemployment rate has risen from 4.9% in 2008 to 7.4% in 2009, indicating that a considerable workforce is seeking jobs in the region (Arizona Department of Commerce 2009e).

Table 4.61 Construction Industry Employment

Area	2006	2007	2008	2009 Forecast	2010 Forecast	Percentage Change 2006 to 2010 (or 2009 if 2010 is not available)
Arizona	240,300	224,900	187,800	147,500	144,600	-39.8%
Annual percentage change	–	-6.4%	-16.5%	-21.4%	-2.0%	–
Phoenix MSA	180,100	169,400	140,700	110,500	108,200	-39.9%
Annual percentage change	–	-5.9%	-16.9%	-30.2%	-2.3%	–
Maricopa County*	179,200	168,400	140,000	106,100	n/a	-40.8
Annual percentage change	–	-6.0%	-32.3%	-24.2%	n/a	–
Pinal County*	3,650	4,225	4,450	3,850	n/a	5.5%
Annual percentage change	–	15.7%	5.3%	-15.4%	n/a	–

Source: Arizona Department of Commerce (2009c, 2009d).
* Includes both construc ion and mining employment.

In summary, in 2008 there were 187,800 construction jobs in the state and 140,700 construction jobs in the Phoenix MSA, or 75% of the state's construction jobs. In 2007 Maricopa County accounted for 98% of construction employment within the two-county MSA region (U.S. Bureau of Economic Analysis 2009). Therefore, of the state's construction job losses, over 70% are occurring in Maricopa County.

The construction workforce for SSEP would be expected to be filled by the available labor supply in Maricopa County and the Phoenix MSA. As stated above, the SSEP would require an average annual workforce of 874 and peak workforce of 1,538. Construction employment resulting from the development of the SSEP would be a beneficial short-term impact to individuals in nearby communities seeking employment, because the project would provide new construction jobs to an area that has recently endured high rates of unemployment.

Operations

The operations workforce would consist of approximately 80 full-time employees for the entire facility. These employees would consist of plant operators and maintenance technicians working on 12-hour shifts and administrative personnel working on eight-hour shifts. The facility would be staffed seven days a week, 24 hours a day, 365 days a year, although the hours of the plant operations would be from sunrise to sunset.

Total full-time annual payroll would be expected to be $8.5 million, which would include benefits and incentive pay in addition to salaries (personal communication, Brandon Stankiewicz 2009). A range of wages would be expected among those employed by the SSEP, from lower wages of a general laborer to higher wages of the project management staff and technical advisors. Staffing for the operations of the SSEP would result in beneficial long-term impacts to individuals seeking stable employment, because the SSEP would provide long-term employment and income throughout the life of the project. For detailed information on the direct, indirect, and induced impacts of employment, income, and sales revenue; see Section 4.12.3.

4.12.2.2.2 Population

Construction

As noted previously, it would be anticipated that most (approximately 90%) of the construction workforce (a peak of 1,538 and an average of 874 workers per month over the 39-month construction period) would commute to the SSEP from their residences, rather than relocate. Construction employees typically commute up to two hours from their homes (Electric Power Research Institute 1982). However, approximately 10% of the workforce is expected to require specialty skills and would either relocate to the region temporarily or permanently, including staying in hotels/motels, apartments, or purchasing a home. Thus, population is expected to grow at least temporarily by approximately 87 individuals over the duration of the construction phase. Buckeye and Goodyear, the closest communities to the SSEP would likely receive these residents. This immigration represents 0.2%, 0.3%, and 0.002% of 2005 population levels for Buckeye, Goodyear, and Maricopa County, respectively. These immigration figures are summarized in Table 4.62. Further, because of the considerable loss of construction jobs in surrounding communities as a result of the current economic recession, there is a significant pool of unemployed skilled construction labor in the region. Consequently, workers hired to construct the SSEP would likely be drawn from the existing workforce, and not from a migratory workforce from outside the Phoenix MSA. As a result, the construction phase of the SSEP would be expected to result in no more than a 0.3% increase in population growth in the Socioeconomic Study Area.

Table 4.62 Population Impacts

Population	Goodyear	Buckeye	Maricopa County
Population (2005)	47,520	32,735	3,646,569
Projected population (2010)	71,354	74,906	4,216,499
Relocating construction workforce	87	87	87
Percent of relocated population (2005)	0.2%	0.3%	0.002%
Percent of relocated population (2010)	0.1%	0.1%	0.002%

Source: Maricopa Association of Governments (MAG) (2007b).

Operations

There would be approximately 5 to 10 project operators with specialized technical skills for this type of solar facility that would be expected to relocate to the area to provide long-term expertise in operations and maintenance. The remainder of the operations workforce would come from local residents. The immigration of 5 to 10 workers to the area for the operations phase of the SSEP would result in less than a 0.1% increase in population in the SESA.

4.12.2.2.3 Housing

Construction

Because 90% of the construction workforce would be expected to commute to SSEP rather than relocate, increased demands on the local housing supply would be expected to be nonexistent. Research indicates that construction workers are willing to commute up to two hours one-way for a job (an average of 73 miles and maximum of 115 miles one-way) (Electric Power Research Institute 1982). As a result, most of the workers would be coming from the City of Phoenix and its suburbs, located approximately 40 miles northeast of the Project Area. Little or no transient housing would be required in the Project Area or in the communities closest to the Project Area.

In addition, because of the availability of hotel and motel accommodations and the fairly consistent housing vacancy rates in nearby communities, workers who choose to relocate temporarily (estimated to be 10% of the workforce) would not be expected to affect housing availability (result in a housing shortage). Housing vacancy rates in 2007 were over 10% in Pinal and Maricopa counties, with over 2,500 available housing units in the communities of Buckeye and Goodyear alone. Additionally, the communities of Buckeye, Goodyear, and Gila Bend have approximately 40 hotels and motels available, with hundreds more hotels in Phoenix and its suburbs. SSEP construction activities would not be expected to affect housing vacancy rates, housing prices, or rental costs.

Operations

The operation of the SSEP would have very little impact on the availability of housing, because the number of workers needed for the operation of the plant is relatively small (80), and because of the large number of vacant housing units in the surrounding communities. Buckeye and Goodyear alone had over 2,500 available housing units in 2007. The SSEP would be constructed in a rural area on BLM land and would not physically alter any existing residential or commercial communities. However, there are approximately 15 parcels of private property, with at least one residential structure per parcel, within 1 mile of the eastern boundary of the Project Area.

The long-term operations of a solar facility and associated transmission lines could affect property values in nearby communities. Property values could decline as a result of the change in aesthetic quality, increases in noise, real or perceived health effects, congestion, or disruption of social connections. In contrast, property values have the potential to increase because of the close proximity to employment opportunities associated with the development and operation of the solar facility (BLM and DOE 2010). Because there are a number of private parcels of land close to the eastern border of the Project Area, it is possible that these parcels would be negatively affected by the development and operations of the SSEP. Research indicates that the effect of industrial site presence on housing prices is only experienced within relatively short distances to the site. Houses within 0.15 mile from an industrial site are predicted to sell at 14.9% less than houses located 1.4 miles (study reference point) from an industrial site. Residential properties located greater than 0.6 mile from an industrial site were found to have no discernable effect on property values (de Vor and de Groot 2009). Similar research has been done on impacts to property values associated with transmission lines. Where there would be negative impacts to property values from transmission lines, they would disappear between 200 and 650 feet from the line (Priestley 2005). Impacts on residential property values within these distances vary considerably depending on the location, amenities, housing markets, size of the industrial site, etc. Generally, single family properties have shown 2% to 10% lower values when in very close proximity (within approximately 200 feet) to transmission lines (Priestley 2005).

Although there is no evidence on the impact of solar facilities on local property values, there has been limited research conducted on the impact of nonrenewable energy development on property values. Communities adjacent to oil and gas drilling activities in western Colorado reportedly endured a decline in property values upon announcement of drilling and during the initial stages of extraction. However, property values rebounded, at least partly, once production was underway (BLM and DOE 2010).

Under the Proposed Action, approximately six private parcels of land with residential structures are located less than 0.6 mile of the Project Area, and therefore could have slight reductions in value (up to 14.9%) due to the construction and operation of the SSEP (de Vor and de Groot 2009). However, based on previous research, this slight adverse impact on property values in the immediate vicinity of the solar facility would likely dissipate as long-term operations get underway (BLM and DOE 2010).

Property values do have the potential to increase under conditions of moderate population growth and housing demand. In studies where expansion of the local employment occurred as a result of a new industrial facility operation, a positive impact on property values was found to be associated with an increase in the demand for local housing (BLM and DOE 2010). However, the operation of SSEP would have little impact on housing demand, based on the existing housing vacancy rates and the small amount of workers anticipated to relocate to the area.

4.12.2.2.4 Public Services

Construction

Construction of the SSEP would not result in an increase in demand for public services. Current police, fire, and medical facilities should be sufficient to handle emergencies during construction activities at the site. Construction workers would be expected to obtain health insurance from their employers.

The SSEP would rely on on-site fire protection systems and off-site fire protection services. The SSEP would establish a construction emergency action program and plan that would include emergency evacuation procedures. The SSEP would also develop and implement a PPE program for both construction and operation phases of the project.

The Buckeye Fire Department would be the first responders in the case of fire and medical emergencies during construction of the SSEP. The department has six fire stations, each of which has its own fire truck. The Buckeye Fire Department currently has the capacity to respond to a potential increase in incidents in the Project Area (personal communication, Van Valkenburg 2009). Station 701 is located at 404 South Miller Road in Buckeye, which is approximately 10 miles north of the Project Area. Fire officials estimate that it would take approximately 10 minutes or less for emergency vehicles to arrive at the Project Area to provide services.

In the event of large numbers of incidents (up to one per day in the Project Area), this station would have the ability to provide emergency fire and medical services (personal communication, Van Valkenburg 2009).The Town of Buckeye Police Department would have the capacity to respond to incidents associated with development of the SSEP in the Project Area, with an average response time of five to eight minutes (personal communication, Phil Harris 2009).

Utilities

Construction of the SSEP would require potable water and electrical utility supplies, and would also generate wastewater and solid waste. Potable water for construction activities would be trucked onto the site. All power would be generated on-site for construction; however, if power is available through existing distribution, the construction contractors may elect to use it.

Waste generated during construction would be disposed of at the closest landfill, the Southwest Regional Landfill, located approximately 2 miles west of the Project Area. This landfill is located just southeast of the intersection of SR-85 and Komatke Road. Currently, the landfill charges $26.25 per ton (prorated) of construction debris and has abundant capacity to receive additional debris (personal communication, Kathy Lugo 2009). The City of Phoenix owns another landfill approximately 5 miles southwest of the Project Area, located west of Highway 85 and south of Patterson Road. Sanitary wastes generated during construction would be collected in portable self-contained toilets and hauled to an appropriate disposal site by a servicing contractor.

Schools

Given that 90% of the workforce would come from surrounding communities, SSEP construction would not have an adverse impact on local school systems. The families of the construction workers are already enrolled in the current school system and would not increase or decrease as a result of the project. Additionally, construction workers who relocate temporarily for a work assignment (10%) typically would not bring their families with them. The school closest to the Project Area is approximately 10 miles away, and school activities would not be affected by SSEP construction activities (e.g., traffic, noise, or air emissions).

Operations

Population would not be expected to change as a result of the operations of the facility, and therefore the capacity of the local emergency services should also not change substantially. The services provided by Buckeye Fire Department, Buckeye Valley Fire District, and Buckeye Police Department would not be expected to be affected by the SSEP facility operation.

Utilities

The SSEP would use on-site groundwater and would therefore have no impact on local water utilities. SSEP sanitary wastes would be disposed of by an on-site waste treatment system, with a septic tank and leach field. Operations would have no impact on the availability of local wastewater treatment capacity.

The SSEP would use natural gas for start-up and HTF freeze protection, and may also be used to support a small percentage (up to 25%) of actual power generation. The annual maximum natural gas usage under the Proposed Action would be 3,982,000 MMBtu. The SSEP may also require electrical power for maintenance activities during nighttime hours when the facility is not generating its own power.

Schools

Operation of the SSEP would have no impact on local schools because of the relatively small number of workers needed for operation of the plant (maximum of 80). Additionally, because almost all of the workers are expected to be local residents, their children would already be enrolled in the local schools and no additional enrollment demand would occur.

4.12.2.2.5 Quality of Life Conditions

Construction

As discussed in Section 3.12.2.5, the communities closest to the Project Area, Buckeye and Goodyear, have historical connections to farming and ranching. The rural, moderately developed area has recently begun to feel development pressure as the urban growth from the Phoenix metropolitan area presses south

and west. Recently completed planning documents suggest that the communities are interested in fostering opportunities for economic growth and mixed-use development.

The communities closest to the Project Area would likely notice adverse impacts to their current rural quality of life. During the construction phase, traffic would increase in the communities near the Project Area. At the peak of construction, approximately 1,000 vehicles carrying workers would commute to and from the Project Area on a daily basis, and 30 to 60 trucks per day would make trips to the site. See Section 4.15 for further detail on the transportation and traffic analysis. Noise levels during construction would increase at outdoor residential receptor locations. However, noise increases as a result of construction would be reduced to sound levels generally considered ~~"~~quiet" if residents near residential receptor sites are indoors (see Section 4.9 for detailed information on noise receptor locations). From a visual perspective, the Proposed Action would change the landscape characteristics, existing landforms, and vegetation in the area, which would contribute to an overall change in the sense of place for members in nearby communities. The shift from a rural, moderately developed landscape to a more industrialized landscape would adversely impact local residents and visitors to the area who are seeking a rural to moderately developed residential community, semiprimitive views, or recreation experience.

Recreation experiences can contribute to a person's overall quality of life and/or shape their identity or self perceptions. Individuals seeking solitude and a primitive recreation experiences would be adversely impacted by the views and noise from the SSEP during construction and operation, as they hear the noise from construction and operations and see the change in landscape. Changes in visual character of the Project Area would be experienced by recreationists in the nearby recreation areas and areas with wilderness characteristics considered for analysis, except for the Buckeye Hills Regional Park (see Section 4.11 for further detail on impacts to recreation). Project-related noise would not likely impact recreationists in recreation and wilderness areas more than 1.75 miles from the Project Area, as stated in Section 4.9. Conversely, new and improved roads and utility corridors surrounding the SSEP would provide for more opportunities for motorized travel, and the Proposed Action would therefore be perceived as a beneficial recreational impact to an OHV user group.

Operations

Although the amount of vehicle traffic and noise would decrease, when compared to the construction phase of the SSEP, the change to the visual landscape would remain for the life of the project. The installation and operation of 3,620 acres of mirrored solar troughs would result in a change in an individuals' identification with the area, as the SSEP would change the existing land use from one they have historically identified with to a more industrialized land use. The long-term operation of the SSEP could lead to a change in the nearby communities' self perception, from identifying with an area that is rural and moderately developed to identifying with a place shaped by industry and renewable energy development.

The industrial nature of the long-term operation may adversely impact those residents and visitors to the area who have previously identified with the area as a moderately developed, rural landscape. Those members of the community who have an adverse reaction to a change in their perceived quality of life may choose to move from the area. People who are seeking to relocate to a rural and moderately developed community, such as Goodyear or Buckeye, may not be attracted to the area and choose to live elsewhere.

4.12.2.3 ALTERNATIVE A: REDUCED WATER USE (DRY-COOLED CST)

The social impacts (population and housing) under Alternative A would be the same as under the Proposed Action because the duration of construction and nonmigratory workforce required to construct and operate the SSEP would be the same as under the Proposed Action. With regard to the delivery and

transmission of public utilities, there would be a decrease in the amount of natural gas required under Alternative A, when compared to the Proposed Action. The annual maximum natural gas usage under Alternative A would be 3,623,620, a 9% decrease in the amount of natural gas required for the SSEP. Groundwater use would be 90% less under Alternative A when compared to the Proposed Action. Quality of life impacts would be the same under Alternative A and the Proposed Action because the change in land use would be the same under both alternatives.

4.12.2.4 SUB-ALTERNATIVE A1: PHOTOVOLTAIC

4.12.2.4.1 Workforce and skills

Construction

Under Sub-alternative A1, project construction would require 61% less full-time skilled and unskilled employees per month than under the Proposed Action. The average workforce required over the 39-month construction period would be 335, compared to 874 under the Proposed Action. The monthly workforce would peak at 378 under Sub-alternative A1, a 75% reduction in peak workforce when compared to the Proposed Action‘s peak workforce of 1,538. Payroll over the life of the construction phase would total approximately $75 million, a 65% reduction in construction payroll when compared to the Proposed Action‘s total estimated payroll cost of $215 million.

Operations

Sub-alternative A1 would require 16 full-time employees, an 80% reduction in operations workforce when compared to the Proposed Action. The total full-time annual operations payroll would be $1.5 million, an 82% reduction in operations payroll when compared to the $8.5 million annual operations payroll under the Proposed Action.

4.12.2.4.2 Population and Housing

Construction

As under the Proposed Action, it is assumed that 10% of the workforce would relocate to the region temporarily or permanently under Sub-alternative A1. These workers would likely stay in hotel/motels, apartments, or purchase homes. The remainder of the construction workforce would be filled by the local workforce. Thus, the population would be expected to grow by approximately 34 individuals during the construction phase, a 0.1 % or less increase in projected population levels for Buckeye, Goodyear, and Maricopa counties. The population increase under Sub-alternative A1 would be 61 % less than the Proposed Action. Because construction activities under Sub-alternative A1 would have negligible impacts on population growth in the communities surrounding the Project Area, housing vacancy rates, housing prices, or rental costs are not likely to be impacted under Sub-alternative A1.

Operations

As under the Proposed Action, the operations workforce positions under Sub-alternative A1 would be mostly filled by local residents. Approximately three to five project operators with specialized technical skills would be required to relocate to the area to provide expertise in operations and maintenance. Throughout the operations phase, negligible impacts on population growth in local communities surrounding the Project Area are anticipated. Housing impacts would also be negligible under Sub-alternative A1 because the number of relocating workers needed for the operation of the plant would be very small.

Both potential adverse and beneficial impacts to property values would be less under Sub-alternative A1 when compared to the Proposed Action. Due to the location and reduced size of the Project Area footprint, there would be no private land within 0.6 mile of the Project Area. As indicated in Section 4.12.2.2.3, an industrial facility situated within 0.6 mile from a private property residence could be subject to a slight decrease in property values. Beneficial impacts to property values as a result of housing near the workplace would be less likely under Sub-alternative A1, because jobs would be fewer and housing would be further from the Project Area.

4.12.2.4.3 Public Services

Construction

Similar to the Proposed Action, the construction phase of Sub-alternative A1 would not result in an increase in demand for public services. Current police, fire, and medical facilities should be sufficient to handle emergencies during construction activities at the site. Construction workers would be expected to obtain health insurance from their employers.

Operations

As discussed under the Proposed Action, the population would not be expected to change noticeably as a result of the operations of the facility, and therefore pressure on the local emergency services would also not change substantially. The services provided by Buckeye Fire Department, Buckeye Valley Fire District, and Buckeye Police Department would not be expected to be affected by the SSEP facility operation.

The long-term operations would require the use of fewer natural resources (water and natural gas) and have less of an impact on local utilities with regard to the delivery/transmission of water and power to the Project Area when compared to the Proposed Action. Sub-alternative A1 would require 98.5% less groundwater use than the Proposed Action. Under Sub-alternative A1, no natural gas would be required to operate the facility, in contrast to the Proposed Action, which would require an annual maximum use of 3,982,000 MMBtu.

4.12.2.4.4 Quality of Life

Construction

Changes to the quality of life for nearby residents would be similar in nature to those described for the Proposed Action, but of a lesser intensity. Although the footprint of the proposed project would be reduced from approximately 3,620 to approximately 2,013 acres, the duration of the construction phase would be identical to the Proposed Action. During the construction phase, traffic would increase in the communities near the Project Area. At the peak of construction, approximately 267 vehicles carrying workers would commute to and from the Project Area on a daily basis compared to 1,000 vehicles under the Proposed Action. Approximately 10–14 trucks per day would make trips to the site compared to 30–60 trucks per day under the Proposed Action. See Section 4.15 for further detail on the transportation and traffic analysis. Construction noise levels under Sub-alternative A1 would be similar to the Proposed Action in terms of duration and intensity (see Section 4.9 for detailed information on receptor locations). From a visual perspective, the Sub-alternative A1 would change the landscape characteristics, existing landforms, and vegetation in the area, which would contribute to an overall change in the sense of place for members in nearby communities. However, the change in landscape characteristics would be reduced under Sub-alternative A1 because the Project Area footprint would decrease by approximately 1,700 acres when compared to the Proposed Action.

Individuals seeking solitude and a primitive recreation experiences would be adversely impacted by the views and noise from the SSEP during construction and operation, as they would hear the noise from construction and operations and see the change in landscape. Conversely, new and improved roads and utility corridors surrounding the SSEP would provide for more opportunities for motorized travel, and Sub-alternative A1 would therefore be perceived as a beneficial recreational impact to an OHV user group. Overall, the shift from a rural, moderately developed landscape to a more industrialized landscape would adversely impact local residents and visitors to the area who are seeking a rural to moderately developed residential community, semiprimitive views, or recreation experiences.

Operations

Although the footprint of the Project Area would be reduced from approximately 3,620 acres to approximately 2,013 acres under Sub-alternative A1, the overall change in land use to the area would have similar quality of life impacts when compared to the Proposed Action. The installation and operation of a utility-scale solar facility would result in a change in an individual's identification with the area, because the SSEP would change the existing land use from one that users have historically identified with to a more industrialized land use. The long-term operation of the SSEP could lead to a change in the nearby communities‘ self perception, from identifying with an area that is rural and moderately developed to identifying with a place shaped by industry and renewable energy development.

The industrial nature of the long-term operation may adversely impact those residents and visitors to the area who have previously identified with the area as a moderately developed, rural landscape. Those members of the community who have an adverse reaction to a change in their perceived quality of life may choose to move from the area. People who are seeking to relocate to a rural or moderately developed community, such as Goodyear or Buckeye, may not be attracted to the area and may choose to live elsewhere.

4.12.2.5 ALTERNATIVE B: REDUCED FOOTPRINT

The social impacts (population and housing) under Alternative B would be largely the same as under the Proposed Action. Under Alternative B, the nonmigratory workforce required to construct and operate the SSEP would be 10% less than the Proposed Action. The annual maximum natural gas usage under Alternative B would be 2,655,000 MMBtu, a 33% decrease in natural gas use when compared to the Proposed Action. Quality of life impacts would be the same under Alternative B as under the Proposed Action because the change in land use, although decreased by approximately 30% compared to the Proposed Action, would be the same as under the Proposed Action.

4.12.3 Economic Impacts

4.12.3.1 NO ACTION

Under the No Action alternative, the SSEP would not be built, and impacts to local economic conditions would be similar to current conditions. The per-AUM-fees obtained by the BLM on the two grazing allotments would remain the same, and local direct and indirect economic impacts from the grazing operations would be similar to current impacts (Section 4.12.4.1). The direct and indirect economic impacts that come from the sale of materials, supplies, and labor related to livestock grazing in the area would remain the same under the No Action alternative. Revenue generated as a result of the dispersed recreation in the area would continue under the No Action alternative.

4.12.3.2 PROPOSED ACTION

4.12.3.2.1 Construction

SSEP construction would create positive, temporary impacts on local economies. Benefits associated with construction would last for the duration of the construction phase of the SSEP, or approximately 39 months. The economic impacts of the SSEP construction phase were estimated with an input-output model, specifically the IMPLAN modeling software and databases (Minnesota IMPLAN Group [MIG] 2009). These types of regional economic models are standard approaches to measuring the production and consumption linkages in an economy among households, industries, and institutions (such as government), thus providing an estimate of the ripple effects in an economy associated with a direct stimulus or investment. IMPLAN's multipliers measure these downstream or ripple impacts.

Maricopa County was chosen as the economic impact study area because construction employees and supporting industries are most likely to reside within Maricopa County given the concentration of available workforce. The data for Maricopa County were obtained from MIG, and multipliers were constructed by the IMPLAN model for the county. IMPLAN multipliers are defined as the sum of the direct, indirect, and induced effect divided by the direct impact. These impact types are further defined below:

- **Direct Impacts**: The set of investments resulting from activity in the geographic location of the county, which are run through the IMPLAN model as the direct effect. During the construction phase, these direct impacts include construction employment and local expenditures on construction supplies and materials.
- **Indirect Impacts**: The inter-industry impacts measuring the economic activity associated with the directly impacted industries selling and purchasing goods and services to and from other industries. The indirect impacts associated with construction investments include industries that support this type of activity, such as truck transportation, engineering and architectural services, wholesale trade, and asphalt manufacturing.
- **Induced Impacts**: The effects of increased consumer and household spending resulting from the direct and indirect income changes. The induced effects would be indirect construction industry employees spending their income in the local economy.

The analysis estimated the total economic impacts (direct, indirect, and induced) associated with construction employment, as well as construction expenditures for supplies and materials paid to businesses in the Phoenix region. Construction industry impacts were estimated for Maricopa County based on the projected average annual construction employment of the SSEP construction phase of 874 full-time equivalents, as described in Section 4.12.2.2.1, and run through the relevant sector in the IMPLAN model (MIG 2009). Local expenditures for construction materials and supplies would total approximately $19 million over the 39-month construction phase, or approximately $5.8 million annually. Construction materials and supplies purchased locally would include concrete, rebar, asphalt, fencing, gravel, hardware, conduits, and local purchases in support of field staff. These expenditures were run through the wholesale trade sector in IMPLAN.

Direct employment, resulting from the construction phase of the SSEP, would be approximately 904 jobs, comprising 874 construction jobs and an additional 30 jobs associated with local construction expenditures ($19 million). Additionally, these direct impacts would support 702 induced and indirect jobs each year for the duration of the construction phase (MIG 2009). Total annual labor income for the project would be approximately $84 million. Economic output, also defined as gross sales or revenues, would be approximately $221.6 million associated with direct, indirect, and induced economic impacts. These IMPLAN-estimated increases in employment, labor income, and economic output as a result of project construction are summarized in Table 4.63. Table 4.64 compares the annual economic impacts from the SSEP during construction per alternative.

Table 4.63 Annual Construction Economic Impacts (2009$) – Proposed Action

Impact	Employment	Labor Income	Output
Direct	904	$50,886,152	$124,243,651
Indirect	271	$15,656,025	$40,537,237
Induced	431	$17,860,035	$56,840,948
Total	**1,606**	**$84,402,211**	**$221,622,804**

Source: MIG (2009).
Note: IMPLAN employment impacts include both full-time and part-time employment.

Table 4.64 Annual Economic Impacts from SSEP Construction per Alternative (2009$)

Alternative	Employment	Labor Income	Output
No Action	–	–	–
Proposed Action	1,606	$84,402,211	$221,622,804
Alternative A: Reduced Water Use (dry-cooled CST)	1,606	$84,402,211	$221,622,804
Sub-alternative A1: Photovoltaic	639	$36,118,518	$88,753,140
Alternative B: Reduced Footprint	1,445	$75,961,990	$199,459,652

The top industries benefiting from increased employment would consist of (in decreasing order): construction, wholesale trade, food services and drinking establishments, real estate, offices of physicians and dentists, private hospitals, retail sales, employment services, and transportation by truck.

Construction of the SSEP under the Proposed Action would result in a 4.5% decrease in acres available for livestock grazing within the Arnold allotment and a 2.6 % decrease in the Beloat allotment. It should be noted that allotments are used only when there is an adequate amount of water to sustain the AUM and have not historically been used to full capacity because of their lack of water (see Section 4.8 for further details on the ephemeral allotments). It is unlikely that a combined 7.1 % decrease in acres available for grazing for two permittees would lead to a measureable decrease in revenue generated as a result of livestock grazing operations in the area because 92.9% of the allotments would still be available for grazing and the generation of grazing-related revenues.

Although construction of the SSEP would displace both motorized and nonmotorized recreation uses on approximately 3,500 acres and on 7.4 miles of primitive roads, there are substantial public lands adjacent and nearby to the Project Area that would provide continued recreation opportunities for resident of nearby communities and other visitors. Recreation use would be expected to shift to other areas and sales of products and services that support outdoor recreation activities would not be expected to decline. Residents and visitors would be expected to continue to purchase products and services and use those on other nearby public lands.

4.12.3.2.2 Operations

As stated previously, there would be approximately 80 full-time operations staff needed to operate and maintain the SSEP facility. This staff would consist of plant operators, maintenance technicians, and administrative personnel with a total payroll of $8.5 million annually, which includes benefits and incentive pay. Most of the 80 employees would be hired locally, with some (approximately 5 to 10) specialized employees coming from outside the local area.

These employment estimates were run through the IMPLAN model (the Electric Power Generation and Transmission Sector) to estimate direct, indirect, and induced impacts of the operations workforce on the local economy. This is a standard regional economic input-output model that is used to estimate multiplier effects on a local economy from a direct stimulus or investment. The IMPLAN Maricopa County model estimated an additional 128 part-time and full-time jobs (indirect and induced) generated by the operation of the SSEP. In total, SSEP operations would support approximately 208 jobs annually, $71.5 million in annual economic output (or sales), and $16.9 million in annual labor income (MIG 2009). Table 4.65 summarizes these IMPLAN-estimated increases in annual jobs and annual economic output as a result of project operations. Table 4.66 compares the annual economic impacts from the SSEP per alternative.

Table 4.65 Annual Economic Impacts from SSEP Operations (2009$) – Proposed Action

Impact	Employment	Output	Labor Income
Direct	80	$54,917,394	$11,143,831
Indirect	43	$5,983,076	$2,153,936
Induced	85	$10,554,288	$3,559,302
Total	**208**	**$71,454,759**	**$16,857,069**

Source: MIG (2009).
Note: IMPLAN employment impacts include both full-time and part-time employment.

Table 4.66 Annual Economic Impacts from SSEP Operations per Alternative (2009$)

Alternative	Employment	Output	Labor Income
No Action	–	–	–
Proposed Action	208	$71,454,759	$16,857,069
Alternative A: Reduced Water Use (dry-cooled CST)	208	$71,454,759	$16,857,069
Sub-alternative A1: Photovoltaic	42	$14,290,951	$3,371,414
Alternative B: Reduced Footprint	183	$62,522,914	$14,749,935

In addition to economic contributions of the operations workforce on the local economy, the Proposed Action would also have an impact on nonpayroll operational expenditures on the local economy. Annual expenditures for contracted maintenance and general and administrative supplies would also contribute to the local economies. These annual operating expenditures were run through the IMPLAN economic model to assess contributions of nonpayroll expenditures on the local economy. They are as follows:

- $1.5 million: wholesale trade (general administrative supplies and purchases)
- $775,000: repair and maintenance construction of nonresidential structures

The economic model estimated that an additional 27 part-time and full-time jobs would be generated by the annual nonpayroll operational expenditures of the Proposed Action. In total, the Proposed Action's operations would be expected to support approximately $4.0 million in annual economic output (or sales), and $1.6 million in annual labor income (MIG 2009). Table 4.67 summarizes these IMPLAN-estimated economic impacts.

Table 4.67 Annual Economic Impacts from Proposed Action Operations Nonpayroll Expenditures (2009$)

Impact	Employment	Output	Labor Income
Direct	14	$2,346,236	$967,767
Indirect	5	$695,741	$278,673
Induced	8	$991,405	$334,149
Total	27	$4,033,485	$1,580,607

Source: MIG (2009).
Note: IMPLAN employment impacts include both full-time and part-time employment.

Under the Proposed Action, the maximum annual output of electrical generation would be 1,155,000 MWh (Table 4.68). The amount of energy generated by the SSEP would facilitate economic growth in the region by contributing to the development of infrastructure needed in growing communities. The energy produced by the SSEP would allow energy suppliers to meet the demands of the area's increasing population and a growing economy. According to the U.S. Energy Information Administration, in 2007 the average Arizona household consumed 1,095kWh (1.095 MWh) per month or 13,140 kWh (13.14 MWh) annually (USEIA 2010). For comparative purposes, an assumption can be made that all of the energy produced by the SSEP would supply residential users (although the actual distribution on energy generated by the SSEP is unknown at this time). Under the Proposed Action, the energy generated from the SSEP would supply 87,899 homes annually.

Table 4.68 Maximum Annual Output per Alternative (MWh) – All Alternatives

Alternative	MWh	Number of Residential Units Supplied
No Action	–	–
Proposed Action	1,155,000	87,899
Alternative A: Reduced Water Use (dry-cooled CST)	1,051,050	79,988
Sub-alternative A1: Photovoltaic	775,000	**58,980**
Alternative B: Reduced Footprint	770,000	**58,599**

4.12.3.3 ALTERNATIVE A: REDUCED WATER USE (DRY-COOLED CST)

Under Alternative A, short-term economic impacts from construction would be the same as the Proposed Action, because the construction and operation employment requirements (and subsequent direct, indirect and induced impacts) would be identical to the Proposed Action. The maximum annual output of electrical generation would decrease by 9% (to 1,051,050 MWh) when compared to the Proposed Action (see Table 4.68). A 9% decrease in the maximum annual output of electrical generation would result in a decrease in the ability of the region to provide infrastructure for economic growth. Alternative A would provide electricity to 79,988 homes annually, a decrease of 7,911 homes when compared to the Proposed Action.

4.12.3.4 SUB-ALTERNATIVE A1: PHOTOVOLTAIC

4.12.3.4.1 Construction

Under Sub-alternative A1, the positive, short-term impacts on local economies would be reduced compared to the Proposed Action. Although the 39-month construction duration would be the same under Sub-alternative A1, the total direct, indirect, and induced impacts of the construction would be reduced. Average, annual direct employment resulting from the construction phase of Sub-alternative A1 would result in 358 jobs, comprising 335 construction jobs and an additional 23 jobs associated with the local construction expenditures ($14 million). Additionally, this direct employment would support 281 induced and indirect jobs each year for the duration of the construction phase (MIG 2009). Sub-alternative A1 would produce a total of 639 jobs, which is a 60% decrease in the total number of jobs than would be produced under the Proposed Action (1,606 jobs). Total labor income would be reduced 57% from $84.4 million to $36.1 million under Sub-alternative A1. The total economic output would be reduced 60% from $221.6 million to $88.8 million over the duration of the construction phase. Table 4.69 summarizes the construction (IMPLAN-estimated) economic impacts of Sub-alternative A1. A comparison of construction-related economic impacts across all alternatives is provided in Table 4.64.

Table 4.69 Construction Economic Impacts (2009$) – Sub-alternative A1

Impact	Employment	Labor Income	Output
Direct	358	$21,762,313	$49,847,949
Indirect	109	$6,713,679	$16,220,736
Induced	172	$7,642,527	$22,684,225
Total	639	$36,118,518	$88,753,140

Source: MIG (2009).
Note: IMPLAN employment impacts include both full-time and part- ime employment.

Identical to the Proposed Action, the top 10 industries that would benefit from increased employment under Sub-alternative A1 are (in decreasing order): construction, wholesale trade, architectural and engineering services, food services and drinking places, real estate, truck transportation, offices of physicians and dentists, private hospitals, retail stores, and employment services.

Under Sub-alternative A1, the amount of land available for livestock grazing in the Beloat and Arnold allotments would be reduced by approximately 1,983 acres in the Sub-alternative A1 footprint. However, the amount of land available for grazing would be 63% higher than under the Proposed Action. Sub-alternative A1 would result in a 1.0% (1,051 acres) reduction in acres available for grazing in the Beloat allotment, compared to a 2.6% decrease under the Proposed Action and a 4.0% (932 acres) decrease in the in the Arnold allotment, compared to a 4.5% decrease under the Proposed Action. Similar to the Proposed Action, it is unlikely that a combined 5.0% decrease in acres available for grazing for two permittees would lead to a measureable decrease in revenue generated as a result of livestock grazing operations, because 95% of the two allotments combined would still be available for grazing and for the generation of grazing-related revenues.

4.12.3.4.2 Operations

Under Sub-alternative A1, the positive, long-term impacts on local economies would be reduced as compared to the Proposed Action. As stated previously, there would be approximately 16 full-time operations employees needed to operate and maintain the solar facility under Sub-alternative A1. Because operations would involve a phased approach, it is likely that the 16 employees would be needed in 2015,

and fewer employees would be needed in 2013 and 2014 while operations ramp up. These employees would consist of plant operators, maintenance technicians, and administrative personnel with a total payroll of $1.5 million annually, which includes benefits and incentive pay. Most of the 16 employees would be hired locally, with some specialized employees coming from outside the local area.

These employment estimates were run through the IMPLAN economic model to estimate direct, indirect, and induced impacts of this economic activity on the local economy. The model estimated that an additional 26 part-time and full-time jobs (indirect and induced) would be generated by the full operation of Sub-alternative A1 in 2015. In total, Sub-alternative A1 operations would be expected to support approximately 42 jobs annually, $14.3 million in annual economic output (or sales), and $3.4 million in annual labor income (MIG 2009). Sub-alternative A1 would produce a total of 42 jobs, which is an 80% decrease in the total amount of jobs that would be produced under the Proposed Action (208 jobs). The SSEP increase in total labor income would be reduced 80% from $71.4 million to $14.2 million under Sub-alternative A1, as compared to the Proposed Action. The total increase in economic output from the SSEP would be $3.3 million over the duration of the operations phase. Although beneficial, the impact would be reduced 80% from the $16.8 million of the Proposed Action. Table 4.70 summarizes these IMPLAN-estimated economic impacts of operations-related employment. A comparison of construction-related economic impacts across all alternatives is provided in Table 4.64.

Table 4.70 Annual Economic Impacts from SSEP Operations Employment – Sub-alternative A1 (2009$)

Impact	Employment	Output	Labor Income
Direct	16	$10,983,478	$2,228,766
Indirect	9	$1,196,615	$430,787
Induced	17	$2,110,858	$711,861
Total	**42**	$14,290,951	$3,371,414

Source: MIG (2009).
Note: IMPLAN employment impacts include both full-time and part-time employment.

Sub-alternative A1 would also include additional annual operational expenditures, which were analyzed with the IMPLAN economic model. In addition to the operations payroll, there would be annual expenditures for consumables, waste disposal, utilities, contracted maintenance, and general and administrative supplies (personal communication, Brandon Stankiewicz, Project Manager, Solar Development, NextEra Energy Resources 2011). These annual operating expenditures were run through the IMPLAN economic model to assess contributions of nonpayroll expenditures on the local economy. They are as follows:

- $800,000: facility support services
- $275,000: wholesale trade (general administrative supplies and purchases)
- $1.5 million: repair and maintenance construction of nonresidential structures

The economic model estimated an additional 41 part-time and full-time jobs generated by the annual nonpayroll operational expenditures of Sub-alternative A1. In total, Sub-alternative A1 operations would support almost $5.0 million in annual economic output (or sales) and $2.1 million in annual labor income (MIG 2009). Table 4.71 summarizes these IMPLAN-estimated economic impacts.

Table 4.71 Annual Economic Impacts from Operations Nonpayroll Expenditures (2009$) – Sub-alternative A1

Impact	Employment	Output	Labor Income
Direct	25	$2,749,112	$1,334,153
Indirect	6	$868,575	$350,594
Induced	10	$1,340,167	$451,682
Total	41	$4,957,855	$2,136,434

Source: MIG (2009).
Note: IMPLAN employment impacts include both full-time and part-time employment.

In total, both operations payroll and annual operating expenditures would support 83 jobs, $5.5 million in labor income, and $19.2 million in economic output.

Under Sub-alternative A1, the maximum annual output of electrical generation would total 775,000 MWh, a 33% decrease from the Proposed Action (Tables 4.68). This reduction in electrical generation would result in the smallest increase in ability, among the action alternatives, to provide infrastructure for economic growth. The amount of electricity generated under Sub-alternative A1 would supply 58,980 homes with electricity annually, 28,919 less homes than the Proposed Action.

4.12.3.5 ALTERNATIVE B: REDUCED FOOTPRINT

4.12.3.5.1 Construction

Construction operations under Alternative B would require a total construction period of approximately 37 months (2 months less than under the Proposed Action). A peak workforce of 1,350 workers (a 10 % reduction in the workforce compared to the Proposed Action) would be required under Alternative B. Compared to the Proposed Action, increases in employment, labor income, and economic output as a result of construction of the SSEP would be 10% less under Alternative B (see Tables 4.64 and 4.72). Compared to the Proposed Action, a two-month reduction in the construction phase would result in an annual decrease of $30,603,373 in labor income and sales generated as a result of the shorter construction timeframe under Alternative B.

Table 4.72 Annual Construction Economic Impacts (2009$) – Alternative B

Impact	Employment	Labor Income	Output
Direct	814	$45,797,537	$111,819,286
Indirect	243	$14,090,426	$36,483,513
Induced	388	$16,074,032	$51,156,853
Total	**1,445**	**$75,961,990**	**$199,459,652**

Source: MIG (2009).
Note: IMPLAN employment impacts include both full-time and part-time employment.

Under Alternative B, impacts to the amount of land available for livestock grazing in the Beloat and Arnold allotments would be reduced by 2,320 acres in the Alternative B footprint. However, the amount of land available for grazing would increase by 61% when compared to the Proposed Action. Alternative

B would result in a 1.3% (1,397 acres) reduction in acres available for grazing in the Beloat allotment, compared to a 2.6% decrease under the Proposed Action and a 4.2% (966 acres) decrease in the in the Arnold allotment, compared to a 4.5% decrease under the Proposed Action. Similar to the Proposed Action, it is unlikely that a combined 5.5% decrease in acres available for grazing for two permittees would lead to a measureable decrease in revenue generated as a result of livestock grazing operations, because 94.5% of the two allotments combined would still be available for grazing and the generation of grazing-related revenues.

4.12.3.5.2 Operations

Under Alternative B, operations would require 70 full-time employees, a 12.5% reduction in the amount of employees required compared to the Proposed Action. Annual and long-term increases in employment and economic output (direct, indirect, and induced) from the SSEP operations under Alternative B would be reduced by 12.5% when compared to the Proposed Action (Table 4.73).

Table 4.73 Annual Economic Impacts from SSEP Operations – Alternative B

Impact	Employment	Output	Labor Income
Direct	70	$48,052,720	$9,750,852
Indirect	38	$5,235,192	$1,884,694
Induced	75	$9,235,002	$3,114,389
Total	**183**	**$62,522,914**	**$14,749,935**

Source: MIG (2009).
Note: IMPLAN employment impacts include both full-time and part-time employment.

Under Alternative B, the maximum annual output of electrical generation would total 777,000 MWh, a 32% decrease from the Proposed Action (Tables 4.68). This reduction in electrical generation would result in the smallest increase in ability, among the action alternatives, to provide infrastructure for economic growth. The amount of electricity generated under Alternative B would supply 58,599 homes with electricity annually, 29,300 less homes than the Proposed Action.

4.12.4 Fiscal Impacts

4.12.4.1 NO ACTION

Under the No Action alternative, the SSEP would not be developed, and the existing land uses would continue. The BLM would continue to collect grazing fees from the two permittees who have allotments in the Project Area. The grazing fees would continue to support the costs of the federal grazing program. The Beloat allotment totals 103,508 acres and 2,988 AUMs. The Arnold allotment totals 23,290 acres and 984 AUMs. The 2010 annual grazing fee, collected by the BLM, is $1.35/AUM. The Beloat allotment currently generates $4,034.00 in grazing fees and the average annual fee for the Arnold allotment is $1,328.00. The average annual maximum fee for the two allotments in the SSEP currently equals $5,362.00

4.12.4.2 PROPOSED ACTION

4.12.4.2.1 Construction

Local purchases of materials, supplies, equipment, and services would total $19 million during the construction phase of the project, which would last approximately 39 months. These expenditures would be subject to sales tax in the location where they are purchased. Currently, the State of Arizona has a sales tax rate of 5.6%, and Maricopa County levies an additional tax of 0.7% to support roads and jails (Hedding 2009). As a result of these taxes, locally purchased construction materials and supplies would contribute $1.1 million and $133,000 to the State of Arizona (the General and Detention Operation Funds) and Maricopa County, respectively, over the 39-month construction period.

Each city in the region also adds an additional sales tax, and it is likely that materials and supplies would be purchased from the cities in the Phoenix metropolitan area. These cities assess various sales tax rates, generally ranging from 1.5% to 3.0%. Although the exact jurisdiction is unknown at this time, these local construction expenditures would contribute from $285,000 to $570,000 in city sales tax revenue over the 39-month construction phase of the project.

Additionally, in Arizona, prime contractors are subject to a transaction privilege tax. The transaction privilege tax is one that is levied by the State of Arizona on contractors for the privilege of conducting business in the state. The current combined state and county tax rate for prime contracting is 6.3% (Arizona Department of Revenue 2009b); the tax base for prime contracting is 65% of the sales proceeds or income derived from the job. To assess the transaction privilege tax receipts, the construction payroll estimate of $215 million is used as a proxy for construction sales. Applying both the tax base and transaction privilege tax rates to the construction payroll spending of $215 million, the SSEP would contribute approximately $8.8 million to the state and county in tax revenue over the entire construction phase of the SSEP. Most of the larger cities within Maricopa County also license and collect privilege tax independently of the state; these city rates typically range from 2 to 4%, which would contribute another $2.8 to $5.6 million to city governments over the construction period.

Construction and operation of the SSEP, under the Proposed Action, would result in a 4.5% decrease in acres available for grazing within the Arnold allotment and a 2.6% decrease in the Beloat allotment compared to the No Action alternative. Assuming a 7.1% reduction in acres available for grazing equates to a 7.1% decrease in AUMs, the revenue generated from grazing fees would also be reduced by 7.1% or $381.00 (a decrease of $105.00 for the Beloat allotment and an average annual decrease of $60.00 for the Arnold allotment).

Construction and operation of the SSEP would also result in the loss of about 3,500 acres and 7.4 miles of primitive roads in the Project Area for recreation uses. Because residents of nearby communities and visitors to the area would be expected to continue to recreate on other adjacent and nearby public lands, they would continue to purchase products and services that generate tax revenue to the State of Arizona. The contribution of existing outdoor recreation activities in the Project Area to Arizona‘s tax base is unknown, but it would not be expected to decline because use would shift to other nearby public lands and these products and service would still be needed and purchased.

4.12.4.2.2 Operations

The 125-MW unit would begin operations in mid 2013, whereas the 250-MW unit would begin operations in mid 2014. During full operation of the facility, local purchases for materials and supplies, as well as maintenance and repair services and other contracted services, would total approximately $11.2 million annually. Within this annual sum, roughly $5.6 million would be used for contracted construction and maintenance services; $5.2 would be used for other facility support services, such as waste disposal, utilities, land maintenance, and others; and $325,000 would be used for general and administrative supplies (personal communication, Brandon Stankiewicz, Project Manager, Solar Development, NextEra Energy Resources 2011). The $325,000 would be subject to sales and use taxes levied by the state (5.6%) and Maricopa County (0.7%), and would contribute $17,920 to the state and $2,227 to the county annually.

Applying both the tax base and transaction privilege tax rates to the $5.6 million annual contracting spending under the Proposed Action, the project would contribute approximately $158,800 to the state and county in tax revenue. The license and privilege tax collected by larger cities in Maricopa County would contribute $40,000 to $80,000 to city governments.

Arizona has two components of property or ad valorem taxes, primary and secondary. Primary property taxes can be collected by the state, counties, cities, and community colleges or school districts, and are dedicated for operation and maintenance expenditures within the respective jurisdiction. Secondary property taxes may be levied for voter-approved budget overrides, special districts, or to pay for bonded indebtedness (Arizona Department of Revenue 2009a). Property taxes apply to real property as well as to secured and unsecured personal property. Arizona‘s property tax system classifies property according to its usage, and each class of property is assigned an assessment ratio, ranging from 1% to 25% (Arizona Department of Revenue 2009a).

The Centrally Valued Properties Unit of the Arizona Department of Revenue is responsible for the annual valuation of 13 industries for ad valorem property tax purposes, including mines, utilities, agricultural railroads, airlines, and other large and more complex properties (Arizona Department of Revenue 2009a). Utilities are typically assessed at 23% of their annual valuation for ad valorem tax purposes, although renewable energy equipment owned by utilities and other entities operating in Arizona is assessed at 20% of its depreciated cost for the purpose of determining property tax payments to the state (DOE 2009b).[10]

The property tax primary rate is $5.69 and the secondary rate is $2.94 per $100 of assessed value in Maricopa County (Arizona Department of Revenue 2009a). A total of $8.63 in primary and secondary tax rates per $100 in assessed valuation is levied by the following revenue recipients (Arizona Department of Revenue 2009):

- School district – 53.8%
- Counties – 20.0%
- State – 0.3%
- Cities – 9.2%
- Community colleges – 10.8%
- Special districts – 5.7%

[10] *Renewable energy equipment* is defined as "electric generation facilities, electric transmission, electric distribution, gas distribution or combination gas and electric transmission and distribution and transmission and distribution cooperative property hat is located in this state, that is used or useful for the generation, storage, transmission or distribution of electric power, energy or fuel derived from solar, wind or other nonpetroleum renewable sources not intended for self-consump ion, including materials and supplies and construction work in progress, but excluding licensed vehicles and property valued under sections 42-14154 and 42-14156" (DOE 2009b).

The fully installed solar field is estimated to cost $1.45 billion. This cost does not reflect the cost of the power plant, piping, or other SSEP equipment. If 20% of the initial cost is considered the assessed value of this equipment, $25 million in primary and secondary property taxes could accrue to the county, cities, colleges, and school districts in Maricopa County. Consistent with the percentages reported above, it is possible that the county would receive approximately 20% of the assessed value, whereas the Town of Buckeye could receive 9.2%, or $7.6 million and $3.9 million, respectively. As this equipment is depreciated, the annual tax revenue would decrease.

The BLM charges both rental and capacity fees for ROWs on BLM lands in accordance with the requirements of Section 504(g) of FLPMA and the provisions of 43 CFR § 2806 (BLM and DOE 2010). The BLM charges the solar energy applicant a base rent to be paid upon the issuance of the ROW authorization. In addition, the BLM charges a MW capacity fee for each ROW authorization. For Maricopa County, the 2010 solar energy base rental fee is $188.34 per acre (BLM and DOE 2010). Because the Proposed Action footprint is approximately 3,620 acres, the annual rental fee paid to the BLM would be $696,858. The rental fees would be adjusted or inflated each year, based on the Implicit Price Deflator-Gross Domestic Product index.

The BLM also charges a MW capacity fee that captures the increased industrial-use value of the ROW authorization (BLM and DOE 2010). The capacity fee would also be charged on an annual basis when the generation of electricity from the facility begins. The current capacity fee for concentrated solar-power projects is $6,570 per MW to be implemented over a five-year period after the start of generation. With phased operations estimated to begin in 2013, the ramp-up period (at 20% of generation fee added per year for five years) is likely to occur between 2013 and 2020. In 2013, the capacity fee would be $164,250 (with 20% the first year, 125 MW, and $6,570 per MW). Over the seven-year period between 2013 and 2020, the capacity fee would be $2,463,780 annually.

4.12.4.3 ALTERNATIVE A: REDUCED WATER USE (DRY-COOLED CST)

Fiscal impacts would be the same under Alternative A as under the Proposed Action, because the duration of construction and workforce required for construction and operations would be identical under both of these alternatives.

4.12.4.4 SUB-ALTERNATIVE A1: PHOTOVOLTAIC

4.12.4.4.1 Construction

Under Sub-alternative A1, the local purchases of materials, supplies, and services would total $14 million over the 39-month period construction phase. This would be a 26% decrease in local purchases when compared to the Proposed Action. Local purchases under Sub-alternative A1 would contribute $798,000 and $98,000 to the state and county, respectively, over the construction period. City sales tax revenue would contribute $210,000–$420,000 over the 39-month construction phase. The sales tax contribution would be 26% less than the contributions of the Proposed Action.

The transaction privilege tax receipts would decrease under Sub-alternative A1 when compared to the Proposed Action. Applying both the tax-based and transaction privilege tax rates to the construction payroll spending of $75 million, Sub-alternative A1 would further contribute $3.1 million, 64% less than the Proposed Action, to the state and county in tax revenue over the entire construction phase. Larger cities in the Phoenix region also license and collect privilege tax independently of the state and county and would receive $1.5–$3.0 million over the construction period.

Construction and operation of the SSEP, under the Sub-alternative A1, would result in a 4.0% decrease in acres available for grazing within the Arnold allotment and a 1.0% decrease in the Beloat allotment compared to the No Action alternative. Assuming a 5.0% reduction in acres available for grazing equates to a 5.0% decrease in AUMs, the revenue generated from grazing fees would also be reduced by 5.0% or $93.00 (a decrease of $40.00 for the Beloat allotment and an average annual decrease of $53.00 for the Arnold allotment).

4.12.4.4.2 Operations

Operation of the entire 300-MW PV facility is expected to start in mid-2015, with partial operations occurring in 2013 and 2014. During full operation of the facility, local purchases for materials and supplies, as well as maintenance and repair services and other contracted services, would total approximately $2.6 million annually, a 76% decrease in local purchases compared to the Proposed Action. Within this annual sum, roughly $1.5 million would be used for contracted construction and maintenance services; $800,000 would be used for other facility support services, such as waste disposal, utilities, land maintenance, and others; and $275,000 would be used for general and administrative supplies (personal communication, Brandon Stankiewicz, Project Manager, Solar Development, NextEra Energy Resources 2011). In 2013 and 2014, a portion of these expenditures would occur as the operations phase of the project gets underway.

General and administrative supplies and purchases of $275,000 would be subject to sales and use taxes levied by the state (5.6%) and Maricopa County (0.7%), contributing $15,400 to the state and $1,925 to the county annually under Sub-alternative A1. The transaction privilege tax receipts during the operations phase would decrease under Sub-alternative A1 when compared to the Proposed Action. Applying both the tax-base and transaction privilege tax rates to the $1.5 million annual contracting spending Sub-alternative A1 would further contribute $61,425 to the state and county in tax revenue over the entire operations phase. Larger cities in the Phoenix region also license and collect privilege tax independently of the state and county, which typically ranges from 2% to 4%, contributing another $19,000–$39,000 to city governments.

As described in the Proposed Action (Section 4.12.4.2.2), solar panels, equipment, and facilities would be assessed in terms of their valuation and would be subject to the collection of country and city property taxes. The fully-installed PV solar panels and arrays and other facilities and equipment are estimated to cost $900 million (personal communication, John Bulich, Engineer, Nextera Energy Resources 2011). If 20% of the initial cost is considered the assessed value of this equipment, $15.5 million in primary and secondary property taxes could accrue to the county, cities, colleges, and school districts in Maricopa County. Consistent with the percentages reported in the Proposed Action analysis (Section 4.12.4.2.2), it is possible that the county would receive approximately 54%, whereas the Town of Buckeye could receive 9.2%, or $8.4 million and $1.4 million, respectively. As this equipment is depreciated, this annual tax revenue would decrease. The BLM charges both rental and capacity fees for ROWs on BLM lands in accordance with the requirements of Section 504(g) of the FLPMA and the provisions of 43 CFR § 2806 (BLM and DOE 2010). The BLM charges the solar energy applicant a base rent to be paid upon the issuance of the ROW authorization. In addition, the BLM charges a MW capacity fee for each ROW authorization. For Maricopa County, the 2010 solar energy base rental fee is $188.34 per acre. Because the Sub-alternative A1 Project Area would total approximately 2,013 acres, the annual rental fee paid to the BLM would be $376,680, a 45% decrease or $320,178 less in rental fees when compared to the Proposed Action.

The BLM also charges a MW capacity fee that captures the increased industrial use value of the ROW authorization (BLM and DOE 2010). The capacity fee would also be charged on an annual basis when the generation of electricity from the facility begins. The current capacity fee for PV solar projects is $5,256

per MW to be implemented over a five-year period after the start of generation. With phased operations over a three-year time period beginning in 2013, the ramp-up period (at 20% of generation fee added per year) would likely occur between 2013 and 2020. In 2013, the capacity fee would be approximately $105,120 (with 20% the first year, 100 MW, and $5,256 per MW). After 2020, the capacity fee would be $1,576,800 annually, a 36% decrease or $886,980 less in annual MW capacity fees when compared to the Proposed Action.

4.12.4.5 ALTERNATIVE B: REDUCED FOOTPRINT

4.12.4.5.1 Construction

Local purchases of materials, supplies, equipment, and services are expected to total $18 million during the construction phase of the project under Alternative B, which would last approximately 37 months. When compared to the Proposed Action, this is a two month or 5% decrease in construction duration. Locally purchased construction materials and supplies would contribute $1.04 million and $126,350 to the State of Arizona (the General and Detention Operation Funds) and Maricopa County, respectively, over the 37-month construction period.

Under Alternative B, the workforce and subsequent payroll would be reduced by 10%, compared to the Proposed Action, during the construction phase. Applying both the tax base and transaction privilege tax rates to the construction payroll spending of $193 million, the SSEP would contribute approximately $7.9 million to the state and county in tax revenue over the entire construction phase of the SSEP. Most of the larger cities within Maricopa County also license and collect privilege tax independently of the state; applying these city rates, implementation of the project under Alternative B would contribute another $2.5 to $5 million to city governments over the 37-month construction period.

Alternative B would result in a 5.5% decrease in the acres available for grazing when compared to the No Action alternative. Assuming a 5.5% reduction in acres available for grazing equates to a 5.5% decrease in AUMs, the revenue generated from grazing fees would also be reduced by 5.5% or $294.00 under Alternative B.

4.12.4.5.2 Operations

Fiscal contributions to the state and county from sales and use taxes would be less under Alternative B than under the Proposed Action because there would be a 12.5% decrease in the workforce and a 30% decrease in the need for materials and supplies when compared to the Proposed Action. During operation it is expected that local purchases for materials and supplies, as well as maintenance and repair services and other contracted services, would total approximately $7.84 million annually. Within this annual sum, roughly $3.92 would be used for contracted services and $192,000 million would be used for general and administrative supplies. The $192,000 million would be subject to sales and use taxes levied by the state (5.6%) and Maricopa County (0.7%), and would contribute $10,752 to the state and $1,344 to the county annually.

Under Alternative B, revenue to the state and the county from the transaction privilege tax levied on prime contractors would be reduced by 12.5% compared to the Proposed Action, because there would be a 12.5% decrease in the workforce when compared to the Proposed Action. When applying both the tax base and transaction privilege tax rates discussed in Section 4.12.4.2.2 to the $3.92 annual contracting spending, the project would contribute approximately $138,250 to the state and county in tax revenue. Licensing and privilege taxes collected by larger cities in the Phoenix region would contribute an additional $35,000 to $70,000 to city governments.

Ad valorem taxes levied on utilities would be up to 30% less under Alternative B when compared to the Proposed Action because of the reduced size of the operation (a 30% reduction from the Proposed Action).

A fully installed, reduced footprint solar field could cost up to 30% less under Alternative B than under the Proposed Action. As mentioned above, this cost would not reflect the cost of the power plant, piping, or other SSEP equipment. If the assessed value of the total equipment is reduced by 30% compared to the Proposed Action, $17.5 million in primary and secondary property taxes could accrue to the counties, cities, colleges and school districts in Maricopa County. Initially, the county would receive $5.3 million in primary taxes and the Town of Buckeye would receive $2.7 million. As the equipment is depreciated, this estimated annual tax revenue would decrease.

The BLM charges both rental and capacity fees for ROWs on BLM lands in accordance with the requirements of Section 504(g) of FLPMA and the provisions of 43 CFR § 2806 (BLM and DOE 2010). The BLM charges the solar energy applicant a base rent to be paid upon the issuance of the ROW authorization. In addition, the BLM charges a MW capacity fee for each ROW authorization. For Maricopa County, the 2010 solar energy base rental fee is $188.34 per acre (BLM and DOE 2010). Because the Alternative B footprint is approximately 2,394 acres, the annual rental fee paid to the BLM would be $436,948. The rental fees would be adjusted or inflated each year, based on the Implicit Price Deflator-Gross Domestic Product index.

The BLM also charges a MW capacity fee that captures the increased industrial-use value of the ROW authorization (BLM and DOE 2010). The capacity fee would also be charged on an annual basis when the generation of electricity from the facility begins. The current capacity fee for concentrated solar-power projects is $6,570 per MW to be implemented over a five-year period after the start of generation. With phased operations estimated to begin in 2013 (with 1 125 MW facility) occur through 2020, the annual capacity fee would be $821,250. With both 125 MW facilities operating at full capacity by 2020, the annual capacity fee would be $1,642,500 under Alternative B.

4.12.5 Environmental Justice Impacts

As described in Section 3.12.5, there are potential EJ populations in nine census blocks within 5 miles of the Proposed Action footprint (Map 18) and the Sub-alternative A footprint. Within each census block, the number of potential EJ populations range from 31 to 125 residents, and there are a total of 612 minority residents within a 5-mile radius of the Proposed Action footprint. The minority populations range from 41 to 125 residents per census block within the 5-mile radius of the Sub-alternative A1 footprint and there are total of 414 minority residents.

The nine census blocks with potential EJ populations within a 5-mile radius of the Proposed Action footprint and the five census blocks within a 5-mile radius of the Sub-alternative A footprint have larger proportions of African American, Hispanic or Latino, Native American, or some other race when compared to populations in Maricopa County and the State of Arizona. These communities lie to the north and slightly east and at least 1.8 miles away from the Project Area. Under Sub-alternative A1, the closest census block with a potential EJ population is approximately 3 miles north of the Project Area.

4.12.5.1 NO ACTION

Under the No Action alternative, adverse impacts to the potential EJ populations would not occur because the current land use would remain unchanged and opportunities for disproportionate adverse impacts would be nonexistent.

4.12.5.2 ALL ACTION ALTERNATIVES

Under all action alternatives, impacts to potential EJ populations would be largely the same because the physical construction and long-term operation of the SSEP would create an opportunity that could induce disproportionately high and adverse impacts to the human health and/or environmental conditions of minority populations. However, Sub-alternative A1 would decrease the number of potential EJ communities potentially impacted by the SSEP because of the reduced project footprint. Under Sub-alternative A1, five census blocks with potential EJ populations would be within the potential impact radius (compared to nine census blocks under the Proposed Action) and a total of 414 residents would be within the potential impact radius (compared to 612 individuals or 32% more people under the Proposed Action). The degree to which potential EJ populations would be impacted is discussed in Table 4.74.

Under many resources, potential adverse impacts resulting from the SSEP would be site specific to the Project Area. Potential EJ populations would not be directly or indirectly impacted by changes to the Project Area. These resources are geology, livestock grazing, paleontology, soils, and vegetation. Resources that may be subject to adverse impacts as a result of the SSEP and have subsequent adverse impacts to potential EJ populations are air, climate, cultural resources, land use, noise, recreation, transportation, visual, and water resources. Consideration as to whether the action alternatives would result in a disproportionate impact to potential EJ populations was given to these resources, and a rationale is provided in Table 4.74.

Table 4.74 Potential Environmental Justice Common to All Action Alternatives

Resources	Adverse Impact/Rationale	Disproportionate Impact/Rationale
Air	Yes	No–Impacts to individuals living in census blocks closer to SSEP would be greater than impacts to potential EJ populations located further from the SSEP
Climate	Yes	No–Impacts not localized to census blocks areas, but region as a whole
Cultural	No – Culturally specific practices and/or sites have not been identified in the Project Area.	–
Geology	No – Impacts limited to Project Area	–
Hazardous	No – Materials would be managed according to laws and regulations within Project Area and transported to appropriate disposal sites	–
Land use	Yes	No–Impacts limited to grazing and recreation land uses within the Project Area
Livestock grazing	No – Impacts limited to Project Area	–
Noise	Yes	No–Impacts to individuals living in census blocks closer to SSEP (within 1.75 miles) would be greater than impacts to potential EJ populations located further from the SSEP
Paleontology	No – Impacts limited to Project Area	–
Recreation	Yes	No–Loss of acres for dispersed recreation not limited to potential EJ populations
Soils	No – Impacts limited to Project Area	–
Special designations	No – Impacts would be felt by all individuals who visit special designation areas, not specific to potential EJ populations	–
Transportation	Yes	No–Increases in traffic would be concentrated along SR-85 and would impact individuals living closer to SR-85 than the potential EJ population who live more than 5 miles from the road
Vegetation	No – Impacts limited to Project Area	–
Visual	Yes	No–Although the SSEP would be visible on KOP 10 (Ray Road) approximately 4 miles from the Project Area and within potential EJ populations, it would be more visible at KOPs, and census blocks closer to the Project Area
Water	Yes	No–Drawdown from wells near potential EJ populations would not exceed the legal requirement of a maximum 10 feet over five years.
Wildlife	No – Loss of wildlife habitat and movement corridors not directly connected to potential EJ populations because they're not dependent on wildlife	–

4.12.6 Potential Mitigation Measures

No mitigation measures are recommended to further decrease or eliminate impacts to social and economic conditions.

4.12.7 Residual Impacts

There would be no mitigation measures for socioeconomics characteristics; therefore, the impacts would be the same as discussed under the alternatives.

4.12.8 Short-term Uses versus Long-term Productivity

Construction and operation of the SSEP would preclude revenue generated from current livestock grazing. Under all action alternatives, new jobs would be created and income would be generated in varying degrees, throughout the life of the project. Upon termination of the project, the land would be reclaimed and revenues from grazing would resume once the area has been revegetated. However, it could take years before the land is suitable for grazing.

The current quality of life that has developed for nearby communities and visitors via the existing land use would be altered as the landscape shifts from one that is moderately developed and rural in nature to one with a more industrial feel. This change in the quality of life would be felt by individuals living or recreating near the SSEP throughout the life of the project.

4.12.9 Irreversible and Irretrievable Commitments of Resources

There would be irretrievable socioeconomic impacts under all action alternatives because existing livestock grazing and recreation uses would be precluded during the life of the SSEP. Upon termination and reclamation of the site, these uses would return.

There would be no irreversible impacts to socioeconomics under all action alternatives because all affected lands uses would resume upon termination and reclamation of the SSEP and the revenue generated and quality of life derived from the landscape would return to its current condition.

4.13 Soils

4.13.1 Analysis Area and Analysis Assumptions

The analysis area for soils comprises the project footprint, ancillary facilities, and any disturbance areas associated with road improvements or ROWs. The primary soils impacts indicator is the acres of surface disturbance to soils in the analysis area, resulting from the implementation of the action alternatives. Sensitive soils percentages within each alternative footprint are also identified to determine erosion and reclamation potential for the Project Area (Table 4.75). Disturbance to soils would be incurred by development and construction activities, as planned under the action alternatives. The degree of impact would depend on the extent (acres) and duration (permanent versus temporary) of the disturbance. Permanent disturbance to soils would occur on most of the Project Area, including ancillary facilities and transportation corridors. Temporary disturbance to soils would be limited to gas and water line developments and gen-tie) line access roads.

Table 4.75 Parameter Ranges Used to Define Sensitive Soils

Soil Features Restrictive to Rehabilitation	Parameters	Highly Restrictive Range	Moderately Restrictive Range
Water erosion hazard[1]	Kw factor of surface layer and Slope	≥ 0.37 and ≥ 10% or 0.20–0.36 and > 30%	0.20–0.36 and 10%–30% or < 0.20 and > 30%
Wind erosion hazard	Wind erodibility group of surface layer	1,2	3,4,4L
Salinity[2]	Salinity (MMHOS/CM) of surface layer	≥16	8-16
Sodium absorption Ratio[3]	Sodium absorption ratio of surface layer	>13	4–13
Alkalinity	pH	>9.0	7.9–9.0
Rooting depth	Minimum depth to bedrock or hardpan (inches)	<10	10–20
Droughtiness[4]	Available water supply (average to 40 inches)	<0.05	0.05–0.10

[1]K Factor of surface layer adjusted for the effect of rock fragments. Slope is the maximum value for the range of slope of a soil component within a map unit.

[2] Maximum value for the range in soil salinity.

[3] Maximum value for the range in sodium adsorption ra io.

[4] Maximum value for the range of available water capacity for the soil layer; inches of water per inches of soil.

4.13.2 No Action

No new impacts to soils would occur under the No Action alternative; although some soil impacts associated with current livestock grazing practices would continue in the Project Area (see Section 3.8 for further discussion on these allotments). Impacts from grazing would be relatively minor in both extent and severity when compared to the disturbances associated with the construction and operation of the SSEP. Impacts under this alternative would include soil compaction due to grazing, but it would generally be limited to discrete paths or grazing areas, and not the larger area of disturbance that would be impacted under the action alternatives. Recreation in the Project Area, consisting mostly of hiking, horseback riding, and OHV travel, would not be expected to impact soils due to its limited use and general confinement to existing roads and trails.

4.13.3 Proposed Action

Under the Proposed Action, long-term disturbance to soils would occur from the clearing of vegetation, grading of the project footprint to 3% slope, compaction within the project footprint, and from the improvement and construction of roads in the Project Area. Long-term disturbance would occur on approximately 3,588.7 acres. Long-term disturbance to soils in the solar field would occur from approximately 37,000 pounds of herbicide used annually to control vegetation under the Proposed Action. Repeated herbicide use in desert soils can result in the loss of the mineral soil, organic matter, and nutrients due to herbicide impacts to BSC organisms (Zaady et al. 2004). Increased sedimentation of the soil surface and waterways can also result due to the loss of crust organisms that hold the soil in place. Short-term disturbance to soils would occur from the installation of the buried gas and water lines, and from temporary access roads. Short-term disturbance would occur on approximately 31 acres. Tables 4.76 and 4.77 provide a breakdown of total acres of long-term and short-term soil disturbance by soil type under all alternatives. Impacts to soils would include the loss of soil productivity from topsoil loss, erosion, and compaction, the latter of which leads to the loss in the ability for water to infiltrate the soils.

Table 4.76 Acres/Percentage of Long-term Soil Disturbance – All Alternatives

Soil Type	No Action	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Sub-alternative A1: Photovoltaic	Alternative B: Reduced Footprint
Denure-Rillito-Why Complex	0 (0.0%)	2,550.3 (71.1%)	2,543.2 (71.0%)	1,401.3 (70.6%)	1,608.7 (68.1%)
Dateland-Cuerda Complex	0 (0.0%)	766.2 (21.4%)	764.6 (21.4%)	525.6 (26.5%)	702.2 (29.7%)
Gunsight-Rillito-Carrizo	0 (0.0%)	269.2 (7.5%)	269.2 (7.5%)	53.5 (2.7%)	49.4 (2.1%)
Denure-Coolidge Complex	0 (0.0%)	2.6 (0.07%)	2.6 (0.07%)	2.6 (0.1%)	2.6 (0.1%)
Gilman Fine Sandy Loam	0 (0.0%)	0.2 (0.01%)	0.2 (0.01%)	0.2 (0.01%)	0.2 (0.01%)
Torriofluvents	0 (0.0%)	0.2 (0.01%)	0.2 (0.01%)	0.2 (0.01%)	0.2 (0.01%)
Carrizo-Momoli	0	0	0	0.3 (0.01%)	0
Total Acreage	0	**3,588.7**	**3,579.9**	**1,983.8**	**2,363.3**

Note: Acreages may not sum to 100% due to rounding.

Table 4.77 Acres/Percentage of Short-term Soil Disturbance – All Alternatives

Soil Type	No Action	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Sub-alternative A1: Photovoltaic	Alternative B: Reduced Footprint
Denure-Rillito-Why Complex	0 (0.0%)	23.8 (76.8%)	22.2 (76.8%)	17.6 (60.0%)	23.1 (76.5%)
Dateland-Cuerda Complex	0 (0.0%)	4.6 (14.8%)	4.2 (14.5%)	8.6 (29.4%)	4.6 (15.2%)
Gunsight-Rillito-Carrizo	0 (0.0%)	2.1 (6.8%)	2.1 (7.3%)	2.1 (7.2%)	2.1 (7.0%)
Denure-Coolidge Complex	0 (0.0%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
Gilman Fine Sandy Loam	0 (0.0%)	0.2 (0.6%)	0.2 (0.7%)	0.2 (0.7%)	0.2 (0.7%)
Torriofluvents	0 (0.0%)	0.2 (0.6%)	0.2 (0.7%)	0.2 (0.7%)	0.2 (0.7%)
Carrizo-Momoli	0	0	0	0.5 (1.7%)	0
Total Acreage	0	**31.0**	**28.9**	**29.3**	**30.2**

Note: Acreages may not sum to 100% due to rounding.

Long-term disturbance to soils would be minimized by implementation of a reclamation plan (to be developed by Boulevard) that would contain specifications for regrading the surface of the project footprint to its approximate original condition, and replacing lost topsoil with native topsoil to an acceptable depth. An approved dust suppression treatment (such as gravelling, MgCl, or commercially available polymers) would be used on dirt roadways in and around the solar field, which would reduce the amount of wind erosion.

Short-term disturbance to soils would be minimized by reclaiming all temporarily disturbed areas as close to their pre-construction conditions as possible. Temporary access roads used during construction would be regraded and restored to pre-existing function and grade. BLM-approved seed mixes would be applied to temporarily disturbed areas, as required.

Impacts under the Proposed Action would be considerably greater (3,620 acres) than under the No Action alternative due to the large-scale removal and replacement of soils that would occur during construction and operation activities (which would not occur under the No Action alternative). Long-term impacts to soils would also be greater than under the No Action alternative due to the application of approximately 37,000 pounds of herbicides in the solar field.

Approximately 0.6%–8.2% of long-term disturbance and 33.8%–46.8% of short-term disturbance under the Proposed Action would occur in soils that are ~~"~~moderately restrictive" for high excess sodium and droughty conditions (Table 4.78 and 4.79). In addition, 99% of both total long-term and short-term disturbance under the Proposed Action would occur in soils with high alkalinity, whereas no disturbance would occur in soils with limited rooting depth or high salinity.

Soils with moderately high wind and water erosion potential would occur on approximately 21.4% of the total long-term disturbance and 15.8% of short-term disturbance under the Proposed Action.

Table 4.78 Acres/Percentage of Long-term Sensitive Soil Disturbance – All Alternatives

Restrictive Feature	Degree of Restriction	No Action	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Sub-alternative A1: Photovoltaic	Alternative B: Reduced Footprint
Water erosion hazard	Moderately restrictive	0 (0.0%)	766.4 (21.4%)	764.8 (21.4%)	525.8 (26.5%)	702.4 (29.7%)
Wind erosion hazard	Moderately restrictive	0 (0.0%)	766.4 (21.4%)	764.8 (21.4%)	525.8 (26.5%)	702.4 (29.7%)
Salinity	Moderately restrictive	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Excess sodium	Moderately restrictive	0 (0.0%)	20.7 (0.6%)	13.6 (0.4%)	15.2 (0.8%)	17.2 (0.7%)
Alkalinity	Moderately restrictive	0 (0.0%)	3,588.5 (99.9%)	3,579.8 (99.9%)	1983.6 (99.9%)	2,363.1 (99.9%)
Rooting depth	Moderately restrictive	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Droughty soils	Moderately restrictive	0 (0.0%)	292.8 (8.2%)	284.1 (8.2%)	51.9 (2.6%)	47.4 (2.0%)

Note: Acreages may not sum to 100% due to rounding.

Table 4.79 Acres/Percentage of Short-tem Sensitive Soil Disturbance – All Alternatives

Restrictive Feature	Degree of Restriction	No Action	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Sub-alternative A1: Photovoltaic	Alternative B: Reduced Footprint
Water erosion hazard	Moderately restrictive	0 (0.0%)	4.9 (15.8%)	4.4 (15.2%)	8.8 (30.0%)	4.9 (16.2%)
Wind erosion hazard	Moderately restrictive	0 (0.0%)	4.9 (15.8%)	4.4 (15.2%)	8.8 (30.0%)	4.9 (16.2%)
Salinity	Moderately restrictive	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Excess sodium	Moderately restrictive	0 (0.0%)	10.5 (33.8%)	8.9 (30.8%)	9.1 (31.1%)	9.7 (32.1%)
Alkalinity	Moderately restrictive	0 (0.0%)	30.8 (99.4%)	28.7 (99.3%)	29.0 (99.0%)	30.0 (99.3%)

Table 4.79 Acres/Percentage of Short-tem Sensitive Soil Disturbance – All Alternatives

Restrictive Feature	Degree of Restriction	No Action	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Sub-alternative A1: Photovoltaic	Alternative B: Reduced Footprint
Rooting depth	Moderately restrictive	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Droughty soils	Moderately restrictive	0 (0.0%)	14.5 (46.8%)	12.5 (43.3%)	0.5 (1.7%)	0 (0.0%)

Note: Acreages may not sum to 100% due to rounding.

Because the Proposed Action would disturb soils over a larger area, more reclamation-limited soils would be affected compared to the No Action alternative, resulting in long-term reduction to soil productivity in areas disturbed by the Proposed Action. Increased erosion rates and decreased soil-infiltration capacity, as a result of sensitive soil disturbance, would potentially impact water quality in the area by increasing sediment and salt concentrations in surface and groundwater resources (see Section 4.18 for a detailed impacts analysis). Revegetation of all disturbed soils (both short-term disturbance and long-term disturbance) would also be of limited success in areas with reclamation-restricted soils, leading to a long-term net loss of native vegetation and an increase in noxious and invasive plant species (see Section 4.16 for a detailed impacts analysis). In the Project Area, the predominant land use is grazing; therefore, anticipated external sources of soil salinity are anticipated to be negligible (see Section 4.7 for a detailed impacts analysis).

4.13.4 Alternative A: Reduced Water Use (dry-cooled CST)

Under Alternative A, a total of 3,579.9 acres of soils would undergo long-term disturbance from operation of the SSEP, compared to 3,588.7 acres under the Proposed Action (a reduction of 8.8 acres). Long-term impacts to soils from the application of herbicides in the solar field would be the same as under the Proposed Action. Short-term disturbance would occur on 28.9 acres, compared to 31.0 acres under the Proposed Action. The elimination of two evaporative cooling ponds under this alternative would result in 9.0 acres less soil disturbance in the long term, and 2.0 acres less in the short term, as compared to the Proposed Action. This reduction would not affect the relative percentage of impact to soil types (as compared to the total acreage of soil disturbance); however, and all other impacts to soil resources under Alternative A would be the same as under the Proposed Action (see Tables 4.76 to 4.79).

4.13.5 Sub-alternative A1: Photovoltaic

Under Sub-alternative A1, a total of 1,983.8 acres of soils would undergo long-term disturbance from operation of the SSEP, compared to 3,588.7 acres under the Proposed Action (a reduction of 1,604.9 acres). Short-term disturbance would occur on 29.3 acres, compared to 31.0 acres under the Proposed Action. This reduction would yield a minor change in the relative percentage of long-term impact to soil types; the Dateland-Cuerda Complex would have a slightly greater percentage of impact as compared to the Proposed Action or Alternative A, whereas the Gunsight-Rillito-Carrizo would have a slightly lower percentage of impacts as compared to the Proposed Action or Alternative A (see Table 4.76). The shift in soil percentages would also result in a greater percentage of disturbances to soils with high wind and water erosion potential relative to other action alternatives, and a smaller percentage of disturbances to droughty soils (see Table 4.78 and Table 4.79). Long-term impacts to soils would also occur from the application of approximately 20,350 pounds of herbicide annually in the solar field, which is 45% less herbicide used than under the Proposed Action. All other impacts to soil resources under Sub-alternative A1 would be the same as under the Proposed Action and Alternative A.

4.13.6 Alternative B: Reduced Footprint

Under Alternative B, a total of 2,363.3 acres of soils would undergo long-term disturbance from the operation of the SSEP, compared to 3,588.7 acres under the Proposed Action (a reduction of 1,225.4 acres). Long-term impacts to soils under Alternative B would occur from the application of approximately 24,050 pounds of herbicide annually in the solar field, which is 35% less herbicide used than under the Proposed Action. Short-term disturbance would occur on 30.2 acres, compared to 31.0 acres under the Proposed Action. This reduction would yield a minor change in the relative percentage of long-term impact to soil types; the Dateland-Cuerda Complex would have a slightly greater percentage of impact as compared to the Proposed Action or Alternative A, whereas the Gunsight-Rillito-Carrizo would have a slightly lower percentage of impact, as compared to the Proposed Action or Alternative A (see Table 4.76). The shift in soil percentages would also result in a greater percentage of disturbances to soils with high wind and water erosion potential relative to other action alternatives; although no disturbance would occur in droughty soils during short-term construction activities (see Table 4.78 and Table 4.79). All other impacts to soil resources under Alternative B would be the same as under the Proposed Action and Alternative A.

4.13.7 Reduced Water Use Option–Brine Concentrator

A brine concentrator could be implemented for either the Proposed Action or Alternative B to provide additional water savings to the SSEP. Utilization of the brine concentrator would not affect the total project footprint or the total acreages of disturbed soils. Consequently, the effects of this alternative on soil resources in the Project Area would be the same as previously described for each alternative. No additional impacts to soils were identified for this option during the analysis.

4.13.8 Generation Tie Line Option

The Gen-tie Line Option could be added to the Proposed Action, Alternative A, Sub-alternative A1, or Alternative B in place of the proposed gen-tie line alignment. Impacts to one soil type, the Denure-Rillito-Why complex, would occur if the Gen-tie Line Option were implemented. These additional impacts would consist of an 8.3-acre increase in disturbance in this soil type if the Gen-tie Line Option were added to the Proposed Action, Alternative A, or Alternative B. If the Gen-tie Line Option were added to Sub-alternative A1, impacts would consist of an 11.4-acre increase in disturbance to the Denure-Rillito-Why complex (Table 4.80). Increased surface disturbance in the Denure-Rillito-Why complex would be less than 1% for all action alternatives if the Gen-tie Line Option were selected. No other soil type would be impacted by the implementation of this option in combination with any action alternative.

Table 4.80 Additional Acres Disturbed with the Gen-tie Line Option – All Action Alternatives

Soil Type	Proposed Action, Alternative A: Reduced Water Use (dry-cooled CST), and Alternative B: Reduced Footprint	Sub-alternative A1: Photovoltaic
Denure-Rillito-Why complex, 1 to 5 % slopes		
Temporary disturbance	5.1	6.8
Long-term disturbance	3.3	4.6
Total Disturbance	**8.3**	**11.4**

If the Gen-tie Line Option were applied to the Proposed Action, Alternative A, or Alternative B in place of the proposed gen-tie line alignment, an additional 5.1 acres of temporary disturbance and 3.3 acres of long-term disturbance would occur in soils that are ~~"~~moderately restrictive" for alkalinity (Table 4.81). If

the Gen-tie Line Option were applied to Sub-alternative A1, an additional 6.8 acres of temporary disturbance and 4.6 acres of long-term disturbance would occur in soils that are "moderately restrictive" for alkalinity. Increased surface disturbance in soils that are "moderately restrictive" for alkalinity would be less than 1% for all action alternatives if the Gen-tie Line Option were selected. No disturbance would occur in soils with a "moderately restrictive" or "highly restrictive" rating for water erosion hazard, wind erosion hazard, salinity, excess sodium, rooting depth, or droughtiness if this option were implemented with any of the action alternatives.

Table 4.81 Additional Acres Disturbed with the Gen-tie Line Option – All Action Alternatives

Restrictive Feature	Proposed Action, Alternative A: Reduced Water Use (dry-cooled CST), and Alternative B: Reduced Footprint	Sub-alternative A1: Photovoltaic
Alkalinity – Moderately restrictive		
Temporary disturbance	5.1	6.8
Long-term disturbance	3.3	4.6
Total Disturbance	**8.3**	**11.4**

4.13.9 *Potential Mitigation Measures*

In addition to the applicant-committed environmental protection measures described in Chapter 2 and the Proposed Action, the following potential mitigation measures could be applied to reduce long-term impacts to soils:

- The applicant would prepare an approved herbicide use plan, or combine it with an integrated vegetation management plan, to ensure that all herbicides are safely applied at the minimum necessary level and that all products used are applied at a rate to minimize adverse impacts. This plan would be incorporated into the POD.
- In areas where some vegetation cover is acceptable from an operational standpoint, herbicides would be applied directly to target noxious weeds and invasive plant species.
- To the degree practicable, the use of herbicides that negatively affect BSC organisms (i.e., those that target photosynthetic structures and functioning versus targeting roots and aboveground structures) would be avoided.
- Herbicides would be applied only to target vegetation and not across the entire soil surface; this would allow BSC organisms to develop on graded areas and enhance soil stabilization following disturbance.

4.13.10 Residual Impacts

The potential mitigation measures listed above would minimize impacts from herbicide use, which is required for operation of the solar field throughout the life of the project. These potential mitigation measures would promote the recovery of soil organisms and BSC structure, and thereby facilitate the recovery of vegetation communities and functioning during the reclamation and restoration period. However, there would still be impacts to soil organisms and BSCs from herbicide use that is required to maintain operation of the solar field, or from herbicides that are inadvertently applied to the soil surface where target plant species are treated.

4.13.11 Short-term Uses versus Long-term Productivity

Construction and operation of the SSEP would result in short-term and long-term impacts that would affect the long-term productivity of soils. During construction and operation, vegetation would be removed and would continue to be cleared in the Project Area. This would result in increased erosion and compaction and the loss of long-term soil productivity needed to support vegetation required to support other land uses (grazing, wildlife habitat, and the setting for dispersed recreation uses) for the life of the project. Following termination and restoration of the Project Area, it is possible that soils in these reclamation-restricted areas would experience some continued loss of productivity due to the difficulty in restoring vegetation.

4.13.12 Irreversible and Irretrievable Commitments of Resources

Construction and operation of the SSEP would result in short-term and long-term changes to soil productivity due to surface disturbance, clearing of vegetation, and the loss of the structure and functioning of BSCs from the use of herbicides. This loss of soil productivity would be irretrievable for the life of the project (30 years) and until restoration is complete. In some areas, soils would restrict rehabilitation success due to compaction, loss of biologically active soil layers, or loss of BSCs. It is possible that soil in these areas would experience some irreversible impacts due to the difficulty in restoring vegetation and BSCs.

4.14 Special Designations

4.14.1 Analysis Area and Analysis Assumptions

This section outlines the impacts to special designation areas from the implementation of the Proposed Action and alternatives. Three special designation areas are considered in this analysis: 1) the North Maricopa Mountains Wilderness, 2) Sierra Estrella Wilderness, and 3) the Sonoran Desert National Monument. The Sonoran Desert National Monument is managed to protect biological, archaeological, and historical resources (66 *Federal Register* 7354–7358). The wilderness areas are managed to maintain or enhance the natural character and vegetation communities, to provide opportunities for primitive recreation and solitude, and to provide habitat for a diversity of fauna (BLM 1995).

These three areas lie outside of the Project Area; however, they would be subject to indirect impacts from changes to the viewshed, increases in ambient sound levels, changes in access, and impacts to wildlife from activities associated with construction and operation of the SSEP. Impacts from noise are evaluated in terms of whether they would increase the ambient noise environment and thus have the potential to affect a visitor's recreation experience. An increase of 1–2 dBA is considered a nonperceptible change. An increase of 3 dBA may or may not be distinguishable in an outdoor environment. A 5-dBA or greater increase is described as a perceptible change and is clearly discernible (ASHRAE 1989). This analysis assumes that a certain portion of visitors to recreational and wilderness areas are seeking opportunities for quiet and that any noise level increase of 5 dBA or greater would perceptibly reduce quietness. It should be noted that 40 dBA gives the subjective impression of "quiet" (Beranek 1988).

Impacts to the recreation are evaluated in terms of whether there would be a change in opportunities for solitude and primitive recreation, a change in the ability of the visitor to access the wilderness or Sonoran Desert National Monument, a change to the current vegetation communities, and changes to the natural or undeveloped character of the landscape. To assess these changes, this analysis uses information from the noise, wildlife, and visual sections of this chapter. As described in Chapter 3, the analysis area for special designations is not a defined polygon but rather any topographic point within the wilderness areas or Sonoran Desert National Monument where sights or sounds from the Project Area may be experienced by a visitor.

4.14.2 No Action

Under the No Action alternative, the SSEP would not be developed, and the existing dispersed/primitive recreation and livestock grazing uses in the special designation areas would continue. The landscape and existing roads and trails surrounding the Project Area would not be altered, and no changes to the viewshed or soundscape would occur. There would be no new barriers to wildlife movement or increases in vehicle traffic. Therefore, there would be no changes to the wildlife or their habitat, vegetation communities, the landscape, or recreational experiences under this alternative.

4.14.3 Proposed Action

Under the Proposed Action, approximately 3,620 acres would be graded to accommodate the project components and fenced for safety and security purposes. Conversion of the natural setting to a high-contrast industrial facility would have long-term adverse impacts to recreation opportunities and users in special designation areas. The SSEP would introduce a large (approximately 3,620-acre) facility to the landscape. There would be no change to the recreational setting in any of the special designation areas; however, the presence (views) of this facility would degrade the primitive experience that some visitors

seek when visiting the nearby monument and wilderness. These changes would not be visible from all locations, and would be most apparent from locations close to the Project Area and from peaks with expansive vistas. According to the visual analysis section of Chapter 4, the project footprint would be visible from all three special designation areas. However, because the western tip of the Sierra Estrella Wilderness is 10 miles to the east of the eastern boundary of the proposed SSEP, this distance would reduce the effects on the view, and it is expected that the project facility would not stand out from the existing development in the area. Topography would also mitigate or eliminate (block) these effects in portions of the adjacent and nearby wilderness areas. Please see the visual simulation description of the view from KOP 18 in Section 3.17 and Map 21. From the higher elevations or peaks of the North Maricopa Mountains Wilderness, visitors would have superior or unobstructed views of the entire SSEP. Based on the visual simulation from KOP 1, the solar fields and vertical structures associated with the SSEP would be visible from the North Maricopa Mountains Wilderness. Similarly, visual simulations from KOP 2, KOP 6, and KOP 19 indicate that the Project Area would also be visible from the higher elevations and peaks of the Sonoran Desert National Monument. The transmission line and structures associated with the power block would be visible, as would the solar field. The reflexive color contrast would be strong throughout the day. This would have an adverse impact on the recreation setting and experience because it would alter the view of the 3,620 acres of the Project Area from a natural setting to an industrial setting. However, the entire viewshed from the mountains already includes residential areas, industrial sites, and utility corridors. The conversion of the SSEP site from open desert to a fenced industrial facility and the removal of vegetation would also have long-term adverse impacts to wildlife because it would reduce the amount of forage and habitat that would be accessible for species that travel from the special designation areas to the Project Area (see Section 4.19). There would be no impacts to the habitat or forage in the special designation areas.

The construction and operation of the SSEP would create noise. As described in the noise section of Chapter 4, the increase in noise levels at the North Maricopa Mountains Wilderness (Receptor ST-3) from ambient to construction noise levels would be approximately 12.0 dBA (Table 4.82). Noise levels during operations would not exceed ambient conditions at this same receptor. At the Sonoran Desert National Monument (Receptor LT-3) noise levels would increase no more than approximately 4.0 dBA above the ambient conditions during construction and would drop below ambient conditions during operations. With an increase of 12 dBA, noise levels would reach a maximum of 44 dBA during construction. The effect of this increase in noise on individual visitors would vary, depending on their desired recreation activity and experience and tolerance to the intrusion. It is not expected that a visitor would hear the noise from the project facility in the Sierra Estrella Wilderness due to the distance between the two (10 miles). All noise from the operation and construction of the SSEP would dissipate within 1.75 miles of the source[11] depending on topography and vegetation, intensity of construction activities, and the range of ambient conditions.

[11] Noise attenuation to background levels was calculated using the Standard Attenuation Calculation: 20 log 10 = [(d2/d1)] where d1 =50 feet and d2 = 9,240 feet (1.75 miles), executed as 20 log 10 [(9,240]/50 feet = 45.3 dBA. Noise from construction is attenuated from 90 dBA to 45.3 dBA at 1.75 miles. The subjective impression of 45 dBA falls between quiet (40 dBA) and light traffic at 100 feet (50 dBA).

Table 4.82 Ambient, Construction, and Operational Noise Levels at Select Noise Receptors

Name/Location of Receptor	Ambient Noise Levels	Construction Noise Levels excluding Sub-alternative A1	Operational Noise Levels excluding Sub-alternative A1
ST-1/Prison frontage	62.7	38	16
ST-3/NMMW	28.2	40	21
LT-2/Baseline Road	46.4	43	26
LT-3/SDNM	39.7	44	27
BHRP	No ambient data	39	19
RBWA	No ambient data	37	11

Notes:
RBWA = Robbins Butte Wildlife Area (to NW of Project Area).
BHRP = Buckeye Hills Regional Park (to WNW of Project Area).

Construction of new roads and improvements to existing roads under the Proposed Action would cause short-term and long-term impacts to wildlife moving between the special designation areas and the Project Area because the roads would create a barrier to wildlife movement. There would be no impacts to wildlife movements within the special designation areas from the Proposed Action.

Under the Proposed Action, there would be an increase of 1,000 vehicles per day during the construction and 82 vehicles per day during the operations of the SSEP. Traffic would come primarily from SR-85 and would travel along the new access road to the project site. This increase in traffic would cause short-term adverse impacts to wildlife because of an increased risk of vehicle strikes and barriers to movement. Traffic would increase the risk of wildlife mortality and fragment populations. There would also be long-term adverse impacts from an increased risk of vehicle strikes during operations; however, traffic would be reduced by a factor of ten as compared to the construction period. There would also be adverse impacts to the recreational setting and experience due to the increase in the traffic volume, creating slower commute times while accessing the special designation areas.

4.14.4 Alternative A: Reduced Water Use (dry-cooled CST)

Impacts under Alternative A would be the same as under the Proposed Action because approximately 3,609 acres (a difference of 11 acres compared to the Proposed Action) would be fenced and converted from open desert to an industrial facility to accommodate the project facility and components. The project footprint would still be visible from the special designation areas, and increases in vehicle traffic would still occur. This would have adverse impacts to the scenic quality of the landscape, recreation opportunities, and to wildlife, as discussed under the Proposed Action.

4.14.5 Sub-alternative A1: Photovoltaic

Under Sub-alternative A1, there would be approximately 1,607 acres (45%) less vegetation removed for the project footprint than under the Proposed Action. Therefore, the project facility would present less of a landscape change and less of an adverse impact to visitors in the special designation areas than under the Proposed Action. Sub-alternative A1 would be significantly less reflective because PV panel surfaces are designed specifically not to reflect light, thus reducing the potential for glint and glare. In addition, the PV panels of this alternative would have a lower profile than the solar troughs of the Proposed Action (approximately 20 feet tall), which would reduce visibility when viewed from level viewing positions. Overall, Sub-alternative A1 would minimize the potential for visual impacts to special designations because of the less reflective panel surfaces, smaller structures, and reduced project footprint. The number

of vehicle trips during peak construction and regular operations would be reduced by 733 trips (73%), but there would be no differences in access between Sub-alternative A1 and the Proposed Action. All other impacts to special designations under Sub-alternative A1 would be the same as under the Proposed Action.

Noise from construction of the SSEP under this sub-alternative at the noise receptors near or within recreation areas would be roughly comparable to the predictions for the Proposed Action. For the Proposed Action, there are instances of noise levels in the low to mid-40 dBA for construction. Under Sub-alternative A1, noise levels would not go above 46 dBA. As visitors venture deeper into the special designation areas and further from the Project Area, this intrusion would lessen and eventually cease. The effect on individual visitors would vary, depending on their desired recreation activity and experience and tolerance to the intrusion. Operational noise levels under this alternative would not exceed ambient conditions; therefore, there would be no effects to the recreational experience during operations.

4.14.6 Alternative B: Reduced Footprint

Under Alternative B, there would be 1,226 acres (34%) less vegetation removed for the project footprint than under the Proposed Action. Therefore the project facility would present less of a landscape change and less of an adverse impact to visitors in the special designation areas. All other impacts to special designations under Alternative B would be the same as under the Proposed Action.

4.14.7 Reduced Water Use Option–Brine Concentrator

Impacts to special designation areas under this option would be the same as under the Proposed Action, because approximately 3,609 acres (a difference of 11 acres compared to the Proposed Action) of the Project Area would be converted from a natural setting to an industrial site and increases in vehicular traffic would still occur. This would have adverse impacts to the scenic quality of the landscape, recreation opportunities, and to wildlife, as discussed under the Proposed Action.

4.14.8 Generation Tie Line Option

If the Gen-tie Line Option were added to the Proposed Action, Alternative A, or Alternative B, there would be an increase of 8.3 acres of disturbed land. Using a total of approximately 3,620 and 3,609 acres of disturbance area for the Proposed Action and Alternative A, respectively, this represents a 0.23% increase in total surface disturbance under these alternatives. Using a total of 2,394 acres of disturbance area for Alternative B, this represents a 0.35% increase in total surface disturbance for this alternative. If the Gen-tie Line Option were added to Sub-alternative A1, an additional 11.4 acres of land would be disturbed. Using a total of 2,013 acres of disturbance area for Sub-alternative A1, this represents a 0.56% increase in total surface disturbance.

The Gen-tie Line Option would not impact noise levels from the construction and operation of the SSEP because it would not generate any new or additional sound. Also, traffic would not be impacted by the selection of this option because no additional vehicles would be required for its implementation compared to the proposed gen-tie alignment.

4.14.9 Potential Mitigation Measures

To meet the objective of protecting the biological resources in the Sonoran Desert National Monument, potential mitigation measures could be implemented to protect wildlife from vehicle strikes and from loss of habitat connectivity. These measures are discussed in the wildlife section of Chapter 4. Additional measures to mitigate visual impacts can be found in Section 4.17 (Visual Resources).

4.14.10 Residual Impacts

Please see the residual impact section of Chapter 4 wildlife for a discussion of residual impacts. Noise and visual residual impacts are discussed in Sections 4.9 and 4.17.

4.14.11 Short-term Uses versus Long-term Productivity

Implementation of the SSEP would create short-term and long-term changes to the scenic quality of the landscape and would cause barriers to wildlife movement and loss of habitat. These impacts would have an indirect impact on the human uses in special designation areas because the sight of the solar facilities would alter the recreational setting and experience. Implementation of the SSEP would also create short-term changes to access during the construction period because of the increase in the number of vehicles traveling in the area.

4.14.12 Irreversible and Irretrievable Commitments of Resources

The proposal outlined in Chapter 2 includes reclamation of the facility and all disturbed areas after the 30-year life of the project. Because the area would be reclaimed, there would be no irreversible impacts associated with the Proposed Action or other alternatives. However, the project footprint could visibly persist from special designation areas for some period of time beyond the project completion until vegetation reestablishes. Even after reclamation efforts are complete, the composition of vegetation species in the recovery area could be different than the original vegetation community, and additional time would then be needed for the native vegetation community to reestablish. Ultimately, the native vegetation community would reestablish and would once again provide habitat and forage for wildlife. Thus, the effect of operation of the SSEP would be an irretrievable adverse impact on wildlife and recreation setting and experience in the adjacent special designation areas.

4.15 Transportation and Traffic

4.15.1 Analysis Area and Analysis Assumptions

The area of analysis for transportation and traffic consists of the Project Area and the access routes that would be used for the SSEP's construction and operation, as discussed in Chapter 3, Section 3.15.

The impacts analysis for transportation and traffic in the Project Area and the adjacent traffic interchanges (as described in Chapter 3) discusses changes to the LOS that would result from the Proposed Action and alternatives. LOS is a measure of the quality of service experienced by motorists on transportation infrastructure; it generally indicates the level of traffic congestion. LOS on divided highways (such as SR-85) reflects traffic flow conditions, average speed, and time spent following other vehicles. The impacts analysis also discusses 1) changes that would occur to the total miles of routes in the existing transportation system and the resulting impacts to transportation and traffic and 2) changes in access to the existing transportation and traffic network.

Based on ADOT guidelines, future PHFs for the SSEP were used, as found in the *ADOT Traffic Engineering Policies Guidelines and Procedures Section 240 Traffic Impact Analyses* (ADOT 2000). They are as follows:

- PHF = 0.80 for < 75 vph per lane
- PHF = 0.85 for 75–300 vph per lane
- PHF = 0.90 for > 300 vph per lane

Future peak hour represents how many vehicles (vph) are predicted to travel through the SR-85/Riggs Road intersection.

To assess the impacts of the SSEP on future traffic operations, traffic predictions are made for 2012 and 2015 (SouthWest Traffic Engineering [SWTE] 2009, 2011). Year 2012 represents the assumed peak construction year, whereas year 2015 is the expected build-out year.

Due to lack of detailed historic traffic data in the Project Area, a growth rate could not be calculated. In light of this, a 3% growth rate was used to estimate traffic growth in the Project Area. A 3% growth rate is lower than the normal 5% growth rate standard used by ADOT when conducting traffic impacts analysis due to the economic recession experienced in 2008 and 2009.

Potential impacts to future transportation and traffic are discussed in Section 4.20.4.13 (Transportation and Traffic).

4.15.2 No Action

Under the No Action alternative, the SSEP would not be developed, and the existing transportation and traffic patterns and infrastructure in and around the Project Area would continue. The existing traffic and transportation patterns and infrastructure are detailed in Chapter 3 and can be considered as having a LOS of B[12] or better with low traffic volume and little to no transportation infrastructure improvements.

[12] LOS B indicates a 10–15-second traffic delay (see Table 3.47, Section 3.15.3.2).

Under the No Action alternative, the following ongoing transportation and traffic actions and activities are assumed to continue:

- Limited dispersed recreation across the Project Area would continue. Motorized vehicle use would be limited to existing routes in the area.
- The existing routes (13.1 miles) in the Project Area (as designated by the *Lower Gila Amendment*, BLM 2005a), would remain open to motorized travel.
- The SR-85/Riggs Road intersection would continue with the existing vehicular traffic volumes as reported by ADOT and MCDOT (see Chapter 3, Section 3.15).
- Riggs Road would continue to service the same volume of traffic.
- The Komatke Road alignment and Haul Road would continue to service the same volume of existing vehicular traffic.

4.15.2.1 LEVEL OF SERVICE

LOS was calculated for each intersection in the area of analysis for 2012 and 2015 under the No Action alternative. The predicted LOS for the SR-85/Riggs Road intersection estimates (SWTE 2009) were analyzed by comparing the predicted LOS with the existing LOS outlined in Chapter 3. Tables 4.83 and 4.84 display the predicted LOS for the SR-85/Riggs Road intersection in 2012 (representative of short-term construction traffic) and in 2015 (representative of long-term operations traffic).

The SR-85/Riggs Road intersection is located west of the Project Area, and it would be the primary access point to the project during construction and operation. The analysis of the SR-85/Riggs Road intersection consists of three separate traffic situations: northbound on SR-85; southbound on SR-85, and the northbound SR-85 exit ramp (Figure 4.1).

Table 4.83 2012 Peak Hour Levels of Service – No Action and Proposed Action

Intersection	No Action Alternative				Proposed Action*			
	AM Peak		PM Peak		AM Peak		PM Peak	
	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
SR-85 Southbound Mainline/Riggs Road								
Southbound left	A	7.5	A	7.4	B	12.5	A	7.4
Eastbound through	B	11.9	B	11.2	F	>120	B	11.2
Eastbound through/right	A	0.0	A	0.0	A	0.0	A	0.0
Westbound left	B	10.3	A	9.9	F	>120	B	10.8
Westbound through	B	11.9	B	11.2	F	>120	B	11.2
Westbound approach	B	10.3	A	9.9	F	>120	B	10.8
SR-85 Northbound Mainline/Riggs Road								
Northbound left	A	7.2	A	7.2	A	7.2	A	7.2
Eastbound left	A	9.2	B	10.2	A	9.2	F	>120
Eastbound through	B	10.8	B	12.6	F	>120	B	12.6
Eastbound approach	B	10.8	A	0.0	F	>120	F	>120
Westbound through	B	10.6	B	13.3	B	10.6	B	14.5
Westbound through/right	A	9.3	B	10.3	A	9.3	F	>120
Westbound approach	A	9.4	B	10.5	A	9.4	F	>120
SR-85 Northbound Ramps/Riggs Road								
Northbound left	A	7.5	A	7.4	n/a	n/a	n/a	n/a
Eastbound left	A	8.8	A	8.6	A	8.8	F	>120
Eastbound right	A	8.6	A	8.3	n/a	n/a	n/a	n/a
Eastbound approach	A	8.6	A	0.0	F	>120	F	>120

Source: SWTE (2009).

* The 2012 LOS for Alternative A, Alternative B, and the Reduced Water Option Alternative would be the same as the Proposed Action.

Table 4.84 2015 Peak Hour Levels of Service – No Action and Proposed Action

Intersection	No Action Alternative				Proposed Action*			
	AM Peak		PM Peak		AM Peak		PM Peak	
	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
SR-85 Southbound Mainline/Riggs Road								
Southbound left	A	7.5	A	7.4	A	7.5	A	7.5
Eastbound through	B	12.1	B	11.3	B	13.4	B	12.2
Eastbound through/right	A	0.0	A	0.0	A	0.0	A	0.0
Westbound left	B	10.4	A	9.9	B	11.6	B	10.7
Westbound through	B	12.1	B	11.3	B	13.4	B	12.2
Westbound approach	B	10.4	A	9.9	B	11.6	B	10.7
SR-85 Northbound Mainline/Riggs Road								
Northbound left	A	7.2	A	7.2	A	7.2	A	7.2
Eastbound left	A	9.3	B	10.3	A	9.5	B	10.9
Eastbound through	B	10.9	B	13.0	B	11.5	B	13.8
Eastbound approach	B	10.9	A	0.0	B	11.5	B	13.8
Westbound through	B	10.7	B	13.6	B	10.7	B	13.7
Westbound through/right	A	9.4	B	10.4	A	9.5	B	10.8
Westbound approach	A	9.5	B	10.7	A	9.6	B	11.0
SR-85 Northbound Ramps/Riggs Road								
Northbound left	A	7.5	A	7.4	n/a	n/a	n/a	n/a
Eastbound left	A	8.8	A	8.7	A	9.1	A	9.0
Eastbound right	A	8.6	A	8.3	n/a	n/a	n/a	n/a
Eastbound approach	A	8.6	A	0.0	A	9.7	A	9.4

Source: SWTE (2009).

* The 2015 LOS for Alternative A, Alternative B, and the Reduced Water Option Alternative would be the same as the Proposed Action.

As illustrated in Tables 4.83 and 4.84, under the No Action alternative the Project Area intersections would continue to operate at an LOS B or better in 2012 and 2015. When compared to the existing SR-85/Riggs Road LOS, the predicted-LOS of SR-85/Riggs Road under the No Action alternative would be very similar. Therefore, the No Action alternative would not result in any impacts to the LOS for transportation and traffic.

4.15.2.2 TRANSPORTATION ROUTES

Using the compounded, yearly traffic growth rate in 2012 and 2015, weekday peak hour traffic volume estimates under the No Action alternative are shown in Figures 4.1 and 4.2, which illustrate an aerial view of the SR-85/Riggs Road intersection. Arrows represent the direction of traffic flow, and the numbers following the arrows represent the vph that each intersection would experience in 2012. This illustrating convention is used throughout this chapter on all weekday peak hour traffic volume figures.

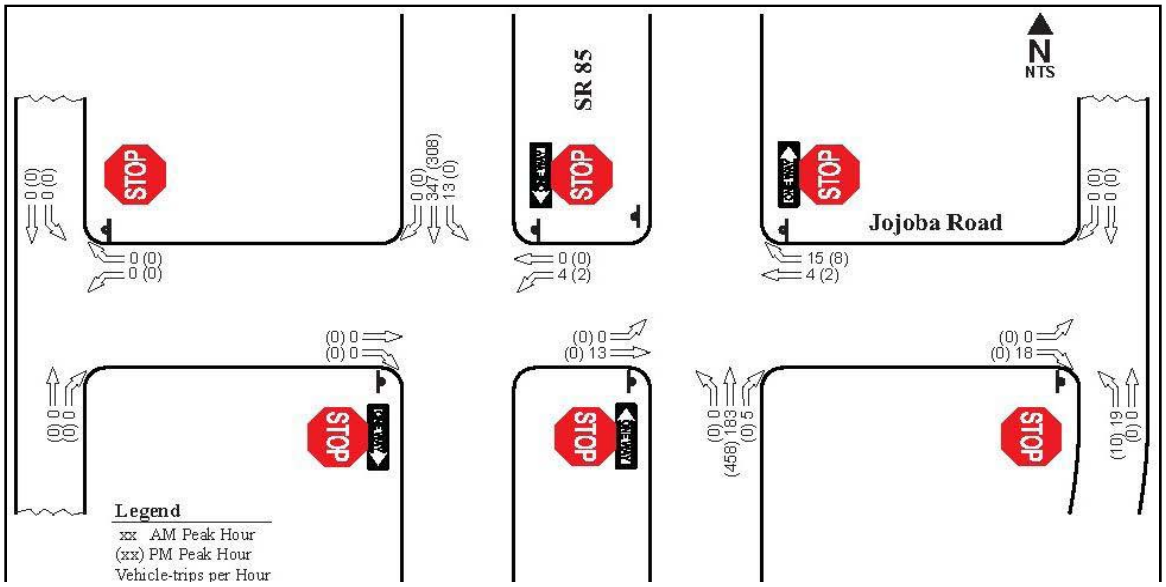

Figure 4.1 2012 weekday peak hour traffic volumes (SWTE 2009) – No Action alternative.
Note: Jojoba Road is referred to as Riggs Road in the final EIS text.

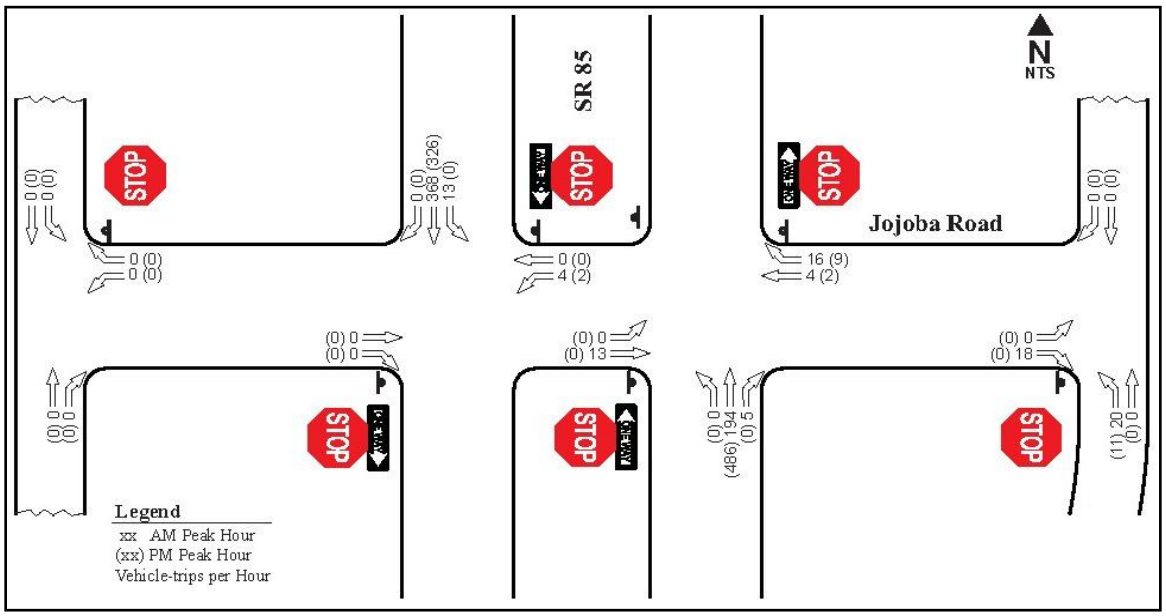

Figure 4.2 2015 weekday peak hour traffic volumes (SWTE 2009) – No Action alternative.
Note: Jojoba Road is referred to as Riggs Road in the final EIS text.

As Figures 4.1 and 4.2 illustrate, the No Action alternative would not increase traffic over the current volume at the SR-85/Riggs Road intersection.

4.15.2.3 CHANGES IN ACCESS AND INFRASTRUCTURE

Access and transportation infrastructure would not be impacted under the No Action alternative because there would be no new roads, upgrades to existing roads, or closures of existing roads under this alternative.

4.15.3 Proposed Action

4.15.3.1 LEVEL OF SERVICE

As illustrated in Table 4.83, the Proposed Action would adversely impact the existing traffic conditions due to the increase in heavy truck traffic and frequent daily trips, resulting in a lower LOS during construction (LOS B under the No Action alternative compared to LOS F under the Proposed Action). At the peak of construction, approximately 1,000 vehicles carrying workers would drive to and from the Project Area each day during the typical AM to PM work hours. Approximately 30 to 60 trucks per day would be required to deliver various materials and construction equipment during nonpeak hours (Table 4.85). To analyze peak construction, it was assumed that 1,000 vehicles carrying construction workers would be driving to and from the Project Area each day during the typical AM and PM peak hours. Although most of the workers would be expected to arrive and depart during these peak hours, specialty workers would be expected to arrive on-site during nonpeak hours.

Table 4.85 Weekday Project Area Generated Trips*

Time Period	Phase I: Construction Peak 2012	Phase II: Operation 2014
AM peak hour, inbound (vph)	1,000	28
AM peak hour, outbound (vph)	0	18
Total AM Peak	**1,000**	**46**
PM peak hour, inbound (vph)	0	18
PM peak hour, outbound (vph)	1,000	28
Total PM peak	**1,000**	**46**

Source: SWTE (2009).

**Note*: The Weekday Project Area Generated Trips for Alternative A, Alternative B, and the Reduced Water Option Alternative would be the same as he Proposed Action.

The predicted construction traffic at the SR-85/Riggs Road intersection would be 10 times (approximately 1,000 vph during the AM and PM peaks) greater under the Proposed Action than under the No Action alternative. This increase in vehicle traffic would temporarily decrease the LOS from LOS B or better to LOS B or worse, with several areas expected to be LOS F for the SR-85/Riggs Road intersection during construction (see Table 4.83).

Under the Proposed Action, the intersection of SR-85 southbound mainline/Riggs Road is predicted to operate at an average of LOS F for the eastbound and westbound movements in the AM peak hour. These delays would be caused by the large, southbound left-turn movement, caused primarily by vehicles headed to the construction site. This would adversely impact traffic travelling north on SR-85 by increasing the likelihood of vehicle collisions with left-turning vehicles and northbound traffic on SR-85, and by slowing the speed that vehicles travelling north can achieve due to the required stop at the SR-85/Riggs Road intersection, which would result in longer travel times for vehicles.

The eastbound movements at the intersection of SR-85 northbound mainline/Riggs Road are predicted to operate at LOS F during the AM peak hour. In the PM peak hour the westbound approach and eastbound left-turn movement are predicted to operate at LOS F as well. Delays at this intersection are also attributable to the AM and PM peak hour flow of construction traffic to and from the Project. These decreases in LOS and increases in travel time (both short-term, construction-related impacts) would improve as the peak construction of 2012 is completed and as the SSEP moves toward operation.

As shown in Table 4.84, the additional operations traffic that would be generated by the SSEP after peak construction and full build-out (2015) has a limited effect on the LOS at the existing project intersections when compared to the No Action alternative. The limited effect can be characterized as such due to the expected delay increases not being substantial enough to warrant a change in the LOS.

The additional traffic generated by the SSEP after full build-out would have a limited effect on the LOS of the existing Project Area intersections. The SR-85/Riggs Road intersections are predicted to continue operating at LOS B or better during the weekday peak hours with full project build-out in 2015.

With construction complete, operation of the SSEP and subsequent operational traffic would continue to result in a similar LOS for the SR-85/Riggs Road intersection, similar to the No Action. Travel times would return back to their existing levels after full build-out is complete (2014). During SSEP operation delay concerns with the increased left turning during construction would return back to the existing levels. Therefore, there would not be any long-term impacts to LOS on the SR-85/Riggs Road intersection under the Proposed Action.

4.15.3.2 TRANSPORTATION ROUTES

The Proposed Action would result in 6.61 miles of new routes. Most of these routes (approximately 3.5 miles) would occur within the project‘s footprint and would be closed to unauthorized use. These routes would serve as internal roads used to access solar fields, power blocks, staff buildings, and other facilities within the project‘s footprint and would only be authorized for SSEP staff and authorized guests, such as BLM staff.

A new access route would be constructed at the existing Jojoba Switchyard and would serve as the primary access to the SSEP (see Map 2). The new access road would be approximately 2.3 miles in length and would be paved. The access road would not be gated at the Riggs Road intersection. Because access routes for the SSEP would not be fenced, these new routes would increase the enforcement obligations of the BLM in order to prevent illegal use of the adjacent BLM-administered land, as well as discourage parking by illegal OHV users. In addition, paving the access route would enable the curious public easy access to the project site and would create a risk of speeding and vehicle racing along the route.

Approximately five spur roads off of the main SSEP access road would be constructed to access the gen-tie line towers, totaling less than 0.5 mile of new routes. Each spur road would lead to a construction pad and a pole structure. As with the primary access road, these new routes would increase the enforcement obligations of the BLM in order to prevent illegal use of the adjacent BLM-administered land. This would be a long-term impact, because the need for additional enforcement would persist for the life of the project.

Finally, a new route would be created along the proposed water pipeline route from Riggs Road to the project well field, resulting in approximately 0.85 mile of new, paved routes. This route would be closed to unauthorized use, but no gate would be installed. The addition of the well field access road would create a new route open to the public. However, because the new road would not be used to access existing transportation infrastructure (it would only access the proposed well field), existing traffic would not be impacted (refer to Section 4.7 for impacts to land use and access).

In addition to new routes, the existing Riggs Road east of the Project Area would serve as emergency access to the Project Area. The Riggs Road alignment is a BLM-authorized road ROW and is maintained by MCDOT. It would continue to be maintained or upgraded (if needed) and provide continued access to adjacent public lands. There is the potential for increased traffic on Riggs Road if construction workers use Riggs Road to the east of the Project Area for access rather than the primary SR-85 access to the west. However, this would be unauthorized use because the primary access is from SR-85 to the west. Additionally, local populations and persons driving for pleasure could also use Riggs Road to access, though not enter, the Project Area. A potential mitigation measure for this impact is included in Section 4.15.9.4. The remaining upgraded routes included in the Proposed Action would occur on the project access road that would use both the existing alignment of the Haul Road and Riggs Road immediately east of the SR-85/Riggs Road intersection. Approximately 1 mile of the Haul Road would be upgraded north of the Komatke Road/Haul Road intersection. Users would likely not traverse a rough road to access a short section of the upgraded Haul Road because other paved routes in the area offer the same experience. Approximately 0.80 mile of Riggs Road would be upgraded just east of the SR-85/Riggs Road intersection, within sight of SR-85. The ease of access to view the open desert and Sonoran Desert National Monument from this major route would increase the likelihood of driving for pleasure and/or casual exploration.

Road damage to existing roadways is not anticipated to occur because the roads used are adequately constructed to handle the types of loads required for construction and operation; however, any unintended damages or temporary improvements would be returned to their existing condition once construction is complete, as described in the Table 2.2 (Applicant-committed Environmental Protection Measures). Upgrades to the existing road system are not anticipated, not including the roads within the Project Area and the new access road.

4.15.3.3 CHANGES IN ACCESS

Under the Proposed Action, approximately 3,500 acres would be occupied by project components and would be fenced for safety and security purposes. This would eliminate 7.4 miles of routes within the project‘s footprint. These routes are available for recreational use; therefore, access for motorized and nonmotorized recreation uses would be lost across the Project Area. The fencing off of the Project Area would eliminate the BLM law-enforcement needs in this area. However, access to adjacent public lands would continue via other public lands and routes around the Project Area. It is not possible to predict the conditions that would exist at the time of the project‘s decommissioning. Therefore, decommissioning details would be developed and provided to BLM when the time for permanent closure is closer and more information is available. BLM would require the proponent to submit an abandonment plan that would be reviewed and approved by BLM. This plan would address transportation and traffic issues, and the BLM would determine whether to re-authorize the two BLM routes at the time of decommissioning.

The SR-85 northbound ramps/Riggs Road intersection is predicted to operate at an inadequate LOS F for the eastbound movements during the AM and PM peak hours. The intersection may also break down during the PM peak hour for the eastbound left and westbound movements. At this intersection, the delays would be associated with the construction traffic but also with the stop sign for eastbound traffic, which would stop major traffic movement. The impact on this intersection would be reduced by converting the eastbound stop sign to a north-south stop control intersection, which is included as a design feature of all action alternatives. Once project construction traffic begins flowing through the intersection, the east-west movement would be the major movement and would not be stop controlled.

Table 4.86 shows the design strategy described above and the corresponding LOS it would provide at the intersection of SR-85 northbound ramps/Riggs Road. The two columns on the right of the table represent the 2012 and 2015 expected delays, respectively.

Table 4.86 SR-85/Riggs Road intersection LOS

Intersection	Improvement	Without Stop Sign (2012)		With Stop Sign (2012)		With Stop Sign (2015)	
		AM Peak		AM Peak		PM Peak	
		LOS	Delay*	LOS	Delay	LOS	Delay
SR-85 Northbound Ramps/Riggs Road							
Northbound left/through/right	Change intersection to northbound/southbound stop control.	A	7.5	D	25.1	C	23.7
Southbound left/through/right		A	7.4	A	0.0	A	0.0
Westbound left/through/right		A	0.0	B	11.7	A	7.4
Eastbound left		A	8.8	A	7.2	B	10.7
Eastbound through/right		F	>120	A	0.0	A	0.0
Eastbound approach		F	>120		n/a		n/a

Source: SWTE (2009).
Note: Illustrative of Project Stop-Sign Design Feature.
*Delay = seconds per vehicle

As shown in Table 4.86, when compared to the existing conditions in Table 3.48, the stop sign would enable the existing LOS to continue during construction (2012) and operation (2015), except during the AM and PM peak traffic period when there would be an LOS D and LOS C, respectively. Mitigation measures (see Section 4.15.9), including car and/or vanpools, would reduce the impact of the SSEP's increase to traffic and LOS.

Figure 4.3 shows the expected lane configurations and traffic control during the peak construction year 2012.

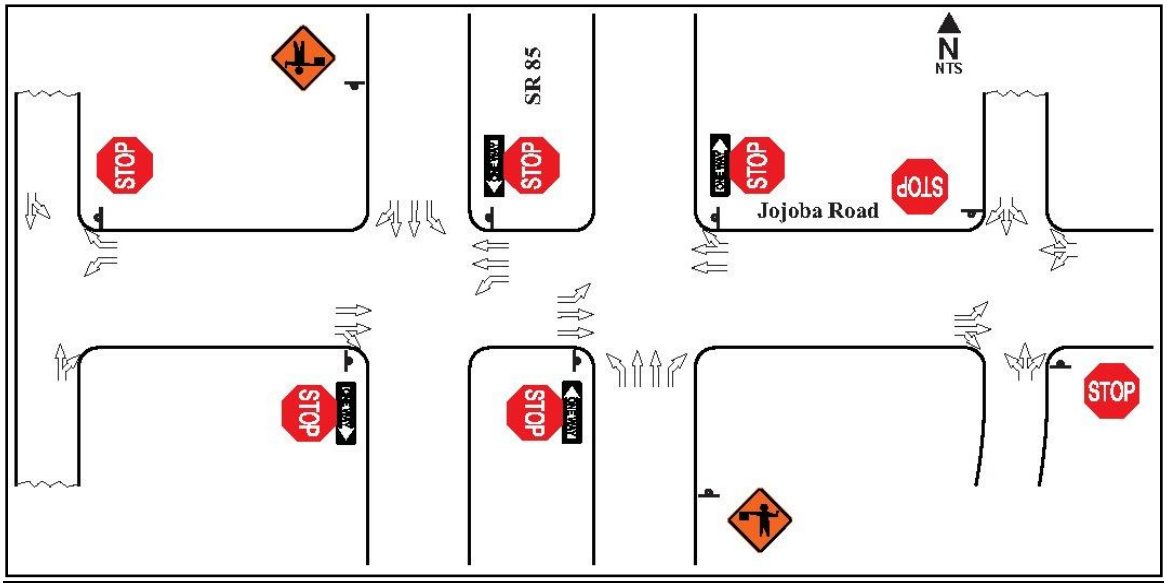

Figure 4.3 2012 construction peak/traffic control and lane configurations (SWTE 2009).
Note: Jojoba Road is referred to as Riggs Road in the final EIS text.

4.15.4 Alternative A: Reduced Water Use (dry-cooled CST)

Under Alternative A, the SSEP would be constructed using a dry-cooling technology rather than the wet cooling considered under the Proposed Action. Impacts to transportation and traffic as a result of the implementation of Alternative A would be the same as under the Proposed Action. As such, only the differences in impacts to transportation and traffic between this alternative and the Proposed Action are described below.

4.15.4.1 LEVEL OF SERVICE

The project's construction schedule would be the same under Alternative A as under the Proposed Action. However, construction would require an average of 900 employees (instead of 870 under the Proposed Action) over the same 39-month period due to additional labor needs. This would equate to approximately 25 more worker vehicles per day than under the Proposed Action using SR-85 to access the Project Area. Despite the increase in worker vehicles per day, under Alternative A the LOS for the SR-85/Riggs Road intersection during construction (2012) and operation (2014) would be the same as under the Proposed Action.

4.15.4.2 TRANSPORTATION ROUTES

Impacts to transportation routes under Alternative A would be the same as under the Proposed Action.

4.15.4.3 CHANGES IN ACCESS

Impacts to changes in access under Alternative A would be the same as under the Proposed Action.

4.15.5 Sub-alternative A1: Photovoltaic

Sub-alternative A1 would use PV technology to generate electricity, resulting in a 51% smaller footprint, 20% reduction in generation, and a 77% decrease in construction workers compared to the Proposed Action. Although access roads and transportation corridors would be the same as under the Proposed Action, the decrease in construction workers would result in different traffic patterns and impacts under Sub-alternative A1, as described below.

4.15.5.1 LEVEL OF SERVICE

The traffic needed for construction and operation under Sub-alternative A1 would not represent a measureable change to the average existing traffic LOS (average LOS B under the No Action alternative compared to average LOS B under Sub-alternative A1) but would result in impairments during peak hours. The change to existing traffic LOS under Sub-alternative A1 would occur during the AM peak hours, and would change from LOS B to LOS C during this period. At the peak of construction, approximately 267 vehicles carrying workers would drive to and from the Project Area each day during the typical AM to PM work hours. Approximately 10–15 trucks per day would be required to deliver various materials and construction equipment during nonpeak hours (Table 4.87).

Table 4.87 Weekday Project Area–Generated Trips – Sub-alternative A1

Time Period	Phase I: Construction Peak 2012	Phase II: Operation 2015
AM peak hour, inbound (vph)	267	16
AM peak hour, outbound (vph)	0	0
Total AM Peak	**267**	**16**
PM peak hour, inbound (vph)	0	0
PM peak hour, outbound (vph)	267	16
Total PM peak	**267**	**16**

Source: SWTE (2011).

The increases in trips generated under Sub-alternative A1 would not change the existing LOS B at the SR-85/Riggs Road intersection during construction (Table 4.88) or operation (Table 4.89).

Table 4.88 2012 Peak Hour Levels of Service – No Action and Sub-alternative A1

Intersection	No Action Alternative				Sub-alternative A1: Photovoltaic			
	AM Peak		PM Peak		AM Peak		PM Peak	
	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
SR-85 Southbound Mainline/Riggs Road								
Southbound left	A	7.5	A	7.4	A	8.0	A	7.4
Eastbound through	B	11.9	B	11.2	C	22.8	B	11.2
Eastbound through/right	A	0.0	A	0.0	A	0.0	A	0.0
Westbound left	B	10.3	A	9.9	C	20.3	B	10.1
Westbound through	B	11.9	B	11.2	C	22.8	B	11.2
Westbound approach	B	10.3	A	9.9	C	20.3	B	10.1
SR-85 Northbound Mainline/Riggs Road								
Northbound left	A	7.2	A	7.2	A	7.2	A	7.2
Eastbound left	A	9.2	B	10.2	A	9.2	B	14.3
Eastbound through	B	10.8	B	12.6	C	16.3	B	12.6
Eastbound approach	B	10.8	A	10.2	C	16.3	B	14.3
Westbound through	B	10.6	B	13.3	B	10.6	B	13.6
Westbound through/right	A	9.3	B	10.3	A	9.3	B	14.1
Westbound approach	A	9.4	B	10.6	A	9.4	B	14.0
SR-85 Northbound Ramps/Riggs Road								
Northbound left	A	7.5	A	7.4	n/a	n/a	n/a	n/a
Eastbound left	A	8.8	A	8.6	A	8.8	B	11.6
Eastbound right	A	8.6	A	8.3	n/a	n/a	n/a	n/a
Eastbound approach	A	8.6	A	0.0	B	12.7	A	0.0

Source: SWTE (2011).

Table 4.89 2015 Peak Hour Levels of Service – No Action and Sub-alternative A1

Intersection	No Action Alternative				Sub-alternative A1: Photovoltaic			
	AM Peak		PM Peak		AM Peak		PM Peak	
	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
SR-85 Southbound Mainline/Riggs Road								
Southbound left	A	7.5	A	7.4	A	7.5	A	7.5
Eastbound through	B	12.2	B	11.3	B	12.6	B	12.2
Eastbound through/right	A	0.0	A	0.0	A	0.0	A	0.0
Westbound left	B	10.5	A	10.0	B	10.9	A	10.0
Westbound through	B	12.2	B	11.4	B	12.6	B	11.4
Westbound approach	B	10.5	A	10.0	B	10.9	B	10.0
SR-85 Northbound Mainline/Riggs Road								
Northbound left	A	7.2	A	7.2	A	7.2	A	7.2
Eastbound left	A	9.3	B	10.4	A	9.3	B	10.6
Eastbound through	B	11.0	B	13.1	B	11.2	B	13.1
Eastbound approach	B	11.0	A	0.0	B	11.2	B	13.1
Westbound through	B	10.8	B	13.8	B	10.8	B	13.9
Westbound through/right	A	9.5	B	10.5	A	9.5	B	10.7
Westbound approach	A	9.6	B	10.7	A	9.6	B	11.0
SR-85 Northbound Ramps/Riggs Road								
Northbound left	A	7.5	A	7.4	n/a	n/a	n/a	n/a
Eastbound left	A	8.8	A	8.7	A	7.2	A	7.2
Eastbound right	A	8.6	A	8.3	n/a	n/a	n/a	n/a
Eastbound approach	A	8.6	A	8.7	A	7.2	A	7.2

Source: SWTE (2011).

As illustrated in Tables 4.88 and 4.89, under Sub-alternative A1, the Project Area intersections would continue to operate at an LOS C or better in 2012 and 2015. The only instance in which Sub-alternative A1 would result in a LOS below LOS B would be during the AM peak hours for eastbound through traffic at the SR-85 southbound mainline/Riggs Road intersection.

4.15.5.2 TRANSPORTATION ROUTES

The transportation routes in Sub-alternative A1 would be the same as under the Proposed Action.

Weekday peak hour traffic volume estimates under Sub-alternative A1 are shown in Figure 4.4, which illustrates an aerial view of the SR-85/Riggs Road intersection.

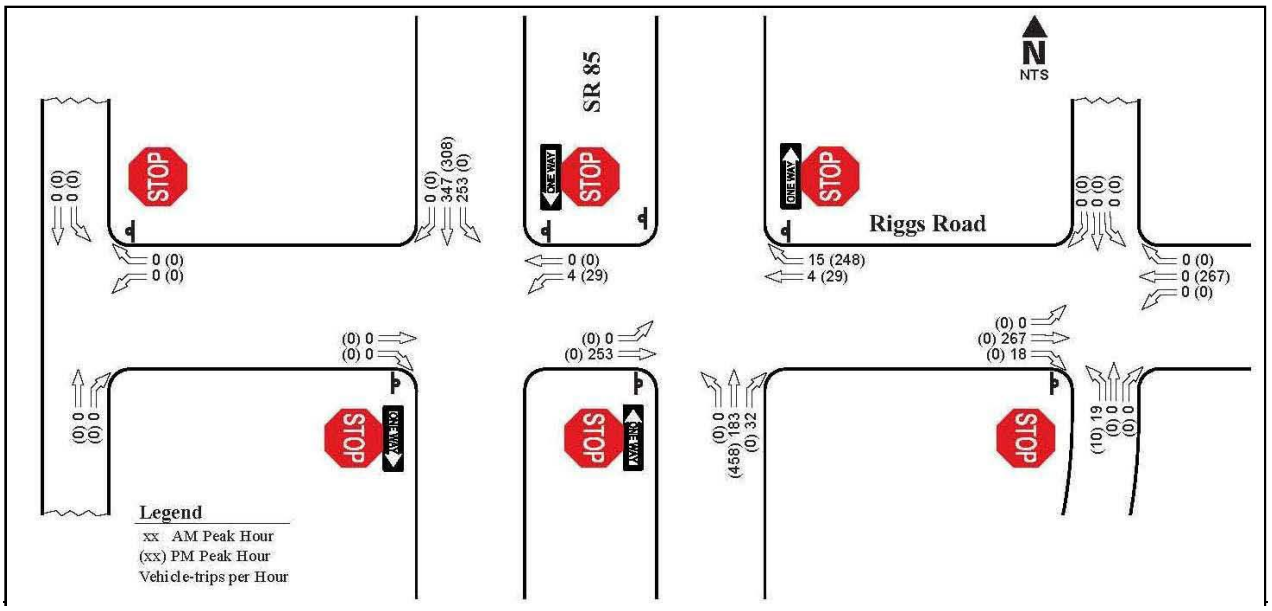

Figure 4.4 2015 weekday peak hour traffic volumes – Sub-alternative A1 (SWTE 2011).

As Figure 4.4 illustrates, the peak hour traffic volume would increase from the existing conditions described in Section 4.15.2.2 and on Figure 4.1. However, as described in Section 4.15.5.1, the LOS would continue at LOS C or better for all transportation routes under Sub-alternative A1 (traffic volume is not currently available for Riggs Road east of the Project Area).

4.15.5.3 CHANGES IN ACCESS

Changes in access under Sub-alternative A1 would be less than described under the Proposed Action because Sub-alternative A1 would require an approximately 50% smaller project footprint. Construction of the SSEP under Sub-alternative A1 would close approximately 3 miles of existing routes.

The stop sign design feature at the SR-85 northbound ramps/Riggs Road intersection would result in less adverse impacts than described under the Proposed Action because the number of trips would be less; however, the access patterns would be the same and the stop sign would have the same mitigating effect as described under the Proposed Action.

4.15.6 Alternative B: Reduced Footprint

In general, most impacts to traffic and transportation under Alternative B would be the same as under the Proposed Action. As such, only those subsections and details that would differ substantively from the Proposed Action are discussed below.

4.15.6.1 LEVEL OF SERVICE

Construction of each unit under Alternative B would take two months less than under the Proposed Action. This would result in a shorter duration of peak-construction traffic than under the Proposed Action. Thus, impacts to transportation and traffic, such as delay concerns at the SR-85/Riggs Road intersection, increased expected travel time, and decreases in the LOS at the SR-85/Riggs Road intersection would be the same as disclosed under the Proposed Action, but would persist for two months less time.

4.15.6.2 TRANSPORTATION ROUTES

Although the power plant footprint under Alternative B would occupy 34% less acreage than the Proposed Action, construction of the SSEP would close 3.7 miles of existing routes.

4.15.6.3 CHANGES IN ACCESS

Impacts to changes in access under Alternative B would be the same as under the Proposed Action, except fewer acres and fewer miles of existing routes would be affected.

4.15.7 Reduced Water Use Option–Brine Concentrator

Impacts to transportation and traffic (under any alternative) would not change with the application of this option.

4.15.8 Generation Tie Line Option

Impacts to transportation and traffic would not change with the application of this option to any of the action alternatives, because the implementation of the Gen-tie Line Option would require the same number of vehicle trips as the implementation of the proposed gen-tie line.

4.15.9 Potential Mitigation Measures

Under all action alternatives except Sub-alternatives A1, all three intersections in the analysis area are predicted to operate at an inadequate LOS F during the construction peak hours in 2012. Proposed mitigation measures or improvements to these intersections, which would help them operate more efficiently during project construction, are discussed below. In a traffic impacts analysis submitted to the ADOT, under all action alternatives except Sub-alternative A1, Boulevard has proposed prohibition of left turns by southbound traffic on SR-85 onto Riggs Road. Final approval by ADOT of an alternative mitigation measure for traffic is expected shortly after details of a lane closure are finalized.

4.15.9.1 INSTALLING SPEED BUMPS AND NO PARKING SIGNAGE ALONG THE NEW ACCESS ROAD

The new SSEP access road would not be gated. To decrease the impact of this new transportation route on public safety and OHV-use enforcement, following construction, Boulevard would install speed bumps every 500–1,000 feet along the access road and install "no parking" signage along the sides of the access road. The speed bumps would include standard dimensions as described in the Federal Highway Administration (FHWA) *Manual on Uniform Traffic Control Device* (FHWA 2009). These measures would effectively eliminate the risk of speeding and vehicle racing along the route, as well as discourage parking by illegal OHV users.

4.15.9.2 CONSTRUCTION WORKERS USING CARPOOL OR VANPOOLS

Table 4.85 discusses the anticipated number of vehicle trips required under all alternatives. To immediately reduce the number of vehicle trips under all alternatives, Boulevard would implement a mandatory (or fund) carpool or vanpool system. Workers travelling to the SSEP from proximate locations would be provided van transportation to the project site or be required to carpool to reduce the number of vehicles required for their transport. Although any carpool/vanpool system would be mandatory under this potential mitigation measure, the details of the system would be at the discretion of Boulevard, except that the carpool/vanpool system would be required to result in LOS C or better.

4.15.9.3 CONTRACTUALLY OBLIGATE CONSTRUCTION WORKERS TO USE SR-85/RIGGS ROAD INTERSECTION (WEST OF PROJECT AREA) AS THE ONLY ACCESS POINT TO SSEP

Riggs Road travels east-west to the south of the Project Area and is currently not paved. To prevent an unintended increase in traffic on the dirt road from construction workers accessing the SSEP from the east, Boulevard would contractually require all construction workers to access the SSEP from the west, using Riggs Road exclusively from SR-85. This mitigation measure would prevent increased fugitive dust and traffic patterns on the portion of Riggs Road east of the Project Area, except for limited use to access the well field and any unanticipated emergency use.

4.15.9.4 RESTORATION OF ALL PUBLIC ROADS, EASEMENTS, AND RIGHTS-OF-WAY

Boulevard would restore (or fund the restoration of) all public roads, easements, and ROWs damaged due to project-related construction activities to original or near-original condition in a timely manner, as directed by the BLM. Potential repairs and restoration of roads may be required at any time during the construction phase of the project to assure safe ingress and egress to all vehicles.

4.15.9.5 ACCELERATION LANES ON NORTHBOUND AND SOUTHBOUND SR-85 DURING CONSTRUCTION ONLY

In order to mitigate the LOS impacts associated with the Proposed Action, Alternative A, and Alternative B, an acceleration lane would be included on the south and northbound lanes of SR-85 during construction only. This would enable thru-traffic to continue travel along SR-85, while also enabling construction traffic to avoid the thru-lanes.

4.15.9.6 ADVANCE SIGNING ON SR-85 TO ALERT TRAVELERS OF CONSTRUCTION

In order to alert travelers on SR-85 both northbound and southbound, advance signage would be placed along SR-85, 1 mile south and north of the Riggs Road intersection. This would allow travelers to make lane changes, reduce speed, and allow safe distances and time for construction traffic that may be turning from southbound SR-85 onto Riggs Road. Contractors would follow the design standards mandated by the FHWA and adhere to the 2009 *Manual on Uniform Traffic Control Devices*.

4.15.9.7 INSTALLATION OF A LOCKED GATE AT THE WELL FIELD ACCESS ROAD ENTRANCE

To prohibit unwanted traffic on the well field access road, a gate would be installed at the entrance along Riggs Road.

4.15.10 Residual Impacts

If the potential mitigation measures above are implemented, several residual impacts would still occur. First, the installation of parking signs would decrease the likelihood of public parking along the new access road to access the public lands, but it would not eliminate it. Second, implementation of a vanpool system would decrease the traffic but would not eliminate it because certain heavy trucks and equipment would use a specific vehicle and could not be consolidated into a vanpool. The residual impacts to the LOS would depend on the alternative and the degree to which vanpooling were used. Therefore even with the mitigation measure of implementing a vanpool, traffic would still increase as a result of the project.

Project-related use of Riggs Road east of the well-access field is not anticipated because employees would be contractually obligated to use SR-85 for commuting to and from SSEP; however, emergency situations could result in project-related use of the portion of Riggs Road that travels east to Rainbow Valley Road to access the project.

Regardless of the alternative implemented, changes to the existing transportation network would result in residual transportation impacts because the routes that currently exist within the project footprint would be precluded by the project and unavailable for use. Depending on the selected alternative, the project would eliminate approximately 3.0–7.4 miles of existing roads.

Finally, there is a temporary risk to transportation and traffic if damage to existing roads is not immediately addressed by Boulevard or another entity.

4.15.11 Short-term Uses versus Long-term Productivity

The short-term use of the Project Area (the 30-year life of the project) would not have a long-term effect on the traffic and transportation system in the surrounding area once site decommissioning occurs. The primary long-term effect would be the loss of travel routes in the Project Area.

4.15.12 Irreversible and Irretrievable Commitments of Resources

Under all action alternatives, existing routes currently crossing the SSEP Project Area would be irretrievably eliminated due to the project‘s construction and operation. These routes would be lost until the project‘s lifespan has expired and until BLM has taken steps to reestablish them. Because the Project Area would be reclaimed following termination, there would be no irreversible impacts associated with the Proposed Action or other alternatives.

4.16 Vegetation and Special-status Plant Species

This section describes the impacts of the Proposed Action and alternatives, as described in Chapter 2, on vegetation communities, special-status plant species, and noxious and invasive plant species.

Four federal regulations pertain to plant species in and adjacent to the Project Area: 1) those plant species listed by the USFWS under the ESA; 2) those plant species listed as sensitive by the BLM under BLM Manual Section 6840; 3) EO 13112 of February 3, 1999–Invasive Species; and 4) the Plant Protection Act. In addition, there are two sets of Arizona State regulations pertinent to the plant species addressed in this section: 1) State of Arizona laws addressing the control and eradication of noxious weeds (A.A.C. §§ R3-4-244 and R3-4-245); and 2) Arizona Native Plant Law (§ R 3-3-1101 through R 3-3-1111; and A.R.S. § 3-901 through 3-916). These regulations are described in Chapter 3, Section 3.16.2.

4.16.1 Analysis Area and Analysis Assumptions

Vegetation communities and special-status plant species would be removed from the Project Area at the beginning of construction, and ongoing treatments would prevent recolonization. Noxious and invasive plant species would establish in perimeter areas from Project Area disturbances to existing seed banks or from the introduction of propagules into the site, but would be mitigated in the Project Area where chemical and mechanical treatments are used to prevent plant establishment for the life of the project.

Deposition of fugitive dust onto plant stems and leaves would reduce photosynthetic activity and overall plant health and productivity. Indirect negative impacts to vegetation adjacent to the Project Area and transportation corridors would occur on untreated roadways. These impacts would be proportional to the number of vehicle trips associated with project activities.

BSCs consist of blue and green algae, lichens, mosses, fungi, and bacteria that bind the surface of the soil (Belnap et al. 2001). BSCs are recognized as important features of desert ecosystems due to their ability to stabilize the soil, capture and retain atmospheric moisture and rainfall, facilitate seed germination, and increase nutrient availability for plant growth (Belnap et al. 2001). BSCs in the Sonoran Desert ecosystem occur as a flat layer on the surface of the soil (Belnap et al. 2001). The removal of this type of BSC allows water to flow unimpeded over the soil surface, which reduces moisture infiltration into the soil and increases soil erosion (Belnap et al. 2001). Because BSCs are a major component of vegetation communities in the Sonoran Desert (Belnap et al. 2001), there is reasonable expectation that BSCs occur in the Project Area – either intact or as remnants due to historic disturbances. All project-related surface disturbance that removes or damages BSCs would negatively impact vegetation communities by slowing vegetation establishment and growth. BSCs in desert ecosystems can require decades to centuries to recover, and the lack of these soil organisms may slow vegetation reestablishment following disturbance or removal by reducing soil stability and the availability of moisture and nutrients to growing plants (Belnap et al. 2001). Disturbance that removes soil crust organisms would result in slower recovery of BSC diversity and functioning than disturbance that leaves crushed crust material in place (Belnap et al. 2001).

4.16.1.1 VEGETATION COMMUNITIES

The analysis area for vegetation communities consists of the Project Area, which includes the project footprint, linear facilities, and transportation and access corridors. Acres of Sonoran Creosotebush-Bursage Scrub and linear feet of Xeroriparian Wash disturbance are used to quantify impacts to vegetation communities that result from implementation of the alternatives. The degree of impacts would depend on the extent (acres and linear feet) and duration (long-term versus temporary) of the disturbance. The rate at which vegetation recovers following restoration, and the effectiveness of restoration activities, would also determine the degree of long-term negative impacts to vegetation communities.

4.16.1.2 SPECIAL-STATUS PLANT SPECIES

The analysis area for special-status plant species consists of the Project Area, which includes the project footprint, linear facilities, and transportation and access corridors. Acres of Sonoran Creosotebush-Bursage Scrub and linear feet of Xeroriparian Wash disturbance are used to quantify impacts to special-status plant species based on the assumption that the number of individual special-status plants affected would be proportional to the number of acres or linear feet affected.

Under Arizona Native Plant Law (ADA 2009a, 2009b; see Section 4.1.1 above) no protected plant can be removed or transported without permission and a permit from the ADA. Implementation of any of the action alternatives would require notification of the ADA 60 days prior to removal of any protected native plant. In both long-term use and temporary use areas, surveys would be conducted to identify and tag native plant species protected under Arizona Native Plant Law, and individual plants would be removed in accordance with appropriate ADA salvage permits prior to land clearing. A list of the native plant species protected under ADA that are known to occur in the Project Area is given in Chapter 3, Section 3.16.4.1. The analysis of impacts assumes that all special-status plant species in the Project Area would be salvaged or destroyed. Because the Project Area is dominated by creosotebush and contains numerous other unprotected plant species, special-status plant species represent only a portion of the vegetation that would be removed.

4.16.1.3 NOXIOUS AND INVASIVE PLANT SPECIES

The analysis area for noxious and invasive plant species consists of the perimeter of the Project Area, including linear facilities and transportation corridors. This perimeter represents the interface between long-term and temporary surface disturbances and vegetation communities, which is where noxious and invasive plant species are most likely to become established and spread into adjacent habitats. There is currently no specific guidance for noxious and invasive plant species mitigation for the BLM LSFO. Because the rate of seed production and seed dispersal (and thereby, the likelihood of introduction) differs for each noxious and invasive plant species, it is difficult to define an area of any given size for impacts analysis. The length (feet) of the project perimeter is used to quantify impacts based on the assumption that the Project Area boundary would be the initial location of the introduction and subsequent spread of any noxious or invasive plant species. The Project Area perimeter would have increased susceptibility to the introduction or spread of noxious and invasive plant species for the following reasons: 1) direct surface disturbance from grading, road construction, road improvement, and maintenance activities could create favorable conditions for the germination and establishment of noxious and invasive plant species that prefer disturbed soils; 2) noxious and invasive plant species seeds, propagules such as root fragments or plantlets, and seed-contaminated soils could be transported into the Project Area on clothing, vehicles, construction equipment, and other materials; 3) any existing noxious and invasive plants could be spread within or out of the Project Area on clothing, vehicles, equipment, and other materials; and 4) dust control activities and equipment washing could inadvertently provide water to existing seed banks and promote the germination and establishment of noxious and invasive plant species. The perimeter of treated areas and any untreated developments associated with project activities would have increased potential for the introduction and spread of noxious and invasive plants. For purposes of analysis, it is assumed that negative impacts from the introduction and spread of noxious and invasive plant species would occur in untreated areas and would be proportional to the length of the project perimeter and to the number of vehicle trips associated with project activities.

Dense concentrations of noxious and invasive plant species contribute to fuel loading that does not normally occur in the Sonoran Desert ecosystem. The increased fuel loading results in increased frequency and intensity of fires. Invasion of noxious and invasive plant species into vegetation communities can also negatively impact BSCs, as weed species commonly invade and spread in the open space between native plants.

BSCs can be directly displaced by invasive plants, or indirectly impacted as a result of the hot ground fires that dense stands of invasive plants facilitate. These hot fires sterilize the soil and the increased fire frequency that results from ongoing fuel loading prevents recovery of BSCs and reduces their compositional diversity (Belnap et al. 2001). The frequent, large fires that are produced by invasive grasses and forbs in the Sonoran Desert ecosystem prohibit recolonization by BSC organisms (Belnap et al. 2001 and references therein).

4.16.1.4 APPLICABLE APPLICANT-COMMITTED MEASURES

The analysis of impacts to vegetation resources assumes that the following applicant-committed measures would be successfully implemented. All temporarily disturbed areas would be reclaimed to as close to pre-construction conditions as possible, as required by the BLM. Temporary access roads used during construction would be regraded and restored to pre-existing function and grade. BLM-approved seed mixes would be applied to temporarily disturbed areas, as required. No fertilizer would be used during stabilization or rehabilitation activities unless authorized by the BLM. When construction of stormwater management structures is complete, contours would be restored to the extent feasible. Applicant-committed dust suppression treatment of dirt roadways and in and around the solar field would be implemented to mitigate or minimize impacts to vegetation from fugitive dust. Impacts to vegetation communities from fugitive dust would be mitigated where dust suppression treatments are used.

Applicant-committed measures for the reclamation of long-term disturbance would consist of the following: structure foundations would be removed to 3 feet below ground surface, contours would be restored over the foundations to pre-project conditions, and stormwater management berms would be removed and restored the pre-project contours. All post-construction ROWs would be restored, as required by the BLM. All practical means would be made to restore the land to its original natural drainage patterns. Because revegetation would be difficult in many areas of the SSEP due to low precipitation in the Sonoran Desert, all practicable measures would be taken to minimize disturbance during construction.

The analysis of impacts to vegetation resources assumes that applicant-committed reclamation and restoration measures would be successful. However, the rate of vegetation recovery would depend on whether seeds, salvaged plants, or container stock are used, and whether seasonal precipitation is sufficient to promote plant establishment and growth (Bean et al. 2004). Other contributing factors to vegetation recovery are the degree of soil compaction (Kade and Warren 2002) and the rate of BSC recovery (Belnap et al. 2001). Recovery times to alleviate soil compaction and for the reestablishment of BSC organisms would be proportional to the length of the disturbance. Because of the variety of potential revegetation methods and fluctuating ecological conditions in the Sonoran Desert, recovery of vegetation structure and functioning would require from a minimum of five to ten years (Bean et al. 2004) to more than fifty years (Kade and Warren 2002, Guo 2004). Prolonged disturbance in arid ecosystems slows vegetation recovery times due to soil compaction and the loss of soil organisms that promote plant growth (Guo 2004).

The analysis of impacts presented here assumes that all applicant-committed measures described above and in Chapter 2 (see Table 2.2), and the regulatory requirements and required mitigation described in Section 4.1.1, would be successfully implemented.

4.16.2 Impacts to Vegetation Communities

Two vegetation communities were identified in the Project Area: Sonoran Creosotebush-Bursage Scrub and Xeroriparian Wash. The Xeroriparian Wash community contains generally the same plant species as the surrounding Sonoran Creosotebush-Bursage Scrub community, but plants occur at higher densities due to ephemeral water availability in the washes. For purposes of impacts analysis, impacts to vegetation communities are described as both acres of Sonoran Creosotebush-Bursage Scrub and linear feet of Xeroriparian Wash. The Xeroriparian Wash community is treated as a distinct vegetation community because higher densities of plants would be affected by proposed activities in the linear wash areas than in upland Sonoran Creosotebush-Bursage Scrub.

Long-term disturbance to vegetation communities would occur on most of the Project Area under all action alternatives due to the removal of all existing vegetation and ongoing treatment to prevent vegetation establishment for the life of the project. Temporary disturbances to existing vegetation would be limited to gas and water line ROWs and temporary work areas, gen-tie line access roads, and development of and improvements to transportation corridors. The removal of vegetation would have several indirect effects, including the loss of BSCs, increased potential for soil erosion (see Section 4.13), increased potential for the introduction and spread of noxious and invasive plant species (see Section 4.16.4 below), and reduced availability and/or quality of wildlife habitat (see Section 4.19).

4.16.2.1 NO ACTION

Under the No Action alternative, the SSEP would not be developed and existing land uses in the Project Area would continue. Management of vegetation would continue at the discretion of the BLM under the *Approved Amendment to the Lower Gila North Management Framework Plan and the Lower Gila South RPM and Decision Record* (BLM 2005). Livestock grazing in the Project Area would continue in two allotments, one of which is ephemeral and only grazed when infrequent (ephemeral) precipitation allows the production of adequate forage. Limited vehicle use of the Project Area, and associated impacts to vegetation communities from fugitive dust, would continue to occur as a result of vehicle use on existing routes in the Project Area. Limited recreational foot traffic would presumably also continue at low levels.

No acres of Sonoran Creosotebush-Bursage Scrub and associated linear feet of Xeroriparian Wash would be disturbed beyond any currently existing surface-disturbing activities (Tables 4.90 and 4.91).

Table 4.90 Acres of Disturbance to the Sonoran Creosotebush-Bursage Scrub Vegetation Community – All Alternatives

Type of Disturbance	No Action	Proposed Action*	Alternative A: Reduced Water Use (dry-cooled CST)	Sub-alternative A1: Photovoltaic	Alternative B: Reduced Footprint*
Long-term use	0	3,568.8	3,561.2	1,963.1	2,343.4
Temporary use	0	31.0	29.0	29.3	30.3
Total Disturbance	**0**	**3,599.8**	**3,590.2**	**1,992.4**	**2,373.7**

Note: Acres of disturbance do not include existing road surfaces.

*Acres of disturbance would be the same for the Proposed Action with brine concentrator option and Alternative B with he brine concentrator option.

Table 4.91 Linear Feet of Disturbance to Xeroriparian Wash Vegetation – All Alternatives

Type of Disturbance	No Action	Proposed Action*	Alternative A: Reduced Water Use (dry-cooled CST)	Sub-alternative A1: Photovoltaic	Alternative B: Reduced Footprint*
Long-term use	0	38,347.0	38,295.7	22,237.0	21,939.8
Temporary use	0	197.8	182.4	223.9	182.4
Total Disturbance	**0**	**38,554.8**	**38,478.1**	**22,460.9**	**22,122.2**

Note: Linear feet of disturbance do not include existing road surfaces.

*Linear feet of disturbance would be the same for the Proposed Action with brine concentrator option and Alternative B with brine concentrator option.

Under the No Action alternative, several water supply test wells in the Project Area would be plugged and abandoned, and any associated site disturbance would be reclaimed. Reclamation of disturbed areas associated with the test wells would have long-term beneficial impacts on vegetation by restoring the structure and functioning of the vegetation community and by reducing the risk of invasion by noxious and invasive plant species by establishing native plant species.

4.16.2.2 PROPOSED ACTION

Vegetation communities would be disturbed by construction, operation, and maintenance activities that remove vegetation in either the long-term (life of the project) or the short-term (temporary, up to 5 years). The primary long-term and short-term impacts to vegetation communities would be from the removal of existing vegetation. Direct impacts to vegetation communities would result from the removal of 3,599.8 acres of Sonoran Creosotebush-Bursage Scrub (including vegetation associated with 38,554.8 linear feet of Xeroriparian Wash) (see Tables 4.90 and 4.91). Long-term direct impacts would result from the removal of 3,568.8 acres of Sonoran Creosotebush-Bursage Scrub (including 38,347 linear feet of Xeroriparian Wash) in the project footprint and for the construction of groundwater well facilities and transportation corridors. Temporary direct impacts would result from the removal of 31 acres of Sonoran Creosotebush-Bursage Scrub (including 197.8 linear feet of Xeroriparian Wash) for the construction of gen-tie line access roads and the construction of, and improvements to, transportation corridors.

The Proposed Action would result in an increased likelihood and amount of wind-borne fugitive dust, which would produce temporary and long-term indirect adverse impacts to vegetation within and adjacent to the Project Area. Wind-borne fugitive dust negatively impacts nearby vegetation by coating leaves and reducing photosynthetic activity and palatability to wildlife. A temporary increase in vehicle and construction equipment traffic into and within the Project Area would occur during project construction. Increased travel associated with day-to-day operations and maintenance activities would occur for the life of the project. Applicant-committed dust suppression treatment of dirt roadways and in and around the solar field would mitigate or minimize impacts to vegetation from fugitive dust that is produced by grading, development and travel on dirt roads. Indirect impacts to vegetation communities would also occur from fugitive dust that is produced by vehicle travel on paved roadways. The extent and degree of these impacts would depend on local climatic conditions and other factors that are difficult to quantify. However, for purposes of analysis we assume that negative impacts to vegetation functioning that result from fugitive dust would be proportional to the number of vehicle trips associated with project activities. At the peak of construction, approximately 1,000 vehicles would travel to and from the Project Area each day on paved roads. Approximately 46 vehicles would travel to and from the Project Area during regular operations.

Direct and indirect impacts to vegetation communities would be greater under the Proposed Action than under the No Action alternative.

As described in Sections 4.18.1.3.1 (Impacts to Surface Water Resources during Construction) and 4.18.1.3.5 (Impacts to Surface Water Resources during Operations), surface water flows in washes, uplands, and floodplains would be returned to pre-construction conditions and would likely match that of the surrounding landscape. Because of this, there would be no broad-scale mortality of vegetation due to disruptions in surface water flows, and no impacts from surface water flows to vegetation communities.

4.16.2.3 ALTERNATIVE A: REDUCED WATER USE (DRY-COOLED CST)

Under Alternative A, long-term impacts to vegetation communities from clearing of the project footprint would be the same as under the Proposed Action. The only difference in impacts to vegetation communities from construction and operation of the project would be a reduction in the number of groundwater well facilities from four wells to two and a reduction in access roads (see Map 5).

Direct impacts to vegetation communities would result from the removal of 3,590.2 acres of Sonoran Creosotebush-Bursage Scrub (including vegetation associated with 38,478.1 linear feet of Xeroriparian Wash) (see Tables 4.90 and 4.91). Long-term direct impacts would result from the removal of 3,561.2 acres of Sonoran Creosotebush-Bursage Scrub (including 38,295.7 linear feet of Xeroriparian Wash) in the project footprint and for the construction of groundwater well facilities and transportation corridors. Temporary direct impacts would result from the removal of 29 acres of Sonoran Creosotebush-Bursage Scrub vegetation (including 182.4 linear feet of Xeroriparian Wash) for the construction of gen-tie line access roads and the construction of, and improvements to, transportation corridors.

Under Alternative A, there would be a 0.3% (9.6 acres) reduction in Sonoran Creosotebush-Bursage Scrub disturbance (including a 0.2% reduction in linear feet of Xeroriparian Wash) compared to the Proposed Action. All other impacts to vegetation resources would be the same under Alternative A as under the Proposed Action. Direct and indirect impacts to vegetation communities would be greater under Alternative A than under the No Action alternative, but would be less than under the Proposed Action.

4.16.2.4 SUB-ALTERNATIVE A1: PHOTOVOLTAIC

Long-term impacts to vegetation communities from clearing of the project footprint would be less than under the Proposed Action due to the smaller footprint of the SSEP under Sub-alternative A1.

Under Sub-alternative A1, direct impacts to vegetation communities would result from the removal of 1,992.4 acres of Sonoran Creosotebush-Bursage Scrub (including vegetation associated with 22,460.9 linear feet of Xeroriparian Wash) (see Tables 4.90 and 4.91). Of this total, long-term direct impacts would result from the removal of 1,963.1 acres of Sonoran Creosotebush-Bursage Scrub (including 22,237 linear feet of Xeroriparian Wash) in the primary project footprint and for the construction of groundwater well facilities and transportation corridors. For the remainder of the total disturbed acres, temporary direct impacts would result from the removal of 29.3 acres of Sonoran Creosotebush-Bursage Scrub vegetation (including 223.9 linear feet of Xeroriparian Wash) for the construction of gen-tie line access roads and the construction of and improvements to transportation corridors. Under Sub-alternative A1, there would be a 45% (1,607.4 acres) reduction in Sonoran Creosotebush-Bursage Scrub disturbance (including a 42% reduction in linear feet of Xeroriparian Wash) compared to the Proposed Action.

At the peak of construction, vehicle trips along roadways would be reduced by 733 trips (73%) per day to 267 trips, with an associated reduction in fugitive dust impacts to vegetation communities compared to the Proposed Action. Approximately 16 vehicles would travel to and from the Project Area during regular operations.

Overall, direct and indirect impacts to vegetation communities would be greater under Sub-alternative A1 than under the No Action alternative, but would be less than under the Proposed Action.

4.16.2.5 ALTERNATIVE B: REDUCED FOOTPRINT

Under Alternative B, long-term impacts to vegetation communities from clearing of vegetation in the project footprint would be reduced, and the number of groundwater well facilities and associated access roads would be reduced from four wells to three (see Map 6).

Direct impacts to vegetation communities would result from the removal of 2,373.7 acres of Sonoran Creosotebush-Bursage Scrub (including vegetation associated with 22,122.2 linear feet of Xeroriparian Wash) (see Tables 4.90 and 4.91). Long-term direct impacts would results from the removal of 2,343.4 acres of Sonoran Creosotebush-Bursage Scrub (including 21,939.8 linear feet of Xeroriparian Wash) in the project footprint and for the construction of groundwater well facilities and transportation corridors. Temporary direct impacts would result from the removal of 30.3 acres of Sonoran Creosotebush-Bursage Scrub vegetation (including 182.4 linear feet of Xeroriparian Wash) for the construction of gen-tie line access roads and the construction of, and improvements to, transportation corridors.

Under Alternative B, there would be a 34.1% (1,226.1 acres) reduction in Sonoran Creosotebush-Bursage Scrub disturbance (including a 42.6% reduction in linear feet of Xeroriparian Wash) compared to the Proposed Action. At the peak of construction, vehicle trips along untreated paved roadways would be reduced by 50 trips (5%) per day to 950 trips, with an associated reduction in indirect impacts to vegetation communities from fugitive dust compared to the Proposed Action. Approximately 46 vehicles would travel to and from the Project Area during regular operations, or 12.5% fewer vehicle trips than under the Proposed Action. All other impacts to vegetation resources would be the same under Alternative B: Reduced Footprint as under the Proposed Action. Direct and indirect impacts to vegetation communities would be greater under Alternative B than under the No Action alternative, but would be less than under the Proposed Action or Alternative A.

4.16.2.6 REDUCED WATER USE OPTION–BRINE CONCENTRATOR

Under the Proposed Action or Alternative B, the use of a brine concentrator would reduce the volume of wastewater exiting the facility. The option would not change impacts to vegetation resources under either the Proposed Action or Alternative B because implementation of the option would not change the area of vegetation communities removed or disturbed.

4.16.2.7 GENERATION TIE LINE OPTION

If the Gen-tie Line Option were added to the Proposed Action, Alternative A, or Alternative B, temporary impacts to vegetation communities would result from the removal of 5.1 additional acres of Sonoran Creosotebush-Bursage Scrub (including vegetation associated with 32 linear feet of Xeroriparian Wash), when compared to the proposed gen-tie line alignment. Long-term impacts would result from the removal of 3.6 additional acres of Sonoran Creosotebush-Bursage Scrub (including 33 linear feet of Xeroriparian Wash). If the Gen-tie Line Option were added to Sub-alternative A1, temporary impacts to vegetation communities would result from the removal of 6.8 acres of Sonoran Creosotebush-Bursage Scrub (including 32 linear feet of Xeroriparian Wash), when compared to the proposed gen-tie line alignment. Long-term impacts would result from the removal of 5.0 acres of Sonoran Creosotebush-Bursage Scrub (including 33 linear feet of Xeroriparian Wash). The increase in disturbance to Sonoran Creosotebush-Bursage Scrub and Xeroriparian Wash would be less than 0.6% if the Gen-tie Line Option were selected in combination with any action alternative.

Fugitive dust from traffic would not be impacted by the selection of this option because no additional vehicles would be required for its implementation.

4.16.3 Impacts to Special-status Species

Thirteen plant species that are protected under Arizona Native Plant Law are known to occur in the Project Area (see Chapter 3, Table 3.52). No federally listed endangered, threatened, candidate, or proposed plant species are known to occur in the Project Area or surrounding vegetation communities. No federally listed species are likely to occur due to a lack of suitable habitats and because the Project Area is outside of the known range of these species (Pape 2009).

Saguaro cactus is protected under Arizona Native Plant Law (ADA 2009a). The species occupies desert slopes and well-drained flats, especially rocky bajadas (Epple and Epple 1995) in the Sonoran Desert. Saguaro cacti are few and widespread in the Project Area. Under Arizona Native Plant Law, saguaros are protected as salvage restricted, which requires a permit for any impacts to the species. Any crested saguaros (saguaro cacti with a fan-shaped top) found in the Project Area would be considered highly safeguarded under Arizona Native Plant Law. No crested saguaro cacti are known to occur in the Project Area or surrounding vegetation communities.

4.16.3.1 NO ACTION

Under the No Action alternative, the SSEP would not be developed and existing land uses in the Project Area would continue, including livestock grazing and dispersed recreation use in the Project Area, and operation of utility systems and vehicle travel in ROWs and on roads adjacent to and within the Project Area. There would be no impacts to special-status plant species beyond any impacts associated with the existing conditions identified in Section 4.16.2.1.

4.16.3.2 PROPOSED ACTION

Under the Proposed Action, the nature and degree of temporary and long-term indirect adverse impacts to special-status plant species would be the same as for vegetation communities. All special-status plant species occurring within the 3,599.8 acres of long-term and temporary disturbance areas would be collected, salvaged, or destroyed by permit (each species in accordance with to its ADA status; see Table 3.52 and Section 4.16.1.2). Direct impacts to special-status plant species from salvage or loss would be greater under the Proposed Action than under the No Action alternative.

4.16.3.3 ALTERNATIVE A: REDUCED WATER USE (DRY-COOLED CST)

Under Alternative A, the nature and degree of temporary and long-term impacts would be the same as for vegetation communities (see Tables 4.90 and 4.91; see Map 5). There would be an approximately 0.3% reduction in disturbance to special-status plant species compared to the Proposed Action. All other impacts to special-status plant species would be the same under Alternative A as under the Proposed Action. Direct and indirect impacts to special-status plant species would be greater under Alternative A than under the No Action alternative, but would be less than would occur under the Proposed Action.

4.16.3.4 SUB-ALTERNATIVE A1: PHOTOVOLTAIC

Under Sub-alternative A1, the nature and degree of temporary and long-term impacts to special-status species would be the same as for vegetation communities (see Tables 4.90 and 4.91; see Map 4). There would be an approximately 45% reduction in disturbance to special-status plant species compared to the Proposed Action. All other impacts to special-status plant species would be the same under Sub-alternative A1 as under the Proposed Action. Direct and indirect impacts to special-status plant species would be greater under Sub-alternative A1 than under the No Action alternative, but would be less than would occur under the Proposed Action.

4.16.3.5 ALTERNATIVE B: REDUCED FOOTPRINT

Under Alternative B, the nature and degree of temporary and long-term impacts would be the same as for vegetation communities (see Tables 4.90 and 4.91; see Map 6). There would be an approximately 34% reduction in disturbance to special-status plant species compared to the Proposed Action. All other impacts to special-status plant species would be the same under Alternative B as under the Proposed Action. Direct and indirect impacts to special-status plant species would be greater under Alternative B than under the No Action alternative, but would be less than would occur under the Proposed Action or Alternative A.

4.16.3.6 REDUCED WATER USE OPTION–BRINE CONCENTRATOR

Under the Proposed Action or Alternative B, the use of a brine concentrator would reduce the volume of wastewater exiting the facility. This option would not change impacts to special-status plant species under either the Proposed Action or Alternative B because implementation of the option would not change the area of each vegetation community and associated special-status plant species removed or disturbed.

4.16.3.7 GENERATION TIE LINE OPTION

Short-term and long-term impacts to special-status plant species as a result of implementing the Gen-tie Line Option in combination with any action alternative would be the same as described above for vegetation communities.

4.16.4 Impacts to Invasive and Noxious Plant Species

Noxious and invasive plant species are undesirable because of their lack of forage value to livestock or wildlife, their potential toxicity to livestock or wildlife, and because they are aggressive invaders that displace native species. Two invasive plant species were observed in the Project Area during reconnaissance surveys (Pape 2009): Saharan mustard and redstem stork‘s bill. Mediterranean grass (*Schismus* species) is also known to occur in the Project Area. In addition, two invasive grass species, buffelgrass and red brome, also have high potential for introduction into the Project Area via transportation corridors or other project-related infrastructure where vehicle use facilitates the movement of seeds or root fragments. Buffelgrass is currently distributed along nearby transportation corridors, including SR-85, SR-86 and I-10, and red brome is widely distributed in the Sonoran Desert (Arizona-Sonora Desert Museum [ASDM] 2010).

Invasive and noxious plant species generally possess dispersal and establishment strategies that give them a competitive advantage over native plant species due to their rapid growth and ability to produce large amounts of seed and plant biomass (Sakai et al. 2001). In addition, some of these species produce allelopathic chemicals that alter surrounding soil conditions and inhibit the growth of native species.

4.16.4.1 NO ACTION

Under the No Action alternative, the SSEP would not be developed and existing land uses in the Project Area would continue, including livestock grazing and dispersed recreation use in the Project Area, and operation of utility systems and vehicle travel in ROWs and on roads adjacent to and within the Project Area. There would be no impacts to noxious and invasive plant species beyond any impacts associated with the existing conditions identified in Section 4.16.2.1, and there would be no project perimeter to increase the likelihood of invasion by noxious and invasive plant species (Table 4.92).

Table 4.92 Noxious and Invasive Plant Species Analysis Perimeter (linear feet) (perimeter of footprint plus all known areas of disturbance surrounding road corridors and other facilities) – All Alternatives

	No Action	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Sub-alternative A1: Photovoltaic	Alternative B: Reduced Footprint
Analysis perimeter	0	198,182.4	184,905.7	171,309	178,399.6

4.16.4.2 PROPOSED ACTION

The entire project perimeter would be at increased risk of invasion by noxious and invasive plant species. There would be little or no potential for noxious or invasive plant species establishment within the project footprint and other portions of the Project Area that would be kept free of vegetation through mechanical removal and the application of approved herbicides for the life of the project. Direct and indirect impacts to vegetation communities would occur where noxious or invasive species are introduced or spread in untreated disturbed soils along or adjacent to the project perimeter. Once introduced, some weed species, particularly red brome and buffelgrass, have the potential to spread into undisturbed habitats where they would disrupt biological crust diversity and functioning, and potentially exclude native plant species through aggressive competition. Once noxious or invasive plant species become established, their direct and indirect impacts to vegetation communities would increase as seeds continue to be dispersed into previously uninfested areas beyond the project boundary. The introduction and establishment of noxious or invasive plant species would also have indirect impacts to vegetation communities and wildlife by increasing fuel loading and fire frequency. If untreated, infestations of noxious or invasive plant species would continue to spread into native habitats, potentially for the life of the project, until actions are taken to curtail their advancement.

For purposes of analysis, we assume that negative impacts from the introduction and spread of noxious and invasive plant species would be proportional to the length of the project perimeter, and the number of vehicle trips associated with project activities. Under the Proposed Action, the Project Area perimeter would be 198,182.4 linear feet (see Map 2). At the peak of construction, approximately 1,000 vehicles would travel to and from the Project Area each day. Vehicles traveling from SR-85 and/or SR-86 and other routes bordered by buffelgrass and other noxious or invasive species, would have increased potential for introducing seeds or propagules from infested roadsides. Approximately 46 vehicles would travel to and from the Project Area during regular operations. Direct and indirect impacts associated with the introduction or spread of noxious and invasive plant species would be greater under the Proposed Action than under the No Action alternative.

4.16.4.3 ALTERNATIVE A: REDUCED WATER USE (DRY-COOLED CST)

Under Alternative A, a 184,906-foot perimeter around the entire Project Area would be at increased risk for the introduction of noxious and invasive plant species into adjacent vegetation communities. Vegetation treatments within the Project Area would be the same as under the Proposed Action. Direct and indirect impacts to vegetation communities from the introduction of noxious or invasive plant species would be the same as under the Proposed Action, but the impact perimeter would be reduced by 13,277 linear feet (6.7%). The number of vehicle trips during peak construction and regular operations would be the same as under the Proposed Action. Direct and indirect impacts associated with the introduction or spread of noxious and invasive plant species into surrounding vegetation communities would be greater under Alternative A than under the No Action alternative, but would be less than would occur under the Proposed Action.

4.16.4.4 SUB-ALTERNATIVE A1: PHOTOVOLTAIC

Under Sub-alternative A1, a 171,309-foot perimeter around the entire Project Area would be at increased risk for the introduction of noxious and invasive plant species into adjacent vegetation communities. Vegetation treatments within the Project Area would be the same as under the Proposed Action, but would occur over a reduced area because of the reduced footprint. Direct and indirect impacts to vegetation communities from the introduction of noxious or invasive plant species would be of the same nature under Sub-alternative A1 as under the Proposed Action, but the impact perimeter would be reduced by 26,874 linear feet (13.6%). The number of vehicle trips during peak construction would be reduced by 733 trips per day (73%), with an associated reduction in direct and indirect impacts that result from the introduction and subsequent spread of noxious and invasive plant species compared to the Proposed Action. Direct and indirect impacts associated with the introduction or spread of noxious and invasive plant species into surrounding vegetation communities would be greater under Sub-alternative A1 than under the No Action alternative, but would be less than would occur under the Proposed Action.

4.16.4.5 ALTERNATIVE B: REDUCED FOOTPRINT

Under Alternative B, a 178,400-foot perimeter around the entire Project Area would be at increased risk for the introduction of noxious and invasive plant species into adjacent vegetation communities. Vegetation treatments within the Project Area would be the same as under the Proposed Action, but would occur over a reduced area because of the reduced footprint. The impact perimeter would be reduced by 19,783 linear feet (10%) compared to the Proposed Action, and associated impacts from noxious and invasive plant species would be proportionally reduced. At the peak of construction, vehicle trips along untreated paved roadways would be reduced by 50 trips (5%) per day to 950 trips, with an associated reduction in direct or indirect impacts that result from the introduction and subsequent spread of noxious and invasive plant species compared to the Proposed Action. Approximately 46 vehicles would travel to and from the Project Area during regular operations, or 12.5% fewer vehicle trips than under the Proposed Action. All other direct and indirect impacts to vegetation communities from the introduction of noxious or invasive plant species would be the same as under the Proposed Action. Direct and indirect impacts associated with the introduction or spread of noxious and invasive plant species into surrounding vegetation communities would be greater under Alternative B than under the No Action alternative, but would be less than would occur under Alternative A or the Proposed Action.

4.16.4.6 REDUCED WATER USE OPTION–BRINE CONCENTRATOR

Under the Proposed Action or Alternative B, the use of a brine concentrator would reduce the volume of wastewater exiting the facility. This option would not change impacts related to noxious and invasive plant species under either the Proposed Action or Alternative B because implementation of the option would entail no additional surface disturbance or changes to the project perimeter than would occur under either alternative.

4.16.4.7 GENERATION TIE LINE OPTION

The application of the Gen-tie Line Option would increase the risk for the introduction of noxious and invasive plant species into adjacent vegetation communities, when compared to the proposed gen-tie line. A perimeter increase of 13,865 feet would occur if the Gen-tie Line Option were applied to the Proposed Action, Alternative A, or Alternative B. This represents approximately a 7% increase in the perimeter of the SSEP compared to these alternatives combined with the proposed gen-tie alignment. A perimeter increase of 18,790 feet would occur if the Gen-tie Line Option were applied to Sub-alternative A1. This represents approximately a 10% increase in the perimeter of the SSEP compared to Sub-alternative A1 combined with the proposed gen-tie alignment. Vegetation treatments and other impacts to vegetation communities from the introduction of noxious or invasive plant species would be the same as under the Proposed Action.

Traffic would not be impacted by the selection of this option because no additional vehicles would be required for its implementation.

4.16.5 Potential Mitigation Measures

In addition to the measures described in Chapter 3 Section 3.16.2, the protective measures described here would minimize or eliminate impacts to vegetation resources from direct and indirect disturbances associated with the Proposed Action and action alternatives. These mitigation measures would help to reduce or eliminate noxious and invasive plant species introduction and would help facilitate the successful restoration of vegetation communities. The following standards would be applicable to vegetation communities, special-status plant species, and noxious and invasive plant species.

4.16.5.1 POTENTIAL MITIGATION MEASURES FOR VEGETATION COMMUNITIES

A detailed reclamation plan would facilitate the prompt reestablishment of vegetation communities following temporary disturbances and project termination. A reclamation plan that includes monitoring and control of invasive and noxious plant species until vegetation is established would further promote successful restoration. The reclamation plan would include, but would not be limited to:

- Reclaim and revegetate all disturbed soils that would not be permanently stabilized by construction.
- Use plants salvaged on-site and/or plant materials native to the surrounding area as revegetation materials. Salvage and replanting of woody native plants and cacti is expected to be more effective than seeding due to the arid climate, vulnerability of the area to weed introduction, and high rates of seed predation.
- Salvage native plants from long-term use and temporary use areas for revegetation activities.
- Control erosion on reclaimed lands prior to seeding using mulch, cover crops, or other approved measures.
- Monitor erosion to identify any need for corrective action during vegetation establishment.
- Create microtopographic or nurse structures (such as rocks and woody debris), as needed, to facilitate plant establishment, prevent erosion, or otherwise promote revegetation success.
- Monitor vegetation establishment and diversity until desired species composition has been achieved.

- Facilitate the recovery of BSCs and vegetation by implementing the following measures:
  - *Salvage:* The objective of inoculation with BSCs is to restore site-appropriate BSC organisms and/or propagules. In short-term disturbance areas where excavation is required, to the extent feasible the top inch of BSC should be removed and retained on-site in an active state, which requires storage in ambient sunlight and moisture regimes (Belnap and Furman 1997). Active BSC organisms can be maintained by spreading salvaged crust materials 1 inch or 2 inches deep to allow sufficient sunlight and moisture to penetrate (Belnap and Furman 1997). In long-term disturbance areas, BSCs should be salvaged to the extent feasible and stored in either an active or dormant state (Belnap and Furman 1997). Active BSCs would be used in reclamation of short-term disturbance areas on-site or off-site. Dormant storage requires that BSCs are stored dry and away from moisture and sunlight (Belnap and Furman 1997). Whenever possible, BSCs should be collected as chunks and not crushed if possible (Belnap and Phillips 2003).
  - *Artificial soil stabilization* The objective of soil stabilization is to prevent soil loss due to wind-erosion or water-erosion. In both temporary and long-term disturbance areas, soils would be stabilized with coarse litter (such as straw or woody debris) and/or the installation of stabilizing vascular plants. As an additional measure, vertical installation of soil stabilizing materials, such as straw, would further enhance BSC recovery by enhancing microtopographic variation while increasing soil stability and moisture-holding capacity (Bowker 2007). Chemical soil stabilizers (e.g., polyacrilimide) have been shown to have either no effect or negative effects on BSCs (Bowker 2007).
  - *Site augmentation*: The objective of site augmentation is to restore the original microtopographic features of the site to the extent feasible, to provide establishment sites for native vegetation, augment wildlife habitat, and to restore drainage patterns. In both temporary and long-term disturbance areas, vascular plant and BSC establishment and recovery would be enhanced by the creation of microtopographic features, such as variations in the soil surface, well-positioned rocks, piles of brush, or coarse woody debris to provide partial shade and capture and hold moisture (Bowker 2007). Site augmentation methods could also include seeding with fast growing perennials to shade the soil (Bowker 2007).
  - *Inoculation*: Inoculation facilitates BSC development by distributing BSC organisms and/or propagules throughout the site (Belnap and Phillips 2003; Bowker 2007). BSC inoculant can include salvaged pieces of BSCs, or crushed BSC materials applied dry or as a slurry. Evidence that BSCs can be stored for long periods of time and retain their inoculant potential (Bowker 2007) indicates that long-term storage of salvaged BSCs is feasible. A commercial BSC inoculant can be used, but the BSC inoculant best suited to on-site conditions would be produced from locally salvaged BSC materials.

    BSC inoculant should be applied following installation of plant materials or propagules (Belnap and Warren 1998). Inoculation of soils below shrub canopies has been shown to promote greater BSC organism recovery compared to the open areas between shrubs (Belnap and Warren 1998). Inoculant should be initially targeted at the soils under shrub canopies or microtopographic features, and spread to plant interspaces as time and materials allow.

4.16.5.2 POTENTIAL MITIGATION MEASURES FOR SPECIAL-STATUS PLANT SPECIES

- Plants protected under Arizona Native Plant Law would be salvaged by local commercial salvage companies or used as on-site revegetation materials in temporary use areas.

4.16.5.3 POTENTIAL MITIGATION MEASURES FOR NOXIOUS AND INVASIVE PLANT SPECIES

The development of a Noxious and Invasive Plant Species Treatment and Control Plan in accordance with contract documents, Arizona State Law, Arizona Revised Statutes, and Executive Orders would mitigate or minimize the direct and indirect impacts described in Section 4.16.4. The management plan would be in accordance with Arizona State Law, Arizona Revised Statutes, and Executive Orders (see Chapter 3 Section 3.16.2). The plan would include, but would not be limited to the following actions:

- Treatment and control of noxious and invasive plant species will not include broadcast treatments. Noxious and invasive species treatments will avoid native vegetation areas whenever possible.
- A list of target species for control will be obtained from the ADOT Roadside Development Section.
- The Noxious and Invasive Plant Species Treatment and Control Plan will include specific protocols for monitoring and treatment of target species infestations.
- Identify, mark, and treat any existing target species infestations in the Project Area to prevent the movement or spread of seeds or root fragments.
- All earth-moving equipment, hauling equipment, and other machinery will be washed with compressed air to remove any attached seeds, roots and rhizomes, and soil or other debris prior to entering or leaving the construction site.
- Verify that any soils or other materials imported for fill or restoration activities are certified as free of noxious and invasive plant species and soil pests.
- Verify that any straw bales or other materials used for stormwater management or other mitigation or restoration activities are ADA-certified as weed free.

4.16.6 Residual Impacts

Impacts from the long-term disturbance and removal of vegetation communities would be the same as the impacts disclosed above because these impacts would remain and could not be mitigated. Residual impacts to special-status plant species due to the salvage or removal of saguaro and other ADA-protected plant species would be the same as the impacts disclosed above because these impacts would remain and could not be mitigated. However, pre-construction surveys to identify and record all affected special-status plant species would reduce the likelihood of protected plants being missed (and subsequently lost) during salvage activities. In addition, impacts to special-status plant species would be reduced where salvaged plants are used in reclamation activities off-site or retained for short-term restoration activities within the Project Area. Long-term disturbance to vegetation communities would be minimized where applicant-committed reclamation and revegetation mitigation measures are implemented immediately following project termination. The implementation of a vegetation reclamation plan would further reduce impacts to vegetation communities by 1) requiring the use of approved plant materials, 2) enforcing measures that would minimize erosion and seed loss, 3) and monitoring vegetation recovery. Impacts to vegetation communities and special-status plant species from the temporary disturbance and removal would be minimized with the implementation of the mitigation measures described in Section 4.16.5.

The implementation of a noxious and invasive plant species management plan would minimize or eliminate impacts to vegetation communities from noxious and invasive plant species. Management practices in the weed management plan would include washing vehicles and equipment prior to entering the Project Area, monitoring of untreated areas and the project perimeter, rapid revegetation of all temporary disturbance areas, and treatment of any identified infestations.

4.16.7 Short-term Uses versus Long-term Productivity

Clearing of vegetation in the Project Area footprint, linear facilities, and transportation and access corridors would negatively impact the long-term productivity of vegetation resources for the life of the project. The vegetation communities present in the Project Area are typically slow to recover following reclamation and restoration activities. Long-term productivity would be lost beyond the life of the project, because restored vegetation communities would require from a minimum of five to ten years (Bean et al. 2004) to more than fifty years (Kade and Warren 2002, Guo 2004) following project termination to be fully restored to pre-project structure and ecological functioning. The rate of recovery would be determined by the restoration methods used and seasonal and long-term climatic conditions (Bean et al. 2004). Until they are fully developed, desert vegetation communities will also possess reduced diversity (Belnap et al. 2001) and less productivity (Garcia-Pichel and Belnap 1996) compared to pre-development conditions. This loss of diversity and functioning occurs where ecologically important habitat components, such as BSCs or other ecological interactions, have been lost. Effective implementation of the mitigation measures described in Section 4.16.5 would minimize impacts to the long-term productivity of vegetation communities.

4.16.8 Irreversible and Irretrievable Commitments of Resources

The applicant-committed measures detailed in Chapter 2 (see Table 2.2) and potential mitigation measures described in Section 4.16.5 would require the reclamation of disturbed areas immediately following temporary disturbances and termination of the project. Long-term disturbance areas would constitute an irretrievable commitment of vegetation resources until active site reclamation and restoration of vegetation takes place. Irreversible commitment of vegetation resources would be limited to any permanently capped project facilities and paved roadways associated with the Proposed Action and alternatives.

4.17 Visual Resources

The visual resources impacts analysis is an assessment of landscape changes that would result from the construction and operation of the SSEP under the Proposed Action and alternatives. As discussed in Chapter 3, visual resources (the landscape) consist of landform (topography and soils), vegetation, bodies of waters (lakes, streams, and rivers), and human-made structures (roads, buildings, and modifications of the land, vegetation, and water). Because changes to the characteristic landscape in the analysis area would be the primary direct impact of the SSEP on visual resources, the relative impacts of each alternative to the characteristic landscape were assessed by comparing visual contrasts (that would result from the construction and operation of the SSEP) with the existing characteristic landscapes surrounding the Project Area. Landscape panorama photographs were recorded to document existing conditions. Visual simulations of the Proposed Action and alternatives were prepared, based on the existing conditions photographs, as seen from all of the KOPs. These simulations are located in Appendix H. Table 4.93 shows the degree of contrast criteria (or the range of potential visual impacts) that were used for this assessment. The degree of contrast criteria are based on the BLM Visual Resource Contrast Rating Manual 8431 (BLM 1986b). The BLM contrast analysis methodology used to assess impacts to the landscape is described below.

Table 4.93 Degree of Contrast Criteria

Degree of Contrast	Criteria
None	The element contrast is not visible or perceived.
Weak	The element contrast can be seen but does not attract attention.
Moderate	The element contrast beings to attract attention and begins to dominate the landscape.
Strong	The element contrast demands attention, will not be overlooked, and is dominant in the landscape.

Source: BLM (1986b).

Contrast analysis is a method by which potential project-related changes to the landscape are assessed. The BLM uses this type of analysis as part of their VRM system to describe landscapes and analyze the impacts to scenic quality; the overall goal of the analysis is to apply a level of objectivity and consistency to the process. Contrast analysis can be summarized as follows: the degree to which a project or activity affects scenic quality depends on the visual contrasts created or imposed by a project on the existing landscape. These imposed contrasts can be measured by comparing the project‘s features with the major features in the existing landscape (BLM 1986b).

The landscape features used to compare the existing landscape with the potentially modified landscape are landscape forms, colors, textures, and lines in the foreground, middleground, and background. Landscape form refers to the unified masses or shapes of the landscape being analyzed, such as existing structures, topography, and natural objects (e.g., conical peaks, rolling grassland, flat river valleys). Landscape color refers to the colors of vegetation, soils, water, rock, sky, and existing structures. Landscape textures are the variations, patterns, density, and graininess of the landscape surface (e.g., uneven, sparse, and randomly spaced shrubs in an arid landscape; dense, tightly packed trees in an old-growth forest); and the dimensions of those surface variations (e.g., tall conifers, low shrubs, short grasses). Linear landscape features are the real or imagined paths that the eye follows when perceiving abrupt changes in form, color, or texture. These are often noticeable as the edge effect created at the boundary of two contrasting areas (e.g., a line of trees along a rocky slope or ledge, the abrupt boundary between forest and grassland, a dark ridgeline silhouetted against a bright sky). It should be noted that all of these observable landscape features (line, form, color, and texture) can be affected by other

environmental factors that include the viewing distance, motion, the angle of view of a project, atmospheric effects (e.g., haze, heat simmer, dust, smoke), lighting conditions, and time of day. These other factors are also included in assessing the potential impacts of projects and activities.

In general, project-related landscape changes that repeat the natural features of the landscape or changes that are well integrated with the existing characteristic landscape features are considered to be in harmony with their surroundings. These changes produce low or weak levels of contrast and are considered to have a low impact on existing visual resources or on the existing scenic values of the landscape. Landscape modifications that do not harmonize with the surrounding landscape are considered to be in moderate to strong contrast with that landscape; that is, the contrasts appear obvious, stand out, and can be aesthetically displeasing to viewers because they are not well-integrated with the existing natural landscape.

Under the BLM contrast analysis method, representative landscape viewpoints (KOPs) are selected for use in analyzing project-related visual impacts. Typically these points are selected from roads, trails, scenic overlooks, road crossings, communities and residences, and campgrounds: places where large numbers of people might be able to view the project for an extended length of time. Visual simulations are created to assist with the impacts analysis from these selected viewpoints. Simulations are created by taking project information (e.g., the dimensions of structures, the areas where vegetation is removed, areas where roads would be built) and then using computer graphic design to overlay images onto photographs. The degree of landscape contrasts (measured as changes in line, form, color, and texture) potentially created by a project are then compared with the existing landscape character and with the scenic management objectives (the designated VRM class objectives) for that area. The comparison allows the evaluator to determine whether the potentially imposed project-related landscape contrasts meet or exceed those designated scenic management objectives. Mitigation measures are used to minimize the visual impacts, even when the impacts meet the visual class objectives. For the SSEP, the project area lies within a designated VRM Class IV area, with management objectives that allow major modifications of the landscape and a high level of change to the landscape.

The SSEP contrast analysis consists of an assessment of visual contrasts resulting from the Proposed Action and action alternatives on the landscape. The assessment was conducted from 19 KOPs. KOPs are critical viewpoints of typical landscapes in the Project Area that a) were selected to represent the views of disturbances throughout the life of the project and that b) would be encountered by the greatest number of people. The KOPs were selected to represent critical viewpoints for each of the three sensitive viewer types (travel routes, recreation areas, and residences), including a variety of viewing conditions (e.g., cloudy, sunny, mid-morning, midday, etc.) and distance zones within the visual analysis area. Distance zones are defined as foreground/middleground (0–5 miles), background (5–15 miles), and seldom seen (screened within foreground/middleground or beyond background). In addition, project-specific distance zones were generated that consider the perception of the project. Using GIS, distance zones were generated and mapped from inventoried moderate and high-sensitivity viewers with potential views of the SSEP on federal land, including residences, recreation areas, and public travel routes (e.g., highways, state routes, and scenic roads), as identified in Section 3. The distance zones are as follows:

- 0–0.25 mile – BLM Foreground Zone
- 0.25–1 mile – BLM Foreground Zone
- 1–3 miles – BLM Foreground Zone
- 3–5 miles – BLM Middleground Zone
- 5 miles and beyond – BLM Background Zone

As noted in Section 3.17, the term *sensitive viewers* refers to BLM VRM sensitive viewing locations and associated KOPs. Eighteen of the 19 KOPs fall within the visual analysis area (see Map 18). KOP 19, identified by special interest groups and located on Quartz Peak in the Sierra Estrella Wilderness, falls outside of the visual analysis area, but it was included because there are superior (high angle of view) viewing positions from the Quartz Peak Trail within the wilderness area. Because the SSEP is proposed on BLM-managed land, the analysis also consists of an assessment of whether the proposed changes to the landscape would meet the BLM's objectives for management of visual resources, as prescribed in the Lower Gila South RMP (BLM 1985). The analysis of impacts to visual resources also considers an assessment of the changes to night sky conditions caused by the Proposed Action and alternatives. Changes to the Bortle Dark-Sky rating class of the Project Area would be the primary direct impact of the SSEP on night sky conditions. The impacts of each alternative to night skies were assessed by comparing the increases in artificial nighttime lighting from the SSEP.

4.17.1 No Action

The current landscape in the visual analysis area is characterized by flat to low desert hills and plains with low vegetative diversity typical of creosotebush flats. Existing human modifications in the Project Area are limited to dirt surface tracks and roads and a single stock pond. Under the No Action alternative, the landscape would continue to be influenced by these factors, and it would meet the BLM's objectives for management of VRM Class IV.

4.17.2 Proposed Action

4.17.2.1 CHANGES TO THE CHARACTERISTIC LANDSCAPE

Under the Proposed Action, the SSEP has three types of facilities that would result in changes to the characteristic landscape: a well field, external linear facilities, and power plants. The power plants would consist of the proposed power blocks, solar fields, evaporation ponds, cooling towers, and HTF land treatment area. The SSEP solar fields, power blocks, and transmission line would occupy approximately 3,313 acres of the approximately 3,620-acre site. Underground gas and water pipelines, access roads, and other support facilities would make up the remainder of the Project Area.

Short-term visual contrasts with the characteristic landscape of the Project Area would result from activities associated with construction of the SSEP. Removal of vegetation, grading (leveling), and trenching would result in visual contrasts to the color and irregular texture and lines of the characteristic landscape over the 39-month construction period. In addition, construction equipment, vehicles, supplies, and associated project activities would be clearly visible during construction activities.

During the long-term operation of the SSEP, the regular geometric forms and strong horizontal and vertical lines associated with the solar fields, power blocks, co-firing boiler stack, and cooling towers would result in a visual contrast with the irregular, organic forms and colors of the existing landform and vegetation. In addition, color contrast associated with the reflective solar thermal troughs would vary throughout the day as the mirrors rotate to track the sun from east to west. Although concentrated light would not be directly reflected toward any of the KOPs, the solar thermal troughs, when viewed from elevated viewing positions at certain times of the day, would reflect the sky, resulting in intermittent bright colors that would sharply contrast with the dull hues of the surrounding tan soils and grey-green vegetation. The proposed transmission line would parallel and repeat the basic visual elements of existing transmission lines that are similar in form, line, and color. The potential impacts caused by construction and operation of the SSEP under the Proposed Action and action alternatives are summarized in Table 4.99 in Section 4.17.2.3 (Key Observation Points).

Numerous parks, monuments, and other special designation areas lie within the visual analysis area. Based on computer analysis of the SSEP's viewshed, the visibility of the SSEP from these special designation areas is summarized in terms of the acres and percentage of each special designation areas (within the analysis area) from which the SSEP would potentially be visible (Table 4.94). This analysis does not factor in buildings, other structures, or vegetative screening; therefore, it is inherently conservative. The analysis was conducted for two cases: 1) the Proposed Action and Alternative A; and 2) Sub-alternative A1, which was assumed to be substantively similar to Alternative B in terms of size and impacts.

Table 4.94 SSEP Visibility from Special Designation Areas within the Visual Analysis Area

	Proposed Action and Alternative A *Acres (% of analysis area)* [1]	Sub-alternative A1 (similar to Alternative B) *Acres (% of analysis area)* [1]
Buckeye Hills Regional Park	2,003 (45.1%)	1,944 (43.8%)
Estrella Mountain Regional Park	6,881 (34.8%)	6,637 (33.6%)
North Maricopa Mountains Wilderness	3,699 (5.8%)	2,708 (4.2%)
Sierra Estrella Wilderness	2,564 (63.7%)	1,213 (63.1%)
Sonoran Desert National Monument	13,933 (11.1%)	12,437 (10.5%)
Woolsey Peak Wilderness	548 (9.5%)	444 (9.2%)

[1] The area in parentheses is the percentage of the special designa ion area that lies within the visual analysis area where he project would be potentially visible.

As discussed below under the Proposed Action and each of the action alternatives, designated VRM Class IV objectives would be met during construction and operation of the SSEP.

4.17.2.2 CHANGES TO VISUAL INVENTORY CAUSED BY THE SSEP

VRI data were developed in consultation with the BLM to develop interim VRI classifications for the SSEP in accordance with BLM VRM policy and IM No. 167-2009. The 375-MW solar plant would occupy approximately 3,528 acres of BLM land within the interim VRI area. The proposed gen-tie line and primary access road would cross approximately 19.8 acres of BLM land within the interim VRI area. The Gen-tie Line Option and primary access road would cross approximately 23.2 to 24.7 acres of BLM land in the interim VRI area. The wells, water pipeline, natural gas pipeline, and access road improvements would require 26.5 acres of BLM land within the interim VRI area.

4.17.2.2.1 Scenic Quality

The project components would occupy (solar facilities) or cross (gen-tie) Class C scenic quality (Table 4.95) on BLM land, which is associated with Rainbow Valley. Class A and B scenic quality associated with the Buckeye Hills and Sonoran Desert National Monument would not be occupied or crossed by the project. Two of the seven landscape factors, vegetation and cultural modification, which contribute to a Class C scenic quality designation would be affected by the project. Approximately 3,528 acres of vegetation would be removed to allow for the construction and operation of the project. In this regard, the local landscape setting would remain modified until the decommissioning plan is implemented and vegetation reoccupied the project ROW. The cultural modification landscape factor would also be affected by the project. Although the existing BLM-designated utility corridors and Hassayampa substation have locally modified the setting, the introduction of the project would further increase the presence of cultural modifications in the landscape. The stronger presence of cultural modifications may further degrade inventoried scenic quality in the project area, although the Class C designation would remain.

Table 4.95 Impacts within Class C Scenic Quality Rating Units

Project Component		Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Sub-alternative A1: Photovoltaic	Alternative B: Reduced Footprint
Main solar field	Acres	3,528	3,528	1,929	2,306
	% of VRI unit[1]	15.7%	15.7%	8.6%	10.3%
Well, water pipeline, and access improvements	Acres	26.5	17.8	20.6	23.1
	% of VRI unit	0.1%	0.08%	0.09%	0.1%
Proposed gen-tie line (with primary access)	Acres	19.8	19.8	19.8	19.8
	% of VRI unit	0.09%	0.09%	0.09%	0.09%
Gen-tie Line Option (with primary access)	Acres	23.2	23.2	24.7	23.2
	% of VRI unit	0.1%	0.1%	0.1%	0.1%

[1] Percentage of VRI unit within interim VRI area

4.17.2.2.2 Sensitivity Level Rating Units

All project components would exclusively occupy or cross BLM land associated with low sensitivity within and adjacent to two BLM-designated utility corridors (Table 4.96). Moderate sensitivity BLM land is associated with BLM land near the Buckeye Hills, north of the Project Area. These areas would not be affected by the project, based on the occurrence of BLM-designated utility corridors and regional cultural modifications including the Hassayampa Substation, prison, and agricultural development. BLM lands associated with high sensitivity include the Sonoran Desert National Monument located south of the Project Area. High sensitivity lands associated with the monument would not be traversed or occupied by the project.

Table 4.96 Impacts within Low Sensitivity Level Rating Units

Project Component		Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Sub-alternative A1: Photovoltaic	Alternative B: Reduced Footprint
Main solar field	Acres	3,528	3,528	1,929	2,306
	% of VRI unit[1]	18.2%	18.2%	10.0%	11.9%
Well, water pipeline, and access improvements	Acres	26.5	17.8	20.6	23.1
	% of VRI unit	0.1%	0.09%	0.1%	0.1%
Proposed gen-tie line (with primary access)	Acres	19.8	19.8	19.8	19.8
	% of VRI unit	0.1%	0.1%	0.1%	0.1%
Gen-tie Line Option (with primary access)	Acres	23.2	23.2	24.7	23.2
	% of VRI unit	0.1%	0.1%	0.1%	0.1%

[1] Percent of VRI unit within the interim VRI area

4.17.2.2.3 Distance Zones

All project components would be located in the foreground/middleground distance zone for all BLM land (Table 4.97) crossed by the project, based on views from Komatke Road, SR-85, and the Sonoran Desert National Monument. No other distance zones would be crossed or occupied.

Table 4.97 Impacts within Foreground/Middleground Distance Zones

Project Component		Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Sub-alternative A1: Photovoltaic	Alternative B: Reduced Footprint
Main solar field	Acres	3,528	3,528	1,929	2,306
	% of VRI unit[1]	13.1%	13.1%	7.2%	8.6%
Well, water pipeline, and access improvements	Acres	26.5	17.8	20.6	23.1
	% of VRI unit	0.1%	0.07%	0.08%	0.09%
Proposed gen-tie line (with primary access)	Acres	19.8	19.8	19.8	19.8
	% of VRI unit	0.07%	0.07%	0.07%	0.07%
Gen-tie Line Option (with primary access)	Acres	23.2	23.2	24.7	23.2
	% of VRI unit	0.08%	0.08%	0.09%	0.08%

[1] Percent of VRI unit within the interim VRI area

4.17.2.2.4 VRI Classes

The BLM land crossed or occupied by all project components has been identified as VRI Class IV (Table 4.98). Isolated areas of VRI Class III are associated with low lands in the Sonoran Desert National Monument and foothills of the Buckeye Hills. VRI Class II is limited to the foothills and Maricopa Mountains within the Sonoran Desert National Monument. VRI Classes II and III would not be traversed or occupied by the project. VRI Class I does not occur within the interim VRI area.

Table 4.98 Impacts within Class IV Visual Resource Inventory Classification

Project Component		Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Sub-alternative A1: Photovoltaic	Alternative B: Reduced Footprint
Main solar field	Acres	3,528	3,528	1,929	2,306
	% of VRI unit[1]	18.2%	18.2%	10.0%	11.9%
Well, water pipeline, and access improvements	Acres	26.5	17.8	20.6	23.1
	% of VRI unit	0.1%	0.09%	0.1%	0.1%
Proposed gen-tie line (with primary access)	Acres	19.8	19.8	19.8	19.8
	% of VRI unit	0.1%	0.1%	0.1%	0.1%
Gen-tie Line Option (with primary access)	Acres	23.2	23.2	24.7	23.2
	% of VRI unit	0.1%	0.1%	0.1%	0.1%

[1] Percent of VRI unit within the interim VRI area

4.17.2.3 KEY OBSERVATION POINTS

Based on the viewshed analysis described in the Affected Environment, Chapter 3, 19 KOPs were selected to represent critical and representative viewpoints for each of the three sensitive viewer types: travel routes, recreation areas, and residences (see Map 18). Selected KOPs also represent different viewing elevations and distance zones relative to the proposed SSEP. KOPs that would be visually screened from the SSEP by topography and/or vegetation would observe little to no change and are described below. The visual contrast visible from the KOPs would range from weak to moderate when the KOP occurs at a similar elevation to the SSEP to moderate to strong when the KOPs are at a higher elevation (a superior perspective) to the SSEP.

A visual resource assessment for the SSEP was completed, including visual contrast ratings and photographic visual simulations (Johnson 2009). Visual contrast ratings were completed for each of the 19 KOPs. Photographic simulations were prepared for all KOPs, and they are representative of the three sensitive viewer types, different viewing elevations, and distances. See Appendix H for photographic simulations and landscape views as seen from each KOP. It should be noted that a range of environmental factors and conditions were considered during the contrast rating assessments, besides landscape lines, forms, colors, and textures. The BLM contrast analysis method requires that angle of observation, length of time the project is in view, project size and scale, season of use, lighting or atmospheric conditions, vegetation regrowth in disturbed areas, spatial relationships landscape forms, and motion within the landscape be considered (BLM 1986). The contrast analyses described below considered these factors; when and where applicable to the analyses, they were noted in the contrast rating.

4.17.2.3.1 Travel Routes

- KOP 5 (Komatke Road): The solar fields, power block stacks, pipeline, and transmission line route would be visible in the foreground distance zone (1 mile) from this KOP. The line and color contrast from these structures would be moderate to strong throughout the day. Komatke Road is within the BLM-designated utility corridor and provides unpaved access for utility maintenance. The duration of viewing would depend on speed as the viewer travels along the length of the road. Travel toward the facility (from the east or west) would result in more prominent views of the facility than travel away from the facility. Travelers also use this route to access the Sonoran Desert National Monument, and those travelers have a higher expectation for aesthetics (e.g., natural or undeveloped landscapes). The transmission line and power block would be backdropped by the Buckeye Hills. Views of the solar fields would be partially screened by existing vegetation, which would reduce the contrasts created by the power block stacks. The project would also be viewed in the context of existing modifications, including two BLM-designated utility corridors (one that parallels Komatke Road), the minerals plant, regional landfill, and switchyard.
- KOP 7, 8 (SR-85): The SSEP would be visible from a level viewing position for a short duration (approximately 2 minutes) in the middleground distance zone (3.75 miles) from these KOPs. Visibility of the SSEP would be limited to the power blocks and transmission line within the context of the tie-in point into the Jojoba Switchyard. Existing modifications that are visible from these KOPs include the regional landfill and facilities within two BLM-designated utility corridors. The regular geometric forms and strong form and lines associated with the power block stacks and transmission line would result in a moderate visual contrast with the irregular, organic forms of the existing landform and vegetation. The distance and timing from this KOP would further reduce visual contrasts to weak or none. Atmospheric haze, heat shimmer, and fugitive dust from wind-blown exposed soil would also contribute to reducing visual contrasts by obscuring the views of the project area. These effects would have greater obscuring impacts with increased viewer distance from the Project Area. Atmospheric effects would be applicable to all of the KOP middleground views.

- KOP 11 (Rainbow Valley Road): The SSEP would be visible in the middleground distance zone (4 miles) from this KOP, though it would be partially screened by vegetation. As a result of the distance and vegetative screening, there would be weak visual contrast visible from this KOP.
- KOP 16 (Riggs Road): Travelers along this route would have level foreground views (approximately 1 mile) of the solar fields associated with the SSEP. The associated gas and water pipeline routes paralleling Riggs Road (within 0.25-mile foreground distance zone) would be visible, but they would mimic the form, line, and color of the existing road resulting in weak visual contrast with the existing landscape. The newer, project-related structures would be compatible with the existing surface disturbances caused by the road and would thus present a low degree of contrast.

4.17.2.3.2 Recreation Areas

- KOP 1 (North Maricopa Mountains Wilderness): The North Maricopa Mountains Wilderness is associated with high sensitivity viewers. KOP 1 is within the North Maricopa Mountains Wilderness and would be approximately 3.0 miles south of the SSEP. Dispersed recreation users at higher elevations or peaks would have superior views of the entire SSEP in the foreground/middleground distance zone. High sensitivity viewers would experience weak to moderate contrast levels. Vertical structures associated with the SSEP (e.g., cooling stacks) would be backdropped by the Buckeye Hills to the northwest. The solar fields would be visible, and the reflection of variable sky conditions would be intermittently visible from this KOP, although it would be seen in the context of existing modifications, including transmission lines in the BLM-designated utility corridor (located approximately 1 mile north of the KOP location).
- KOP 2, 6, 19 (Sonoran Desert National Monument): The Sonoran Desert National Monument includes recreation travel routes, multiuse trails, and trailheads associated with the Sonoran Desert National Monument and North Maricopa Mountains Wilderness. Dispersed recreation users at higher elevation trails or peaks would have superior views of the entire SSEP in the foreground distance zone (1.25 miles) from these KOPs. The transmission line and structures associated with the power block would be backdropped by the surrounding landforms and the Buckeye Hills. The solar field would be clearly visible, and the reflective color contrast would be strong throughout the day from the elevated viewpoints. Existing modifications that are visible from these KOPs in the Sonoran Desert National Monument include the mineral plant, regional landfill, and transmission lines in the two BLM-designated utility corridors (one that parallels Komatke Road).
- KOP 3, 4 (Margie‘s Cove Road, West): This route is one of the few designated recreation access roads within the Sonoran Desert National Monument. Margie‘s Cove Road is a primitive four-wheel drive (4WD) recreation route. The SSEP would be clearly visible to motorists traveling west on Margie‘s Cove Road, The SSEP would come into view within the foreground distance zone, approximately 0.25 to 0.50 mile of the Komatke Road junction (KOP 3) looking north. For KOP 3, the contrast would be moderate to strong for high sensitivity viewers with level foreground views (1.25 miles) of the project. Moderate to strong contrast is anticipated for viewers with superior foreground views (approximately 2.75 miles) of the project for KOP 4. The SSEP would be intermittently screened by topography and vegetation for portions of this route between 0.50 and 1.75 miles (KOP 4), and at this distance it would be seen in context with facilities located in the existing BLM utility corridor. Topography would completely screen the SSEP after 2 miles as this route continues south into the Sonoran Desert National Monument. Views of the SSEP would be completely screened by topography for motorists traveling east on Margie‘s Cove Road.

- KOP 9 (Buckeye Hills Regional Park): The SSEP would be completely screened by topography and vegetation from the entire park.
- KOP 18 (Sierra Estrella Wilderness, Quartz Peak Trail/Quartz Peak Trailhead): The Quartz Peak Trail would be approximately 18 miles from the SSEP and would have superior views of the SSEP in the background distance zone. Contrast resulting from the project would be strong from Quartz Peak. The entire facility would be visible from the KOP; however, at this distance, the geometric patterns associated with the SSEP would mimic and repeat the existing modifications associated with agricultural fields and development also visible from the trail. Reflections of the sky in the solar thermal troughs would be visible intermittently throughout the day depending on meteorological conditions. The bright reflective mirrors would contrast with the dull hues of the existing developments, fields, and surrounding tan soils and gray-green vegetation.

4.17.2.3.3 Residences

The SSEP would be completely screened by topography from residences located in Buckeye, Estrella Mountain Ranch, Palo Verde, Cotton Center, Arlington, Liberty, and Perryville.

- KOP 10 (Ray Road): Residences along Ray Road would have level views of the proposed solar fields and power block stacks located in the middleground distance zone (4 miles). Topography and vegetation would partially screen the SSEP, and the SSEP would be viewed in the context of existing landscape modifications. The regular geometric forms and strong form and lines associated with the solar fields and power block stacks would result in a weak to moderate contrast with the irregular, organic forms of the existing landform and vegetation. The distance from this KOP would further reduce contrast.
- KOP 12 (Queen Creek Road): Residences along Queen Creek Road would have level views of the proposed solar fields, power block, and transmission line route in the foreground distance zone (approximately 0.85 mile) that would be partially screened by vegetation. The regular geometric forms and strong form and lines associated with the solar fields, power block, and transmission line would result in a moderate to strong contrast with the irregular, organic forms of the existing landform and vegetation. Because views of the SSEP would be partially screened by vegetation, contrast would be reduced.
- KOP 13 (Ocotillo Road): Residences along Ocotillo Road would have an unobstructed, clear view of portions of the SSEP. The regular geometric forms and strong lines associated with the SSEP would result in a strong contrast with the irregular lines and dull colors of the surrounding soils and vegetation intermittently throughout the day. Existing structures and facilities that have modified the landscape are not visible from this distance zone and KOP.
- KOP 14 (Chandler Heights Road): Residences along Chandler Heights Road would have level views of the SSEP in the foreground distance zone (approximately 0.25 mile). Although residences would be located immediately adjacent to the SSEP, vegetation would screen most of the SSEP from view. The regular geometric forms and lines associated with the solar fields, power block, and transmission line would result in a moderate contrast with the irregular, organic forms of the existing landform and vegetation. Because most of the SSEP would be screened from view by vegetation, contrast would be reduced. Existing structures and facilities that have modified the landscape are not visible from this distance zone and viewing position.
- KOP 15 (South Hayes Road): Although residences would be located immediately adjacent to the SSEP, vegetation would partially screen those views. Existing modifications to the landscape are not visible in this distance zone. There would be a moderate contrast with the irregular lines and dull colors of the surrounding soils and vegetation.

- KOP 17 (195th Avenue): Residences would have a partially screened view of the solar fields within the foreground distance zone (approximately 2 miles). The power block and transmission line would be backdropped by the adjacent terrain. The pipeline routes would be completely screened by vegetation. The regular geometric forms and strong form and lines associated with the solar fields would result in a moderate contrast with the irregular, organic forms of the existing landform and vegetation. Because views of the SSEP, including the pipeline routes, would be partially screened by vegetation, contrast would be reduced.

The potential impacts caused by construction and operation of the SSEP under the Proposed Action and action alternatives are summarized in Table 4.99.

Table 4.99 Proposed Action and Action Alternatives Summary of Impacts by KOP

KOP by Sensitive Viewing Category	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Sub-alternative A1: Photovoltaic	Alternative B: Reduced Footprint
Travel Routes				
KOP 5 (Komatke Road)	Moderate to strong line and color contrasts from structures	Same as Proposed Action, except color contrasts reduced from reduction in pond size	Weak to moderate foreground contrasts; impacts reduced by vegetation screening	Same as Proposed Action, except contrasts reduced by a smaller project area
KOP 7, 8 (SR-85)	Moderate form contrasts, but distance and timing would reduce to weak	Same as Proposed Action	Weak foreground contrasts; no impacts in middleground from vegetation and topographic screening	Same as Proposed Action
KOP 11 (Rainbow Valley Road)	Weak contrasts	Same as Proposed Action	Weak contrasts from superior views of project; negligible middleground and background views from vegetation and topographic screening	Same as Proposed Action
KOP 16 (Riggs Road)	Weak contrasts	Same as Proposed Action	Weak to moderate contrasts in level foreground/middleground; negligible level foreground impacts from vegetation screening	Same as Proposed Action
Recreation Areas				
KOP 1 (Maricopa Wilderness)	Weak to moderate contrasts in foreground/middleground from superior views of project area	Same as Proposed Action, except color contrasts reduced from reduction in pond size	Weak to moderate middleground contrasts from superior views of project area	Same as Proposed Action, except contrasts reduced by a smaller project area
KOP 2, 6, 19 (Sonoran Desert Wilderness)	Strong, foreground/middleground color contrasts from solar field, from elevated, superior views	Same as Proposed Action, except color contrasts reduced from reduction in pond size	Moderate to strong foreground/middleground contrasts, from elevated, superior views of project	Same as Proposed Action, except contrasts reduced by a smaller project area
KOP 3, 4 (Margie‘s Cove Road)	Moderate to strong foreground/middleground contrasts, from elevated and level views	Same as Proposed Action, except color contrasts reduced from reduction in pond size	Weak, level, foreground contrasts at KOP 3; weak to moderate, superior view, foreground contrasts at KOP 4	Same as Proposed Action, except contrasts reduced by a smaller project area and increased vegetation and topographic screening

Table 4.99 Proposed Action and Action Alternatives Summary of Impacts by KOP

KOP by Sensitive Viewing Category	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Sub-alternative A1: Photovoltaic	Alternative B: Reduced Footprint
KOP 9 (Buckeye Hills Park)	No impacts, from total vegetation and topographic screening	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
KOP 18 (Sierra Estrella Wilderness, Quartz Peak Trail)	Strong color contrasts from superior views of project	Same as Proposed Action, except color contrasts reduced from reduction in pond size	Weak to moderate contrasts	Same as Proposed Action, except contrasts slightly reduced by smaller project area
Residences				
KOP 10 (Ray Road)	Weak to moderate form contrasts in the middleground, with partial topographic and vegetation screening; impacts reduced by distance	Same as Proposed Action	Weak contrasts; complete topgraphic and vegetation screening of project	Same as Proposed Action
KOP 12 (Queen Creek Road)	Moderate to strong form contrasts in the foreground; contrasts reduced by vegetation screening	Same as Proposed Action	Weak contrasts; complete foreground topographic and vegetation screening of project	Same as Proposed Action
KOP 13 (Ocotillo Road)	Strong line and form contrasts; unobstructed views of project	Same as Proposed Action	Weak contrasts in foreground/middleground; level foreground views partially screened by vegetation	Same as Proposed Action
KOP 14 (Chandler Heights Road)	Moderate form and line contrasts in the foreground; impacts reduced by vegetation screening	Same as Proposed Action	Weak foreground contrasts; impacts reduced by vegetation screening	Same as Proposed Action
KOP 15 (South Hayes Road)	Moderate, foreground line and color contrasts; impacts reduced by vegetation screening	Same as Proposed Action	Weak foreground contrasts	Same as Proposed Action
KOP 17 (195th Avenue)	Moderate, foreground form and line contrasts; impacts reduced by vegetation screening	Same as Proposed Action	Weak foreground/middleground contrasts, reduced by vegetation and topographic screening;	Same as Proposed Action

4.17.2.4 BLM VISUAL RESOURCE MANAGEMENT OBJECTIVES

VRM objectives for public lands in the Project Area are Class IV. Under the BLM VRM system, the objective of Class IV is to provide for management activities that require major modifications to the existing character of the landscape. These activities may dominate the view and may be the major focus of viewer attention (BLM 1986a). Under the Proposed Action, the level of change to the characteristic landscape would range from weak to strong, based on the visual resource contrast analysis, and would meet BLM VRM Class IV objectives.

4.17.2.5 NIGHTTIME LIGHTING AND EXTENT OF SKYGLOW

Lighting for the SSEP under the Proposed Action would be designed to provide the minimum illumination needed to achieve safety and security objectives. Lighting would be shielded and directed to focus illumination downward on the desired areas and to minimize additional nighttime illumination from the SSEP. Because of the level of artificial lighting being introduced at the SSEP, skyglow resulting from the Proposed Action would not contribute to an increase in the existing skyglow and would not result in a change to the Bortle Dark-Sky rating Class 5. Under Class 5, artificial light sources are visible in most, if not all, directions, and clouds are noticeably brighter than the sky. Existing artificial light sources include residences of Rainbow Valley, the nearby landfill, tree nursery, minerals plant, and prison. Phoenix is the largest source of nighttime light and skyglow in the region, and is approximately 30 miles from the Project Area.

4.17.2.6 GLINT AND GLARE

Glint is defined as a bright, momentary flash of light; *glare* is defined as a more continuous and sustained presence of light that may appear to ~~-s~~parkle" from public viewing locations. Although a visible light study has not been conducted for this project, the following conclusions are based on a literature review of glint and glare studies for solar power facilities and the *Draft Programmatic Environmental Impact Statement (DPEIS) for Solar Development in Six Southwestern States* (BLM and DOE 2010). In general, all action alternatives would produce glint and glare that could be visible to the viewing public and would increase contrast for all KOPs with views of the SSEP. However, this increase to contrast would be intermittent or limited to certain times of the day for some sensitive viewers.

Sensitive viewers with superior views of the SSEP may be affected by glint and glare throughout the day, because larger portions of the Project Area would be visible. In addition to viewer elevation, contrast associated with glint and glare is anticipated to decrease as distance between the SSEP and the viewer increases (BLM 2010). Studies indicate that luminance (light intensity) diminishes over distance exponentially; thus views from 5.3 miles or more would see levels significantly lower than that of a 50-watt bulb at 9.8 feet (BLM 2011b).

Under the Proposed Action, when solar troughs are moving into or out of stow position (shortly before dawn or after dusk), they could produce glint and glare (BLM 2010). For sensitive viewers with unobstructed level views of the SSEP, glint and glare associated with movement times would be generally limited to the first row of solar troughs. Solar troughs have highly reflective surfaces and at certain times of the day would replicate the sky. Reflections from these highly reflective surfaces result from unabsorbed light, which has a greater potential to produce glint and glare. KOPs (travel routes, recreation areas, and residences) that may have views of glint and glare for the project are discussed below.

4.17.2.6.1 Travel Routes

Travelers along SR-85 (KOPs 7 and 8) are associated with level views of the SSEP, which would occur at a distance of 3.75 miles within the middleground distance zone and would most likely not be affected by glint and glare with the project due to vegetation screening. Komatke Road (KOP 5) and Riggs Road (KOP 16) are also associated with level views of the project, which would be screened by vegetation; therefore, travel route viewers at a level viewing position would most likely not be affected by glint and glare.

Travel route viewers along Rainbow Valley Road (KOP 11) would have slightly superior views of the SSEP within the background distance zone (5 miles), and may have views of glint and glare. The project would be viewed in the background distance zone; therefore, contrast would be greatly reduced by distance.

4.17.2.6.2 Recreation Areas

Generally, dispersed recreation viewers associated with the Sonoran Desert National Monument (KOPs 2, 3, 4, 6, and 19), North Maricopa Mountains Wilderness (KOP 1), and Quartz Peak (KOP 18) would have elevated or superior views of the SSEP. Glint and glare for the SSEP would be visible from these dispersed superior viewing conditions, because a larger portion of the Project Area would be apparent. Glint and glare associated with early morning movement of the troughs may be visible for a limited duration from KOP 1, which is located southeast of the SSEP within the foreground/middleground distance zone (approximately 4 miles). KOPs 2, 3, 4, 6, and 19 are located directly south of the SSEP and would be in the foreground/middleground distance zone (between 1.5 and 2 miles). Contrast associated with glint and glare would not be greatly reduced for these KOPs, due to the proximity and superior views of the entire Project Area. Dispersed recreation viewers at Quartz Peak (KOP 18) would have superior views within the background distance zone (approximately 18 miles), which would greatly reduce contrast associated with glint and glare.

4.17.2.6.3 Residences

Residences along Ocotillo Road (KOP 13) would have partially screened views of the SSEP, which would be visible within 0.125 mile (foreground distance zone). These residences would be more likely to experience glint and glare associated with the solar troughs. Contrast associated with glint and glare would be limited to certain times of the day, primarily early morning, when the solar troughs are moving out of stow position and are directed toward the east. Residences along Chandler Heights Road (KOP 14) and Hayes Road (KOP 15) would have partially to completely screened views of the SSEP within 0.5 mile (foreground distance zone). For portions of the SSEP that are unscreened (limited to the first row of solar troughs upper portions), residences may have views of glint and glare during the early morning.

4.17.3 Alternative A: Reduced Water Use (dry-cooled CST)

4.17.3.1 CHANGES TO THE CHARACTERISTIC LANDSCAPE

Changes to the characteristic landscape from construction and operation actions associated with Alternative A would be similar to those described for the Proposed Action. Under Alternative A, the SSEP would not require wet cooling towers, and the six evaporative ponds would be 2 acres in size for the 125-MW unit and 4 acres for the 250-MW unit, instead of 10 acres and 20 acres, respectively, under the Proposed Action.

The cooling towers would be replaced with an ACC in each power block, as well as two "wet surface air coolers" that would be used for auxiliary cooling. Replacing the vertical cooling towers in the SSEP would result in reduced visual contrast to the irregular forms and lines of the current landscape visible from KOPs with level views. A reduction in the size of the evaporative ponds would result in less reflective color contrast visible from the following KOPs (which would be at a higher elevation than the SSEP):

- KOP 5 (Komatke Road)
- KOP 1 (North Maricopa Mountains Wilderness)
- KOP 2, 6, 19 (Sonoran Desert National Monument)
- KOP 3, 4 (Margie's Cove Road, West)
- KOP 18 (Sierra Estrella Wilderness, Quartz Peak Trail/Quartz Peak Trailhead)

4.17.3.2 CHANGES TO VISUAL INVENTORY CAUSED BY THE SSEP

Under Alternative A, changes to the visual inventory caused by the SSEP would be the same as described under the Proposed Action, except that the project would occupy less area (Tables 4.95–4.98). As under the Proposed Action, construction and operation of the SSEP would occur exclusively within lands with low visual sensitivity, Class C scenic quality, and in the foreground/middleground distance zone. The project may further degrade inventoried scenic quality in the Project Area due to a stronger presence of cultural modifications, although the Class C designation would remain.

4.17.3.3 KEY OBSERVATION POINTS

Under Alternative A, the contrast perceived by viewers at each KOP would be the same as under the Proposed Action, except that contrast would be slightly diminished due to the smaller evaporation ponds under this alternative. See Table 4.99 for a comparison of visual contrast between alternatives.

4.17.3.4 BLM VISUAL RESOURCE MANAGEMENT OBJECTIVES

VRM objectives under Alternative A are the same as under the Proposed Action. The level of change to the characteristic landscape would range from weak to strong, based on the visual resource contrast analysis, and would meet BLM VRM Class IV objectives.

4.17.3.5 NIGHTTIME LIGHTING AND EXTENT OF SKYGLOW

Nighttime lighting and skyglow would be the same under Alternative A as under the Proposed Action because the design and configuration of the SSEP would be the same under these alternatives except for the cooling method. As under the Proposed Action, the SSEP under Alternative A would meet BLM VRM objectives for the area.

4.17.3.6 GLINT AND GLARE

The impacts from potential glint and glare would be the same under Alternative A as under the Proposed Action.

4.17.4 Sub-alternative A1: Photovoltaic

4.17.4.1 CHANGES TO THE CHARACTERISTIC LANDSCAPE

Changes to the characteristic landscape from construction and operation activities associated with Sub-alternative A1 would be similar to those described for the Proposed Action and Alternative A, except that there would be fewer changes due to the reduction in the project footprint, changes in equipment and materials, and the resulting changes to contrast levels. Contrast levels would change from predominately moderate (with strong contrasts at a few locations) under the Proposed Action to predominately weak (with moderate contrasts at a few locations) under Sub-alternative A1. Due to the existing industrial facilities, the contrast would be low both locally and regionally. The SSEP under this sub-alternative would use PV technology and would cover approximately 2,013 acres of land (1,607 fewer acres than under the Proposed Action) that would consist of the proposed PV panel arrays, inverter transformer sets, operations and maintenance buildings, and linear facilities, such as the access road, gen-tie line, water pipeline, and well field.

Visual changes due to the geometric forms, vertical lines, and concentrated light associated with the structural components of the SSEP would be the same as under the Proposed Action, except that concentrated light would not be reflected toward any sensitive viewer because PV panels are designed to minimize light reflectance. PV solar arrays would appear to be a dark color, typically appearing dark blue, when viewed from slightly elevated to superior viewing positions at certain times of the day.

4.17.4.2 CHANGES TO VISUAL INVENTORY CAUSED BY THE SSEP

Under Sub-alternative A1, changes to the visual inventory caused by the SSEP would be the same as described under the Proposed Action, except that the project would occupy less area (Tables 4.95–4.98). As under the Proposed Action, construction and operation of the SSEP would occur exclusively within lands with low visual sensitivity, Class C scenic quality, and in the foreground/middleground distance zone. The project may further degrade inventoried scenic quality in the Project Area due to a stronger presence of cultural modifications, although the Class C designation would remain.

4.17.4.3 KEY OBSERVATION POINTS

Please see Section 4.17.2.3 (Key Observation Points) for information on the selection of the KOPs for the analysis. Impacts under this alternative are the same as the Proposed Action unless otherwise noted.

4.17.4.3.1 Travel Routes

- KOP 5 (Komatke Road): Contrast would be weak to moderate for moderate sensitivity viewers with level views of the project (PV panel arrays and gen-tie line route alternatives) in the foreground distance zone (1 mile). In this distance zone, views of the panel arrays would be completely screened by vegetation. As described for the Proposed Action, this route lies within an existing utility corridor, an area typically associated with low visual sensitivity. Travelers to and from the Sonoran Desert Nation Monument raise this area to a level of moderate sensitivity.
- KOP 7, 8 (SR-85): The SSEP would be visible for a short duration in the foreground/middleground (0–5 miles) distance zone between the Arizona State Prison Complex-Lewis and the Buckeye Hills. Views of the SSEP along all other portions of this route would be level and completely screened by topography (KOPs 7 and 8). Overall, contrast would be weak for moderate sensitivity viewers using SR-85. The SSEP (PV solar arrays, access road, water pipeline, and well site) would be obstructed by vegetation and topography for viewers in the middleground distance zone (approximately 3.75 miles). Also, viewing would be in the context of the regional landfill and two BLM-designated utility corridors; therefore, impacts from the project would be reduced by surrounding development.

- KOP 11 (Rainbow Valley Road): Topography, vegetation, and development would partially or completely screen SSEP facilities (in the background distance zone) along most portions of this route. Moderate sensitivity viewers with superior views of the Project Area would see weak contrasts between the facility and surrounding landscape. The SSEP PV panel arrays would be viewed in the background distance zone (5 miles), and visibility of the SSEP would be minimized due to screening by vegetation. In addition to vegetation screening, the surrounding landscape has been modified by agricultural and commercial development; therefore, impacts from the project would be reduced by surrounding development.
- KOP 16 (Riggs Road): The SSEP would be located in the foreground/middleground distance zone from this route, and views of its facilities would be partially screened by vegetation. A weak to moderate contrast is anticipated for moderate sensitivity viewers with level views of the SSEP. Travelers using this route would also have foreground views (approximately 1 mile) of the PV panel arrays, which are associated with a moderate-strong level of visual change. However, at a level viewing condition, views of the PV panel arrays would be completely screened by vegetation.

4.17.4.3.2 Recreation Areas

- KOP 1 (North Maricopa Mountains Wilderness): Dispersed recreation users at higher elevations or peaks would have superior views of the entire project in the middleground distance zone. The project would create weak to moderate contrasts. The project would be visible, but would be seen in the context of existing development that includes the BLM-designated utility corridor.
- KOP 2, 6, 19 (Sonoran Desert National Monument): Dispersed recreation users at higher elevation trails or peaks would have superior views of the entire project in the foreground/middleground distance zone. High sensitivity viewers would see a moderate-strong contrast due to superior views of the entire proposed facility in the foreground distance zone (1.25 miles).
- KOP 3, 4 (Margie‘s Cove Road, West and East): For Margie‘s Cove Road West (KOP 3), contrasts would be weak for high sensitivity viewers with level foreground views (1.25 miles) of the SSEP rather than moderate to strong because of intermittent vegetation and topographic screening between 0.5 and 1.75 miles, and it would be seen in the context of the existing utility corridor. After 2 miles, the project would be completely screened by topography. For Margie‘s Cove Road East (KOP 4), weak to moderate contrast is anticipated for viewers with superior foreground views (approximately 2.75 miles) of the SSEP rather than a moderate to strong contrast as in under the Proposed Action.
- KOP 18 (Sierra Estrella Wilderness, Quartz Peak Trail/Quartz Peak Trailhead): The contrast resulting from the SSEP would be weak to moderate from Quartz Peak. The superior views at higher elevations from this KOP would be just beyond the background distance zone (at approximately 18 miles); therefore, the long viewing distance would mitigate the view of the Project Area.

4.17.4.3.3 Residences

- KOP 10 (Ray Road): The SSEP visual contrasts would be weak for high sensitivity residential viewers (located approximately 5 miles to northeast of the Project Area). Residents along the eastern portion of the road would have limited views of the project. These residents would have level views, and topography and vegetation would completely screen middleground views of the project, rather than partially screen the project, as under the Proposed Action.
- KOP 12 (Queen Creek Road): Overall, weak contrast is anticipated for high sensitivity residential viewers along Queen Creek Road. Residential viewers would have level views of the proposed PV panel arrays in the foreground distance zone (approximately 1.6 miles); however, views would be completely screened by vegetation.

- KOP 13 (Ocotillo Road): Residences adjacent to the eastern side of the Project Area would have level foreground/middleground views that would be partially screened by vegetation. Although residences along Ocotillo Road lie near the SSEP (at approximately 1 mile), vegetation screening would obstruct views of the PV panel arrays and would produce weak project visual contrasts.
- KOP 14, 15 (Residences along Chandler Heights and Hayes Road): High sensitivity residential viewers would see weak visual contrasts. Residences would have level views of SSEP facilities in the foreground distance zone (at approximately 1.4 miles from the Project Area); however, existing vegetation would partially screen views of the PV panel arrays.
- KOP 17 (195th Avenue): Residences located to the southeast of the Project Area (approximately 3 miles) may have partially to completely screened foreground/middleground views of the project. Within the middleground distance zone of the Project Area (approximately 3 miles), residences would have completely screened level views of the PV panel arrays; however, the proposed gen-tie line and the Gen-tie Line Option would be backdropped by adjacent terrain, creating weak visual contrasts.

4.17.4.4 BLM VISUAL RESOURCE MANAGEMENT OBJECTIVES

VRM objectives under Sub-alternative A1 are the same as under the Proposed Action, with the Project Area sitting within designated VRM Class IV landscapes in both cases. Under VRM Class IV, management objectives allow for major landscape modification and the level of change can be high. Project activities are allowed to dominate the landscape and be a focus of casual viewer attention; however, management objectives require that every effort be made to mitigate the impacts of activities. Under this alternative, the level of change to the characteristic landscape would range from weak to strong, based on the visual resource contrast analysis, and it would meet BLM VRM Class IV objectives.

4.17.4.5 NIGHTTIME LIGHTING AND EXTENT OF SKYGLOW

Nighttime lighting and the extent of skyglow would be the same as under the Proposed Action, except that it would be reduced by approximately 30% due to the smaller project footprint.

4.17.4.6 GLINT AND GLARE

PV panels do not have an equivalent stow position as solar troughs because the panels are much less susceptible to damage from high wind events or debris. A PV plant with single-axis tracking technology typically stows between 0 and 20 degrees above horizontal when not in operation. The range of motion for these trackers is confined to the angles at which they would track the sun: generally 45 degrees above horizontal in either direction. A typical fixed panel PV plant has panels installed at approximately 20–35 degrees above horizontal and are permanently fixed in a southern facing skyward direction; therefore, no movement of the panels is possible.

Sub-alternative A1 would be significantly less reflective because PV panel surfaces are designed specifically not to reflect light, thus reducing the potential for glint and glare (U.S. Air Force 2011). In addition, the PV panels of this alternative would have a lower profile than the solar troughs of the Proposed Action (approximately 20 feet tall), which would reduce visibility when viewed from level viewing positions. Overall, Sub-alternative A1 would minimize the potential for glint and glare because of the less reflective panel surfaces, smaller structures, and reduced project footprint.

KOPs that may have views of glint and glare for Sub-alternative A1 are discussed below.

4.17.4.6.1 Travel Routes

Travel route glint and glare impacts under Sub-alternative A1 would be the same as under the Proposed Action, with one exception. Along Rainbow Valley Road (KOP 11), views of glint and glare may have slightly lower contrast levels than those under the Proposed Action due to differences in technology.

4.17.4.6.2 Recreation Areas

Recreation area glint and glare impacts under Sub-alternative A1 would be the same as under the Proposed Action, except that there would be no glint and glare at KOP 1 associated with early morning movement of solar troughs.

4.17.4.6.3 Residences

Residential viewers (KOPs 10, 12, 13, 14, 15, and 17) associated with level views would not be affected by glint and glare for Sub-alternative A1, because the project would be obstructed by vegetation.

4.17.5 Alternative B: Reduced Footprint

4.17.5.1 CHANGES TO THE CHARACTERISTIC LANDSCAPE

Changes to the characteristic landscape from construction and operations associated with Alternative B would be similar to those described for the Proposed Action. Under Alternative B, the SSEP would have a 30% smaller solar field layout, would produce less energy, and would result in a smaller area of disturbance than under the Proposed Action. The types of visual contrasts associated with Alternative B would be similar to those described under the Proposed Action, but because they would occur within a smaller geographic area, they would be less apparent from KOPs.

Because the reduced footprint of the SSEP under Alternative B would not be apparent from KOPs at similar elevations with level views, the visible visual contrasts would be the same as those described for the Proposed Action. KOPs that would have level views of the SSEP include those from SR-85, Rainbow Valley Road, and Riggs Road as well as each of the residential KOPs.

4.17.5.2 CHANGES TO VISUAL INVENTORY CAUSED BY THE SSEP

Under Alternative B, changes to the visual inventory from the SSEP would be the same as described under the Proposed Action, except that the project would occupy approximately one third fewer acres (Tables 4.95–4.98). As under the Proposed Action, construction and operation of the SSEP would occur exclusively within lands with low visual sensitivity, Class C scenic quality, and in the foreground/middleground distance zone. The project may further degrade inventoried scenic quality in the Project Area due to a stronger presence of cultural modifications, although the Class C designation would remain.

4.17.5.3 KEY OBSERVATION POINTS

Because the reduced footprint of the SSEP under Alternative B would be apparent from KOPs at higher elevations, the visible visual contrasts would be similar to those described under the Proposed Action, but they would occur over a smaller geographic area. Contrasts in form, line, and color would diminish more over distance than those under the Proposed Action. Under Alternative B, impacts on KOPs would be the same as the Proposed Action with the following exceptions:

- KOP 5 (Komatke Road): The solar fields, power block stacks, pipeline, and transmission line route would be visible in the foreground distance zone (1 mile) from this KOP. The 30% smaller solar field would result in contrasts apparent over a smaller area.
- KOP 1 (North Maricopa Mountains Wilderness): The solar fields would be less visible than under the Proposed Action. The reflection of variable sky conditions would be similar to the Proposed Action and would be intermittently visible throughout the day.
- KOP 2, 6, 19 (Sonoran Desert National Monument): Dispersed recreation users at higher elevation trails or peaks would have superior views of the entire SSEP in the foreground distance zone (1.25 miles) from these KOPs. The solar field would be clearly visible, and the reflective color contrast would be strong throughout the day from the elevated viewpoints.
- KOP 3, 4 (Margie‘s Cove Road, West): The 30% smaller solar field footprint would be clearly visible to motorists traveling west on Margie‘s Cove Road, The SSEP would come into view within the foreground distance zone, approximately 0.25–0.50 mile of the Komatke Road junction (KOP 3) looking north. The SSEP would be screened by topography and vegetation more so under Alternative B than under the Proposed Action, as result of the smaller footprint (KOP 4).
- KOP 18 (Sierra Estrella Wilderness**,** Quartz Peak Trail/Quartz Peak Trailhead): The 30% smaller solar field footprint would be less apparent from this distance than under the Proposed Action. The entire facility would continue to be visible from the KOP, and reflections of the sky in the solar thermal troughs would be clearly visible intermittently throughout the day, depending on meteorological conditions. The bright reflective mirrors would introduce similar contrasts as the Proposed Action.

4.17.5.4 BLM VISUAL RESOURCE MANAGEMENT OBJECTIVES

VRM objectives would be met under Alternative B, as under the Proposed Action. However, the project footprint would be reduced by approximately 30%. The level of change to the characteristic landscape would range from weak to strong, based on the visual resource contrast analysis, and would meet BLM VRM Class IV objectives.

4.17.5.5 NIGHTTIME LIGHTING AND EXTENT OF SKYGLOW

Nighttime lighting and the extent of skyglow would be the same as under the Proposed Action, except that they would be reduced by approximately 30% due to the smaller project footprint.

4.17.5.6 POTENTIAL GLINT AND GLARE IMPACTS

The potential glint and glare impacts would be the same under Alternative A as under the Proposed Action, except that they would be reduced by approximately 30% due to the smaller project footprint.

4.17.6 Reduced Water Use Option–Brine Concentrator

The brine concentrator would be located in the power block site of each alternative. The addition of a brine concentrator would not result in additional changes to the characteristic landscape of the Project Area under either the Proposed Action or Alternative B.

4.17.7 Generation Tie Line Option

Under the action alternatives, three SSEP facilities would result in changes to the characteristic landscape: a well field, external linear facilities, and power plants. The application of the Gen-tie Line Option would apply to external linear facilities only. As with the proposed gen-tie line alignment, short-term visual contrasts would be created by Gen-tie Line Option construction activities, such as the removal of vegetation, grading (leveling), and trenching, and the presence of construction equipment, vehicles, and supplies. During the long-term operation of the SSEP, the Gen-tie Line Option transmission line would parallel and repeat the basic visual elements of existing transmission lines that are similar in form, line, and color.

Because the gen-tie line is the most visually prominent feature of the Gen-tie Line Option, changes to miles of line are an appropriate measure of impacts. If the Gen-tie Line Option were added to any of the action alternatives, there would be an increase of 0.4 mile of line when compared to the proposed gen-tie line. Using a total of 3.0 miles of line for the Proposed Action, Alternative A, and Alternative B, this represents a 13% increase in gen-tie line miles under these alternatives. Using a total of 3.2 miles of line for Sub-alternative A1, this also represents a 13% increase in gen-tie line miles under this alternative.

4.17.7.1 POTENTIAL MITIGATION MEASURES

A number of mitigation measures could be used to reduce or eliminate impacts to visual resources and scenic quality during construction and operation of the project, and following project closure. The BLM has identified the following potential mitigation measures for the Proposed Action and the action alternatives, which may be selected for implementation in the ROD.

4.17.7.1.1 General Mitigation

- To reduce foreground and middleground impacts, a suitable BLM environmental color (from Color Chart CC-001) would be used to diminish structural color contrasts (for example, transmission line towers, support structures for solar collectors, buildings, etc.). A preliminary assessment has identified Slate Gray (5Y 6/1) as the recommended color. This environmental color is composed of a color and hue (the shade or tint). Final color selection would be based on the BLM standard method used to select colors. A careful study of the site would be performed to identify appropriate colors and textures for materials; both summer and winter appearance would be considered as well as seasons of peak visitor use. The choice of colors would be based on the appearance at typical viewing distances and consider the entire landscape around the proposed development. Appropriate colors for smooth surfaces often need to be two to three shades darker than the background color to compensate for shadows that darken most textured natural surfaces. The study would reference the BLM Standard Environmental Color Chart CC-001 and guidance when selecting colors. The simulations and field assessment would be used to determine the background color shades, and an appropriate color would then be selected. The effectiveness of this color would be field-assessed.
- Solar troughs should have the backs color treated, as needed, to reduce visual contrast with the landscape setting. One option is to use Acciona‘s method for accomplishing this contrast reduction using a tinted mirror product that provides added protective strength to the front panels to keep them from shattering.

- Landform grading, vegetation, or fencing in limited cases would be used to interrupt the line of site from nearby KOPs at or near the same elevation of the project.
- Vegetation and ground disturbance would be minimized near roads, and the use of existing clearings would be maximized.
- Topsoil from the site would be stripped, stockpiled, and stabilized before excavating earth for facility construction.
- All electrical collector lines and pipelines would be buried in a manner that minimizes additional surface disturbance (e.g., along roads or other paths of surface disturbance).
- A careful study of the site shall be performed to identify appropriate colors and textures for materials; both summer and winter appearance shall be considered as well as seasons of peak visitor use. The choice of colors shall be based on the appearance at typical viewing distances and consider the entire landscape around the proposed development. Appropriate colors for smooth surfaces often need to be two to three shades darker than the background color to compensate for shadows that darken most textured natural surfaces. Reference the BLM Standard Environmental Color Chart CC-001 and guidance when selecting colors. Materials and surface treatments would repeat and/or blend with the existing form, line, color, and texture of the landscape.
- Appropriately colored materials would be selected for structures, or appropriate stains/coatings would be applied to blend with the project‘s backdrop.
- Materials, coatings, or paints having little or no reflectivity would be used whenever possible.
- Grouped structures would all be painted the same color to reduce visual complexity and color contrast.
- Aboveground pipelines would be painted or coated to match their surroundings, or other equally effective treatment.
- Mirrors/heliostats would be deployed and operated to avoid high-intensity light (glare) being reflected toward off-site ground receptors. Where off-site glare is unavoidable and Project Area/ off-site spatial relationships favor effective results, fencing with privacy slats or similar screening materials would be employed.
- Electricity transmission-distribution projects would use nonspecular conductors and nonreflective coatings on insulators.
- The use of non-necessary and/or nonsafety–related signs and project construction signs should be minimized; necessary signs would be made of nonglare materials and use unobtrusive colors; reverse sides of signs and mounts would be painted or coated using the most suitable color selected from the BLM Standard Environmental Color Chart to reduce color contrasts with the existing landscape; however, placement and design of any signs required by safety regulations must conform to regulatory requirements.
- Commercial symbols or signs and associated lighting on buildings or other structures would be prohibited, except where basic information is needed to identify the site (particularly for safety reasons).
- ~~“~~Good housekeeping” procedures would be developed to ensure that the site is kept clean of debris, garbage, fugitive trash or waste, and graffiti; to prohibit scrap heaps and dumps; and to minimize storage yards. Design features regarding waste management would be applied.

4.17.7.1.2 Night Sky Mitigation

- A lighting plan would be prepared that documents how lighting will be designed and installed to minimize night-sky impacts during facility construction and operations phases. Lighting for facilities would not exceed the minimum number of lights and brightness required for safety and security, and would not cause excessive reflected glare. Full cut-off luminaires would be used to minimize upward shining lighting. Lights would be directed downward or toward the area to be illuminated. Light fixtures would not spill light beyond the project boundary. Lights in high illumination areas not occupied on a continuous basis would have switches, timer switches, or motion detectors so that the lights operate only when the area is occupied. Where feasible, vehicle-mounted lights would be used for night maintenance activities. Wherever feasible, consistent with safety and security, lighting would be kept off when not in use. The lighting plan would include a process for promptly addressing and mitigating complaints about potential lighting impacts.

4.17.7.1.3 Glint and Glare Mitigation

- The SSEP would be adequately screened by existing vegetation or through the application of perimeter fencing to reduce contrast from glint and glare for KOPs with level views. Consideration for the height of the fence is necessary.
- Security fencing would be polyvinyl coated the selected color of choice to eliminate shine and glare from the galvanized surfaces; or, galvanized surfaces would be treated (darkened) to reduce glint and glare. Other reflective surfaces could be treated to reduce the potential for glint and glare as long as the treatment would not impair proper function of the equipment or structure. Prior to construction, a study would accurately assess and quantify potential glinting and glare effects of the approved alternative. It would also determine potential health, safety, and visual mitigation associated with glinting and glare effects. The study would be conducted by qualified individuals using appropriate and commonly accepted software and procedures.

4.17.7.1.4 Construction Mitigation

- A pre-construction meeting with BLM landscape architects or other designated visual/scenic resource specialist would be held before construction begins to coordinate on the VRM mitigation strategy and confirm the compliance-checking schedule and procedures. Final design and construction documents will be reviewed for completeness relevant to the visual mitigation elements assuring that requirements and commitments are adequately addressed. The construction documents would include, but not limited to grading, drainage, revegetation, vegetation clearing and feathering plans and demonstrate how VRM objectives will be met, monitored, and measured for conformance.
- Project developers would integrate interim/final reclamation VRM mitigation elements early in the construction, which may include treatments such as thinning and feathering vegetation along project edges, enhanced contour grading, salvaging landscape materials from within construction areas, defining special revegetation requirements, etc.
- Reduce visual impacts during construction by clearly delineating construction boundaries. Within interim reclamation areas (those areas not intended for long-term use), impacts will be reduced by minimizing areas of surface disturbance within those boundaries; preserving vegetation to the greatest extent possible; using undulating surface disturbance edges; stripping, salvaging, and replacing topsoil; contoured grading; controlling erosion; using fugitive dust suppression techniques; and restoring exposed soils to their original contour and vegetation.

- An interim reclamation plan would be in place prior to construction. Interim reclamation of the construction site would begin immediately after construction to reduce the likelihood of visual contrasts associated with erosion and invasive weed infestation and to reduce the visibility of impacted areas as quickly as possible.
- Existing rocks, vegetation, and drainage patterns would be preserved to the maximum extent practicable, particularly within temporary use areas.
- Brush-beating or mowing, or using protective surface matting rather than vegetation removal would be done where feasible.
- For interim reclamation areas, slash from vegetation removal would be mulched and spread to cover fresh soil disturbances as part of the revegetation plan. Slash piles would not be left in sensitive viewing areas. All areas of disturbed soil within interim reclamation areas would be reclaimed by using weed-free native grasses, forbs, and shrubs representative of the surrounding and intact native vegetation composition and/or use non-native species, if necessary to ensure successful revegetation.
- Graveled-surface visual color contrast would be reduced with approved color treatment practices; or, gravel will be of a color to effectively and equivalently reduce contrasts.
- Horizontal and vertical pipeline bending would be used in place of cut-and-fill activities where feasible.
- Road-cut slopes would be rounded, and the cut-and-fill pitch would be varied to reduce contrasts in form and line; the slope would be varied to preserve specimen trees and nonhazardous rock outcroppings.
- Topsoil from cut-and-fill activities would be segregated and spread on freshly disturbed areas to reduce color contrast and aid rapid revegetation. Topsoil piles would not be left in sensitive viewing areas.
- Disposal of excess fill material downslope would be avoided to avoid creating color contrast with existing vegetation and soils.
- Excess cut-and-fill materials would be hauled in or out to minimize ground disturbance and impacts from fill piles.
- Communication and other local utility cables would be buried where feasible.
- Culvert ends would be painted or coated to reduce color contrasts with existing landscape. Alternatively, galvanized ends would be treated (darkened) to reduce glare.
- No paint or permanent discoloring agents would be applied to rocks or vegetation to indicate surveyor construction activity limits, except in areas defined and designated for disturbance.
- All stakes and flagging would be removed from the construction area and disposed of in an approved facility.

4.17.7.1.5 Operations Mitigation

- The project developer would maintain revegetated surfaces (from interim reclamation and site decommissioning) until a self-sustaining stand of vegetation is re-established and visually adapted to the undisturbed surrounding vegetation. For new areas of disturbance (beyond the scope of this NEPA analysis), no new disturbance would be created during operations without completion of a VRM analysis and approval by the authorized officer.

- Interim restoration would be undertaken during the operating life of the project as soon as possible after disturbances.
- Maintenance activities would include fugitive dust abatement (in arid environments) and noxious weed control.
- Road maintenance activities would avoid blading existing forbs and grasses in ditches and adjacent to roads.
- Painted facilities would be kept in good repair and repainted when color fades or flakes increase visual contrast.
- As applicable, color-treated solar panel/trough backs would be kept in good repair and retreated when color fades and flakes.

4.17.7.1.6 Post-operations Decommissioning and Site Reclamation Mitigation

- A decommissioning and site reclamation plan, including visual impact design features, would be in place prior to construction, and reclamation activities would be undertaken as soon as possible after disturbances occur and be maintained throughout the life of the project.
- Review pre-development visual conditions(e.g. inventoried visual quality rating [A, B, and C] and integrity), and restore the visual elements of form, line, color and texture to pre-development visual compatibility or to that of the surrounding landscape setting conditions, whichever achieves the greater visual quality and ecologically sound outcome.
- A decommissioning and site reclamation plan would be developed, approved by the BLM, and implemented. The plan would require that all aboveground and near-ground structures be removed. Some structures would only be removed to a level below the ground surface that will allow reclamation/restoration. Topsoil from all decommissioning activities would be salvaged and reapplied during final reclamation. The plan would include provisions for monitoring and determining compliance with the project‘s visual mitigation and reclamation objectives.
- Soil borrow areas, cut-and-fill slopes, berms, water bars, and other disturbed areas would be contoured to approximate naturally occurring slopes, thereby avoiding form and line contrasts with the existing landscapes. Contouring to a rough texture would trap seed and discourage offroad travel, thereby reducing associated visual impacts.
- Cut slopes would be randomly scarified and roughened to reduce texture contrasts with existing landscapes and aid in revegetation.
- A combination of seeding, planting of nursery stock, transplanting of local vegetation within the proposed disturbance areas, and staging of construction enabling direct transplanting would be considered. Where feasible, native vegetation would be used for revegetating, establishing a composition consistent with the form, line, color, and texture of the surrounding undisturbed landscape.
- Stockpiled topsoil would be reapplied to disturbed areas and the areas revegetated by using a mix of native species selected for visual compatibility with existing vegetation, where applicable, or a mix of native and non-native species if necessary to ensure successful revegetation.
- Gravel and other surface treatments would be removed or buried.
- Rocks, brush, and forest debris would be restored whenever possible to approximate pre-existing visual conditions.

- Edges of revegetated areas would be feathered to reduce form and line contrasts with the existing landscapes.
- A decommissioning VRM monitoring and compliance plan would be prepared by the operator and approved by the BLM that establishes the schedule and terms for monitoring and conditions and methods of measurement for determining compliance.

4.17.8 Residual Impacts

The effectiveness of using standard desert colors for painted facilities would, in general, be limited by the distance of most facilities to KOPs and the presence of other sources of contrast. The BLM's mitigation handbook for fluid minerals (BLM 2007c) states that the effectiveness of color mitigation diminishes over distance. Beyond approximately 1,000 feet, color becomes less effective for structural mitigation; however, hue does remain effective for much longer distances. To reduce foreground and middleground residual impacts, BLM Environmental Color Slate Gray (5Y 6/1) is recommended for use to diminish structural color contrasts. Selection of this color was based on the BLM standard method used to select color, which is to apply a color tone approximately two shades darker than the landscape background color. The simulations were used to determine the background color shades, and an appropriate color was then selected.

It is likely that large structures (solar arrays, power blocks) and linear features (transmission lines and support towers) would be visible after mitigation measures have been applied. The relatively flat landscape surrounding the SSEP precludes topographic hiding of the structures, and the height and width of the transmission lines are not likely to be hidden through color mitigation. Roads and access ways within the Project Area would probably remain visible from superior views after edge feathering because of the color contrasts created by exposed soil, loss of vegetation, and/or paving. Mitigation measures such as fencing may not effectively reduce contrast for KOPs at higher elevations. The presence and movement of construction and operations vehicles, heavy equipment, and project personnel trucks and automobiles would have a residual impact on visual quality after mitigation because mitigation would be unlikely to reduce the color and form contrasts created by these vehicles during the life of the project. The typically slow revegetation and soil coverage during reclamation in this arid region would create long-term color and line contrasts with the surrounding vegetated landscape.

4.17.9 Short-term Uses versus Long-term Productivity

Construction and operation of the SSEP would require short-term and long-term uses of land and other resources for renewable energy. Implementation of the SSEP would create long-term disruptions of the characteristic landscape from soil and vegetation disturbances and would change the land use from a natural setting to an industrial setting (with industrial uses). This change to the landscape would continue throughout the lifetime of the SSEP.

4.17.10 Irreversible and Irretrievable Commitments of Resources

Changes to the characteristic landscape would occur over the lifetime of the SSEP. The SSEP would have an effective lifetime of 30 years. All visible structures and materials would be removed from the Project Area and surface contours would be restored. There would be no irreversible impacts to the landscape of the area; however, it could take years before the project footprint is no longer visible. Even when vegetation is established during reclamation efforts, the composition of species in the recovery area is often different than the original vegetation community. Typically grasses would establish early on, whereas shrubs would take much longer to reestablish. The project footprint would visibly persist for many years beyond the project completion.

There would be irretrievable impacts associated with the operation of the SSEP. The visual contrasts that would result from the introduction of facilities associated with the SSEP would be an irretrievable loss of the characteristic landscape until the SSEP operation is closed and reclamation activities have been completed.

4.18 Water Resources

Impacts to water resources are discussed below in two sections: surface water resources (Section 4.18.1) and groundwater resources (Section 4.18.2). These impacts are further divided and discussed in terms of potential impacts to water resources resulting from project construction and project operation and maintenance.

4.18.1 Surface Water

4.18.1.1.1 Floodplains and Washes

The Project Area is located on a surface water drainage divide between two watersheds: the Waterman Wash watershed and the Rainbow Wash watershed. The eastern portion of the Project Area is located in the Waterman Wash watershed. Surface water flows in small ephemeral drainages on the eastern portion of the Project Area. This surface water drains to an unnamed tributary to Waterman Wash, and ultimately to the Gila River. Surface water also flows in small ephemeral drainages on the western portion of the Project Area. This surface water drains to Rainbow Wash, and ultimately to the Gila River. Therefore, the analysis area for floodplains and washes consists of the Waterman Wash watershed, including the unnamed tributary to Waterman Wash; and the Rainbow Wash watershed, including Rainbow Wash (Map 26). This analysis area is defined for floodplains and washes because a portion of the precipitation that falls on the watersheds flows to drainages across the Project Area, discharges to either Rainbow Wash or Waterman Wash, and flows to the Gila River.

Surface water resources that would be impacted under the Proposed Action and the other action alternatives include disturbance or removal of drainages and pending Federal Emergency Management Agency (FEMA) floodplains (~~"~~floodplains"), and changes in water quantity and water quality. The number and linear miles of drainages disturbed, and the acres of floodplains disturbed, are used as the primary means of evaluating and comparing the impacts to surface water conveyance that would result from the implementation of each alternative. Changes in surface water quantity are evaluated using estimates of groundwater that would be introduced to the surface from well testing. Changes in surface water quality are evaluated on the basis of the potential for change to water chemistry (i.e., increased suspended solids) and by the potential for a release of hazardous materials or solid wastes. These potential impacts to surface water resources are discussed below for the No Action alternative, the Proposed Action, and other action alternatives during construction and operation and maintenance of the SSEP.

4.18.1.1.2 Water Quality

The analysis area for water quality comprises the Waterman Wash and its tributaries, Rainbow Wash and its tributaries, and the Gila River between Waterman Wash and Rainbow Wash. Several reaches of the Gila River downstream of the Project Area are impaired by low dissolved oxygen, selenium, boron, DDT metabolites, toxaphene in fish tissue, and chlordane in fish tissue. These compounds are typically associated with agricultural irrigation practices. Construction, operation, and maintenance of the SSEP would not generate these types of compounds and therefore would not contribute to the downstream impairment due to these pollutants.

4.18.1.1.3 Surface Water Quantity

Under the Proposed Action and other action alternatives, changes in surface water quantity are not expected to occur from evaporation. This is because precipitation and surface water runoff in the proposed solar field would be collected in stormwater detention basins and then released to match the pre-

development hydrological conditions. The basins would be designed to drain within 36 hours of a storm event. The location of these stormwater detention basins and their outfalls to existing washes are shown in Map 7 and Figure 2.9. In addition, water draining from the upper reaches of the affected watersheds would be rerouted around the solar field and discharged to the same points identified on Map 7 and Figure 2.9. Reductions in surface water quantity due to losses by evaporation are expected to be small due to the short residence time of water detained in the stormwater basins. Therefore, impacts to surface water quantities due to evaporation are not discussed further.

4.18.1.2 NO ACTION

Under the No Action alternative, the SSEP would not be developed and existing land uses in the Project Area would continue, including livestock grazing and dispersed recreation. No drainages or floodplains would be disturbed by these land uses and there would, therefore, be no impacts to stormwater, floods, or surface water flows in the analysis area.

4.18.1.3 PROPOSED ACTION

4.18.1.3.1 Impacts to Surface Water Resources during Construction

4.18.1.3.2 Water Quality

Under the Proposed Action, impacts to surface water resources during construction of the SSEP would be primarily associated with surface-disturbing activities. The use of heavy construction equipment would cause compaction of near-surface soils and soil scarification and loosening. This soil disturbance would increase the risk of additional surface water runoff, thereby increasing erosion and the transport of sediment from adjacent areas. Clearing and grading during construction would also expose soils to erosion. Soils disturbed during clearing and grading would be susceptible to water erosion and could be transported as suspended solids and deposited as sediment in drainages, washes, and floodplains.

These effects would be temporary during the initial phases of construction prior to the completion of stormwater detention measures. Existing hydraulic studies would be used to estimate pre-construction surface water flow depths and velocities within drainages on the Project Area. Discharge of stormwater during the SSEP's construction period would be permitted through an AZPDES permit. To further reduce the risk of increased erosion and sediment transport during construction, Boulevard would implement the applicant-committed environmental protection measures and construction-related BMPs (presented in Chapter 2) listed below:

- *Clean-up and Site Reclamation:* All post-construction ROWs would be restored, as required by the BLM. All practical means would be made to restore the land to its original, natural drainage patterns. Because revegetation would be difficult in many areas of the Project Area due to low amounts of precipitation, all practicable measures would be taken to minimize disturbance during construction.
- *Reclamation of Temporary Disturbance:* All temporarily disturbed areas would be reclaimed to as close to their pre-construction conditions as possible, as required by the BLM. Temporary access roads used during construction would also be regraded and restored to pre-existing function and grade.
- *Erosion Control:* Temporary drainage ditches and berms would be designed around construction work areas, soil stockpile areas, and excavation areas to minimize the amount of potential pollutant or sediment-laden surface water runoff.

Changes in surface water quality would occur if surface water flows from infrequent storm events transport disturbed soils during construction of the SSEP. In this situation, surface water quality would be degraded by the addition of suspended solids. This risk would be present at all locations where road and pipeline grading and trenching activities are conducted near drainages and floodplains. However, the risk of increasing suspended solids concentrations in surface water would be the highest during construction of the proposed solar field where all drainages and floodplains would be removed. The Proposed Action would be permitted under an AZPDES permit for construction projects and would implement a SWPPP.

The use of heavy equipment during construction would increase the risk of impact (contamination) to surface water quality due to accidental releases, spills, and leaks of equipment fluids, including fuels, lubricants, and degreasers. Vehicle refueling, equipment failure, and storage of hazardous substances would create an increased risk of surface water contamination if a spill or release were to occur. Potential contamination of surface water during construction would also result from accidental spills during the handling of stored hazardous chemicals and solid wastes. However, the SPP developed for the Proposed Action also outlines spill prevention practices, emergency response and cleanup procedures, and storage protocols. All contractors involved with the construction of the SSEP under the Proposed Action would be required to adhere to the protocols outlined in the SPP and environmental protection measures described in Chapter 2. As a result of adherence to spill prevention and control measures, any accidental releases, spills, or leaks would not result in surface water contamination above regulatory limits for these constituents in surface water.

Surface discharge of contaminated hydrostatic testing waters would also increase the risk of impact to surface water quality. To reduce this risk, Boulevard has developed a hydrostatic testing plan that describes appropriate measures to minimize environmental impacts. More specifically, after hydrostatic testing is completed, the test water would be discharged to the surrounding area pursuant to the construction SWPPP, unless the chemical analysis shows that the water is contaminated. In this case, the water would be properly disposed at an appropriate off-site waste facility. In the event that the hydrostatic testing water is disposed off-site, changes in surface water quantity due to surface discharge of these waters (as described above) would be eliminated. No impacts to water quality would be anticipated because all of the discharged water would have to meet the regulatory water quality discharge criteria.

Storage, handling, and disposal of fluids during well drilling for the SSEP would present an increased risk of impact (contamination) to surface waters if a spill or release occurred. However, all drilling fluids would be stored and handled according to environmental protection measures outlined in the SPP developed for the Proposed Action and other action alternatives. Therefore, storage, handling, and disposal of drilling fluids would not result in surface water contamination above regulatory limits for these constituents in surface water.

4.18.1.3.3 Floodplains and Drainage

Under the Proposed Action, impacts to surface water resources during construction of the SSEP would be primarily associated with surface-disturbing activities. The use of heavy construction equipment would cause compaction of near-surface soils and soil scarification and loosening. This soil disturbance would increase the risk of additional surface water runoff, thereby increasing erosion and the transport of sediment from adjacent areas. Clearing and grading during construction would also expose soils to erosion. Soils disturbed during clearing and grading would be susceptible to water erosion and could be transported as suspended solids and deposited as sediment in drainages, washes and floodplains.

Construction of the SSEP would cross numerous ephemeral drainages in the Project Area. Most of these drainages are small erosion features that are less than 4 feet wide and tend to be shallow with depths ranging from 2 feet or less, to depths a little over 3 feet. These drainages are generally dry and only carry water during periods of heavy rainfall, most often associated with summer thunderstorms. There are no perennial or intermittent watercourses in the Project Area.

Under the Proposed Action, approximately 40.5 linear miles of drainages would be temporarily disturbed during construction activities (road construction, pipeline trenching, gen-tie line installation, solar field grading, and well drilling). Road construction and pipeline trenching would require crossings at approximately 27 mapped drainages, for a total drainage disturbance, of 0.9 linear mile. During road construction and pipeline trenching, 0.5 linear mile of drainages would be disturbed for temporary construction use corridors and reclaimed once the temporary use is concluded. Following reclamation in temporary construction use corridors, 0.4 linear mile of drainages would be permanently modified by the presence of culverts and/or crossings (permanent, operations related impacts are discussed in Section 4.18.1.3.2). Most (98%) drainages that would be disturbed by construction of the SSEP are located within the proposed solar field, where 39.6 linear miles of surface water drainages would be removed. Disturbance due to culverts and/or crossings in the well field would total less than 0.01 linear mile.

Assuming a drainage density of 0.012 linear mile per acre for the combined Rainbow Valley watershed and Waterman Wash watershed (Moody and Frazee 2009), the drainages that would be disturbed by construction of the SSEP represent approximately 1.1% of the total linear miles of drainages in these watersheds. A summary of the drainages removed or modified (by culverts and/or crossings) to construct each component of the SSEP under the Proposed Action is provided in Table 4.100.

Table 4.100 Construction-related Disturbances to Surface Water Drainages – Proposed Action

Disturbance	Area	Linear Miles
Drainage removal, culvert and crossing installation	Roads, pipelines, and gen-tie line	0.9
	Proposed solar field	39.6
	Well field	<0.01
	Total	**40.5**

The temporary disturbance of surface water drainages in the Project Area would result in trampled or removed vegetation, soil compaction (from construction equipment), and soil scarification and loosening. These disturbances would result in alterations to drainage form and function which would increase the risk of erosion and sediment transport in the event of an infrequent storm and runoff through the drainage. Construction activities within these drainages would be short term (persisting only for the necessary construction timeframe). All temporary drainage crossings would be restored at the completion of road, pipeline, and gen-tie line construction, and no changes in drainage patterns would be anticipated to occur due to these activities. Once the temporary use is concluded and the site is reclaimed, the risk of erosion and sediment transport would likely match that of the surrounding landscape, which is also prone to erosion due to its fine-grained alluvial soils and general lack of vegetation.

Floodplains are present in the proposed solar field, along Riggs Road, and the road to the well field. There are no FEMA-regulated floodplains in the Project Area. Under the Proposed Action, approximately 221.7 acres of floodplains would be temporarily disturbed during construction activities. Similar to drainages, most of the floodplains that would be disturbed during construction are located within the proposed solar field where 215 acres of floodplains would be permanently removed. Outside the proposed solar field, there are five floodplains with an area of 6 acres that would be disturbed during road improvements and pipeline trenching along Riggs Road. Three floodplains with an area of 0.7 acre are present within or directly adjacent to the proposed well field area. Some of these floodplains would be disturbed during road improvements made to the well field. A summary of the floodplains temporarily disturbed during construction of the SSEP is provided in Table 4.101.

Table 4.101 Construction-related Disturbances to Floodplains – Proposed Action

Disturbance	Area	Acres
Temporary	Roads and pipelines	6
	Proposed solar field	215
	Well field	0.7
	Total	**221.7**

Construction would result in trampled or removed vegetation, soil compaction (from construction equipment), and soil scarification and loosening. These disturbances would result in alterations to floodplain form and function such that there would be a loss of area for flood flows to disperse and infiltrate, which would increase the magnitude of downstream flooding in the event of a low-frequency (i.e., 50- or 100-year) flood event occurring during construction. Construction activities within these floodplains, and their attendant impacts as described above, would be localized and short term because they would occur over a limited land area according to the construction schedule and they would only persist for the duration of construction and rehabilitation immediately following construction.

Final engineering of the drainage plan for the site would involve hydrologic modeling to understand the pre-construction conditions and function of the floodplains. The floodplains would be hydraulically modeled using detailed methods and new 2-foot contour mapping. The USACE Hydrologic Engineering Centers River Analysis System (HEC-RAS) application (Version 4.0) would be used to estimate the flow depth and velocities within these floodplains. The modeling parameters that would be used in the HEC-RAS application include the hydrologic modeling results, Manning‘s n values, channel cross-section geometry, the channel slope, and the distance to the downstream reach. These parameters would be estimated from the existing topography for the Project Area and from field visits. If a more detailed analysis is required at any location, Flo-2D may be used to estimate the flow depths and velocities. This may be required at flow split locations or other locations that are difficult to model correctly with HEC-RAS. In addition to HEC-RAS and Flo-2D, Bentley‘s FlowMaster may be used to evaluate normal flow depths and velocities in channels and the Federal Highway Administration HY-8 Program may be used for detailed hydraulic calculations. The results from this modeling would be used to restore the floodplains to their pre-construction conditions. All floodplain disturbances outside the proposed solar field would be restored at the completion of road and pipeline construction, and no permanent changes in floodplain patterns would be anticipated to occur.

4.18.1.3.4 Surface Water Quantity

Changes in hydrology would increase slightly due to surface discharges of water used for hydrostatic testing, well development, and well testing. Under the Proposed Action, groundwater would be pumped from four production wells. One existing well (designated TW-1) is located in the well field for the SSEP and has been developed and tested. Three additional groundwater wells would be drilled. These additional wells would require development and testing. Well development involves the pumping of groundwater from the well to remove fine-grained sediments from the well and filter pack adjacent to the well screen until the water is relatively clear. Aquifer test pumping is also required to estimate the sustainable yield of the wells and evaluate aquifer hydrogeologic parameters. These aquifer tests are anticipated to involve step-rate tests and constant-rate tests.

To estimate the quantity of groundwater pumped and discharged to the surrounding area from well development and testing activities, the quantities of groundwater generated during well development and testing of the existing well (TW-1) were used. During well development of TW-1 approximately 81,000 gallons of water were produced (Carr 2010). During the step-rate test on TW-1, the well was pumped for five 2-hour intervals at rates averaging 793 gpm, 1,017 gpm, 1,210 gpm, 1,408 gpm, and 1,600 gpm, totaling 531,360 gallons. Aquifer testing of TW-1 consisted of a 72-hour, constant-rate aquifer test using an average pumping rate of approximately 1,400 gpm, totaling 6,048,000 gallons. Therefore, approximately 6,660,360 gallons of groundwater were pumped during well development and aquifer testing of TW-1. The groundwater produced during well development and aquifer testing of test well TW-1 was conveyed by a pipeline to a nearby wash approximately 1 mile west of TW-1 (Carr 2010). Prior to well development, ADEQ was notified by letter to ensure that the discharge would be covered under the AZPDES (personal communication, David A. Carr 2010).

Under the Proposed Action, it is assumed that well development and aquifer testing of the three additional groundwater wells would generate approximately 20 million gallons of groundwater. The future discharge location(s) for this water would be identified and permitted prior to beginning well development and well testing activities (personal communication, David A. Carr 2010).

The combined quantities of groundwater (20 million gallons from well installation and an unknown volume from hydrostatic testing) would be surface discharged within the Project Area and would result in a short-term increase in surface water flows. This increase in surface water flows would increase the risk of erosion and transport of suspended solids that would be deposited as sediment in drainages, washes and floodplains. However, these discharges would be localized and the discharge rates would be controlled.

Prior to well testing, Boulevard would notify ADEQ to ensure that the discharges would be covered under the AZPDES permit. The assumed maximum groundwater pump test rate of 1,400 gpm is roughly equivalent to a storm event of 3.1 cubic feet/second (cfs). Runoff from storm events in the Rainbow Valley Sub-basin ranged from 3.7 cfs to 1,827 cfs. The number of groundwater production wells proposed under other action alternatives is less than the Proposed Action. Therefore, changes in surface water quantities due to discharges of groundwater from well development and testing under other action alternatives would be less that under the Proposed Action and are not further addressed.

4.18.1.3.5 Impacts to Surface Water Resources during Operations

The impacts to surface water resources during operation and maintenance of the SSEP would be associated with 1) changes in surface water drainage patterns due to the installation of culverts and/or crossings; 2) permanent removal of drainages and floodplains in the proposed solar field; and 3) re-routing of stormwater in and around the proposed solar field. These changes to surface water resources are discussed below. The potential for contamination of surface waters during operation and maintenance of the SSEP are also discussed.

4.18.1.3.6 Water Quality

During operation and maintenance of the SSEP, changes in surface water quality would occur due to changes in the amount of suspended solids in surface waters that would run off from the proposed solar field during storm events. Under the Proposed Action, surface water runoff from precipitation on the proposed solar field would be collected in four stormwater sediment/detention basins in the proposed solar field. Suspended solids in surface water flows would settle out in these basins and deposit as sediments. The amount of sediment accumulated in these basins would be monitored and removed as needed. The removal of sediments from water released from the retention basins would decrease the suspended solids concentration in these waters. The reduction in suspended solids concentrations would

result in an increased risk in the erosion potential of waters released from the retention basins due to the decreased sediment load and increased sediment load capacity. This increase in load capacity could cause increased erosion downgradient of the proposed solar field. Furthermore, the location for disposal of the accumulated sediments, not currently stated, would affect the potential for change in water quality (for example, sediments disposed near drainages have a higher potential to be washed downstream during a storm event than if disposed away from drainages).

Impacts to surface water (contamination) during operation and maintenance would also result from accidental spills during the handling of stored hazardous chemicals and solid wastes. The SPP developed for the Proposed Action outlines spill prevention practices, emergency response and cleanup procedures, and storage protocols. These spill prevention and cleanup procedures would prevent surface water contamination so that the concentrations of these constituents in surface water would be within regulatory limits.

Because the proposed solar field would remain unpaved, a dust suppression coating would be used on dirt roadways in and around the solar field. In addition, herbicides would be used as needed to prevent vegetation establishment. The use of dust suppressants and herbicides would increase the risk of contamination to surface waters in the event that these chemicals are transported to surface waters and runoff from the Project Area. The risk of herbicide transport would be minimized by the stipulations of the required pesticide use permit. Typical requirements include minimizing application to the lowest effective level, the use of nonpersisting compounds that will break down before they can reach water, strict adherence to label directions, use of appropriate personal protective equipment, avoidance of use or storage near surface water, and mandatory application during periods of weather that minimize the risk of transport by precipitation. Adherence to such stipulations and BLM approval of a permit and vegetation management plan would greatly reduce the remote risk of herbicides being transported to surface waters, the nearest of which is typically the Gila River, located several miles away. Some herbicides can be toxic to aquatic life at certain concentrations. Because of the remote distance of surface waters supporting aquatic life, and the risk minimization through permit requirements and standard application practices, the risk of toxicity would be negligible.

4.18.1.3.7 Floodplains and Drainage

Under the Proposed Action, 12 permanent culverts would be installed along the access road alignment. In addition, there would be 15 permanent crossings in the well field. The culverts and crossing would be installed to mimic natural surface water flows, and therefore no changes to the function of these drainages would be expected to occur (WorleyParsons Group Inc. and Cardno WRG, Inc. 2011).

During operation of the SSEP, 40 linear miles of drainages would be permanently disturbed (removed or modified with culverts and crossings). Most of these drainages are located within the proposed solar field where 39.6 linear miles of surface water drainages would be permanently removed. The removal of these surface water drainages from within the solar field would result in the long-term alteration of surface flows in this area. Any runoff that previously flowed through these ephemeral drainages to receiving waters (the Gila River) would now either be 1) collected within detention basins in the solar field and released to surface waters slowly or 2) be diverted around the solar field via surface water drainage control structures (berms) constructed to prevent surface flows from entering the solar field area. Less than 0.01 linear mile of drainages would be disturbed in the well field by vehicle access to the wells. A summary of the drainages disturbed in each area of the SSEP is provided in Table 4.102.

Table 4.102 Operation-related Disturbances to Surface Water Drainages – Proposed Action

Disturbance	Area	Linear Mile(s)
Permanent (Modification to surface flows and an increased risk of erosion and downstream sedimentation as a result of blading and grading the solar field and installing drainage control structures)	Roads, pipelines, and gen-tie line	0.4
	Proposed solar field	39.6
	Well field	<0.01
	Total	**40.0**

The overall drainage concept for the Proposed Action is shown in Figure 2.9 and Map 7 (WorleyParsons Group, Inc. and Cardno WRG, Inc. 2010). As described in Section 2.5.2.8, stormwater generated on-site would be directed to stormwater detention basins and retained so that sediment settles out prior to the water being released to existing washes downstream of the Project Area. The detention basins would attenuate storm-event runoff from each solar field and release it to washes at or below the pre-developed 100-year, 24-hour storm-event flow rate. Therefore, there would not be any downstream habitat or physical changes associated with rerouting surface water because the hydrology would mimic natural flow patterns. Further, the design of the outfalls includes scour protection to further reduce erosion. As described in Section 2.5.2.7, off-site stormwater runoff would be collected and conveyed around the perimeter of the Project Area where it would be released back into the natural washes in a manner similar to the existing condition. Finally, because fences and other infrastructure would be designed to accommodate large flow events, they would not act as barriers or be threatened by large storms.

The permanent disturbance (culverts and crossings) of surface water drainages along roads would result in alterations to drainage form and geometry. However, once completed, surface water flow velocities and sediment load are expected to be the same as pre-construction conditions. These changes are expected to be minimal due to the installation of engineered culverts and crossings that would be designed to mimic the natural surface water flow velocities.

Long-term changes to surface water drainages would mainly occur in the proposed solar field where the drainages would be permanently removed and off-site stormwater would be routed around the solar field. These changes are expected to be minimal due to the planned engineered stormwater interceptor basin, conveyance diversion channels, and controlled release points. The permanent disturbance of surface water drainages in the proposed solar field would result in alterations to drainage form. However, no changes in drainage function in the proposed solar field would be anticipated to occur during operation of the SSEP.

Additionally, Boulevard would implement the applicant-committed environmental protection measures and BMPs during operation and maintenance of the SSEP, as presented in Chapter 2. For example:

> *Site Drainage and Runoff Control*–The post-development sediment/detention basin at the discharge points would provide stormwater pollution prevention BMP controls (along with retention time) to reduce the peak off-site discharge and to match pre-development conditions. The road berm and collection channel system would also be constructed to provide site protection from stormwater runoff during a 100-year return storm event. The toe of the western protective berm slope may be armored with soil cement cover and riprap to provide for slope erosion protection during a heavy storm event. Erosion protection may be necessary along portions of the channel collection system, as identified in the hydraulic evaluation.

Floodplains are present in the proposed solar field, cross Riggs Road, and are present along the road to the well field. Under the Proposed Action, approximately 218.7 acres of these floodplains would be permanently disturbed during operation of the SSEP. Of the 219 acres, 3 acres are located along Riggs

Road where culverts and/or crossings would be required at five floodplain channels. Less than 1 acre of floodplains is present in the proposed well field, where the floodplains would require culverts and/or crossings. The floodplains in the proposed solar field would be permanently removed. Similar to drainages, most of the floodplains are located within the proposed solar field where 215 acres of floodplains would be permanently removed. A summary of the floodplains permanently disturbed during operation of the SSEP is provided in Table 4.103.

Table 4.103 Operation-related Disturbances to Floodplains – Proposed Action

Disturbance	Area	Acre(s)
Permanent	Roads, pipelines, and gen-tie line	3
	Proposed solar field	215
	Well field	0.7
	Total	**218.7**

The permanent disturbance of floodplains would result in alterations to floodplain form and function. The long-term changes to floodplains due to the presence of new roads and culverts and/or crossings would result in a slight modification of floodplain form; however, once completed, flood flow velocities and sediment load are expected to be the same as pre-construction conditions. These changes are expected to be minimal due to the installation of engineered culverts and crossings that would be designed to mimic the natural surface water flow/flood velocities. Therefore, no changes in floodplain function due to road construction or pipeline installation would be anticipated to occur during operation of the SSEP.

The permanent removal of floodplains in the proposed solar field would result in a loss of area for flood waters to disperse and infiltrate, which could increase the risk of downstream flooding in the event of low-frequency (i.e., 50- or 100- year) flood events. This risk would be addressed by the re-routing of surface water runoff around the proposed solar field and by the construction of diversion channels. The diverted water would then be released to existing washes through a series of controlled release points. The engineered release points would be sized to match existing condition flow rates as much as practicable. Hydrologic modeling done for the SSEP (Frazee and Moody 2010) indicates that post-construction peak discharges (100-year, 24-hour peak flows) would be less than or equal to pre-development flows in Waterman Wash, Rainbow Wash, and their unnamed tributaries. Watershed integrity would be maintained by configuring the stormwater interceptor and diversion channel system to segregate the natural flows contributing to Rainbow Wash and the unnamed tributary to Waterman Wash. Additionally, the proponent would implement the applicant-committed environmental protection measures and BMPs during operation and maintenance of the SSEP, as listed above for surface water flows and drainages. Therefore, the risk of downstream flooding from flood waters that would naturally flow across the proposed solar field would be reduced during operation of the SSEP.

4.18.1.4 ALTERNATIVE A: REDUCED WATER USE (DRY-COOLED CST)

Under Alternative A, groundwater consumptive rates would be reduced (see Section 4.18.2) along with a slight reduction in the total Project Area (9 acres). The reduction in the surface area of the SSEP under Alternative A would result from a reduction in the number of wells in the well field. The number of groundwater wells would be reduced from four under the Proposed Action to two under Alternative A. This reduction in the area of the SSEP under Alternative A compared to the Proposed Action would result in a slight decrease in the number of drainages and floodplains impacted under Alternative A. Impacts to surface water resources would be the same in nature under Alternative A and the Proposed Action. The extent of impacts would vary between these alternatives as a result of differences in acres of disturbance and groundwater pumping rates.

4.18.1.4.1 Impacts to Surface Water Resources during Construction

Under Alternative A, construction of the SSEP would be the same as under the Proposed Action, with the minor exceptions discussed below.

Under Alternative A, the number of drainages crossed by roads during construction would be reduced from 27 to 21, because two fewer well sites would be necessary. Therefore, under this alternative, the total linear miles of disturbed drainages in the Project Area would be reduced from 40.5 miles to 40.4 miles (a 0.2% reduction in linear miles of disturbed drainages compared to the Proposed Action). All other disturbances to drainages during construction would be the same as under the Proposed Action.

Under Alternative A, the disturbance to floodplains during construction would be reduced from 221.7 acres to 220.7 acres (a 0.5% reduction in floodplain acreage disturbed compared to the Proposed Action), because two fewer well sites would be necessary. The nature of impacts to floodplains would be the same under both alternatives.

4.18.1.4.2 Impacts to Surface Water Resources during Operation

Under Alternative A, potential changes to surface water resources during operation and maintenance of the SSEP would be the same as under the Proposed Action, with the minor exceptions discussed below.

Changes to surface water drainages for Alternative A would be the same as the Proposed Action. There would be fewer impacts to drainages due to six fewer crossings in the well field. All other disturbances to drainages during operation would be the same as under the Proposed Action.

Under Alternative A, the disturbance to floodplains during operation and maintenance of the SSEP would be reduced from 218.7 acres to 218.2 acres (a 0.2% reduction in floodplain acreage disturbed compared to the Proposed Action), because two fewer well sites would be necessary.

4.18.1.5 SUB-ALTERNATIVE A1: PHOTOVOLTAIC

Under Sub-alternative A1, the total acres of permanent disturbance in the Project Area would be reduced from 3,589 acres under the Proposed Action to 1,984 acres. This equals a reduction in the permanent disturbance of Project Area of 1,605 acres (a 45% reduction). Most of this reduction is in the proposed solar field, which would be reduced from 3,528 acres to 2,306 acres (1,226 acres or 35% reduced area). Impacts to surface water resources under Sub-alternative A1 would be reduced due to a reduction in the number and miles of drainages and reduced acres of floodplains impacted. These changes and associated impacts are discussed below. The number of groundwater production wells would be reduced from four under the Proposed Action to two under Sub-alternative A1 (see Section 4.18.2).

4.18.1.5.1 Impacts to Surface Water Resources during Construction

Under Sub-alternative A1, the total acres of temporary disturbance in the Project Area would be reduced from 3,620 acres under the Proposed Action to 2,013 acres. This equals a reduction in the temporary disturbance of Project Area of 1,607 acres or 44%.

Under Sub-alternative A1, the number of drainages crossed by roads during construction would be reduced from 27 under the Proposed Action to 19, due to two fewer well sites. Therefore, under this alternative, the total linear miles of disturbed drainages during construction of the SSEP would be reduced from 40.5 linear miles to 20.1 linear miles (a 50% reduction compared to the Proposed Action) (Table 4.104). The nature of disturbances to drainages during construction would be the same as under the Proposed Action.

Table 4.104 Construction-related Disturbances to Surface Water Drainages – Sub-alternative A1

Disturbance	Area	Linear Mile(s)
		Sub-alternative A: Photovoltaic
Temporary	Roads, pipelines, and gen-tie line	0.69
	Proposed solar field	19.45
	Well field	0.001
	Total	**20.15**

Under Sub-alternative A1, disturbance to floodplains during construction would be reduced from 221.7 acres (Proposed Action) to 3.9 acres (98% reduction), because the Project Area under Sub-alternative A1 would occupy less land than the Proposed Action and would avoid most of the floodplains in the area. This alternative would also result in the elimination of floodplains disturbed in the well field (see Table 4.105).

Table 4.105 Construction-related Disturbances to Floodplains – Sub-alternative A1

Disturbance	Area	Acre(s)	
		Proposed Action	Sub-alternative A1: Photovoltaic
Temporary	Roads and pipelines	6	3.9
	Proposed solar field	215	0
	Well field	0.7	0
	Total	**221.7**	**3.9**

4.18.1.5.2 Impacts to Surface Water Resources during Operation

Under Sub-alternative A1, changes to surface water resources during operation and maintenance of the SSEP in the Rainbow Wash watershed would be the same as under the Proposed Action. The off-site drainage on the Waterman Wash side of the Project will remain in the natural washes and drainage paths.

Under Sub-alternative A1, the number of permanent culverts installed along the access road would be 13 compared to 12 under the Proposed Action (Map 7). Under the Proposed Action, this wash would fall inside the solar field, but under Sub-alternative A1, it would be outside the solar field and therefore crossed by the access road alignment. There would also be six permanent crossings in the well field. Under this alternative, the total linear miles of disturbed drainages during operation and maintenance of the SSEP would be reduced from 40.0 miles to 19.8 miles, a 50% reduction.

The long-term impacts to surface water drainages would be the same under Sub-alternative A1 as under the Proposed Action, although the impacts would apply to fewer miles of drainages.

Under Sub-alternative A1, 1.9 acres of disturbance to floodplains would occur during operation and maintenance of the SSEP. This is a 99% reduction compared to the Proposed Action (where 218.7 acres of disturbance to floodplains would occur). The reduction in acres of disturbance in floodplains under Sub-alternative A1 is due to the reduced footprint of the proposed solar field compared to the Proposed Action and the avoidance of most floodplains under this alternative.

4.18.1.6 ALTERNATIVE B: REDUCED FOOTPRINT

Under Alternative B, the total acres of permanent disturbance in the Project Area would be reduced from 3,589 acres under the Proposed Action to 2,363 acres. This equals a reduction in the permanent disturbance of Project Area of 1,226 acres (-34%). Most of this reduction is in the proposed solar field, which would be reduced from 3,528 acres to 2,306 acres (1,226 acres or 35% reduced area). Impacts to surface water resources under Alternative B would be reduced due to a reduction in the number and miles of drainages and reduced acres of floodplains impacted. These changes and associated impacts are discussed below. The number of groundwater production wells would be reduced from four under the Proposed Action to three under Alternative B (see Section 4.18.2).

4.18.1.6.1 Impacts to Surface Water Resources during Construction

Under Alternative B, the total acres of temporary disturbance in the Project Area would be reduced from 3,620 acres under the Proposed Action to 2,394 acres. This equals a reduction in the temporary disturbance of Project Area of 1,226 acres (-34%).

Under Alternative B, the number of drainages crossed by roads during construction would be reduced from 27 under the Proposed Action to 23, due to one fewer well site. Therefore, under this alternative, the total linear miles of disturbed drainages during construction of the SSEP would be reduced from 40.5 linear miles to 26.2 linear miles (a 35% reduction compared to the Proposed Action) (see Table 4.106). The nature of disturbances to drainages during construction would be the same as under the Proposed Action.

Table 4.106 Construction-related Disturbances to Surface Water Drainages – Alternative B

Disturbance	Area	Linear Mile(s)
		Alternative B: Reduced Footprint
Temporary	Roads, pipelines, and gen-tie line	0.9
	Proposed solar field	25.4
	Well field	0
	Total	**26.2**

Under Alternative B, disturbance to floodplains during construction would be reduced from 221.7 acres (Proposed Action) to 114.8 acres (48%) because the Project Area under Alternative B would occupy less land than the Proposed Action and therefore avoid disturbing 106.4 acres of floodplains. A small reduction (13%) in the change to floodplains would also occur along the well road (from 3.1 acres under the Proposed Action to 2.7 acres under Alternative B) (Table 4.107).

Table 4.107 Construction-related Disturbances to Floodplains – Alternative B

Disturbance	Area	Acre(s)	
		Proposed Action	Alternative B: Reduced Footprint
Temporary	Roads and pipelines	6	5.5
	Proposed solar field	215	108.6
	Well field	0.7	0.7
	Total	**221.7**	**114.8**

4.18.1.6.2 Impacts to Surface Water Resources during Operation

Under Alternative B, potential changes to surface water resources during operation and maintenance of the SSEP would be the same as under the Proposed Action.

Under Alternative B, the number of permanent culverts installed along the access road would be the same as under the Proposed Action. However, the number of permanent crossings in the well field would be reduced from 15 under the Proposed Action to 11, due to one less well site. Under this alternative, the total linear miles of disturbed drainages during operation and maintenance of the SSEP would be reduced from 40.0 miles to 25.8 miles (36%).

The long-term impacts to surface water drainages would be the same under Alternative B as under the Proposed Action, although the impacts would apply to fewer miles of drainages. There would be fewer impacts to drainages due to four less drainage crossings in the well field. All other disturbances to drainages during operation would be the same as under the Proposed Action.

Under Alternative B, 112 acres of disturbance to floodplains would occur during operation and maintenance of the SSEP. This is a 49% reduction compared to the Proposed Action (where 218.7 acres of disturbance to floodplains would occur). The reduction in acres of disturbance in floodplains under Alternative B is due to the reduced footprint of the proposed solar field compared to the Proposed Action.

4.18.1.7 REDUCED WATER USE OPTION–BRINE CONCENTRATOR

The use of a brine concentrator to reduce SSEP water use would not affect the environmental consequences to surface water resources under either the Proposed Action or Alternative B.

4.18.1.8 GENERATION TIE LINE OPTION

The addition of the Gen-tie Line Option to the Proposed Action, Alternative A, or Alternative B would result in the additional disturbance of 809 feet of surface water drainages when compared to the proposed gen-tie line (Table 4.108). The location of culverts under this option would shift, and the number of culverts would increase from 12 to 22. Using a total of 40 miles or 211,200 feet for the Proposed Action disturbance, this represents a 0.4% increase in total surface disturbance. If the Gen-tie Line Option were implemented with Sub-alternative A1, an additional disturbance to surface water drainages of 836 feet would occur. Using a total of 104,652 linear feet for the Sub-alternative A1 disturbance, this represents a 0.8% increase in total surface disturbance.

Table 4.108 Additional Feet Disturbed with the Gen-tie Line Option

	Proposed Action, Alternative A: Reduced Water Use (dry-cooled CST), and Alternative B: Reduced Footprint	Sub-alternative A1: Photovoltaic
Disturbance to Surface Water Drainages		
Temporary disturbance	581	581
Long-term disturbance	228	255
Total disturbance	**809**	**836**

No additional acres of disturbance to floodplains would occur if the Gen-tie Line Option were applied to any of the action alternatives.

4.18.1.9 POTENTIAL MITIGATION MEASURES

No potential mitigation measures are suggested.

4.18.1.10 RESIDUAL IMPACTS

Because no potential mitigation measures are suggested, the residual impacts to surface water would be the same as discussed under the Proposed Action and other action alternatives.

4.18.1.11 SHORT-TERM USES VERSUS LONG-TERM PRODUCTIVITY

The short-term use of the Project Area for constructing, operating, and maintaining the SSEP would have no impact on the long-term productivity of surface water resources as described above. Applicant-committed environmental protection measures, surface water control structures that mimic the outcomes of natural flow conditions, and BMPs would allow the quality and quantity of surface water to be maintained for the life of the project and beyond (following decommissioning). Short-term and long-term gains in productivity associated with the Proposed Action and other action alternatives would consist of improvements in the control of flood stage waters that flow through the proposed solar field, because these flows would be controlled by designed releases from the solar field.

4.18.1.12 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The applicant-committed measures listed in Chapter 2 (see Table 2.2) would require the reclamation of disturbed areas immediately following temporary disturbances and termination of the project. Long-term disturbance areas would constitute an irretrievable commitment of water resources until active site reclamation and restoration of drainages and floodplains is completed. Irretrievable commitments of water resources would include any permanently capped project areas, permanent culverts, and paved roadways associated with the Proposed Action and other action alternatives that would persist for the life of the project.

There would be an irretrievable loss of natural drainages and floodplains from the SSEP, because the proposed solar field would be graded, and those surface water features would be precluded for the life of the project. However, there would be no irreversible commitments of surface water resources, because the area would be reclaimed after termination of the project.

The SSEP would have relatively limited effects on surface water flows. All naturally occurring flows would pass largely unaffected to the downstream washes. Therefore, the SSEP would not result in any irreversible or irretrievable commitments of water resources with respect to surface water quantity.

4.18.2 Groundwater

4.18.2.1 ANALYSIS AREA AND ANALYSIS ASSUMPTIONS

Under the Proposed Action and other action alternatives, water required for the SSEP would be pumped from the Rainbow Valley aquifer in the Rainbow Valley Sub-basin of the Phoenix active management area. The analysis area used to evaluate the potential impacts to groundwater resources is the Rainbow Valley Sub-basin (Map 27).

The Proposed Action and other action alternatives would include removal of groundwater from the local Rainbow Valley aquifer at one well field located within the Project Area, east of the proposed solar field. The water would then be piped to the proposed solar field. Impacts from groundwater withdrawals are analyzed in terms of potential effects on the depth to groundwater (drawdown). Therefore, impacts to groundwater resources are measured by changes in groundwater levels and the associated changes in groundwater reserves stored in the Rainbow Valley aquifer.

Common to all groundwater pumping projects, groundwater pumping from a well causes groundwater to change flow directions within a portion of the aquifer, and groundwater within the influence of the pump flows toward the well. In an unconfined (water table) aquifer (e.g., the Rainbow Valley aquifer), as groundwater flows into the well, the water levels in the aquifer around the well are lowered (drawdown). The amount of groundwater drawdown is less with distance from the well, resulting in a conical-shaped depression radiating away from the well. This conical-shaped drawdown in groundwater levels is referred to as a cone of depression. The size and shape (slope) of the cone of depression depends on many factors, including the pumping rate and pumping duration. The primary potential impacts to water users in the Rainbow Valley Sub-basin would be increased depth to groundwater within the cone of depression. These increases in depth to groundwater would increase the risk to other groundwater users by requiring them to make adjustments in pump intake placement, and/or make upgrades to pumping equipment.

To evaluate changes in groundwater levels in the Rainbow Valley aquifer during operation of the SSEP, a groundwater flow model was developed by Carr (2010). This groundwater flow model simulated the effects on groundwater levels due to pumping groundwater at the rates anticipated for the Proposed Action. Therefore, the groundwater modeling results provided by Carr (2010) were used to quantify the drawdown in groundwater levels due to pumping from the Rainbow Valley aquifer for the SSEP. Changes in groundwater reserves stored in the Rainbow Valley aquifer were evaluated based on the proposed pumping rates and durations provided in the Proposed Action and other action alternatives.

Under the Proposed Action and other action alternatives, groundwater pumped from the Rainbow Valley aquifer is not expected to have a direct or indirect impact on surface water flows or resources in the Rainbow Valley Sub-basin. Locally, surface waters that flow in drainages and washes are only present after storm events. These short duration surface flows are not fed by groundwater, and no gaining streams are known to exist in the Rainbow Valley Sub-basin. In addition, flow rates in the Gila River are not expected to be impacted by groundwater pumping for the SSEP. The hydrologic disconnect between the Rainbow Valley aquifer and the Gila River is best shown by the results of a gravity survey conducted by Carr (2010). This gravity survey evaluated the depth to bedrock in a portion of the Rainbow Valley Sub-basin, and the results indicate the presence of a bedrock ridge located north of the Project Area. This bedrock ridge forms a no-flow boundary condition in the Rainbow Valley aquifer that separates the aquifer from the Gila River. Therefore, project-induced effects on local and regional groundwater levels

are not expected to impact surface flows in the Rainbow Valley Sub-basin or the Gila River and impacts to surface water flows due to groundwater pumping for the SSEP are not discussed further.

Under the Proposed Action and other action alternatives, recharge to the Rainbow Valley aquifer is not expected to be changed due to construction or operation of the SSEP. Natural groundwater recharge to the Rainbow Valley aquifer consists of mountain front recharge and stream channel recharge from flood-stage flows in Waterman Wash. Groundwater recharge near the SSEP is believed to be minimal due to the lack of a mountain front capable of providing recharge, lack of a primary stream channel, and significant evapotranspiration (Carr 2010).

The risk of land subsidence due to groundwater withdrawals is addressed qualitatively based on the proximity of areas with historic land subsidence, the rate of subsidence, and the hydrogeology of the Rainbow Valley aquifer. Areas east of the Project Area have subsidence features mapped by the Arizona Geologic Survey (Schumann and Genualdi 1986). These subsidence features are located approximately 1 mile east and 2 miles north of the proposed SSEP well field (see Map 10). The rate of subsidence in the Rainbow Valley Sub-basin is estimated to be 1 centimeter per year and is limited to small areas where agriculture is present (personal communication, Brian Conway 2010).

The potential for land subsidence due to groundwater pumping can increase depending on the hydrogeology of the aquifer. Interbedded aquifer-aquitard systems are more susceptible to compaction due to the compressibility of fine-grained sediments (clays and silts) that result in a lowering of the land surface (subsidence). In other words, if an aquifer consists of beds of clay or silt within or next to it, the lowered water pressure in the sand and gravel causes slow drainage of water from the clay and silt beds. The reduced water pressure is a loss of support for the clay and silt beds. Golder (2009) notes three distinct hydrogeologic units in the exploratory borings: 1) an upper unit consisting of sand and gravel, 2) a middle unit consisting mainly of clay and silty clay, and 3) a lower, highly consolidated conglomerate (see the hydrogeologic cross-section from Carr 2010, Figure 20). The clay and silty clay unit extends from 920 feet to 1,100 feet below land surface and is referred to as an aquitard (Carr 2010). The screened interval in test well TW-1 extends from 519 to 919 feet below land surface. If other production wells extract water near the clay/silt aquitard, or if the aquitard pore pressure is reduced, land subsidence would occur. Groundwater pumping solely for the SSEP is not expected to have an impact on the valley fill alluvial deposits of the Rainbow Valley aquifer or contribute to land subsidence. Therefore, land subsidence due to groundwater pumping for the SSEP is not discussed further.

It is assumed that the risk of arsenic contamination to groundwater resources would be low under the Proposed Action and other action alternatives. Based on preliminary results, the maximum concentration of arsenic is approximately 0.012 ppm. Although the EPA drinking water quality standard is 0.010 ppm, industrial wastewater produced from water treatment would be cooled on-site in six evaporation ponds. According to Arizona's Aquifer Protection Program, these ponds are classified as categorical discharging facilities and would require an APP from ADEQ. The statutes requiring the APP dictate that the facility ~~"~~be so designed, constructed and operated as to ensure the greatest degree of discharge reduction achievable through application of the best available demonstrated control technology" (A.R.S. § 49-243.B.1). The SSEP evaporation ponds would be constructed to meet ADEQ's prescriptive requirements for process solution compounds. Each pond would have a double liner system consisting of two high-density polyethylene liners separated by a synthetic drainage geonet and a leachate collection and removal system. Other prescriptive elements would be designed to ensure that contamination from arsenic or other constituents of concern do not interact with groundwater resources; however, if deemed necessary by ADEQ, groundwater quality would be monitored on-site to ensure compliance with Arizona Water Quality Standards.

Construction and operation of the SSEP are not expected to change groundwater recharge rates. Groundwater recharge to the Rainbow Valley aquifer consists of infiltration from agricultural irrigation occurring primarily in the northern part of the sub-basin, mountain front recharge, and stream channel recharge from flood-stage flows in Waterman Wash (Carr 2010). Groundwater recharge near the SSEP is believed to be minimal due to the lack of agricultural irrigation, a primary stream channel or a mountain front capable of providing recharge, and significant evapotranspiration. Depth-to-groundwater data are limited for the Project Area; however, the average depth to groundwater across the SSEP is estimated to be greater than 300 feet below land surface (Carr 2010). Due to the arid desert environment in the greater Project Area, infrequent and low precipitation, and thickness of the unsaturated zone (300 feet) in the Project Area, no impacts to groundwater recharge resulting from construction or operation of the SSEP are anticipated.

No impacts to groundwater (except withdrawals during well development and well testing, which are discussed below) are expected to occur during construction of the SSEP; therefore, only groundwater impacts that would occur during operation and maintenance of the SSEP are evaluated. The following sections discuss the potential project-induced effects on local and regional groundwater levels.

4.18.2.2 NO ACTION

Under the No Action alternative, no changes in the depth to groundwater, or groundwater reserves stored in the Rainbow Valley aquifer would occur because groundwater would not be used for the SSEP.

4.18.2.3 PROPOSED ACTION

Under the Proposed Action, four groundwater wells would be constructed within the well field location. The average groundwater usage for the Proposed Action is estimated to range from 2,305 to 3,003 afy (equivalent to an average pumping rate of approximately 1,429 to 1,862 gpm) depending on the amount of thermal storage and gas co-firing used. An acre-foot is the quantity of water that would fill an area of 1 acre, 1 foot in depth. This quantity is equal to 325,851 gallons and is approximately equivalent to the annual water use of four people. The minimum groundwater use (1,429 gpm) assumes solar production only; the maximum groundwater use (1,862 gpm) assumes 25% power production from thermal storage and gas co-firing production.

Figure 4.5 shows the changes in depth to groundwater as modeled for the SSEP (Golder 2009b) for the Proposed Action. The short-term (5-year) changes in depth to groundwater due to pumping at the two proposed rates (1,429 gpm and 1,862 gpm) are shown. The long-term (30-year) changes in depth to groundwater due to pumping at the proposed rates are also shown.

Short-term changes in groundwater levels were simulated by modeling the water level drawdown from the SSEP groundwater production wells for the first five years of operation at 1,429 and 1,862 gpm. The predicted drawdowns at the end of the five-year simulation period for the proposed pump rates are shown on Figure 4.5. The modeling results for the five-year simulation show maximum drawdown at the well field of approximately 16 feet and 20 feet, respectively for 1,429 and 1,862 gpm. The maximum extent of the cone of depression for both proposed pump rates is based on the 2-foot drawdown contour that is located approximately 2.0–2.5 miles east, west, and north of the well field (Golder 2009b).

Long-term changes in groundwater levels were also simulated from pumping at the SSEP production wells for 30 years of operation at 1,429 and 1,862 gpm. The predicted drawdowns at the end of the 30-year simulation period for the proposed pump rates are shown on Figure 4.5. The modeling results for the 30-year simulation show maximum drawdown at the well field of approximately 32 feet and 44 feet, respectively for 1,429 and 1,862 gpm. The maximum extent of the cone of depression for both proposed pump rates is based on the 2-foot drawdown contour that is located approximately 7–8 miles southeast of the well field (Golder 2009b).

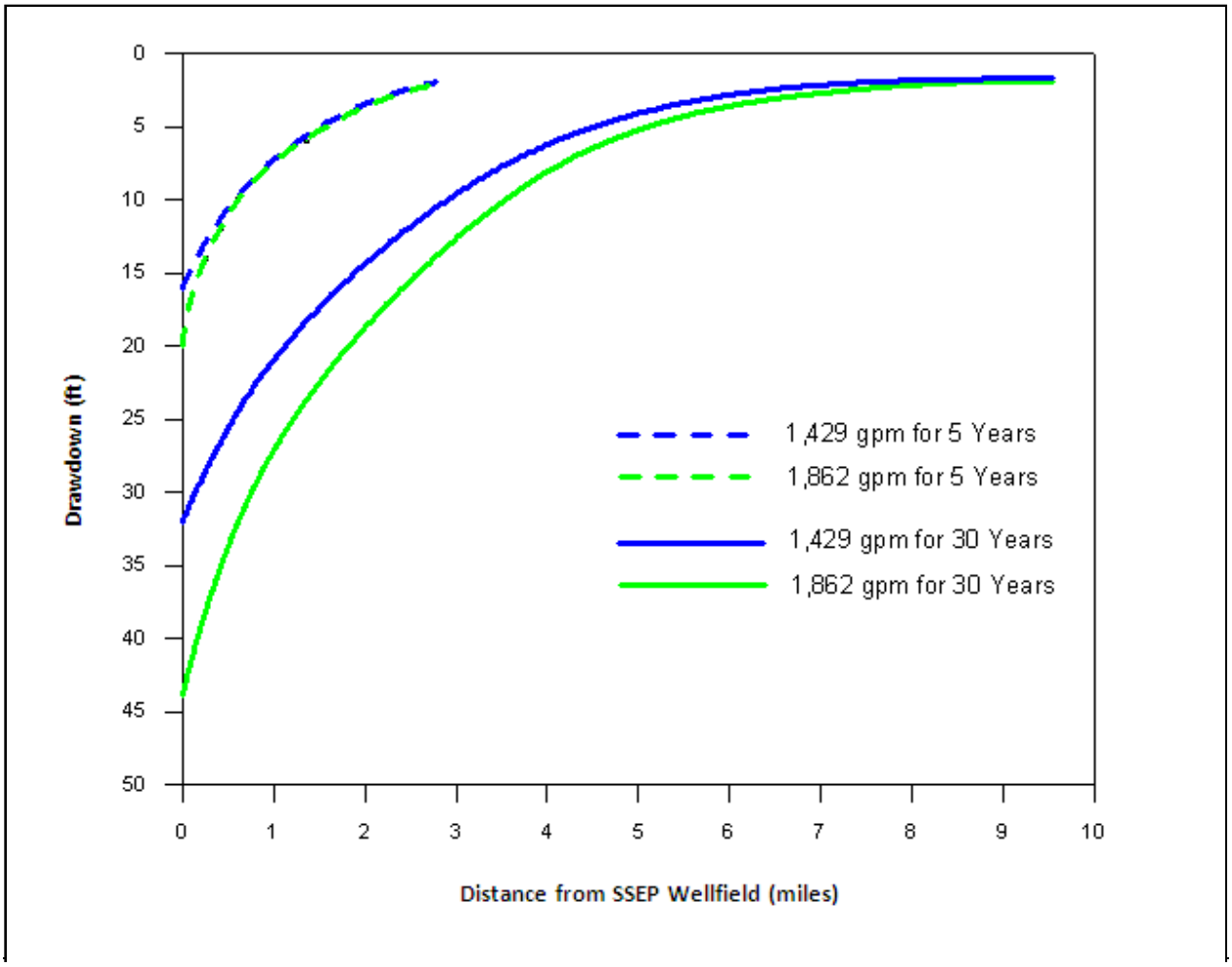

Figure 4.5 Groundwater level drawdown.

Short-term changes in groundwater levels due to groundwater pumping for the SSEP would cause an increase in the depth to water in registered wells. There are 355 registered wells in the Rainbow Valley Sub-basin. Under the Proposed Action pumping scenario of 1,429 gpm for five years, groundwater drawdown would occur in 79 registered wells. The amount of drawdown depends on the distance of the well from the SSEP well field and would range from 2 to 10 feet (Table 4.109).

Table 4.109 Groundwater Drawdown and Number of Wells Impacted (modeled groundwater drawdown in surrounding wells with a groundwater pumping rate of 1,429 gpm)

Groundwater Drawdown (feet)	Number of Wells Experiencing Level of Drawdown after 5 Years	Number of Wells Experiencing Level of Drawdown after 30 years
24–26	0	2
22–24	0	8
20–22	0	9
18–20	0	12
16–18	0	19
14–16	0	21
12–14	0	23
10–12	0	8
8–10	3	21
6–8	20	10
4–6	17	17
2–4	39	20

Note: Modeled groundwater drawdown in surrounding wells with a groundwater pumping rate of 1,429 gpm.

ADWR's well spacing requirements at A.A.C § R12-15-1302 require that groundwater withdrawals from proposed wells do not cause 10 feet of additional drawdown in surrounding wells after the first five years of operation. Under the Proposed Action pumping scenario of 1,429 gpm for five years, the maximum groundwater drawdown would be less than 10 feet in all other wells. The registered well's groundwater drawdown and associated water use are provided in Appendix F, Table F-1 for the 1,429 gpm, five-year groundwater pumping scenario.

Under the Proposed Action pumping scenario of 1,862 gpm for five years, groundwater drawdown would occur in 90 registered wells. The amount of drawdown under this scenario would range from 2 to 12 feet (Table 4.110).

Table 4.110 Groundwater Drawdown and Number of Wells Impacted (modeled groundwater drawdown in surrounding wells with a groundwater pumping rate of 1,862 gpm)

Groundwater Drawdown	Number of Wells Experiencing Level of Drawdown after 5 Years	Number of Wells Experiencing Level of Drawdown after 30 Years
30–32	0	8
28–30	0	7
26–28	0	4
24–26	0	12
22–24	0	9
20–22	0	21
18–20	0	12
16–18	0	11
14–16	0	15
12–14	0	10
10–12	6	16
8–10	15	7
6–8	15	10
4–6	17	20
2–4	37	14

Note: Modeled groundwater drawdown in surrounding wells with a groundwater pumping rate of **1,862 gpm.**

Under the Proposed Action pumping scenario of 1,862 gpm for five years, the maximum groundwater drawdown would be less than 12 feet in all other wells. The registered well's groundwater drawdown and associated water use are provided in Appendix F, Table F-2 for the 1,862 gpm, five-year groundwater pumping scenario.

Under the 1,862-gpm groundwater pumping scenario, the groundwater level drawdown in six wells would be between 10 and 12 feet after five years of pumping. In accordance with ADWR's well spacing and well impact requirements, waivers would be required from the owners of these wells prior to groundwater pumping of the magnitude that would result in this level of drawdown. To determine the maximum short-term pump rate that would meet ADWR's well spacing and well impact requirements, Carr (2010) developed a pumping scenario that simulated a maximum 10 foot drawdown in other wells after five years of pumping. The results of this modeling scenario demonstrated that the maximum average annual pumping rate for the well field that meets ADWR's well spacing and well impact requirements is 1,600 gpm. Pumping at a rate in excess of 1,600 gpm would require waivers from the owners of any neighboring wells that could be impacted (i.e., see groundwater level drawdown greater than 10 feet after five years of pumping) as a result of SSEP groundwater pumping.

Long-term changes in groundwater levels were also simulated by Golder by modeling the drawdown due to pumping at the proposed rates of 1,492 gpm and 1,862 gpm for 30 years (the life of the project). Under the Proposed Action pumping scenario of 1,492 gpm for 30 years, the groundwater level in 170 registered wells would be drawn down from 2 to 26 feet.

The registered well's groundwater drawdown and associated water use are provided in Appendix F, Table F-3 for the 1,492 gpm, 30-year groundwater pumping scenario.

Under the Proposed Action pumping scenario of 1,862 gpm for 30 years, the groundwater level in 176 registered wells would be drawn down. The amount of drawdown under this scenario would range from two to 34 feet (see Table 4.110).

Under the Proposed Action pumping scenario of 1,862 gpm for 30 years, the maximum groundwater drawdown would be less than 2 feet in all other wells. The registered well's groundwater drawdown and associated water use are provided in Appendix F, Table F-4 for the 1,862 gpm, 30-year groundwater pumping scenario.

Under the Proposed Action and other action alternatives, groundwater pumping from the Rainbow Valley aquifer would result in reductions in groundwater reserves stored in the Rainbow Valley aquifer for the life of the SSEP. These reductions are summarized in Table 4.111.

Table 4.111 Long-term Reductions in Groundwater Reserves

Action	Proposed Operational Pump Rate (gpm)	Proposed Operational Pump Rate (afy)	Reduction in Groundwater Reserves (acre-feet) for 30 years
Proposed Action	1,429	2,305	69,150
With gas co-firing	1,862	3,003	90,090
Alternative A: Reduced Water Use (dry-cooled CST)	72	116	3,480
With gas co-firing	94	151	4,530
Sub-alternative A1: Photovoltaic	20.5	33	2,165*
With gas co-firing	n/a	n/a	n/a
Alternative B: Reduced Footprint	941	1,518	45,540
With gas co-firing	1,242	2,003	60,090
Proposed Action with Brine Concentrator	1,329	2,144	64,320
With gas co-firing	1,732	2,793	83,790
Alternative B – Reduced Footprint with Brine Concentrator	875	1,412	42,360
With gas co-firing	1,155	1,863	55,890

Note: Calculated reductions in groundwater storage due to operational pumping for 30 years.

*The reduction in groundwater reserves for Sub-alternative A1 is based on 186–310 gpm pump rate for the first 3.25 years of construction, followed by 30 years of pumping at the operational rate of 20 5 gpm (33.25 years total).

4.18.2.3.1 Wells Impacts Analysis

Impacts to existing wells resulting from drawdown would primarily consist of the following effects: increased electrical power consumption, dewatering of well screen, and loss of sufficient hydraulic head above pump intake.

As water levels decline, the amount of electrical power required to pump groundwater to the surface would increase, increasing water production costs to the well owner. The degree of increase in pumping costs would be dependent on several factors, including the pump specifications, material of pipe, and electricity rates. Most domestic wells typically have a pump located near the bottom of the screened interval of the well. If the water levels decline to a level below the top of the screen, this would result in a

proportional decrease in well yield, potentially reducing the operational life of the well. The most severe impact to an individual well would be a declining water level to an elevation that is below the pump intake. In this case, it would be necessary to lower the pump further into the screened portion of the well, if possible. If the pump could not be lowered any further, the well would become inoperable as long as the water level was below the pump intake.

Approximately one-half of the wells in the northern part of Rainbow Valley are domestic and/or livestock wells, approximately one-fourth are irrigation wells, and the remaining one-fourth fall into other categories such as industrial supply, groundwater monitoring, or testing (Golder 2011). Most of the domestic/livestock wells range in depth from approximately 200 to 600 feet below land surface (bls), whereas most irrigation wells range in depth from approximately 600 to 1,200 feet bls. For this reason, domestic/livestock wells would be more likely than irrigation wells to be impacted by the regional water level decline rate as well as future water level declines related to residential development, agricultural activity, or the SSEP.

In general, wells that are located closest to the SSEP would be more likely to be impacted by SSEP-related water level drawdown than wells located several miles away. According to the Well Registry Database (ADWR 2009b), there are approximately 30 existing wells located within an approximately 1-mile radius of the proposed SSEP well field. All of these wells are small diameter (4–8 inches), low-capacity wells that have been registered with ADWR solely for domestic use, or for domestic use and livestock watering. The wells range in depth from 390 to approximately 670 feet bls; the average depth to groundwater in the area is approximately 360 feet bls.

Based on groundwater modeling results (Carr 2010), potential impacts to wells in the surrounding area would likely consist solely of additional electricity for groundwater pumping from a deeper level.

The percent reduction in groundwater reserves due to pumping for the SSEP is difficult to quantify because the existing reserves in the Rainbow Valley Sub-basin have not been estimated. The following sections discuss the various groundwater consumption rates and groundwater drawdown for the other action alternatives.

4.18.2.4 ALTERNATIVE A: REDUCED WATER USE (DRY-COOLED CST)

Under Alternative A, the average groundwater usage is estimated to range from 116 to 151 afy (72 to 94 gpm) depending on the amount of thermal storage and gas co-firing used. The minimum groundwater use (72 gpm) assumes solar production only; the maximum groundwater use (94 gpm) assumes solar and gas co-firing production. Under this alternative, groundwater consumption would be approximately 90% less than under the Proposed Action. Two groundwater extraction wells would be constructed instead of four under the Proposed Action.

Because impacts would be within the range considered under other model scenarios (the Proposed Action and the No Action cumulative cases, see Appendix F and G), groundwater modeling was not conducted for the pumping rates proposed under Alternative A. Therefore the groundwater-level changes in the Rainbow Valley Sub-basin due to pumping for the SSEP are not quantified in this analysis. However, as in the Proposed Action, the changes in groundwater levels would be long-term direct impacts because groundwater levels would be lowered throughout the life of the project. Although a direct correlation is not possible, drawdown under this alternative would be expected to be much closer to the No Action alternative than to the Proposed Action (due to Alternative A's approximately 90% reduction in pumping rates relative to the Proposed Action).

Under the proposed pumping rate for Alternative A of 72 gpm, the reduction in stored groundwater in the Rainbow Valley aquifer would be 1,135 million gallons (Mgals) for the life of the SSEP (as compared to 22,532 Mgals under the Proposed Action). For the proposed pumping rate under Alternative A of 94 gpm,

the reduction in stored groundwater in the Rainbow Valley aquifer would be 1,482 Mgals for the life of the SSEP (as compared to 29,360 Mgals under the Proposed Action). The reduction in stored groundwater associated with groundwater pumping for the SSEP would be long-term because this reduction in groundwater storage would occur throughout the life of the project.

4.18.2.5 SUB-ALTERNATIVE A1: PHOTOVOLTAIC

Sub-alternative A1 would result in the lowest amount of groundwater usage of all the action alternatives. Groundwater usage would range from 300 to 500 afy (186 to 310 gpm) during construction and would be approximately 33 afy (20.5gpm) during operation. Operational uses of water under this sub-alternative would include PV panel washing, dust control, and potable uses. Operational groundwater use under this sub-alternative would be less than 1.5% of the groundwater use under the Proposed Action. When calculated over the life of the project with construction and operational use factored in, the average annual water use would be 65 afy. Two groundwater wells would be constructed under this alternative, as opposed to four under the Proposed Alternative. Groundwater pumping would be pumped from one well at a time, and would alternate between the two wells.

As under the other action alternatives, long-term changes in groundwater levels after five and 30 years were simulated under Sub-alternative A1, but assumed an operational pumping rate of 20.5 gpm. Under this sub-alternative, predicted drawdown at the well field after 30 years would be approximately 0.7 foot, which represents approximately 1.0% of the cumulative drawdown.

Short-term changes in groundwater levels were simulated assuming a pumping rate of 310 gpm for the first year of construction, 186 gpm for the next 27 months, and at the operational rate of 20.5 gpm for the remaining five years (21 months). Under this sub-alternative, the predicted drawdown at the well field after five years would be approximately 0.8 foot. The drawdown after five years would be greater than the drawdown after 30 years because of the higher pumping rates during the construction phase of the project.

These predicted levels of drawdown would be in compliance with ADWR's A.A.C § R12-15-1302 well spacing requirements that require groundwater withdrawals from proposed wells not to cause 10 feet of additional drawdown in surrounding wells after the first five years of operation. Under Sub-alternative A1, the maximum groundwater drawdown would be less than 1 foot in all other wells. Of the 355 registered wells in the Rainbow Valley Sub-basin, none are expected to experience a drawdown greater than 1 foot after five years, nor after 30 years.

Under Sub-alternative A1, groundwater reserves stored in the Rainbow Valley aquifer would be reduced by approximately 2,165 acre-feet over the life of the SSEP (see Table 4.111).

Under Sub-alternative A1, even the wells located closest to the SSEP well field would likely experience drawdown of less than 1 foot and would therefore experience no detectable impacts.

4.18.2.6 ALTERNATIVE B: REDUCED FOOTPRINT

Under Alternative B, the average groundwater usage is estimated to range from 1,518 to 2,003 afy (941 to 1,242 gpm) depending on the amount of thermal storage and gas co-firing used. The minimum groundwater use (941 gpm) assumes solar production only; the maximum groundwater use (1,242 gpm) assumes solar and gas co-firing production. Under this alternative, groundwater consumption would be approximately 30% less than under the Proposed Action. Three groundwater extraction wells would be constructed instead of four as under the Proposed Action.

Because impacts would be within the range considered under other model scenarios (the Proposed Action and the No Action cumulative cases, see Appendix F and G), groundwater modeling was not conducted

for the pumping rates proposed under Alternative B. Therefore the groundwater-level changes in the Rainbow Valley Sub-basin due to pumping for the SSEP are not quantified in this analysis. However, as in the Proposed Action, the changes in groundwater levels would be long-term direct impacts because groundwater levels would be lowered throughout the life of the project. Although a direct correlation is not possible, drawdown under this alternative would be expected to be closer to the Proposed Action than to the No Action (due to Alternative B's approximately 30% reduction in pumping rates relative to the Proposed Action).

Under the proposed pumping rate for Alternative B of 941 gpm, the reduction in stored groundwater in the Rainbow Valley aquifer would be 14,838 Mgals for the life of the SSEP (as compared to 22,532 Mgals under the Proposed Action). For the proposed pumping rate under Alternative B of 1,242 gpm, the reduction in stored groundwater in the Rainbow Valley aquifer would be 19,584 Mgals for the life of the SSEP (as compared to 29,360 Mgals under the Proposed Action). The reduction in stored groundwater associated with groundwater pumping for the SSEP would be long-term because this reduction in groundwater storage would occur throughout the life of the project.

4.18.2.7 REDUCED WATER USE OPTION–BRINE CONCENTRATOR

This option applies to either the Proposed Action or Alternative B and would reduce groundwater consumption by approximately 7% compared to the level of groundwater consumption that would occur under either of these alternatives. Therefore, under the Proposed Action the average groundwater usage is estimated to range from 1,412 to 1,863 afy (875 to 1,155 gpm) depending on the amount of thermal storage and gas co-firing used. The minimum groundwater use (875 gpm) assumes solar production only, the maximum groundwater use (1,155 gpm) assumes solar and gas co-firing production. It is assumed that the number of extraction wells would be three or four.

Groundwater modeling was not conducted for the pumping rates proposed under this option. Therefore the groundwater-level changes in the Rainbow Valley Sub-basin due to pumping for the SSEP are not quantified. However, as in the Proposed Action, the changes in groundwater levels would be long-term direct impacts because groundwater levels would be lowered throughout the life of the project.

Under the proposed pumping rate for this option of 875 gpm, the reduction in stored groundwater in the Rainbow Valley aquifer would be 13,797 Mgals for the life of the SSEP (as compared to 22,532 Mgals under the Proposed Action). For the proposed pumping rate of 1,155 gpm, the reduction in stored groundwater in the Rainbow Valley aquifer would be 18,212 Mgals for the life of the SSEP (as compared to 29,360 Mgals under the Proposed Action). The reduction in stored groundwater associated with groundwater pumping for the SSEP would be long-term because this reduction in groundwater storage would occur throughout the life of the SSEP project.

4.18.2.8 GENERATION TIE LINE OPTION

The addition of the Gen-tie Line Option to any of the action alternatives would not change impacts to groundwater resources because groundwater withdrawals under the Gen-tie Line Option would be the same as described above under the analysis of the alternatives. Likewise, the implementation of the Gen-tie Option would not influence natural groundwater recharge.

4.18.2.9 POTENTIAL MITIGATION MEASURES

No mitigation measures are suggested to further reduce groundwater drawdown.

4.18.2.10 RESIDUAL IMPACTS

Because no potential mitigation measures are suggested, the residual impacts to groundwater resources would be the same as discussed under the Proposed Action and other action alternatives.

4.18.2.11 SHORT-TERM USES VERSUS LONG-TERM PRODUCTIVITY

The short-term use of water resources for the SSEP would result in a long-term (but not permanent) impact on the productivity of the groundwater resources in the Rainbow Valley Sub-basin. Under the groundwater consumption scenarios described above, groundwater drawdown (due to the SSEP) over the 30 year life of the project would range from approximately 0.7 feet–34 feet. At project decommissioning groundwater consumption would cease. However, groundwater levels would be reduced by 2 feet to 34 feet until natural groundwater recharge replenishes the groundwater resource in the area. The groundwater recharge rate in the Rainbow Valley Sub-basin is estimated at 2,550 afy (Carr 2010). Reductions (i.e., groundwater level drawdown) in the long-term productivity of the groundwater resources in the Rainbow Valley Sub-basin due to the SSEP would therefore be limited to up to 25 years following project decommissioning and the cessation of project related groundwater use. Cumulative impacts to groundwater, including other projects, are discussed in Section 4.20.4.17, below.

4.18.2.12 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Changes in groundwater levels would be long-term direct impacts because groundwater levels would be lowered throughout the life of the project. This change in groundwater levels would be an irretrievable impact because groundwater levels would be lowered until natural recharge replenishes the aquifer. The quantities of groundwater needed to operate the SSEP would almost all be evaporated rather than discharged back to surface or groundwater and would be considered irretrievably consumed from the Rainbow Valley aquifer. However, the groundwater consumed by SSEP would not be irreversible. Groundwater withdrawals from the Rainbow Valley aquifer would cease immediately and concurrently with retirement of the SSEP. As a result, groundwater levels in the Rainbow Valley aquifer would recover following SSEP retirement.

Natural recharge to the Rainbow Valley aquifer consists of mountain front recharge and steam channel recharge. Carr (2010) estimated recharge to the Rainbow Valley aquifer as 2,550 afy. This estimate includes mountain front recharge and stream channel recharge from flood-stage flows in Waterman Wash. Assuming a natural, and constant, recharge rate of 2,550 afy, the recharge recovery time for SSEP withdrawls from the Rainbow Valley aquifer can be estimated as shown in Table 4.112).

Table 4.112 Long-term Groundwater Recharge Recovery of SSEP Withdrawals

Action	Proposed Operational Pump Rate (gpm)	Proposed Pump Rate (afy)	Reduction in Groundwater Reserves (acre-feet) for 30 years	Aquifer Recovery Time Year(s)
Proposed Action	1,429	2,305	69,150	27
With gas co-firing	1,862	3,003	90,090	35
Alternative A: Reduced Water Use (dry-cooled CST)	72	116	3,480	1
With gas co-firing	94	151	4,530	2
Sub-alternative A1: Photovoltaic	20.5	33	2.125*	1
With gas co-firing	n/a	n/a	n/a	n/a
Alternative B: Reduced Footprint	941	1,518	45,540	18
With gas co-firing	1,242	2,003	60,090	24
Proposed Action with Brine Concentrator	1,329	2,144	64,320	25
With gas co-firing	1,732	2,793	83,790	33
Alternative B: Reduced Footprint with Brine Concentrator	875	1,412	42,360	17
With gas co-firing	1,155	1,863	55,890	21

*The reduction in groundwater reserves for Sub-alternative A1 is based on 186–310 gpm pump rate for the first 3.25 years of construction, followed by 30 years of pumping at the operational rate of 20.5 gpm (33.25 years total).

Based on the above assumptions, under the Proposed Action, groundwater levels would recover to their pre-SSEP condition after 27–35 years, assuming no other withdrawals in the area. Under Alternative A, groundwater levels would recover in approximately one to two years. Under Alternative B, groundwater levels would recover in about 18 to 24 years. Under the Proposed Action with the brine concentrator applied and under Alternative B with the brine concentrator applied, groundwater levels would recover in approximately 25–33 years and 17–21 years, respectively. Finally, under Sub-alternative A1, water levels would recover from SSEP withdrawals after approximately 1 year.

4.19 Wildlife and Special-status Species

4.19.1 Analysis Area and Analysis Assumptions

The area of analysis for wildlife resources consists of the Project Area (see Section 3.19.1) and includes portions of the Buckeye Hills and the North Maricopa Mountains, including the northern portion of the Sonoran Desert National Monument. The analysis area includes these hills and mountains because certain wildlife species may pass through the Project Area while in transit between these areas. The analysis area also includes portions of the Gila River, Rainbow Wash, and an unnamed tributary to Waterman Wash, all of which are within 2 miles of the Project Area. Wash habitat is included in the analysis area due to its potential for wildlife species richness and its potential for use as wildlife travel corridors.

This impacts analysis for wildlife and special-status species takes into account the implementation of the applicant-committed measures described in Section 2.3.3.

The ESA of 1973 directs all federal agencies to work toward conserving endangered and threatened species and to use their authority to further the purposes of the act. The BLM has initiated informal consultation with USFWS for the SSEP. A BA has been prepared for the SSEP and has determined that there would not be any project-related impacts to any federally listed species and/or their designated critical habitat, because suitable foraging and/or breeding habitat is not present in the Project Area (EPG 2009). The USFWS has provided concurrence for this determination (USFWS 2010).

The MBTA makes it unlawful to pursue, hunt, take, capture, kill, or sell most birds listed under the act. The requirements under this act would be followed during all project phases. Mitigation measures are proposed in Section 4.19.5 to ensure compliance with this act.

Special-status wildlife species are designated by the BLM LSFO (sensitive), AZGFD (species of special concern), and USFWS (birds of conservation concern). Special-status species under each designation are managed so as not to become federally listed. Effects of this project on special-status species are analyzed in this section. Additional species-specific mitigation measures to lessen adverse impacts on these special-status species are considered in Section 4.19.5.

Wildlife habitat is defined by the presence or absence of a species in an area within a particular vegetation community type or using a particular resource (e.g., water). Because the presence of wildlife species is so closely tied to the presence and quality of a vegetation community or resource, the analysis of impacts to wildlife is measured in the following ways: acres of vegetation lost or degraded and the percent of the width of each linkage lost or degraded. The acreage of a vegetation community that is lost or degraded describes the type of habitat that is lost. This number is used when in reference to wildlife to describe an area in which animals would be displaced or otherwise affected, and to compare these areas among alternatives. Because the discussion in this section focuses on impacts to wildlife species, although referring to specific vegetation community types, impacts will be discussed in regard to wildlife habitat.

Additional analysis assumptions focus on wildlife responses to human-made noise, including vehicle noise. In general, animals can learn to react to noise with three response types: avoidance, attraction, and habituation (Bowles 1995; Knight and Temple 1995). Avoidance is defined as an animal staying away from an area because of negative or painful associations (e.g., hazing or injury). Attraction is defined as the strengthening of an animal‘s behavior because of rewards or reinforcements (e.g., feeding). Finally, habituation is defined as the waning of an animal‘s response to a repeated stimulus (Knight and Temple 1995). The response of each individual animal is derived from ~~"~~the result of the number and outcome of interactions between an individual and its environment over the individual‘s lifetime" (Knight and

Temple 1995). Furthermore, the type of response elicited from wildlife may also be influenced by a range of other factors, including the source, type, degree, and duration of the disturbance. Nonlearned responses are referred to as ~~"~~genetic responses". Genetic responses are those that have evolved in wildlife as instinct, such as defense and predator avoidance responses, and may also influence how an animal responds to a disturbance. For the purposes of this analysis, it is assumed that an animal may respond to a stimulus with avoidance, attraction, or habituation. In particular, an animal may habituate to a nonthreatening and nonattractive stimulus. However, because of the variety of factors that influences the way in which any individual animal responds, this analysis does not attempt to predict which animals will respond in which way.

The presence of human noise and activity has been shown to affect wildlife behavior. This research has typically been conducted by identifying the impacts of recreation on wildlife, focusing on impacts of human presence and differentiating between motorized and nonmotorized types of recreation (Knight and Cole 1995b; Taylor and Knight 2003). Studies have shown that wildlife can be negatively impacted by human-produced noises, and that the intensity of impacts depends on the timing, frequency and magnitude, and predictability of the disturbances. Negative impacts consist of modified behavior, which can alter the animal's vigor (e.g., increase stress levels) and productivity (especially if disturbed during critical times of year such as breeding and wintering) (Gabrielsen and Smith 1995; Knight and Cole 1995a). If the disturbance persists, wildlife populations can ultimately be negatively impacted by a change in distribution (avoidance, abandonment of preferred areas), a reduction in population size, or a shift in the population demographics (Knight and Cole 1995b). These responses vary by animal type and species, group size, age, and sex (Knight and Cole 1995a). For the purpose of this analysis, it is assumed that the presence of human noise and activity constitutes a negative impact on wildlife, and that the magnitude of the impact is directly correlated with the timing, duration, volume, and predictability of the produced noise and activity.

Vehicle noise is discussed throughout this section because it is representative of decreased wildlife habitat quality near roads. Studies have shown that effects on wildlife from vehicle noise are proportionate to both the volume of traffic on roads and the speed the cars are traveling (Reijnen et al. 1995; Reijnen et al. 1996). Additionally, the distance from the road at which the animal feels the impact increases with traffic volume (Forman and Alexander 1998). For the purposes of this analysis, it is assumed that wildlife incur more negative effects of vehicle noise at greater distances from the roads with increased traffic volume and speeds. Wildlife can respond to reduced habitat quality near roads in two ways: numerically, such as a decrease in abundance or density of breeding individuals, or behaviorally, such as road avoidance (Forman et al. 2003). The reasons for these responses to vehicle noise include hearing loss and sensitivities to frequencies that humans cannot hear, an increase in stress hormones, altered behaviors, interference with communication during breeding activities, and increased home range size (due to decreased habitat quality) leading to decreased density of the breeding population (Forman and Alexander 1998; Larkin 1996; Reijnen et al. 1996). Additionally, predator populations are negatively impacted when prey populations decrease due to vehicle disturbance. Many of these effects, with increased intensity and duration, can lead to decreased reproductive success and ultimately affect local wildlife populations (Knight and Cole 1995b; Larkin 1996). The wildlife group most sensitive to noise disturbance is songbirds, which show impacts to breeding populations beginning at approximately 42 dB, which is less than the sound of human conversation at normal levels (Reijnen et al. 1996). Wildlife groups that are most impacted by vehicle disturbance include small mammals, forest and grassland birds, and large mammals (Forman and Alexander 1998).

Activity during construction includes both human noise and activity as well as vehicle noise. Vehicle noise during construction would be louder than during maintenance activities because more heavy equipment would be used. Impacts that would occur to wildlife during construction would be a combination of the impacts described above for human noise and activity and vehicle noise.

4.19.2 General Wildlife

Two vegetation communities were identified in the Project Area: Sonoran Creosotebush-Bursage Scrub and Xeroriparian Wash series (Brown 1994). The plant species and structure of these communities is described in section 3.16.3 (Vegetation Communities). Each vegetation community provides habitat for a suite of wildlife species in various ways (described below). Because the discussion in this section focuses on impacts to wildlife species, although referring to specific vegetation community types, impacts will be discussed in regard to wildlife habitat.

Tables 4.113 and 4.114 display the acres and/or linear feet of each wildlife habitat type that would be removed under each alternative. Permanent-use vegetation removal would occur as a result of project construction, operations, and maintenance within the solar field footprint; new and improved roads; water well sites; and the gen-tie power line. Permanent disturbances would eliminate wildlife habitat from use in the long-term (greater than five years) because these areas would be converted to an industrial landscape. These areas would be fenced (solar field) or paved (roads) making them either inaccessible to or unsuitable as wildlife habitat.

Temporary vegetation removal would occur at access road locations for the gen-tie power line, buried gas pipelines, and temporary access road improvements. Temporary vegetation removal would be reclaimed within the short term (less than five years), and would be returned to as close to their pre-construction conditions as possible (see Table 2.2 Applicant-committed Environmental Protection Measures). These areas would be used by certain wildlife species after reclamation. The vegetation communities in Tables 4.113 and 4.114 are described in detail in Section 3.16. Acres of additional habitat disturbance associated with the Gen-tie Line Option are described in detail in Section 4.16.2.7 (Generation Tie Line Option).

Table 4.113 Acres of Wildlife Habitat Removed or Disturbed in the Sonoran Creosotebush-Bursage Scrub Vegetation Community – All Alternatives

Type of Disturbance	No Action	Proposed Action*	Alternative A: Reduced Water Use (dry-cooled CST)	Sub-alternative A1: Photovoltaic	Alternative B: Reduced Footprint*
Permanent use	0	3,568.8	3,561.2	1,983.7	2,343.4
Temporary use	0	31.0	29.0	29.3	30.3
Total Disturbance	**0**	**3,599.8**	**3,590.2**	**2,013.0**	**2,373.7**

Note: Acres of disturbance do not include existing road surfaces.

*Acres of disturbance would be the same for the Proposed Action with brine concentrator op ion and Alternative B with the brine concentrator option.

Table 4.114 Linear Feet of Wildlife Habitat Removed or Disturbed in the Xeroriparian Wash Vegetation Community – All Alternatives

Type of Disturbance	No Action	Proposed Action*	Alternative A: Reduced Water Use (dry-cooled CST)	Sub-alternative A1: Photovoltaic	Alternative B: Reduced Footprint*
Long-term use	0	38,342.0	38,295.7	22,237.0	21,939.8
Temporary use	0	197.8	182.4	223.9	182.4
Total Disturbance	**0**	**38,539.8**	**38,478.1**	**22,460.9**	**22,122.2**

Note: Linear feet of disturbance do not include existing road surfaces.

*Linear feet of disturbance would be the same for the proposed ac ion with brine concentrator op ion and alternative b with brine concentrator option.

The Sonoran Creotsotebush-Bursage Scrub community functions as breeding, foraging, cover, and movement habitat for many wildlife species. This community is breeding habitat primarily for medium to small-sized mammals and for reptiles and amphibians. Examples of species that use this vegetation community for breeding include the kit fox, coyote, badger, desert cottontail, desert pocket mouse, rock pocket mouse, woodrat, and various lizard species. This vegetation community is also used by wildlife as habitat for foraging (finding food), and cover (for hiding and heat retention). Many migratory bird and raptor species use the Sonoran Creotsotebush-Bursage Scrub community for these purposes, including the turkey vulture, red-tailed hawk, northern flicker, ash-throated flycatcher, cactus wren, and canyon towhee, as well as the breeding species listed above. Some wildlife species use this vegetation community primarily as habitat to move between habitat patches that may be more suitable for breeding or foraging activities. The bighorn sheep uses the Sonoran Creotsotebush-Bursage Scrub community for this purpose.

The ecological functions of the Xeroriparian Wash vegetation community are similar to the Sonoran Creotsotebush-Bursage Scrub community. However, this community may have disproportionately higher use by many resident and migratory birds for breeding, cover, perching, and foraging when compared to the Creotsotebush-Bursage Scrub community. In addition, many small mammals that use seeds from palo verde, mesquite, and other shrubs that occur within the Xeroriparian Wash vegetation community may be found in higher proportions in this habitat type. Another important difference is the potential for wash habitat to be used as a movement corridor. Species that rely on the use of this vegetation community as a movement corridor are mainly highly mobile big game species, and include the mule deer, mountain lion, and javelina.

A more detailed discussion of wildlife species associated with these vegetation communities can be found in Section 3.19.4.

4.19.2.1 NO ACTION

Under the No Action alternative, the SSEP would not be developed and the existing land uses would continue. These land uses include cattle grazing and dispersed recreation use (both motorized and nonmotorized).

Impacts to wildlife species from livestock grazing consist primarily of habitat competition, habitat modification, and soil compaction. Cattle compete for habitat by using the same food resources and occupying nesting habitat. Additionally, cattle may trample and collapse underground dens and burrows of fossorial species such as the kit fox and badger. Areas attractive to cattle (such as xeroriparian habitats and shaded areas) could result in compacted soils. Compacted soils are difficult to dig, and are therefore unsuitable for burrowing animals. If these disturbances happened repeatedly, wildlife could be displaced from suitable habitat into poorer quality habitat. Ultimately, population levels would decline due to a lack of suitable habitat. However, due to the ephemeral nature of the current grazing in the allotments in the analysis area and its adherence to the BLM‘s Rangeland Health Standards, the effects on wildlife described above would likely be minimal.

The Project Area contains approximately 7.4 miles of primitive routes. Wildlife habitat is impacted by motorized use of these routes in several ways, including fragmentation of habitat, disruption and displacement of wildlife from preferred habitat by vehicle noise, and wildlife mortality from collisions with vehicles. The fragmentation of habitat due to roads would disrupt wildlife movement and dispersal, resulting in altered population dynamics. Wildlife would respond to vehicle noise in the ways described in Section 4.19.1 (Analysis Area and Analysis Assumptions). Finally, motor vehicle use increases the risk of collisions and wildlife mortality. Nonmotorized use of the Project Area would affect wildlife behavior in ways similar to those described for motorized use, but typically with less intensity. Habitat fragmentation and disruption and displacement of wildlife from human noise are the main effects of nonmotorized use.

Due to the low levels of current motorized and nonmotorized use in the Project Area, the impacts described above would likely be infrequent and would not adversely affect wildlife populations.

Under the No Action alternative, wildlife species that are currently in the Project Area would continue to use the habitat. Infrequent disturbance would persist under this alternative in the form of livestock grazing and motor vehicle use. The adverse impacts described above would continue to affect wildlife individuals, but populations would remain unaffected.

4.19.2.2 PROPOSED ACTION

Activities associated with the Proposed Action are described in detail in Chapter 2 of this document. The project footprint under the Proposed Action includes a solar field, improved and new roads, a power line (gen-tie line), water pipelines, and four well sites. Evaporation ponds, land-treatment units, power blocks, and stormwater detention basins would all be located within the solar field footprint, which would be surrounded by perimeter fencing.

Wildlife species described in Section 3.19.4 would be adversely affected in several ways by the Proposed Action. These effects include displacement, habitat degradation, habitat fragmentation and road barrier effects, an increased risk of exposure to potentially toxic constituents in evaporative ponds, an increased risk of electrocution from power lines, and loss of ephemeral water source and breeding habitat through removal of a stock pond.

As displayed in Table 4.113, the Proposed Action would result in the permanent removal of 3,568.8 acres of wildlife habitat in the Sonoran Creosotebush-Bursage Scrub vegetation community, and the temporary removal (pending rehabilitation) of 31 acres of wildlife habitat in the same vegetation community. It would also result in the permanent removal of 38,342 linear feet of wildlife habitat in the Xeroriparian Wash vegetation community and the removal of 197.8 linear feet of Xeroriparian Wash vegetation community for temporary use (see Table 4.114).

The permanent removal of wildlife habitat in the Sonoran Creosotebush-Bursage Scrub vegetation community and its conversion into a landscape unsuitable for wildlife would displace wildlife individuals. This would impact wildlife that currently use this habitat for breeding, cover, foraging, and movement, such as those described above (Section 4.19.2). These individuals would be either forced into adjacent habitat that may be less suitable, or forced to travel long distances to find suitable habitat. Adjacent habitat may be less suitable because breeding territories may already be established and defended by other individuals, good breeding and nesting sites may already be occupied, and food resources may be at a carrying capacity to maintain current population levels and may not be able to accommodate growth. The displacement of wildlife individuals into less suitable habitat may lead to a reduced body condition of individuals, which would ultimately affect population health. The removal of this wildlife habitat for temporary uses would have the same effect on wildlife individuals as permanent removal of vegetation. Vegetation reclamation would begin after construction is complete and temporary use areas are no longer necessary. Due to the slow growing vegetation of the Sonoran Desert, these areas may not resemble pre-construction habitat in the short term (5 years), and displacement effects may persist into the long term. Vegetation reclamation is further discussed in Section 4.16.1. Once successful reclamation is accomplished wildlife species may return to the area.

Wildlife habitat in the Xeroriparian Wash community would be removed and replaced with a stormwater channeling system designed to divert water around the Project Area. Wildlife species that use the wildlife habitat in this vegetation community for cover and forage (migratory birds and raptors, reptiles, amphibians) would be forced out of this area and into adjacent upland habitat. Movement patterns would be altered for highly mobile big game species, such as the mule deer, mountain lion, and javelina. Individuals of these species would be forced to walk around the fenced solar field, which may affect individual stress levels because of increased exposure to human noise and activity, as described in Section 4.19.1 (Analysis Area and

Analysis Assumptions). If these individuals parallel the perimeter fencing while searching for suitable habitat, they would be funneled to the access roads to either the east or south of the solar field and would be exposed to the road impacts discussed below. Because the Xeroriparian Community would be permanently eliminated and wildlife would be excluded from the solar field, impacts to wildlife would be long term and would persist for the life of the project. Impacts from the removal of wildlife habitat for temporary uses would persist into the long term because of the slow rate of vegetative growth of the Sonoran desert. Typical wildlife use may resume after successful vegetation reclamation is accomplished.

SSEP construction activities would degrade wildlife habitat in areas within and immediately adjacent to the Project Area by introducing increased amounts of human noise and activity. Although construction noise would displace many wildlife individuals from an area surrounding the Project Area, this impact would be short term. Under the Proposed Action and during construction, daily peak hour vehicle trips are projected at 1,000 vehicles both during peak morning hours and again at peak evening hours during construction (Table 2.15, Comparison of Alternatives). This rate of vehicle use represents a proportion of the amount of human noise and activity on-site, because carpooling is expected. Also, construction activities include the use of loud vehicles, such as heavy machinery. In the long term, 46 vehicles would be expected to enter and exit the project site during peak hours, resulting in far less human noise and activity than during the construction phase, but more than under the No Action alternative. Although some vehicle use would occur during facility operation, minimal use of heavy machinery would be expected. Because of the projected low amounts of human activity on the project site during the long-term operation of the facility, many wildlife species may return to the habitat surrounding the Project Area following construction (Gabrielsen and Smith 1995; Knight and Cole 1995a; Knight and Cole 1995b).

Ground disturbance during construction, including vegetation removal and vehicles and heavy machinery entering and exiting the Project Area during the construction phase, would lead to an increased risk of weed invasion in the habitat surrounding the Project Area. Weed invasions degrade wildlife habitat in several ways. Weeds outcompete most native plants, and weed invasions often lead to a homogenous vegetative landscape. Weedy habitats often contain fewer highly nutritious forage species for grazers and herbivores. A heavy weed invasion would either displace wildlife from this habitat or lead to reduced health for individuals. Furthermore, some weed species, such as red brome, are fire dependent and create an environment that is prone to frequent wildfires. Under certain and natural conditions, wildfires can be beneficial to wildlife, but they are harmful to wildlife when they promote further weed invasion or result in direct mortality of wildlife. Furthermore, the Sonoran Desert ecosystem takes up to 30 years to recover from fire (Alford et al. 2005); therefore, the introduction of species such as red brome would create an unnatural fire regime. The Proposed Action includes a 198,182.4 linear-foot project perimeter, which would be where the potential for a noxious weed invasion is highest. Section 4.16.4 (Impacts to Invasive and Noxious Plant Species) describes this concept in detail.

Road construction, improvements, and use can result in direct impacts to wildlife individuals (such as collisions between wildlife and vehicles), resulting in wildlife mortality. High levels of mortality in a population can lead to an overall reduction in the regional population size and health. The potential for wildlife to be struck and killed by vehicles decreases with decreased rates of traffic. It is expected that during construction, approximately 1,000 vehicle trips would be taken on the proposed access roads both during peak morning hours and again at peak evening hours (Table 2.15, Comparison of Alternatives) After construction is over, vehicle trips would be reduced to approximately 46 trips during peak morning hours and again during peak evening hours. These numbers suggest that although the risk of wildlife mortality due to vehicle collisions would rise throughout the long term, risks in the short term (during the 39 months of construction) would be much higher than the long-term risk. Furthermore, because peak traffic hours are anticipated to occur in the morning and again in the evening, crepuscular species (species that are most active during the morning and evening hours), such as mule deer, mountain lion, and coyote, have a higher risk of being affected by road traffic.

Roads can also effectively act as a movement barrier to some wildlife species, especially when the road is wide, paved, and handles high amounts of traffic, as would occur on the western access road during the construction period. Species that are most susceptible to barrier effects are those that tend to avoid roads and also require large tracts of habitat for survival (Forman et al. 2003), such as the bighorn sheep, bobcat, mountain lion, and Sonoran desert tortoise. Other wildlife groups vulnerable to these effects include small mammal and amphibian species. Because of the presence of roads and barrier effects (which reduce landscape connectivity), these species are more susceptible to reduced gene flow and a reduced regional population size. Many wildlife species are therefore at a greater risk of a reduction in the regional population size due to the presence of roads. Wildlife movement in the analysis area is further discussed in Section 4.19.4 (Wildlife Linkages).

After project construction is complete, operational and maintenance activities would alter the surrounding environment in a variety of ways that would impact wildlife behavior and increase the risk of health effects on wildlife. Some of these impacts would result from light and noise pollution, ground vibration, steam venting, windborne fugitive dust, the potential for on-site residual pollutants to be mobilized during stormwater discharge events, and the control of noxious and invasive plants through the use of herbicides. Although Section 4.9.3.2 (Operations) states that ground vibrations would not be felt from the nearest noise receptors, these receptors are based on human perception, and are located 0.9 mile away from the rotating machinery that would produce these vibrations. Wildlife would be able to walk up to the project fence line, and may be able to feel ground vibrations from the rotating machinery from that proximity. Operational and maintenance activities would result in noise and light pollution, infrequent steam venting, and fugitive dust, which would increase stress levels of individuals in proximity and alter normal patterns of behavior away from these activities, as described in Section 4.19.1 (Analysis Areas and Analysis Assumptions). In addition, the presence of leaked HTF and herbicides would increase the risk of health consequences to individuals and local populations.

During the maintenance and operation of the facility, wildlife would be displaced from an area beyond the project footprint due to human noise and activity and operations activities described above. Because there is no research to support to what extent displacement beyond the project footprint would occur relative to large-scale solar development, the exact effects are unknown (see Section 4.19.1 [Analysis Area and Analysis Assumptions] for a discussion on the effects of human noise and activity on wildlife). However, wildlife avoidance of anthropogenic disturbances has been studied for other types of development such as road construction and urban development. An avoidance area surrounding roads, termed a ―road-effect zone" (Forman and Deblinger 2003) has been documented for snakes (Rudolph et al. 1999, Shine et al. 2004, Andrews and Gibbons 2005), desert tortoises (von Seckendorff Hoff and Marlow 2002, Boarman and Sazaki 2006), birds (van der Zande et al. 1980, Reijnen et al. 1995, Pocock and Lawrence 2006), bobcats (Lovallo and Anderson 1996), desert bighorn sheep (McKinney and Smith 2007), and mule deer (Rost and Baily 1979). Similarly, a ―disturbance zone" in which animals avoid seemingly suitable habitat adjacent to urban development (Theobald et al. 1997) has been documented for lizards (Germaine and Wakeling 2001), deer (Vogel 1989), and other species. These studies indicate that the influence of anthropogenic features such as roads and urban development extend beyond the physical footprint of the structures themselves, degrading adjacent habitat and altering species composition and behavior. These effects would continue for the life of the project.

Ninety acres of evaporation pond surface would be constructed under the Proposed Action, consisting of three 10-acre ponds for the 125-MW unit and three 20-acre ponds for the 250-MW unit (Section 2.5.4.2.1, Wastewater). Based on experience at other solar facilities, it is expected that these ponds would accumulate substances that are nonhazardous at low concentrations. These substances could include chloride, sodium, sulfate, total dissolved solids, biphenyl, diphenyl oxide, potassium, selenium, and phosphate. Evaporation ponds would be located within the fenced portion of the solar field footprint, and they would not be accessible by most wildlife groups. However, they would be accessible by some birds

and bats, which would be able to fly into the project footprint. Given the proximity of the Project Area to the Gila River, the evaporation ponds will likely attract migratory and resident waterfowl, shorebirds, and passerines. The evaporation ponds would be designed with sloping sides intended to discourage wading birds from accessing the ponds (Table 2.2 Applicant-committed Environmental Protection Measures). Small mammals, reptiles, and amphibians would also be able to pass through the perimeter fencing into the project footprint and gain access to the evaporation ponds. Due to the scarcity of available water in the Sonoran Desert ecosystem, and the high use of wildlife of small manmade waters throughout the region, it is likely that wildlife will try to use these ponds regardless of the size.

The effects of selenium ingestion on aquatic birds have been studied intensely. Selenium is known to bioaccumulate, meaning that it can be ingested by animals through food and water and accumulates in the body. It is concentrated into species that rank high on the food chain, such as insectivorous and predatory birds and bats and can become toxic (Brix et al. 2000). Effects of selenium ingestion on birds often show up as egg and chick defects (Eisler 1985). Exact effects of selenium ingestion on bats are unknown, but because they are long lived, there is a high potential for dangerous levels of bioaccumulation of potentially toxic substances, such as selenium (O'Shea et al. 2000). The proposed evaporation ponds would also have the potential to collect high levels of sodium, creating a hypersaline environment for exposed wildlife. Effects of hypersalinity on birds have been studied in evaporation ponds associated with oil fields. Some effects include a condition called salt toxicosis and feather encrustation (Gordus 2002; USFWS 2009). These conditions can result in internal organ failure, neurological damage, hypothermia, or drowning.

Effects on wildlife from many other substances that would accumulate in the evaporation ponds are largely unknown; however, high exposure levels of many of these other substances have been shown to be harmful to human health (Ouw et al. 1976, Mazaffarian and Rimm 2006). Exposure to high levels of selenium, sodium, and other potentially toxic constituents would have long-term adverse effects on birds, bats, small mammals, amphibians, and reptiles in the analysis area.

The presence of a gen-tie power line, as described under the Proposed Action, would increase the potential for raptor and other migratory bird species to be killed from power line collisions and electrocution. Power poles are attractive sites for raptors and migratory birds to perch, roost, loaf, and nest (Avian Power Line Interaction Committee [APLIC] 2006). This behavior brings birds into the proximity of live power lines and can often lead to collisions with wires and electrocution. The exact effects that power line mortalities have on avian populations are unclear, especially because power line construction often occurs concomitant with other types of development. However, all migratory birds and raptors are protected under the MBTA, and the ~~"t~~aking" of any individual is a violation of that act.

Factors that influence avian risk of collision with power lines can be divided into three categories: 1) those related to avian species (i.e., habitat use, body type, age), 2) those related to the environment (i.e., weather, line visibility, human activities that may flush birds into lines), and 3) those related to the configuration and location of lines (i.e., inadequate separation between energized conductors, proximity of line to important bird habitat and topographical features) (APLIC 2006). In the Project Area, the risk of avian mortality due to these factors would be identical among all alternatives because these three factors would be the same across all alternatives. All of these factors being equal, the probability of a bird encountering the power line increases with power line length. Under the Proposed Action, approximately 3 miles of transmission line would be built.

Under the Proposed Action the CCC stock pond located in the eastern portion of the Project Area would be removed. This action would affect big game and other wildlife species that regularly use this pond as a source of drinking water by forcing them to travel longer distances for water. In addition, this pond may serve as breeding habitat for amphibian species. Species breeding in the pond would be forced to travel to

different breeding sites. However, several more stock ponds are present in the analysis area, and they would continue to provide aquatic habitat for wildlife. Amphibian eggs, tadpoles, and other aquatic wildlife would be killed during pond removal.

As described in Section 2.5.2.7 (Off-site Drainage Collection and Discharge Facilities), collection channels would be constructed outside of the perimeter fence at the southern perimeter of the main project footprint to collect the upstream stormwater drainage. The design of these collection channels would allow wildlife to move across the channel and not become entrapped inside because of the following design features: channel sides would have gentle slopes (6 feet horizontally to 1 foot vertically); channel walls would not be greater than 6 feet, except in short sections where the outside bank of a curve would reach up to 8 feet (super-elevated); and the channel substrate would be either earthen or riprap. The presence of these collection channels would not create an entrapment hazard for wildlife, nor would they impact wildlife movement patterns.

As described in Sections 4.18.1.3.1 (Impacts to Surface Water Resources during Construction) and 4.18.1.3.5 (Impacts to Surface Water Resources during Operations), surface water flows in washes, uplands, and floodplains would be returned to pre-construction conditions and would likely match that of the surrounding landscape. Because of this, there would be no broad-scale mortality of vegetation due to disruptions in surface water flows, and there would therefore be no impact on wildlife distribution and abundance beyond the SSEP footprint.

4.19.2.3 ALTERNATIVE A: REDUCED WATER USE (DRY-COOLED CST)

Effects on general wildlife species from Alternative A would be identical to those described for the Proposed Action, except for the following details.

As displayed in Table 4.113, Alternative A would disturb 9.6 fewer acres of wildlife habitat in the Sonoran Creosotebush-Bursage Scrub vegetation community. This represents a <1% change in total disturbance when compared to the Proposed Action. It would also disturb 61.7 fewer linear feet (<1%) of wildlife habitat in the Xeroriparian Wash vegetation community. The reduction in disturbed acres and linear feet would occur because water demands under Alternative A would require two groundwater wells, compared to four wells under the Proposed Action. Although there would be a slight reduction in disturbed habitat under Alternative A, it would not represent a considerable overall reduction, and the difference in effects between alternatives would be negligible.

Alternative A would create a project perimeter of 184,905.7 linear-feet. This perimeter would be 13,276.7 linear-feet (7%) smaller than the Proposed Action, reflecting the project perimeter associated with two fewer water wells and the associated access road. This smaller perimeter would reduce the area of increased potential for weed invasion. The impacts on wildlife described above regarding noxious weed invasions would still occur under this alternative, but would occur at a lower intensity than the Proposed Action.

4.19.2.4 SUB-ALTERNATIVE A1: PHOTOVOLTAIC

Sub-alternative A1 would have a smaller footprint and therefore displace fewer wildlife individuals than under the Proposed Action. As displayed in Table 4.113, Sub-alternative A1 would disturb 1,607.4 fewer acres of wildlife habitat in the Sonoran Creosotebush-Bursage Scrub vegetation community. This represents a 44% decrease in total disturbance when compared to the Proposed Action. It would also disturb 16,078.9 fewer linear feet (41% less) of wildlife habitat in the Xeroriparian Wash vegetation community. Furthermore, all impacts related to the removal of the CCC stock tank would be avoided under this alternative. An approximately 1-acre evaporation pond would be constructed under this Sub-alternative (Sections 2.7.2.3 and 2.7.4.2.1), which is 89 fewer acres than under the Proposed Action. The impacts to wildlife from evaporation

pond water ingestion, as described under the Proposed Action, would still occur to animals able to access the pond; however, the probability that these effects would impact wildlife populations is decreased when compared to the Proposed Action. The nature and magnitude of impacts resulting from the proposed roads would remain the same.

Under Sub-alternative A1, the gen-tie power line would run approximately 3.2 miles, which represents a 6.7% increase in power line length when compared to the Proposed Action. Under this sub-alternative, the nature of impacts of power lines on avian species, as described under the Proposed Action, would remain the same, but the magnitude would be slightly increased.

This alternative would leave intact a riparian wash that runs along the east side of the Project Area, which functions as a wildlife movement corridor. By leaving this corridor intact, this alternative would avoid the impacts to wildlife movement in that riparian wash, as discussed under the Proposed Action.

Sub-alternative A1 would create a project perimeter of 171,308 linear feet. This perimeter would be 26,874.4 linear feet (13.6%) smaller than the Proposed Action. This smaller perimeter would reduce the area of increased potential for weed invasion compared to the Proposed Action. The impacts on wildlife described above regarding noxious weed invasions would still occur under this alternative, but would occur at a lower intensity than the Proposed Action.

Under Sub-alternative A1, a maximum of 282 daily peak hour vehicle trips during construction and 16 daily peak hour vehicle trips during operations would be anticipated. This is 64.5% and 65.2% fewer vehicle trips (respectively) than projected under both the Proposed Action and Alternative A. The nature of habitat fragmentation and road barrier impacts to wildlife is described in Section 4.19.2.2.

4.19.2.5 ALTERNATIVE B: REDUCED FOOTPRINT

Alternative B was developed in part due to concerns regarding impacts to wildlife linkages and travel corridors. Under this alternative, a smaller generating facility would be built, and therefore a smaller project footprint would be necessary. Water demands would dictate that three water wells would be drilled, as compared to four under the Proposed Action. Because of the reduced footprint, fewer wildlife individuals would be displaced, as described under the Proposed Action, both during project construction and throughout the life of the project. As displayed in Table 4.113, Alternative B would disturb 1,226.1 fewer acres of wildlife habitat in the Sonoran Creosotebush-Bursage Scrub vegetation community than the Proposed Action. This represents a 34% change in total disturbance. It would also disturb 16,417.6 fewer linear feet (43%) of wildlife habitat in the Xeroriparian Wash vegetation community. This alternative would leave intact a large riparian wash that runs along the east side of the Project Area, which functions as a wildlife movement corridor. By leaving this corridor intact, this alternative would avoid some of the impacts to wildlife movement discussed under the Proposed Action.

Under Alternative B, a maximum of 950 vehicle trips at morning peak hours and 950 trips at evening peak hours during construction would be anticipated. This is 5% fewer vehicle trips than projected under both the Proposed Action and Alternative A. It is unlikely that a 5% reduction in vehicle trips would result in measurably reduced road barrier impacts to wildlife (described in Section 4.19.2.2).Alternative B would create a project perimeter of 178,399.6 linear-feet. This perimeter would be 19,782.8 linear-feet (10%) smaller than the Proposed Action, reducing the area of high potential for weed invasion. Impacts from noxious weed invasion (described under the Proposed Action) would still occur under this alternative, but would occur at a lower intensity than under both the Proposed Action and Alternative A, because fewer linear feet of surface disturbance would be susceptible to weed invasion.

The CCC stock pond east of the Project Area would remain intact under Alternative B, leaving this water source intact for wildlife use. This alternative would avoid displacement impacts on wildlife using this pond. For these reasons, Alternative B would have fewer long-term adverse effects on wildlife than would the Proposed Action.

4.19.2.6 REDUCED WATER USE OPTION–BRINE CONCENTRATOR

Impacts on general wildlife with the Reduced Water Use Option would be identical to those described under each alternative. This is because the area of vegetation removal proposed and the activities prescribed with the potential to affect wildlife would not change under this option.

4.19.2.7 GENERATION TIE LINE OPTION

Impacts to wildlife habitat as a result of the Gen-tie Line Option would be the same as those described under vegetation and special-status species in Section 4.16.2.7 and 4.16.3.7.

The Gen-tie Line Option would not change noise levels because it would not generate any new or additional sound. Traffic would also not change by the selection of this option, because no additional vehicles would be required for its implementation.

Under the Gen-tie Line Option, the gen-tie power line would run approximately 3.6 miles when combined with Sub-alternative A1 and 3.4 miles when combined with all other action alternatives. This represents a 20% and 13.3% increase in power line length (respectively) when compared to the Proposed Action. Under this option, the nature of impacts of power lines on avian species, as described under the Proposed Action, would remain the same, but the magnitude would be slightly increased.

4.19.3 Special-status Species

The following section describes impacts to special-status species under the No Action alternative, Proposed Action, and each of the alternatives. Special-status species are listed and defined in Section 3.19.5.2 (Wildlife, Special-status Species). Use of the vegetation types within the Project Area by special-status species is summarized below.

Special-status wildlife species with the potential to use the Sonoran Creosotebush-Bursage Scrub vegetation community for breeding consist of avian species such as the Western burrowing owl, Costa‘s hummingbird, and Gila woodpecker. All special-status bird species identified for this project use this vegetation community for foraging and cover. All special-status bat species identified for this project would use this vegetation community for foraging. The Sonoran desert tortoise would use this habitat for movement between more suitable habitat patches.

Use of the Xeroriparian Wash vegetation community by special-status species is similar to that described for the Sonoran Creosotebush-Bursage Scrub community except that the suite of breeding birds would shift. Special-status birds with the potential to breed in Xeroriparian Wash habitat also include crissal thrasher and Lucy‘s warbler.

4.19.3.1 NO ACTION ALTERNATIVE

Under the No Action alternative, wildlife habitat would not be removed, and therefore no displacement effects on special-status species would occur. Impacts associated with the continuation of livestock grazing and dispersed recreation use would continue to affect fossorial special-status species (such as the Western burrowing owl) through habitat competition, as described in Section 4.19.2.1 (General Wildlife, No Action).

4.19.3.2 PROPOSED ACTION

In general, special-status species would also be affected by the impacts to general wildlife species identified under the Proposed Action (Section 4.19.2.2). Additional impacts on individual species are described in this section.

During field reconnaissance in 2009, Western burrowing owl individuals, burrows, and sign were found in the northern portion of the Project Area. Surveys were conducted again in May 2011 and found owl individuals, burrows, and sign throughout the Project Area. Details of the results of this survey can be found in Appendix I (Burrowing Owl Relocation Analysis). Individuals breeding and/or wintering in the Project Area would be displaced from habitat in the long term (at least 30 years) due to project construction and operations. These individuals may be forced into areas of less-suitable habitat. In addition, potential Western burrowing owl breeding habitat located in permanent disturbance areas would be removed, eliminating the potential for future breeding in that area. The long-term removal of vegetation would also reduce the amount of habitat available for burrowing owl prey species (large insects and small mammals), which may lead to reduced health in owl individuals.

In the short term, human noise and activity during construction would displace burrowing owls from an area surrounding the Project Area, as described in Section 4.19.1 (Analysis Area and Analysis Assumptions). The size of this temporary disturbance buffer would depend on the amount of human noise and activity in the Project Area, as described under Section 4.19.2.2 (General Wildlife, Proposed Action). This displacement buffer would increase during the owl breeding and nesting seasons, when individuals are more protective of their young (April–July) and therefore more sensitive to disturbance. The removal of vegetation for temporary uses would displace breeding owls in the short term, but depending on the success of reclamation efforts, may create breeding owl habitat in the long term by loosening otherwise compacted soils and allowing burrows to be created.

As per the action alternatives‘ applicant-committed environmental protection measures (see Table 2.2), the Project Area and a 200-m buffer would be surveyed for burrowing owls prior to construction. If any burrowing owl individuals are located during these surveys, they would be relocated to a suitable site within the analysis area and an artificial burrow site would be built for their use. The relocation site would be defined by the BLM and cooperating agencies. The relocation of burrowing owls is a standard practice and would ensure compliance with the MBTA. The relocation site would be selected in part because it resembles suitable habitat and has a low probability of outside disturbances (e.g., feral dogs, vehicular traffic, vandalism, further changes in vegetation structure).

Owl relocation would affect the owl individuals being moved by increasing stress levels during the relocation event. If the location to which the owls are moved is currently supporting a burrowing owl population, competition for food and other resources would be locally increased, resulting in decreased health for the population. If the location to which to owls are moved is not currently supporting a burrowing owl population, it may be somewhat less suitable than the Project Area location, resulting in decreased health for the relocated owls. The relocation of burrowing owls has occasionally proven to be unsuccessful, and had resulted in owl mortalities. However, it is generally seen as an effective and viable means of compliance, and qualified biologists would be responsible for the relocation.

Although there is no breeding habitat for golden eagles within a 10-mile radius of the Project Area, migratory and nonbreeding individuals may forage in the analysis area. A decline in the population of prey species such as jackrabbits, snakes, juvenile ungulates, and passerines due to displacement and other effects described in Section 4.19.2.2 (Proposed Action) would cause foraging golden eagles to seek out other more suitable foraging habitat. However, roadkill is often a source of food for golden eagles, and they may benefit from wildlife getting struck and killed by cars. Due to their large wing span, golden

eagles would have a higher potential than smaller raptors for mortality from electrocution on the gen-tie power line. This is because an eagle's large wing span can connect energized conductors (or an energized conductor with grounded hardware) on power poles, inducing electrocution. Because of the typical spacing of the conductors, smaller birds cannot touch two at the same time (APLIC and USFWS 2005).

Seven special-status bat species have the potential to forage in the Project Area and roost in the analysis area. As described above, bats would be able to access the proposed evaporation ponds, which could increase their risk of toxin-related health effects through exposure to potentially toxic levels of selenium and other constituents, as described in Section 4.19.2.2. All of the bat species that may be present in the Project Area are insectivorous, and if potentially toxic constituent levels in the ponds rise to a high level, bioaccumulation of selenium and other potentially toxic constituents in bats is likely (O'Shea et al. 2000).

Under the Proposed Action, the CCC stock pond that is located in the eastern portion of the Project Area would be removed. This action would reduce potential breeding areas for the Great Plains toad, forcing individuals to travel to other breeding areas. Toad eggs or tadpoles that may be in the water prior to pond removal would be unable to move, and would be killed. Although the exact effect of the removal of this pond is unknown, several more stock ponds are present in the analysis area, and they would continue to provide breeding habitat for this species. Toads and other amphibians are also susceptible to road barrier effects and high levels of mortality due to vehicle strikes, as described in Section 4.19.2 above (General Wildlife).

Although there is no BLM-designated habitat in the Project Area for the Sonoran desert tortoise, habitat exists for this species in the analysis area within 1.2 miles both north and south of the Project Area (see Map 29). It is unlikely that the tortoise uses the Project Area habitat for breeding and foraging; however, this species would likely use this habitat for dispersal between suitable habitat patches. Tortoise dispersal across valleys between desert mountain ranges is estimated to occur approximately once per generation (Edwards 2003), and these events seem to be very important for the long-term maintenance of populations (Edwards 2004). Therefore, some amount of tortoise dispersal would be impeded in the long term due to the presence of the SSEP and associated roads.

Predation on juvenile desert tortoises by ravens has been documented in parts of the Mojave Desert (Boarman 2003). Ravens may be attracted to the Project Area by human refuse and ponded water, thereby increasing the chances of predation on juvenile desert tortoises. This attraction may impact the dispersal of desert tortoises en route through the analysis area. However, applicant-committed environmental protection measures state that "Construction sites, material storage yards, and access roads would be kept in an orderly condition throughout the construction period. Approved enclosed refuse containers would be used throughout the SSEP. Refuse and trash would be removed from the sites and disposed of in an approved manner" (Table 2.2 Applicant-committed Environmental Protection Measures). This measure would minimize raven attraction to the Project Area by making trash unavailable to wildlife. Ponded water, including the proposed evaporation ponds, could still attract ravens to the Project Area.

4.19.3.3 ALTERNATIVE A: REDUCED WATER USE (DRY-COOLED CST)

Impacts to special-status species under Alternative A would be identical to those described for the Proposed Action. Impacts resulting from total disturbance acres, as described under Section 4.19.2.3 (General Wildlife, Alternative A), would also occur.

4.19.3.4 SUB-ALTERNATIVE A1: PHOTOVOLTAIC

Impacts to special-status wildlife species under this alternative would be similar to those described for Alternative B in terms of impacts on burrowing owls, golden eagle foraging habitat, and the CCC stock pond, because direct disturbance comparable to Alternative B would occur under Sub-alternative A1.

4.19.3.5 ALTERNATIVE B: REDUCE FOOTPRINT

During site reconnaissance, all owl and burrow sightings were located in a tight cluster at the northeastern corner of the solar field, a portion of which is avoided under Alternative B (Pape 2009; see Map 29). Two burrow locations and one owl sighting were located outside of Alternative B's Project Area, and one burrow location and owl sighting were located in Alternative B's Project Area. Because of the two burrowing owl burrow locations outside of the Project Area, Alternative B would likely avoid the direct disturbance of an unknown amount of suitable burrowing owl breeding habitat (see Map 29). However, because these burrow locations are adjacent to the Project Area, it is likely that some habitat degradation, including human noise and activity during construction (as described in Section 4.19.1, Analysis Area and Analysis Assumptions), and some degree of noxious weed invasion (as described in Section 4.19.2.2, Proposed Action), would still occur.

Direct disturbance to the one known burrow located inside the Project Area would also occur. However, because this alternative would disturb fewer acres of habitat than the Proposed Action, it is possible that fewer burrowing owls would need to be relocated. This would result in the avoidance of the relocation effects, as described under the Proposed Action, for an unknown number of burrowing owls.

Under this alternative, golden eagle prey populations would be impacted to a lesser degree (thereby reducing impacts to foraging golden eagle populations) than under the Proposed Actions due to less direct disturbance. This is because the main project footprint would occupy approximately 1,800 acres, or 51% of the footprint under the Proposed Action.

Because the CCC stock pond would remain intact under this alternative, this source of potential breeding habitat would remain available for the Great Plains toad. Existing eggs and tadpoles would not be killed. Alternative B would avoid impacts to breeding habitat for this species.

4.19.3.6 REDUCED WATER USE OPTION–BRINE CONCENTRATOR

Impacts on special-status species with the Reduced Water Use Option would be identical to those described under each alternative. This is because the area of vegetation removal proposed and the activities prescribed with the potential to affect wildlife would not change under this option.

4.19.3.7 GENERATION TIE LINE OPTION

Impacts to special-status species with the addition of the Gen-tie Line Option would be the same as those described under each alternative.

4.19.4 Wildlife Linkages

Wildlife linkage models are described in Section 3.19.6 (Wildlife Linkages). Table 4.115 displays the acres of wildlife habitat (by vegetation community type) that would be removed in the Gila Bend-Sonoran Desert National Monument and Buckeye Hills-Sonoran Desert National Monument linkages. The acreage of wildlife habitat removal within each linkage would be the same under all action alternatives. The total amount of acres of wildlife habitat that would be removed or disturbed under all action alternatives is identical to the acres expressed for the Buckeye Hills-Sonoran Desert National Monument Linkage. This is because the portion of the Gila Bend-Sonoran Desert National Monument linkage that would be affected by the project is completely contained within the Buckeye Hills-Sonoran Desert National Monument linkage (see Map 29).

The removal and disturbance of wildlife habitat would impact wildlife individuals and populations both in the long term and in the short term. Wildlife habitat removal for permanent use (new and improved roads,

water well sites, and the gen-tie power line) would occur due to project construction, operations, and maintenance within the solar field footprint. Permanent disturbances would eliminate wildlife habitat from use in the long term by replacing native vegetation with an industrial landscape unsuitable for wildlife. The removal of wildlife habitat for temporary uses would occur at access road locations for the gen-tie power line, buried gas pipelines, and temporary access road improvements. Temporary vegetation removal would be reclaimed, but affects may persist into the long term (greater than five years). Successful reclamation would return wildlife habitat to as close to pre-construction conditions as possible, and because of the slow vegetative growth of the Sonoran desert, may take from five to ten years (see Table 2.2 Applicant-committed Environmental Protection Measures and Section 4.16.1). These areas would be used by certain wildlife species after reclamation.

Table 4.115 Disturbance to Wildlife Habitat by Linkage Corridor under All Alternatives for Wildlife Linkages

Type of Disturbance	No Action	All Action Alternatives except Sub-alternative A1* Wildlife Habitat in the Sonoran Creosotebush-Bursage Scrub Vegetation Community (Acres)	All Action Alternatives except Sub-alternative A1** Wildlife Habitat in the Xeroriparian Wash Vegetation Community (Linear feet)	Sub-alternative A1: Photovoltaic Wildlife Habitat in the Sonoran Creosotebush-Bursage Scrub Vegetation Community (Acres)	Sub-alternative A1: Photovoltaic Wildlife Habitat in the Xeroriparian Wash Vegetation Community (Linear feet)
Gila Bend-Sonoran Desert National Monument Linkage					
Permanent use	0	7.7	53.2	n/a	n/a
Temporary use	0	1.2	0	n/a	n/a
Total Disturbance	**0**	**8.9**	**53.2**	**n/a**	**n/a**
Buckeye Hills-Sonoran Desert National Monument Linkage (SSEP Total)* **					
Permanent use	0	1,143.5	12,624.6	1,115.9	12,426.2
Temporary use	0	5.1	0	5.1	0.0
Total Disturbance	**0**	**1,148.6**	**12,624.6**	**1,121.0**	**12,426.2**

Note: Acres of disturbance do not include existing road surfaces.

*Acres of disturbance would be the same for all action alternatives with brine concentrator option and Alternative B with he brine concentrator option, except Sub-alternative A1.

**Linear feet of disturbance would be the same for all action alternatives with brine concentrator option and Alternative B with the brine concentrator option, except Sub-alternative A1.

*** The acres expressed for this linkage also represent total acres of disturbance for the SSEP. This is because the portion of the Gila Bend-Sonoran Desert National Monument linkage that would be affected by the SSEP is completely contained within the Buckeye Hills-Sonoran Desert National Monument linkage.

4.19.4.1 NO ACTION ALTERNATIVE

Activities described under the No Action alternative would not impact wildlife linkages. This alternative would not disrupt normal wildlife movement patterns because no wildlife habitat would be removed or otherwise disturbed.

4.19.4.2 PROPOSED ACTION

4.19.4.2.1 Gila Bend-Sonoran Desert National Monument Linkage

Under the Proposed Action, 8.9 acres of wildlife habitat in the Sonoran Creosotebush-Bursage Scrub vegetation community in the Gila Bend-Sonoran Desert National Monument linkage would be removed; 1.2 acres of this would be for temporary uses (pending rehabilitation) (see Table 4.115). In addition, 53.2 linear feet of wildlife habitat in the Xeroriparian Wash vegetation community would be removed. The Proposed Action would bisect the northernmost arm of this linkage with a new road and the gen-tie power line, affecting 100% of the width of the linkage (see Map 29). The road and vegetation clearing necessary for power line construction and maintenance would form a barrier to the movement of the focal species used to develop this model (see Chapter 3 for focal species descriptions). Vehicle travel along the access road would result in an increased risk of wildlife strikes and road mortality. This is described in more detail in Section 4.19.4.2.2 below. Most impacts would occur in the short term due to the higher projected traffic levels during construction, and would decrease once construction finished.

Although the boundary of this linkage was devised to connect the Sonoran Desert National Monument ultimately with the Gila Bend Mountains, it also provides connectivity from the monument (by way of the Buckeye Hills) to the Gila River corridor. Riparian systems are one of the rarest habitat types in North America, and they are very important for the persistence of wildlife in arid environments, such as the Southwest. The Gila River and its associated riparian vegetation provide habitat for many species. Bisecting this linkage with a road and gen-tie power line (affecting 100% of the width of the linkage and acres of habitat displayed in Table 4.115) would create obstacles to wildlife movement from Sonoran Desert National Monument into the Buckeye Hills and finally to the Gila River. This would mostly affect highly mobile species, such as the bighorn sheep, mule deer, mountain lion, bobcat, and desert tortoise. However, the Sonoran Desert National Monument linkage has four arms that cross from the Gila Bend Mountains over the Gila River and to the monument (Beier et al. 2008). The arm that would be bisected by the Proposed Action is the most circuitous route from the Sonoran Desert National Monument to the Gila River. The impacted linkage arm is considered the "biologically best corridor" by AGFD only for the desert tortoise, which is a species that would not be traveling long distances in search of water. For these reasons, the Proposed Action would impact wildlife species accessing the Gila River from the monument by way of the Buckeye Hills.

Effects of the Proposed Action on the Sonoran desert tortoise are discussed under Section 4.19.3.2 (Special-status Species, Proposed Action).

4.19.4.2.2 Buckeye Hills-Sonoran Desert National Monument Linkage

Under all action alternatives, 1,148.6 acres of wildlife habitat in the Sonoran Creosotebush-Bursage Scrub vegetation community within the Buckeye Hills-Sonoran Desert National Monument linkage would be disturbed; 5.1 acres of this would be for temporary use (pending rehabilitation) (see Table 4.115). In addition, 12,624.6 linear feet of wildlife habitat in the Xeroriparian Wash vegetation community would be disturbed. This disturbance includes the construction of portions of new road, upgrading existing roads, construction of the gen-tie power line, and construction of (a portion of) the solar field footprint (see Map 29). Solar field construction would impact the eastern portion of the linkage by removing a large area of

existing wildlife habitat and replacing it with a fenced (industrial) solar field incompatible with wildlife use. Displacement effects are described in the General Wildlife section above (Section 4.19.2.2). Excluding the roads and power line, the solar field at its widest point would occupy approximately 38% of the width of the linkage, effectively narrowing the width of the travel corridor. The roads and power line would cut across the remaining width of the linkage, from SR-85 to the solar field (see Map 29). The combined area of the solar field, roads, and power line would affect 100% of the width of the linkage.

Highly mobile species, such as bighorn sheep, mule deer, mountain lion, and Sonoran desert tortoise, can move long distances to access suitable breeding or foraging sites. They rely on linkages to connect large blocks of suitable habitat. For highly mobile species, the Proposed Action would create a barrier to wildlife movement patterns. These effects are described in more detail in Section 4.19.2.2 (General Wildlife, Proposed Action). The solar field would be fenced and impermeable to wildlife movement (Section 4.19.5, Mitigation Measures). Wildlife movement in this area would be funneled around the solar field for the long term, and across the access roads to the west and south of the Project Area. The proposed access road and gen-tie power line that connect the solar field with SR-85 would also impede wildlife movement through this linkage. Because peak traffic hours are projected to occur in the morning and evening, crepuscular wildlife species would be at a higher risk of being affected by the road barriers. Highly mobile crepuscular species (species with high levels of activity during morning and evening hours) modeled for this linkage consist of the mule deer and mountain lion. Traffic volume on this road during the construction period is projected at 1,000 trips at morning and evening peak times. During operation of the facility, peak traffic volumes are projected at 46 trips at peak times. Because of this, road barrier effects on wildlife would be more severe in the short term, during construction, and would occur at a relatively lower intensity in the long term (during operation).

Dispersal and genetic mixing between isolated populations of bighorn sheep contribute to the viability of the larger metapopulation. Because of this, the location of the Proposed Action inside wildlife linkages could make it more difficult and hazardous for individuals to travel between populations, and thereby limit genetic mixing and viability. Limiting genetic mixing would contribute to the further isolation of local populations and potentially contribute to the decline of the metapopulations as a whole (personal communication, Dana Warnecke 2011). It could also contribute to local extinctions of isolated populations. Excluding the roads and power line, the solar field at its widest point would occupy approximately 38% of the width of the linkage, effectively narrowing the width of the travel corridor. The roads and power line would cut across the remaining width of the linkage, from SR-85 to the solar field (see Map 29). The combined area of the solar field, roads, and power line would affect 100% of the width of the linkage.

Less mobile species, such as the badger, kit fox, javelina, Gila monster, Sonoran desert toad, and Tucson shovelnose snake, rely on linkage habitat for long-term genetic flow and for connectivity among populations. Linkages are also important for less mobile species to allow populations to shift their range in response to climate change, and to allow for recolonization after fire or epidemics (Beier et al. 2008a). For less mobile species, impacts to the Buckeye-Hills-Sonoran Desert National Monument linkage from the SSEP center on displacement due to the destruction and degradation of habitat as well as the effects of road barriers described for highly mobile species. The Proposed Action includes the permanent removal of 1,143.5 acres of wildlife habitat in the Sonoran Creosotebush-Bursage Scrub community, the removal of vegetation for temporary purposes (pending rehabilitation) of 5.1 acres this habitat, and the permanent removal of 12,624.6 linear feet of wildlife habitat in the Xeroriparian Wash vegetation community within the linkage corridor.

Mule deer and javelina are examples of wildlife species that use Xeroriparian Wash vegetation community as travel corridors. These species would also be more susceptible to road barrier effects where roads intersect xeroriparian corridors. Movement patterns of these species would be especially altered and

possibly impeded by the 12,624.6 linear feet of this type of habitat that would be removed under the Proposed Action.

4.19.4.3 ALTERNATIVE A: REDUCED WATER USE (DRY-COOLED CST)

Impacts on wildlife linkages under Alternative A would be identical to those described under the Proposed Action. This is because the area of vegetation removal proposed and the activities prescribed inside each linkage would not change under this alternative.

4.19.4.4 SUB-ALTERNATIVE A1: PHOTOVOLTAIC

The nature of impacts to wildlife linkages under Sub-alternative A1 would be the same as those described under the Proposed Action, but the intensity of impacts would be slightly reduced. This is because the area of vegetation removal proposed and the activities prescribed inside each linkage would comprise 27.6 fewer acres (2.4%) of Sonoran Creosotebush-Bursage Scrub vegetation community. The nature and intensity of impacts in the Xeroriparian Wash vegetation community would be identical to those described for the Proposed Action. However, during construction hours under Sub-alternative A1, a maximum of 282 daily peak hour vehicle trips during construction and 16 daily peak hour vehicle trips during operations would be anticipated. This is 64.5% and 65.2% fewer vehicle trips (respectively) than projected under the Proposed Action, which would result in reduced road barrier impacts to wildlife as described in Section 4.19.2.2 (Proposed Action).

4.19.4.5 ALTERNATIVE B: REDUCED FOOTPRINT

Impacts on wildlife linkages under Alternative B would be identical to those described under the Proposed Action. This is because the area of vegetation removal proposed and the activities prescribed inside each linkage would not change except for the following detail. Under this alternative and during construction hours, a maximum of 950 vehicle trips at morning and evening peak hours is projected. This is 5% fewer vehicle trips than projected under both the Proposed Action and Alternative A. It is unknown whether a 5% reduction in vehicle trips would result in reduced road barrier impacts to wildlife (described in Section 4.19.2.2 [Proposed Action]).

4.19.4.6 REDUCED WATER USE OPTION–BRINE CONCENTRATOR

Impacts on wildlife linkages with the Reduced Water Use Option would be identical to those described under each alternative. This is because the area of vegetation removal proposed and the activities prescribed inside each linkage would not change under this option.

4.19.4.7 GENERATION TIE LINE OPTION

Impacts to wildlife linkages with the addition of the Gen-tie Line Option would consist of disturbance to the Sonoran Creosotebush-Bursage Scrub and Xeroriparian Wash vegetation communities within the Buckeye Hills-Sonoran Desert National Monument and the Gila Bend-Sonoran Desert National Monument linkages.

If the Gen-tie Line Option were added to the Proposed Action, Alternative A, or Alternative B, additional impacts, when compared to the proposed gen-tie line alignment, would consist of 5.1 acres of temporary and 3.6 acres of long-term disturbance to Sonoran Creosotebush-Bursage Scrub vegetation in the Buckeye Hills-Sonoran Desert National Monument linkage (Table 4.116). If the Gen-tie Line Option were added to Sub-alternative A1, additional impacts would consist of 6.8 acres of temporary and 5.0 acres of long-term impact to Sonoran Creosotebush-Bursage Scrub in the Buckeye Hills-Sonoran Desert National Monument linkage. For Sonoran Creosotebush-Bursage Scrub vegetation in the Gila Bend-Sonoran Desert National

Monument linkage, an additional 0.2 acre of temporary and 0.2 acre of long-term disturbance would occur if the Gen-tie Line Option were added to any of the action alternatives. In all cases, the implementation of the Gen-tie Line Option in combination with any action alternative would result in less than a 1% increase and less than a 5% increase in surface disturbance in the Buckeye Hills-Sonoran Desert National Monument linkage and Gila Bend-Sonoran Desert National Monument linkage, respectively.

Table 4.116 Additional Acres Disturbed with the Gen-tie Line Option

	Proposed Action, Alternative A: Reduced Water Use (dry-cooled CST), and Alternative B: Reduced Footprint	Sub-alternative A1: Photovoltaic
Buckeye Hills-Sonoran Desert National Monument linkage		
Temporary disturbance	5.1	6.8
Long-term disturbance	3.6	5.0
Total disturbance	**8.7**	**11.8**
Gila Bend-Sonoran Desert National Monument linkage		
Temporary disturbance	0.2	0.2
Long-term disturbance	0.2	0.2
Total disturbance	**0.3**	**0.3**

Note: Acres of disturbance do not include existing road surfaces.

If the Gen-tie Line Option were added to any of the action alternatives, additional impacts when compared to the proposed gen-tie line alignment would consist of 65 linear feet of disturbance to Xeroriparian Wash habitat in the Buckeye Hills-Sonoran Desert National Monument linkage (a 0.5% increase). There would be no additional impact to the Xeroriparian Wash in the Gila Bend-Sonoran Desert National Monument linkage from the Gen-tie Line Option.

Road barrier impacts to wildlife would not change with the selection of this option because no additional vehicles would be required for its implementation.

4.19.5 Potential Mitigation Measures

To reduce or eliminate the impacts of the Proposed Action and the action alternatives on wildlife and their habitat, the following potential mitigation measures are considered.

- To avoid the impacts of wildlife contacting hazardous and other human-made substances as well as to minimize the potential for vehicle collisions and exposure to human noise and activity, perimeter fencing of the SSEP would be designed to effectively exclude wildlife. Measures would include burying the fence at least 1 foot underground to keep animals from burrowing under it, and reinforcing the first 3 feet off the ground with small diameter mesh and/or silt fencing to keep small animals from entering.
- To minimize the potential for avian collisions with and electrocutions from power lines, the design and construction of all power lines would comply with the *Avian Protection Plan Guidelines* (APLIC and USFWS 2005) and the *Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006* (APLIC 2006).
- To prevent wildlife exposure to selenium or other potentially toxic constituents in evaporation pond water, wildlife would be excluded from accessing these ponds through a combination of fencing, netting, hazing, or other similarly effective measures.

- To protect migratory bird resources and comply with the MBTA, nest clearance surveys would be conducted by a qualified biologist prior to all vegetation clearing (and other surface-disturbing activities) taking place inside the bird nesting season (February 15–September 15) (Corman and Wise-Gervais 2005). All nests would either be protected in place until the chicks had fledged, or relocated into suitable habitat.
- To minimize the potential for wildlife mortality from vehicle collisions, caution signs indicating the potential for mule deer, bighorn sheep, and desert tortoise crossing would be posted periodically along each access route. Particular locations for these signs would be at the beginning and end of each access road and where roads intersect xeroriparian washes. Speed bumps would also be installed to further limit the speed of vehicles, as described in Section 4.15.9.1 (Installing Speed Bumps and No Parking Signage along New Access Road).
- To decrease the impacts of habitat fragmentation, access roads would remain unfenced perpendicular to the road alignment to the maximum extent possible while still ensuring public safety. This would allow for wildlife movement across roads.
- To minimize the impacts described above (Sections 4.19.2.2 and 4.19.3.2) of removing the CCC stock pond under the Proposed Action, the pond would be rebuilt in another nearby location outside of the Project Area but within the Buckeye Hills-Sonoran Desert National Monument linkage for wildlife use. The new location would be selected (and surveyed) to ensure that it would not result in significant conflicts with other resources.
- To minimize the risk of wildlife mortality from vehicle collisions, trash would be collected periodically from project access roads.

4.19.5.1 MITIGATION SPECIFIC TO THE SONORAN DESERT TORTOISE

- To minimize the potential for desert tortoise mortality, prior to ground-clearing construction activities, a desert tortoise monitor would survey the Project Area, followed by the enclosure of the solar fields with chain-link fencing. If tortoises are encountered they would be relocated outside of the Project Area.
- To minimize the potential for vehicle collisions with desert tortoises, vehicle speeds would not exceed 20 mph on all access roads. Speed limit signs would be installed. Caution signs indicating the potential presence of Sonoran desert tortoises would be posted at the beginning of any access road, and midway to the SSEP on each access road.
- Training would be provided to all construction personnel who would be present before and during the ground-clearing and fencing of the site. Training would include procedures on how to reduce tortoise mortality, such as checking stationary vehicles for tortoises, and recommendations on how to avoid disturbing tortoises that are detected.
- If any Sonoran desert tortoises are encountered during construction and operations, the contractor shall adhere to AZGFD *Guidelines for Handling Sonoran Desert Tortoises Encountered on Development Projects* (Revised October 23, 2007).
- To facilitate movement and dispersal across new and upgraded roads as well as to minimize the potential for vehicle collisions, under-road crossing structures for the Sonoran desert tortoise, in the form of culverts would be placed along the western access road, from SR-85 to the solar field. The most current data regarding culvert size, frequency, placement, and use of guidance fencing would be used at the time of construction. Additional educational signage denoting the potential for road kill would be placed in this zone.

4.19.6 Residual Impacts

Residual impacts would include the long-term removal of breeding, foraging, and cover habitat in all areas occupied by the SSEP. All of the action alternatives would include the removal of known and potential breeding habitat for the burrowing owl, foraging and cover habitat for many species of migratory birds, and portions of the Xeroriparian Wash vegetation community used as movement corridors by mule deer, mountain lions, and javelina. Species that currently inhabit the Project Area would be permanently displaced into adjacent habitat.

Although efforts would be made to educate drivers on the potential for wildlife to cross the proposed access roads, the risk of wildlife mortality due to collisions with vehicles could not be fully mitigated. The mitigation measures listed above would help to lower the potential for road kills.

Road-related mitigation measures would attempt to make roads and other linear features more permeable to wildlife movement. Signs educating drivers on the potential for wildlife crossings on the road surface would help to reduce road barrier effects on large-bodied species. Slow speed limits (20 mph) would further increase the permeability of access roads. Despite these mitigation measures, road-related barrier effects may still occur and result in reduced gene flow between some wildlife populations.

Although mitigation measures regarding noxious weeds (Section 4.16.5.1 [Potential Mitigation Measures for Vegetation Communities]) would help to reduce the level of noxious weed invasion into the Project Area, some level of weed introduction would likely occur.

Although completely excluding birds and bats from access to the proposed evaporation ponds is ultimately the goal of mitigation, this would be an iterative process, including trials and evaluations of several different protocols and techniques for exclusion. It is likely that some wildlife would gain access to the ponds during the course of choosing the most effective technique and implementation. Techniques such as hazing may initially be effective. Gas-operated exploders have proven relatively effective as an avian deterrent (Read 1999; Ronconi and St. Clair 2006). However, the effectiveness depends on a variety of factors, including the targeted species, numbers of birds present, availability of alternative sites for repelled birds, density of exploders, interval between explosions, and wind conditions (Marsh et al. 1991). It has been shown that individuals can become habituated to the explosions over time (Bomford and O'Brien 1990). Electronically produced distress calls and visual deterrents tend to be effective initially, but birds are often habituated to these deterrents, potentially rendering them ineffective over time (Belant et al. 1998; Esmoil and Anderson 1995; James et al. 1999; Marsh et al. 1991).

Excluding wildlife from access to potentially toxic constituents would help to reduce the long-term impacts (described in Sections 4.19.2.2 and 4.19.3.2) of constituent bioaccumulation in bird and bat species. Although health effects to some individuals may still occur due to the consumption of insects using the evaporation ponds, this measure would lessen the potential for effects on individuals and populations, and would prevent acute toxicity to individuals by preventing their use of the pond.

Exclusion of small-bodied wildlife (e.g., small mammals, amphibians, and reptiles) from the evaporation ponds would be attempted through the use of small-diameter mesh and/or silt fencing. However, these wildlife groups are able to penetrate very tight spaces, and may gain access to the ponds regardless of the attempted mitigation measures. Health effects and mortality of some small-bodied wildlife individuals may occur due to the inability to exclude them from the evaporation ponds.

Under the Proposed Action and Alternative A, the CCC stock pond would be filled in and removed, which would force wildlife to travel to another source of water, and would permanently displace breeding amphibians from this area. Replacement the stock pond in an alternate location would reduce the distance wildlife would need to travel and would provide a new water source and potential breeding location.

4.19.7 Short-term Uses versus Long-term Productivity

Impacts associated with construction activities would degrade the quality of wildlife habitat as described in Section 4.19.1 (Analysis Area and Analysis Assumptions) in the short term. Construction impacts include increased human noise and activity, increased vehicle traffic on access roads, and the removal of wildlife habitat for temporary use. After construction has finished, levels of human noise and activity and vehicle traffic would reduce, and temporary vegetation disturbances would be reclaimed. This project would reduce the amount of habitat available to wildlife species and displace wildlife individuals from habitat that has been removed or degraded. Because of road barriers and habitat disturbance to wildlife linkage corridors, this project would also affect wildlife movement patterns between adjacent mountainous habitats and reduce population gene flow and connectivity.

After the life of the project (approximately 30 years), all aboveground infrastructure would be removed, the ground would be recontoured, and the vegetation reclaimed to pre-project conditions. Once this was accomplished, wildlife would likely return to the area and use it as breeding, foraging, and cover habitat. With the decommissioning and rehabilitation of access roads, pre-project wildlife movement patterns, habitat connectivity, and gene flow might resume for some or all species that currently occur in the area.

4.19.8 Irreversible and Irretrievable Commitments of Resources

Irreversible impacts would consist of the increased risk of bioaccumulation of potentially toxic constituents in some bird, bat, small mammals, reptile, and amphibian individuals. Irretrievable commitments would consist of wildlife habitat removal and wildlife displacement for the project footprint and associated roads, pipelines, and power lines, which would be reclaimed after the life of the project.

4.20 Cumulative Impacts

4.20.1 Introduction

CEQ regulations for implementing NEPA define *cumulative impacts* as "... the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable actions (RFA) regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR § 1508.7).

BLM's NEPA Handbook states that the purpose of the cumulative effects analysis is to ensure the decision makers consider the full range of the consequences of the Proposed Action, alternatives to the Proposed Action, and No Action alternative (BLM 2008). Assessing the cumulative effects of the actions begins early in the NEPA process, during the identification of issues. During the scoping process for the SSEP EIS, the public and agency personnel identified several questions (issues) relating to cumulative effects for consideration and analysis in the EIS. The following is an excerpt from the *Sonoran Solar Energy Project Environmental Impact Statement Public and Agency Scoping Report* (BLM 2009d) that identifies the cumulative impact issues.

Cumulative Impact Issues

Issue 32: A number of other solar-generating power facilities are being considered in western Arizona, California, and Nevada and may impact a variety of resource values and uses, including water supply, endangered species, visual resource, and wildlife and threatened, endangered, and sensitive species habitat.

- What would be the cumulative effect of these facilities on the Sonoran Desert landscape?
- What past, present, and reasonably foreseeable projects and their connected actions (i.e., transmission needs associated projects) would be appropriate to include in a cumulative impacts analysis?
- What resources are appropriate to include in a cumulative impacts analysis? What are appropriate impact indicators and information to include in that analysis?
- How might climate change impact the cumulative effect on these facilities on the Sonoran Desert?

This issue and these questions form the foundation for the assessment of cumulative effects of the actions on the resource values and uses of the Project Area. Those resources that would be directly or indirectly affected by the Proposed Action, alternatives to the Proposed Action, and No Action alternative are analyzed below. If the actions under each alternative have no direct or indirect effect on a resource (as disclosed in Chapter 4, Environmental Consequences), then the cumulative impacts on that resource are not addressed below.

In framing the cumulative effects analysis, a geographic scope for the analysis must be established for each resource. Geographic scope is usually defined by the natural boundaries of the resources, rather than agency administrative boundaries, and it usually extends beyond the geographic scope of the Project Area. In this analysis, the cumulative effects analysis area (CEAA) is most often the Rainbow Valley, including the Waterman Wash watershed and the Rainbow Wash watershed. In some cases, the CEAA is much larger. For example, the CEAA for the assessment of cumulative effects on social and economic conditions includes Maricopa and Pinal counties. See Section 4.20.2 below for a description of each

resource CEAA and rationale for that selection. In addition to the geographic scope of the analysis, a timeframe for the analysis must also be established. For this cumulative effects analysis, the temporal scope is the projected life of the SSEP, which is 30 years.

In any NEPA analysis, it is preferable to quantify the assessment of effects (changes) on each affected resource. This is true for direct, indirect, and cumulative effects. Where possible, the following analysis is quantified. Where quantification is not available, a meaningful and qualified judgment of cumulative effects is included to inform the public and the decision maker.

An ID team was formed to analyze and disclose the direct, indirect, and cumulative effects of the Proposed Action, alternatives to the Proposed Action, and No Action alternative on the affected environment (resource values and uses of the Project Area). In the sections that follow, the ID team has identified and described the CEAAs by resource value and use, compiled a list of RFAs for use in the cumulative effects analysis (see Table 4.119), and analyzed and disclosed the effects of past, present, and RFAs, including the SSEP, on the affected elements of the environment.

4.20.2 Cumulative Effects Analysis Area(s)

The geographic scope for the cumulative impacts analysis is presented in six different CEAAs around the Project Area:

- Rainbow Wash CEAA
- Pinal and Maricopa Counties CEAA
- Grazing (the Beloat and the Arnold grazing allotments) CEAA
- Waterman Watershed CEAA
- Noise CEAA (5 km)
- Air Quality Nonattainment Areas

Six different CEAAs are necessary to capture the proper spatial scope of cumulative impacts for each resource. These areas were selected because they are large enough to include all potentially significant effects on the resources of concern and effects from the combined impacts of the SSEP and other actions. The six CEAAs and the rationale for the selection of each CEAA are described in Sections 4.20.2.1 through 4.20.2.7 and shown on Maps 30 and 31.

All CEAAs described below (except for climate change) are a mixture of BLM, state, and private lands. Public lands managed by BLM are used for a variety of purposes, including dispersed recreation, wildlife, livestock grazing, mining, and utility corridors for electric transmission lines and gas pipelines. Public lands are also managed for special values, including the Sonoran Desert National Monument and wilderness resources. State lands are typically managed for commercial uses that generate revenue for the benefit of Arizona‘s schools. Other state lands are managed with emphasis on management of wildlife and their habitat and recreation opportunities. Private lands in each CEAA have been developed for agricultural purposes, commercial and residential development, and public purposes such as roads, highways, landfills, and prisons. The lands in each CEAA are a mixture of undeveloped public lands, interspersed with cities and towns, roads and highways, agriculture, mining, utilities, and commercial development.

4.20.2.1 GLOBAL – CLIMATE CHANGE

Climate change and its effects are a global phenomenon; hence, the CCEA for climate change is the world. GHG emissions, from natural and human sources, that contribute to climate change are generally localized; however, their mixing and distribution in the atmosphere (globally) is what leads to the global extent of the problem. Because emissions of GHGs do not generally remain localized, this analysis cannot separate the particular contribution of SSEP emissions or emissions reductions to global climate change (and its regional implications) from the multitude of other past, present, and RFAs that would produce or mitigate GHG emissions.

4.20.2.2 MARICOPA AND PINAL COUNTIES – SOCIOECONOMIC CONDITIONS

The CEAA for socioeconomics consists of Maricopa and Pinal counties (see Map 31). This CEAA is identical to the SESA discussed in Section 3.12.1 and 4.12.1 of this EIS (Socioeconomics). All data on socioeconomic conditions, fiscal conditions, public services and utilities, and environmental justice apply to the CEAA. This CEAA includes the population centers of the greater Phoenix area and the municipalities (cities or towns) of Goodyear, Buckeye, and Gila Bend. The approximate geographic dimensions of the two-county boundaries include lands 70 miles east and west of the Project Area, 40 miles north, and 65 miles south of Phoenix, for a total of approximately 9,342,720 acres. They include public, private, and state lands. These counties provide a reasonable area for analysis of the cumulative impacts to socioeconomics because they have similar suburban and rural character and are affected similarly, socially, and economically by land-use decisions. In addition, census and employment data are catalogued by county.

4.20.2.3 PROJECT AREA AND NONATTAINMENT AREAS FOR PM_{10} AND OZONE – AIR RESOURCES

The CEAA for air quality is the Project Area and the nonattainment areas for PM_{10} and ozone around Maricopa County (see Map 31). This CEAA was chosen because it is the extent of pollutant emissions regulations under the CAA. The CEAA totals approximately 3.2 million acres.

4.20.2.4 PROJECT AREA AND 5-KM RADIUS – NOISE

The CEAA for noise consists of the Project Area and all lands within a 5-km radius around the Project Area, for a total of 73,554 acres (see Map 31). The CEAA includes the northern portion of the Sonoran Desert National Monument, Buckeye Hills Regional Park, and low density residential areas to the east. There are several secondary roads in the 5-km CEAA, including Komatke, Riggs, and Haul roads. The size of the CEAA was chosen to capture other sources of noise that may overlap the dissipation distance noted and to better disclose cumulative impacts. The size is appropriate because construction noise usually dissipates to background levels within 2.8 km or 1.75 miles of the source[14], depending on topography and vegetation, intensity of the construction activities, and the range of ambient conditions.

[14] The assumption that noise usually dissipates to background levels was calculated using the Standard Attenuation Calculation: 20 log 10 = [(d2/d1)] where d1 =50 feet and d2 = 9,240 feet (1.75 miles), executed as 20 log 10 [(9,240]/50 feet = 45.3 dBA. Noise from construction is attenuated from 90 dBA to 45.3 dBA at 1.75 miles. The subjective impression of 45 dBA falls between quiet (40 dBA) and light traffic at 100 feet (50 dBA) and is the assumed distance for dissipation of noise to background levels for this analysis.

4.20.2.5 ARNOLD AND BELOAT GRAZING ALLOTMENTS – LIVESTOCK GRAZING

The CEAA for livestock grazing includes the Arnold and Beloat grazing allotments (see Map 30). Together they consist of 126,798 acres of BLM, state, and private lands. Vegetation communities on undeveloped lands in the allotments include Sonoran Creosotebush-Bursage Scrub and Xeroriparian Wash. Agricultural lands are characterized by crops and pasturelands or fallow fields. The rationale for using this geographic scope for the livestock grazing analysis is that these are the only two allotments that would be affected by the Proposed Action and alternatives.

4.20.2.6 RAINBOW VALLEY SUB-BASIN – GROUNDWATER

The CEAA for groundwater is the Rainbow Valley Sub-basin (see Map 30). The Rainbow Valley Sub-basin encompasses an area of about 420 square miles (268,800 acres) and consists primarily of agricultural land in the north and undeveloped desert land in the south. Developed and privately owned agricultural land lies east of the undeveloped SSEP study area. The boundaries of the sub-basin are defined on the north by the Buckeye Hills and the northern part of the Sierra Estrella, on the west and southwest by the Maricopa Mountains, on the southeast by the Haley Hills, Booth Hills, and Palo Verde Mountains, and on the east by Sevenmile Mountain and the southern part of the Sierra Estrella (see Map 30). The sub-basin is drained by Waterman Wash, an ephemeral stream that flows northwest and joins the Gila River near Buckeye. This sub-basin would be the source of groundwater for the SSEP well field, and is the primary natural unit on which to assess impacts.

4.20.2.7 RAINBOW VALLEY (WATERMAN WASH AND RAINBOW WASH WATERSHEDS COMBINED) – ALL OTHER RESOURCE VALUES/USES

The CEAA for all other resources (listed below) is the Rainbow Valley (see Map 30). This CEAA covers 312,499 acres and is defined as the Waterman Wash watershed and the Rainbow Wash watershed, bounded generally by the Buckeye Hills and the Gila River to the north, the Maricopa Mountains on the south and west, and the Sierra Estrella Mountains on the east. Waterman Wash drains into the Gila River on the north and the Rainbow Wash drains into the Gila River to the west of the CEAA.

Table 4.117 identifies the rationale for the selection of the Rainbow Valley as the CEAA for these resources.

Table 4.117 Rationale for Rainbow Valley CEAA by Resource

Resource	Rationale for Rainbow Valley CEAA
Soils	Several soil types (predominantly the Denure-Rilito-Why complex) dominate the Project Area. These fan terrace/alluvial soils only extend along the valley bottom, and thus form a more or less continuous unit within the valley.
Geology and paleontological resources	This is the area of current subsidence due to groundwater pumping for irrigation. This is also the aquifer that would supply the water needed for the SSEP.
Minerals	Sand and gravel operations are found throughout the Phoenix Valley. The mineral resource within this area is under similar development pressure and management, and is essentially a local resource.
Surface Water	Two on-site washes; impact to total watershed should be restricted to flow into/from these watersheds. Direct impacts to a larger watershed (i.e., Gila River) are unlikely.
Vegetation	Similar slopes and soils within the Rainbow Valley; discrete ~~b~~lock" of similar habitat, bounded on all sides by other habitat types.
Wildlife	Contiguous habitat and movement (linkage) corridors.
Cultural	Encompasses viewsheds, related prehistoric activity similar to that in the Project Area, and TCPs and other areas of concern.
Visual resources	Adjacent peaks are recreation (hiking) destinations and located in sensitive areas where the view (recreation setting/experience) would be affected.
Land use	These are the municipalities most likely to be affected by similar land uses and development types, including residential development, transportation/infrastructure, mining (sand and gravel), grazing, landfills, prisons, and other energy projects.
Transportation and traffic	Includes the primary transportation system to the SSEP.
Recreation	The recreation use within this area is managed in a similar manner (generally dispersed and undeveloped), and is under similar pressures from other land uses and developments; representing a total impact on regional recreational opportunities (county trails, state recreation areas).
Special designation areas	There would be no physical effect on lands within the SNDM or nearby wilderness. The anticipated effects would be on wildlife that travel the linkage corridors across the Project Area to adjacent special designation areas, and the recreation setting and experience in these special designation areas.
Hazardous materials	Includes primary disposal sites for material used and generated at the SSEP.

4.20.3 Reasonably Foreseeable Actions

This section of the EIS identifies key ongoing, proposed, and potential actions within each CEAA that may result in incremental impacts or synergistic effects if implemented in combination with the alternatives considered in the EIS. Table 4.118 identifies the planning documents, studies, records, cities, agency websites, and agency staff consulted in determining the pertinent existing and RFAs.

Table 4.118 Sources Consulted for Development of Reasonably Foreseeable Actions

BLM in house search of pending applications
Records search at the Arizona State Lands Department
The Interstate 10/Hassayampa Valley Roadway Framework Study
Katie Wilkin (City of Goodyear planner)
The Southwest Area Transportation Study report (2003)
Final Lower Gila South Resource Management Plan and Environmental Impact Statement (1986)
Records search of the Land and Mineral Legacy Rehost 2000 System
Joe Schmitz (principal planner with City of Goodyear)
Rick Buss (City Manager and Principal Planner from the Town of Gila Bend)
Tom Dixon (Town of Buckeye planner)
Goodyear's Planned Area Developments table
Estrella III Major General Plan Amendment map
City of Goodyear General Plan 2003-2013
Town of Buckeye General Plan 2008a
LR2000 records search
Town of Buckeye Parks, Trails and Open Space Master Plan (2005)
Maricopa County Park's website
Arizona Game and Fish's website
Maricopa County Regional Trail System Plan (2004)
ADWR Designated Assured Water Supply Records
Maricopa County's State Route 85 Corridor Area Plan (2003)

For analysis purposes, the RFAs and development projections identified below come from the planning documents, studies, records, agencies, and staff consulted as identified above in Table 4.118. It should be noted that most of these plans are not yet complete. Use of these action plans does not intend to imply those actions are final decisions; rather, they are reasonably foreseeable assumptions for this cumulative impacts analysis. Further, the projections are not to be considered part of the Proposed Action, or alternatives, to this proposal. Table 4.119 identifies the RFAs identified for each CEAA and Map 32 identifies the approximate locations of these actions in relation to the SSEP. The cumulative analysis of impacts to groundwater resources incorporated complex modeling. RFAs had to be considered separately for groundwater to meet the needs of the modeling approach, as explained in Section 4.20.4.17 below.

As previously mentioned, in any NEPA analysis, it is preferable to quantify the assessment of effects (changes) on each affected resource. Table 4.119 details acreages of RFAs where it is appropriate (and possible) to quantify by acreage. If quantification by acreage is not appropriate (or possible), the table states if the RFA occurs within the CEAA or not.

Table 4.119 Reasonably Foreseeable Actions (expressed in acres) within Each Cumulative Effects Analysis Area

Reasonably Foreseeable Actions	Rainbow Valley CEAA	Rainbow Valley Sub-basin CEAA	Grazing CEAA	5-km CEAA	Air Quality Nonattainment Areas	Maricopa and Pinal Counties CEAA
Mining						
Wesco Mine	56.2	0	56.2	56.2	In	In
Mining Total	***56.2***	***0***	***56.2***	***56.2***		
Master Planned Communities (MPC)						
Arnold Baker Farm	332.5	332.5	332.5	0.0	In	In
*Estrella Highlands	1,217.1	1,217.1	1,217.1	1,217.1	In	In
Estrella Region I	2,807.1	2,807.1	11,391.5	190.9	In	In
*Madeira	2,369.5	2,369.5	2,369.5	1,874.1	In	In
*McRae Holdings	2,379.5	2,379.5	2,379.5	1,855.8	In	In
Rainbow Ranch	1,631.2	1,631.2	1,631.2	1,608.7	In	In
Rainbow Valley	868.4	868.4	868.4	294.0	In	In
Terrasante	892.4	892.4	892.4	202.9	In	In
Copper Falls	0.00	0.00	0.00	0.00	In	In
Blue Horizons	0.00	0.00	0.00	0.00	In	In
Southwest Ranch	0.00	0.00	0.00	0.00	In	In
Sundance	0.00	0.00	0.00	0.00	In	In
Desert Creek	0.00	0.00	0.00	0.00	In	In
Silver Rock	0.00	0.00	0.00	0.00	In	In
Westwind	0.00	0.00	0.00	0.00	In	In
Westpark	0.00	0.00	0.00	0.00	In	In
Sonoran Trails	0.00	0.00	0.00	0.00	Out	In
Dos Lagos	0.00	0.00	0.00	0.00	In	In
Ski Lakes	0.00	0.00	0.00	0.00	In	In
	0.00	0.00	0.00	0.00	Out	In
MPC Total	***12,497.8***	***12,497.8***	***21,082.1***	***7,243.3***		
Recreation						
Buckeye Trail corridors	49.8	13.7	38.9	50.8	In	In
Maricopa Regional Trails	81.8	43.6	63.7	55.0	In	In
Recreation Total	***131.5***	***57.3***	***102.5***	***105.8***		
Solar						
Mobile	3,569.0	3,569.0	0.0	0.0	In	In
Solar Reserve	0.0	0.0	0.0	0.0	Out	In
Solana – Abengoa Solar	0.00	0.00	0.00	0.00	Out	In

Table 4.119 Reasonably Foreseeable Actions (expressed in acres) within Each Cumulative Effects Analysis Area

Reasonably Foreseeable Actions	Rainbow Valley CEAA	Rainbow Valley Sub-basin CEAA	Grazing CEAA	5-km CEAA	Air Quality Nonattainment Areas	Maricopa and Pinal Counties CEAA
Res America	0.00	0.00	0.00	0.00	In	In
LS Power	0.00	0.00	0.00	0.00	In	In
Ausra AZ–II	0.0	0.0	0.0	0.00	Out	In
Solar Total	***3,569.0***	***3,569.0***	***0.00***	***0.00***		
Transportation						
Hassayampa Freeway	1,243.0	913.2	805.7	600.1	In	In
Sonoran Valley Parkway	420.6	420.6	548.5	218.0	In	In
Transportation Total	***1,663.6***	***1,333.8***	***1,354.2***	***818.1***		
Grand Total	**17,918.0**	**17,457.8**	**22,595.0**	**8,233.4**		

*Water withdrawals from these MPCs were considered RFAs for cumulative groundwater impacts because they have been issued Assured Water Supply determinations from ADWR.

4.20.4 Cumulative Impacts Related to the Proposed Action and Alternatives

4.20.4.1 AIR QUALITY

4.20.4.1.1 Proposed Action, Alternative A, Sub-alternative A1, and Alternative B

The CEAA for air quality is the Project Area and a 50-km radius around the Project Area, as described in Section 4.20.2. The past and present land uses in the CEAA have had a substantial effect on air quality in the CEAA. The CEAA is located in Maricopa County, a serious nonattainment area for $PM_{10}$and nonattainment area for 8-hour ozone. The CEAA is managed to prevent exceedances of NAAQS, and to improve air quality. However, background data from the Buckeye monitoring station indicate routine exceedances of 24-hour PM_{10} and $PM_{2.5}$ standards. Emissions from present land uses in the CEAA continue to contribute to these exceedances.

RFAs in the PM_{10} and ozone nonattainment areas over the next 30 years would be expected to result in additional emissions to the Maricopa County serious nonattainment area for PM_{10} and the nonattainment area for ozone. Construction and operation of the RFAs included in Table 4.119 would be permitted and mitigated in accordance with the SIP and CAA to ensure that they do not cause or contribute to exceedances of NAAQS.

Under the Proposed Action, Alternative A, Sub-alternative A1, and Alternative B, construction and operation of the SSEP would result in additional emissions of criteria pollutants. However, emissions from the SSEP would be below the major source threshold for all criteria pollutants, and all air emissions would be appropriately mitigated to comply with the CAA, MACQD Air Pollution Control Regulations, and the Arizona SIP. Therefore, the project would not contribute to existing exceedances of NAAQS in the region.

4.20.4.1.2 No Action

Under the No Action alternative, the past, present, and reasonably foreseeable future land uses would have the same cumulative effect on air quality as described under the Proposed Action, Alternative A, Sub-alternative A1, and Alternative B, except that the SSEP would not be constructed.

4.20.4.2 CLIMATE CHANGE

4.20.4.2.1 Proposed Action, Alternative A, Sub-alternative A1, and Alternative B

The CEAA for climate change is the world, as described in Section 4.20.2.1. However, data are available to show the likely effects of climate change on the Southwest region of the United States. Therefore, the cumulative impacts from climate change are also considered at this scale.

Emissions of GHGs do not generally remain localized, but become well mixed with the general composition of the earth's atmosphere. Therefore, this analysis cannot separate the particular contribution of SSEP emissions or emissions reductions to global climate change (and its regional implications) from the multitude of other past, present, and reasonably foreseeable projects that would produce or mitigate GHG emissions. Although the SSEP would serve as a net mitigation for global climate change under all action alternatives, it is not possible to quantify the amount of mitigation that would occur on a global scale. However, current research suggests that climate change would have several irreversible impacts on the Southwest region.

Temperature levels in the Southwest are anticipated to rise as a result of global climate change. By 2020 temperatures could rise by approximately 1.7°F to 3.0°F, and by 2090 they could rise by approximately 3.8°F to 10.2°F. Overall precipitation levels in the Southwest are anticipated to fall as a result of global climate change. The higher temperatures and lower precipitation would likely lead to an increased risk of drought, wildfire, and flash flooding.

The construction of new sources of renewable energy production within the AZNM eGrid subregion would reduce the GHG emissions intensity of AZNM grid electricity, and would therefore reduce the GHG emissions savings of the SSEP versus the grid. However, it is not known to what extent such projects will be built. Therefore, the associated reduction in GHG emissions savings cannot be estimated at this time. In the absence of strong policy or regulatory drivers impacting the United States energy infrastructure, it is not anticipated that the generation mix of the AZNM subregion will change dramatically over the lifetime of the SSEP.

With net negative lifetime GHG emissions levels, all alternatives under which the SSEP is constructed, as well as other potential solar projects under the reasonably foreseeable developments, would serve as a net mitigation of the irreversible climate change impacts.

4.20.4.2.2 No Action

Under the No Action alternative, the past, present, and reasonably foreseeable future land uses would have the same cumulative effect on climate change as described under the Proposed Action, Alternative A, Sub-alternative A1, and Alternative B, except that the SSEP would not be constructed.

4.20.4.3 CULTURAL RESOURCES

4.20.4.3.1 Proposed Action, Alternative A, Sub-alternative A1, and Alternative B

The CEAA for cultural resources is the Rainbow Valley, as described in Section 4.20.2. The past and present land uses in the CEAA have had a direct effect on cultural resource values in the CEAA. Direct effects have included the loss, disturbance, theft, and burial of cultural artifacts and sites, as well as the modification and alteration of the setting of cultural sites and resources. Although surveys are conducted prior to development on state and federal lands to determine the presence of cultural resources sites eligible for listing on the NRHP (Section 106 NHPA), information may not be captured or sites protected from disturbance on private lands. If eligible sites are found, mitigation is implemented prior to construction to avoid sites or record (including excavation) the information from the sites prior to disturbance.

The development of private, state, and public lands for multiple purposes has lead to the recordation of information about previous cultures that occupied or traveled through the CEAA. Development of these lands has led to the collection of information about previous cultures, but also the physical loss of cultural resources sites in the CEAA.

RFAs in the Rainbow Valley CEAA over the next 30 years would be expected to result in the expansion of 56 acres of the Wesco Mine, development of 12,498 acres of lands for growth and expansion of master planned communities, construction of 132 acres of trails for the Town of Buckeye and Maricopa County, development of 3,569 acres of other solar energy facilities, and construction of 1,664 acres of freeways and parkways (see Table 4.119). These developments of public, state, and private land would result in the disturbance of 17,918 acres (6% of the CEAA) and multiple consequences to cultural resources in the Rainbow Valley CEAA. Where these actions would occur on state and public lands, surveys prior to construction would identify the presence of cultural resources and eligible sites prior to surface disturbance for construction. These surveys would provide for mitigation measures needed to capture the information these sites provide before construction and disturbance or removal of the affected sites. Although physical sites would be lost, the information these sites provide about previous cultures would be recorded before construction. Development on private land does not require the same survey and mitigation, and information about sites and cultures on these lands may be lost. Ultimately, the result would be the collection of additional information about previous cultures and site, but the loss of the physical presence of other sites.

Construction and operation of the SSEP under the Proposed Action (3,620 acres), Alternative A (3,609 acres), Sub-alternative A1 (2,013 acres), and Alternative B (2,394 acres) would result in up to a 20% growth in development in the Rainbow Valley CEAA over the next 30 years and contribute to the loss of site integrity of two sites in proximity to the Project Area. The construction and presence of the solar-generating facility would also alter the natural setting that contributes to the relevance of the setting to these sites. Further, one site is located in the Project Area and would be physically lost to development of the SSEP. Prior to construction, however, the information the site provides would be recorded.

4.20.4.3.2 No Action

Under the No Action alternative, the past, present, and reasonably foreseeable future land uses would have the same cumulative effect on cultural resources as described under the Proposed Action, Alternative A, Sub-alternative A1, and Alternative B, except that the SSEP would not be constructed. Continuation of existing livestock grazing and dispersed recreation uses would result in the modification of site integrity of three sites dues to grazing and trailing disturbance by cattle. However, no sites would be physically lost to disturbance resulting from construction or operation of the SSEP.

4.20.4.4 GEOLOGY AND MINERALS

4.20.4.4.1 Proposed Action, Alternative A, Sub-alternative A1, and Alternative B

The CEAA for geology and minerals is the Rainbow Valley, as described in Section 4.20.2. The past and present activities within the Rainbow Valley have had direct impacts on the geology of the area due to terrain modifications that have resulted in a more consistent landform across the CEAA. Mining of sand and gravel resources is currently occurring within the CEAA, which removes the resource for use in other areas.

RFAs in the Rainbow Valley CEAA over the next 30 years would be expected to result in the expansion of 56 acres of the Wesco Mine, development of 12,498 acres of lands for growth and expansion of the communities of master planned communities, construction of 132 acres of trails for the Town of Buckeye and Maricopa County, development of 3,569 acres of other solar energy facilities, and construction of 1,664 acres of freeways and parkways (see Table 4.119). These actions, totaling 17,918 acres (6% of the CEAA), would cumulatively contribute to a more consistent landform across the CEAA. With the exception of the Wesco Mine that is currently developing sand and gravel resources, the RFAs could preclude mining of potential sand and gravel resources within the footprint of the actions.

Under the Proposed Action, construction and operation of the SSEP would cumulatively contribute 3,620 acres of disturbance to geologic resources (which represents 20% of the reasonably foreseeable developments and an additional 1.2% disturbance within the CEAA). Alternative A would contribute 3,609 acres (20% of the reasonably foreseeable developments and an additional 1.2% disturbance within the CEAA), Sub-alternative A1 would contribute 2,013 acres (11% of the reasonably foreseeable developments and an additional 0.6% disturbance within the CEAA), and Alternative B would contribute 2,394 acres (13% of the reasonably foreseeable developments and an additional 0.8% disturbance within the CEAA).

4.20.4.4.2 No Action

Under the No Action alternative, the past, present, and reasonably foreseeable future land uses would have the same cumulative effect on geology and minerals as described under the Proposed Action, Alternative A, Sub-alternative A1, and Alternative B, except that the SSEP would not be constructed.

4.20.4.5 HAZARDOUS MATERIALS AND HAZARDOUS AND SOLID WASTE

4.20.4.5.1 Proposed Action, Alternative A, Sub-alternative A1, and Alternative B

The CEAA for hazardous materials and hazardous and solid waste is the Rainbow Valley, as described in Section 4.20.2. RFAs in the Rainbow Valley CEAA over the next 30 years would be expected to result in the expansion of 56 acres of the Wesco Mine, development of 12,498 acres of lands for growth and expansion of the communities of master planned communities, construction of 132 acres of trails for the Town of Buckeye and Maricopa County, development of 3,569 acres of other solar energy facilities, and construction of 1,664 acres of freeways and parkways, for a total of 17,918 acres (6% of the CEAA) (see Table 4.119). Other solar energy projects would be assumed to use similar types and amounts of hazardous materials and hazardous and solid waste. Other RFAs may produce unknown types and amounts of materials and wastes. The use of hazardous wastes and materials at SSEP would contribute to the cumulative use, transportation, and disposed of these wastes and materials in the CEAA.

The handling, transporting, and disposal of hazardous materials and hazardous and solid wastes are subject to stringent LORS under the EPA, ADEQ, AZSERC, and OSHA. Hazardous wastes generated during the construction and operation of any of the RFAs would be required to comply with these LORS. With adherence to these LORS, cumulative impacts from hazardous materials and hazardous and solid waste in the CEAA would be minimal.

4.20.4.5.2 No Action

Under the No Action alternative, the past, present, and reasonably foreseeable future land uses would generate, use, transport, and dispose of various hazardous materials and hazardous and solid wastes, however, the SSEP would not be constructed and would not contribute to the production, use or transportation of wastes.

4.20.4.6 LAND USE AND ACCESS

4.20.4.6.1 Proposed Action, Alternative A, Sub-alternative A1, and Alternative B

The CEAA for land use and access is the Rainbow Valley, as described above in Section 4.20.2. The past and present land uses in the CEAA have had a direct effect on the conversion of lands from one use to another and on the ability to access the area. Land in the Rainbow Valley is largely undeveloped and is characterized by vacant desert, agricultural lands, and by areas used for grazing mining, utilities, recreation, and widely dispersed, low-density residential development. Open desert and agricultural lands have been converted to residential, commercial, and industrial uses. Access has been altered by the addition of roads and utility corridors. Recreation use consists mostly of hiking, biking, and horseback riding; OHV use has been limited by the conversion of open lands to other uses. Grazing still occurs on most public land within the Rainbow Valley.

RFAs in the Rainbow Valley CEAA over the next 30 years would be expected to result in the expansion of 56 acres of the Wesco Mine, development of 12,498 acres of lands for growth and expansion of master planned communities, construction of 132 acres of trails for the Town of Buckeye and Maricopa County, development of 3,569 acres of solar facilities, and construction of 1,664 acres of freeways and parkways (see Table 4.119). These developments, totaling 17,918 acres (6% of the CEAA), would result in further changes to the type of land uses and would continue to alter access to the Rainbow Valley CEAA. The Hassayampa Freeway, a conceptual freeway alignment currently in the framework study stage of development (Interstate 8/Interstate 10 Hidden Valley Framework Study, [MAG 2009]), would be located within the designated corridor south of the SSEP. The Hassayampa Freeway, as currently depicted in the conceptual designs, would overlap with the southern portion of the solar field and the proposed access road and gen-tie line. When considered with past, present, and future action, this would result in an additive cumulative impact of changes to the existing land use of the designated corridor.

The Town of Buckeye's Parks, Trails, and Open Space Master Plan (Buckeye 2005) designates the Buckeye Hills region as having a strong potential for preserving the open space character currently exhibited in the CEAA between Buckeye Hills to the north and Sonoran Desert National Monument to the south. When considered with the Proposed Action, this would have a countervailing impact because the Proposed Action would be a conflicting land use with the potential of preserving open space.

Under the Proposed Action and Alternative A, the SSEP would convert approximately 3,620 acres and 3,609 acres, respectively, from open desert to an industrial site. This represents approximately 21% of the changes to land uses projected by RFAs over the next 30 years under both alternatives, which would impact an additional approximately 1.2% of lands within the CEAA. This would further reduce the amount of open space in which to recreate and graze cattle, but would increase the ability for nearby communities to get renewable energy. The conversion of approximately 3,620 acres (Proposed Action) and 3,609 acres (Alternative A) would result in an approximately 104% increase in the acreage of land in the CEAA used for renewable energy. Under Sub-alternative A1, the SSEP would convert 2,013 acres from open desert to an industrial site. This represents 11% of the projected change in land uses over the next 30 years (impacting an additional 0.6% of lands within the CEAA) and approximately a 56% increase in the acreage of land in the CEAA used for renewable energy. Under Alternative B, the SSEP

would convert 2,394 acres from open desert to an industrial site. This represents 13% of the projected change in land uses over the next 30 years (impacting an additional 0.7% of lands within the CEAA) and approximately a 65% increase in the acreage of land in the CEAA used for renewable energy.

4.20.4.6.2 No Action

Under the No Action alternative, the past, present, and reasonably foreseeable future land uses would have the same cumulative effect on land use as described under the Proposed Action, Alternative A, Sub-alternative A1, and Alternative B, except that the SSEP would not be constructed. Continuation of existing livestock grazing dispersed recreation, residential and commercial uses, and utility corridors would continue without land conversion to renewable energy.

4.20.4.7 LIVESTOCK GRAZING

4.20.4.7.1 Proposed Action, Alternative A, Sub-alternative A1, and Alternative B

The CEAA for livestock grazing includes the Arnold and Beloat grazing allotments, as describe in Section 4.20.2. Together they consist of 126,898 acres. Vegetation communities on undeveloped lands in the allotments include Sonoran Creosotebush-Bursage Scrub and Xeroriparian Wash. Agricultural lands are characterized by crops and pasturelands or fallow fields.

The past and present land uses in the CEAA have had a direct effect on extent of grazing and the amount of forage in the area. Commercial and residential development has encroached on lands used for grazing and reduced the amount of land and forage available for cattle in the Beloat and Arnold allotments. Because of the type of vegetation communities and arid conditions of the CEAA, the Arnold allotment is only used for ephemeral grazing. The two allotments include 126,898 acres with authorized grazing of 122 AUMs.

RFAs in the livestock grazing CEAA over the next 30 years would be expected to result in the expansion of 56 acres of the Wesco Mine, development of 21,082 acres of lands for growth and expansion of master planned communities, construction of 102 acres of trails for the Town of Buckeye and Maricopa County, and construction of 1,354 acres of freeways and parkways (see Table 4.119). These developments of public, state, and private land would result in further changes to the vegetation communities that are used as forage for cattle grazing in the livestock grazing CEAA. Commercial development would result in the removal of vegetation communities and forage (both native and agricultural). The growth of master planned communities would convert more lands to structures and urban landscaping. And, construction of freeways and parkway would result in the removal and transformation of native vegetation communities to roadways, with a mixture of native and urban vegetation restoration in road ROWs. These RFAs would result in 22,595 additional acres of surface (including vegetation) disturbance in the CEAA, or an additional 18% of the CEAA.

Construction and operation of the SSEP under the Proposed Action (3,620 acres), Alternative A (3,609 acres), Sub-alternative A1 (2,013 acres), and Alternative B (2,394 acres) would contribute to the removal of forage from the livestock grazing CEAA over the next 30 years, further reducing forage in the CEAA. Under the Proposed Action and Alternative A, approximately 3,620 acres and 3,609 acres, respectively, of forage would be removed for construction of the SSEP. That is an approximately 16% contribution to the anticipated disturbance of all RFAs in the next 30 years under both alternatives, yielding an additional approximately 2.8% disturbance within the CEAA. Under Sub-alternative A1, removal of 2,013 acres of forage would contribute 9% of the anticipated forage reduction over the next 30 years (for an additional 1.6% disturbance within the CEAA). Under Alternative B, removal of 2,394 acres of forage would contribute 11% of the anticipated forage reduction over the next 30 years (for an additional 1.9% disturbance within the CEAA).

4.20.4.7.2 No Action

Under the No Action alternative, the past, present, and reasonably foreseeable future land uses would have the same cumulative effect on land use as described under the Proposed Action, Alternative A, Sub-alternative A1, and Alternative B, except that the SSEP would not be constructed. Existing livestock grazing would continue without land conversion to renewable energy.

4.20.4.8 NOISE

4.20.4.8.1 Proposed Action, Alternative A, Sub-alternative A1, and Alternative B

The CEAA for noise consists of the Project Area and all lands within a 5-km radius around the Project Area, as described in Section 4.20.2. The CEAA includes the northern portion of the Sonoran Desert National Monument, Buckeye Hills Regional Park, and low density residential areas to the east. There are several secondary roads in the 5-km CEAA, including Komatke, Riggs, and Haul roads.

Field observations indicate that there are very few area-wide noise sources that are noteworthy (such as local traffic, industrial, commercial, or agricultural sources). There are few daytime noise sources in the 5-km CEAA. SR-85 is nearly 8 miles away from areas with residential land uses. The nearest paved road is Rainbow Valley Road, a north-south, two-lane road that is 4.4 miles to the east of the eastern power block. All other roads near the Project Area, including Riggs Road, Pipeline Road, and all residential access roads, are dirt roads that are generally flat and well maintained. The noise environments in the recreational and residential areas are very similar and are dominated by the general background noise effects during most daytime hours. Typically, the lack of noise sources makes for an extremely quiet environment. Even during quiet periods, the traffic on SR-85 is not audible, and the noise environment was mainly influenced by insects and distant dogs. The summary of the ambient 24-hour L_{eq} long-term noise-level metrics indicates that a minimum of 39.7 dBA to a maximum of 47.6 dBA are produced in the area. A summary of the short-term data indicates a minimum L_{90}[15] of 22.1 dBA and a maximum of L_{10} of 66.0 dBA are produced in the area.

RFAs in the 5-km CEAA over the next 30 years would be expected to result in the expansion of 56 acres of the Wesco Mine, development of 7,243 acres of lands for growth and expansion of master planned communities, construction of 106 acres of trails for the Town of Buckeye and Maricopa County, development of the SSEP, and construction of 818 acres of freeways and parkways (see Table 4.119). These developments of public, state, and private land would result in further changes to the noise levels in the 5-km CEAA. Commercial and residential development along with the growth of master-planned communities and construction of freeways would bring more people and traffic to the area, which would result in an increase in noise levels in some areas. The projects that could occur directly adjacent to the SSEP, including the Wesco Mine expansion and Hassayampa Freeway, would result in the greatest cumulative impacts. However, because the SSEP would be in the operational phase during their operation and construction, its contribution to cumulative noise impacts would be relatively loud, as described earlier in Chapter 4. Relative to these new RFAs, the operation of SSEP would likely not be detectable, because it would be less loud than these sources during their construction (and potentially their operation). These RFAs would result in the conversion of 8,233 acres of open lands (11% of the CEAA) to other uses that would produce noise of varying levels. It is not possible to quantify the increase in dBA for these projects.

[15] The most common statistical sound levels used in community noise analyses are the L_{90}, L_{50}, and L_{10} levels. The L_{90} is the sound level exceeded 90% of the time and is often considered the effective background or residual noise level. The L_{50} is the sound level exceeded 50% of the time and is known as the median noise level. The L_{10} is the sound level exceeded 10% of the time and is a measurement of intrusive sounds (such as aircraft flying overhead), and is commonly known as the effective maximum or intrusive sound level.

Construction Noise Levels

Construction of the SSEP under all action alternatives would contribute to the increase in noise levels in the 5-km CEAA over the 37–39-month construction period. Under the Proposed Action and Alternative A, increases in noise levels during construction would be 20 dBA or less. The increases would range from 17 to 20 dBA at ST-2, 7 to 12 dBA at ST-3, 2 to 5 dBA at LT-1, and 2 to 4 dBA at LT-3. Ambient noise levels are greater than construction noise levels at noise receptors LT-3 and ST-1 by 7 and 25 dBA, respectively. Ground attenuation, vegetation, and topography would likely reduce these levels even further. See Table 4.54 (Predicted Construction Noise Levels Compared to Ambient Noise Levels for the Proposed Action) in Section 4.9 (Noise) for more information.

Under Sub-alternative A1, increases in noise levels during construction would be 12 dBA or less. The increases would range from 4 to 12 dBA at ST-2, 7 to 8 dBA at ST-3, and 1 to 2 dBA at LT-3. Ambient noise levels are greater than construction noise levels at noise receptors ST-1, LT-1, and LT-2. The maximum noise level at any of the receptor locations caused by construction would be 54 dBA at ST-2.

Operations Noise Levels

There would be an increase in daytime noise levels in the 5-km CEAA during operation of the SSEP at the ST-2 receptor. This would occur under all action alternatives except for Sub-alternative A1. Noise levels at the other receptors would remain below ambient conditions. The maximum noise level at ST-2 would be 42 dBA, or approximately 7–8 dBA above ambient conditions. Ground attenuation, vegetation, and topography would likely reduce these levels even further. There would be no increase in the ambient noise levels at the other receptors during operations.

Daytime noise levels would be below ambient conditions at all receptors under Sub-alternative A1. Nighttime noise levels during operations would be less than ambient levels under all alternatives. See Table 4.55 (Predicted Operations Noise Levels (dBA) Compared to Ambient Noise Levels – Proposed Action) and Table 4.57 (Predicted Operations Noise Levels Compared to Ambient Noise Levels – Sub-alternative A1) in Section 4.9 (Noise) for more information.

4.20.4.8.2 No Action

Existing noise sources in the area of analysis consist of sporadic vehicle traffic, small machinery, distant aircraft, and natural sounds from wind, rustling vegetation, birds, and insects. Under the No Action alternative, current ambient noise levels in the CEAA would continue to be influenced by these factors, and the sound conditions would remain quiet. The hourly average noise level (L_{eq}) recorded at Hayes Road was 47.6 L_{eq}, and sound conditions in the CEAA under the No Action alternative would not exceed this level.

4.20.4.9 PALEONTOLOGY

The low potential rating within the Project Area suggests that the presence of paleontological resources is unlikely. As such, there would be no anticipated short or long-term impacts to paleontological resources associated with construction and operation of the SSEP. Because there would be no direct or indirect impacts of construction and operation of the SSEP on fossils, there would be no contribution to the cumulative effects on paleontological resources in the CEAA.

4.20.4.10 RECREATION, WILDERNESS CHARACTERISTICS, AND SPECIAL DESIGNATIONS

4.20.4.10.1 Proposed Action, Alternative A, Sub-alternative A1, and Alternative B

The CEAA for recreation, wilderness characteristics, and special designations is the Rainbow Valley as described above in Section 4.20.2. The past and present land uses in the CEAA have had a direct effect on recreation opportunities, wilderness characteristics, and special designation values. The Sonoran Desert National Monument is managed to protect the biological, scientific, and historical resources. Lands with wilderness characteristics provide opportunities for solitude and primitive and unconfined recreation and to protect natural or undeveloped landscapes. Lands within the CEAA provide opportunities for dispersed recreation, including camping, hunting, wildlife observation, photography, backpacking, horseback riding, hiking, and backcountry driving. Low-density residential and agricultural developments have converted native shrub communities of the Rainbow Valley to urban landscaping and agricultural crops and pastures. Commercial and residential developments have lead to surface disturbances and clearing of vegetation and planting of urban vegetation species, both native and non-native. Population growth has increased traffic and pressure in recreational areas. Although large parts of the CEAA remain undeveloped, the mixture of land use development has altered the land, its character, and the viewshed, especially in the valley.

RFAs in the Rainbow Valley CEAA over the next 30 years would be expected to result in the expansion of 56 acres of the Wesco Mine, development of 12,498 acres of lands for growth and expansion of master planned communities, construction of 132 acres of trails for the Town of Buckeye and Maricopa County, development of 3,569 acres of other solar energy facilities, and construction of 1,664 acres of freeways and parkways (see Table 4.119). Except for the construction of trails, these developments of public, state, and private land would result in a loss of opportunities for dispersed recreation and would impact opportunities for solitude and primitive and unconfined recreation by affecting the visual resources of the recreation setting (creating more human developments) and the desired experience in the CEAA. Commercial development would result in the removal of vegetation communities (both native and agricultural) that would impact wildlife and reduce or change their habitat. The growth of adjacent cities and towns would convert more lands to structures and urban landscaping. Construction of freeways and parkway would result in the removal and transformation of native vegetation communities to roadways, with a mixture of native and urban vegetation restoration in road ROWs. Additional roads and structures reduce available habitat and block or alter wildlife movements.

This development would result in 17,918 additional acres (6% of the CEAA) converted from open lands to other uses in the CEAA, reducing opportunities for recreation and reducing or changing special area values. There would be, however, 132 acres of additional recreation opportunities from the construction of the Buckeye Trail corridors and the Maricopa Regional trails.

Construction and operation of the SSEP under the Proposed Action (3,620 acres), Alternative A (3,609 acres), Sub-alternative A1 (2,013 acres), and Alternative B (2,394 acres) would contribute to the development of the Rainbow Valley CEAA over the next 30 years and the continued alternation of the landscape and reduction of dispersed recreation activities and special area values in the CEAA. Under the Proposed Action and Alternative A, approximately 3,620 acres and 3,609 acres, respectively, of landform and native vegetation communities would be disturbed (leveled and removed) for construction of the SSEP. That would be an approximately 21% contribution to the anticipated landscape disturbance of all RFAs in the next 30 years (impacting an additional 1.2% of lands within the CEAA) under both alternatives. Under Sub-alternative A1, disturbance of 2,013 acres of the landscape would contribute 11% of the anticipated disturbance of all RFAs over the next 30 years (impacting an additional 0.6% of lands within the CEAA). Under Alternative B, disturbance of 2,394 acres of the landscape would contribute 13% of the anticipated disturbance of all RFAs over the next 30 years (impacting an additional 0.8% of lands within the CEAA).

The population in the Rainbow Valley is expected to grow and correspondingly the demand for areas in which to recreate. Conversion of public lands from open desert to other uses such as housing, energy development, and roadways would limit opportunities for dispersed, unconfined and primitive recreation, and solitude. Increased use in areas such as the Sonoran Desert National Monument, the Maricopa Wilderness Complex, Robbins Wildlife Refuge, and the Buckeye Hills Regional Park may create conflicts between users and impact vegetation, wildlife, and other wilderness and monument values. The SSEP under the Proposed Action (3,620 acres), Alternative A (3,609 acres), Sub-alternative A1 (2,013 acres), and Alternative B (2,394 acres) would contribute to the loss of dispersed recreation and special area values and contribute to the conversion of open lands to other uses.

4.20.4.10.2 No Action

Under the No Action alternative, the past, present, and reasonably foreseeable future land uses would have the same cumulative effect on recreation opportunities, lands with wilderness characteristic, and special designation values as described under the Proposed Action, Alternative A, Sub-alternative A1 and Alternative B, except that the SSEP would not be constructed. Continuation of existing livestock grazing and other uses would not result in any changes to recreation, wilderness character, or special designation area values.

4.20.4.11 SOCIOECONOMICS

4.20.4.11.1 Proposed Action, Alternative A, Sub-alternative A1, and Alternative B

The CEAA for socioeconomics is the combined area of Pinal and Maricopa counties, as described above in Section 4.20.2. This CEAA is identical to the SESA discussed in Sections 3.12.1 and 4.12.1 of this EIS (Socioeconomics). All data on socioeconomic conditions, fiscal conditions, public services and utilities, and environmental justice apply to the CEAA analysis. The past and present land uses in the CEAA have had a direct effect on socioeconomics of the CEAA through changes to employment (both types and amount), changes to the landscape which effect sense of place, increased housing availability, and changes to the overall population. Past and present actions have resulted in the current socioeconomic conditions in the CEAA, as described in Chapter 3.

In general, construction of RFAs within the two counties would create positive, temporary impacts on local economies and increased employment opportunities. RFAs would be expected to draw on the large regional construction workforce in the Phoenix area, where there is currently a considerable supply of qualified workers. Master planned communities would increase the housing availability within the CEAA, though currently there are a large number of vacant housing units available.

Concurrent construction of similar (reasonably foreseeable) projects in the future could result in a demand for labor that cannot be met by the region‘s labor pool, which could lead to an influx of nonlocal workers. This population increase could impact socioeconomic conditions and public services and utility.

From a lifestyle perspective, further development within the CEAA would change the landscape characteristics, existing landforms, and vegetation in the area which would contribute to an overall change in the sense of place for members of these counties. With the exception of the urban developed areas, the CEAA has a rural, moderately developed landscape. RFAs such as additional solar facilities, master planned communities, freeways and parkways could shift the landscape to a more developed landscape and would adversely impact local residents and visitors to the area who are seeking a rural residential community or a semiprimitive view or recreation experience.

4.20.4.11.2 No Action

Under the No Action alternative, the past, present, and reasonably foreseeable future land uses would have the same cumulative effect on socioeconomics as described under the Proposed Action, Alternative A, Sub-alternative A1, and Alternative B, except that the SSEP would not be constructed and would not contribute to the socioeconomic changes within the CEAA.

4.20.4.12 SOILS

4.20.4.12.1 Proposed Action, Alternative A, Sub-alternative A1, and Alternative B

The CEAA for soils is the Rainbow Valley, as described in Section 4.20.2. The past and present land uses in the CEAA have had a direct effect on the soils within the CEAA from clearing of vegetation; diminished soil productivity from topsoil loss; erosion; and compaction, which leads to inability of water to infiltrate the soils.

RFAs in the Rainbow Valley CEAA over the next 30 years would be expected to result in the expansion of 56 acres of the Wesco Mine, development of 12,498 acres of lands for growth and expansion of master planned communities, construction of 132 acres of trails for the Town of Buckeye and Maricopa County, development of 3,569 acres of other solar energy facilities, and construction of 1,664 acres of freeways and parkways (see Table 4.119). These developments of public, state, and private land would result in further impacts to the soils occurring in the Rainbow Valley CEAA. These RFAs would result in 17,918 additional acres of surface disturbance in the CEAA, or an additional 6% of the CEAA.

Construction and operation of the SSEP under all action alternatives would contribute to the disturbance of soils from the Rainbow Valley CEAA over the next 30 years, increasing the potential for topsoil loss, erosion, compaction, and loss of productivity. Under the Proposed Action and Alternative A, 3,589 acres and 3,580 acres of soil disturbance, respectively, would occur during construction and operation of the SSEP, a 20% contribution to the anticipated disturbance of all RFAs in the next 30 years and an additional 1.1% disturbance within the CEAA. Under Sub-alternative A1, there would be 1,984 acres of disturbance to soils that would contribute 11% of the anticipated soil disturbance of all RFAs over the next 30 years and an additional 0.6% disturbance within the CEAA. Under Alternative B, there would be 2,363 acres of disturbance to soils that would contribute 13% of the anticipated soil disturbance of all RFAs over the next 30 years and an additional 0.8% disturbance within the CEAA.

4.20.4.12.2 No Action

Under the No Action alternative, the past, present, and reasonably foreseeable future land uses would have the same cumulative effect on soils as described under the Proposed Action, Alternative A, Sub-alternative A1 and Alternative B, except that the SSEP would not be constructed and would not further contribute to soils disturbance within the CEAA.

4.20.4.13 TRANSPORTATION AND TRAFFIC

4.20.4.13.1 Proposed Action, Alternative A, Sub-alternative A1, and Alternative B

The CEAA for transportation is the Rainbow Valley, as described in Section 4.20.2. The primary transportation corridor is SR-85. Other local-two lane roadways consist of Rainbow Valley and Riggs Road. Numerous improved and unimproved roads follow the section lines and half-section lines for access to dispersed agriculture and residential areas throughout the CEAA. The Komatke Road alignment and Haul Road are unimproved roadways used as access to existing utility facilities (i.e., switchyard) and the Wesco Mine. Several unimproved roads provide access from Komatke Road to the Sonoran Desert

National Monument. Roads, also used off-highway vehicle trails, are located along the BLM-designated utility corridors. The Southern Pacific railroad crosses the southern portion of CEAA from east to west for approximately 12 miles.

The past and present land uses in the CEAA have had a direct effect on the transportation in the Rainbow Valley CEAA. Commercial, industrial, and residential development related to population growth have added traffic to existing roadways and created the need for additional roads. However, LOS are still ranked at the LOS A and LOS B levels, which signify little or no congestion.

RFAs in the Rainbow Valley CEAA over the next 30 years would be expected to result in the expansion of 56 acres of the Wesco Mine, development of 12,498 acres of lands for growth and expansion of master planned communities, construction of 132 acres of trails for the Town of Buckeye and Maricopa County, development of 3,569 acres of solar facilities, and construction of 1,664 acres of freeways and parkways (see Table 4.119). These developments would result in further increases to the traffic volume and may reduce LOS (i.e., more congestion and delays). Construction of freeways and a parkway would improve traffic flows to some degree. The *Revised Interstate 8 and Interstate 10 Hidden Valley Roadway Framework Study* (MAG 2009) discusses the location of the conceptual Hassayampa Freeway, which would be primarily located within the BLM-designated utility corridor directly south of the Project Area. The Hassayampa Freeway, as currently depicted in the conceptual designs, would overlap with the southern portion of the solar field and the proposed access road and gen-tie line. The additive impact of this project to the Hassayampa Freeway would be adverse because the two proposals have overlapping project components (see Map 32). A traffic interchange at the SR-85 and Riggs Road intersection is no longer being considered in the 2011–2014 *State Transportation Improvement Program* (ADOT 2011). Commercial development would increase and concentrate traffic in particular areas, as would the growth of the master planned communities. Construction of other solar facilities would result in additional traffic, especially during construction.

Construction and operation of the SSEP under the Proposed Action, Alternative A, Sub-alternative A1, and Alternative B would contribute to the increase in traffic volume and alter the LOS. Under the Proposed Action and Alternatives A and B, there would be an increase of 1,000 vehicle trips to and from the construction site twice per day (AM and PM). The LOS would temporarily decrease from an LOS B or better to LOS B or worse during that time. These decreases in LOS and short-term impacts to traffic and transportation would improve as the peak construction of 2012 is completed and as the SSEP moves toward operation. The additional operations traffic that would be generated by the SSEP after peak construction would have limited effect on the LOS of the existing project intersections. Construction and operation of the SSEP under these alternatives would contribute to the increases in traffic and decreases in levels of service during construction in the CEAA, but would return to existing levels during operations.

Under Sub-alternative A1, there would be an increase of 267 vehicle trips to and from the construction site twice per day (AM and PM). LOS would temporarily decrease from an LOS B or better to LOS C during AM peak traffic conditions on several SR-85 southbound and northbound mainline/Riggs Road intersections; otherwise, LOS would remain at an LOS B or higher. Decreases in LOS and short-term impacts to traffic and transportation would improve as the peak construction of 2012 is completed and as the SSEP moves toward operation. The additional operations traffic that would be generated by the SSEP after peak construction would have limited effect on the LOS of the existing project intersections. Construction and operation of the SSEP under Sub-alternative A1 would contribute to increases in traffic and decreases in LOS during construction in the CEAA, but would return to existing levels during operations.

4.20.4.13.2 No Action

Under the No Action alternative, the past, present, and reasonably foreseeable future land uses would have the same cumulative effect on transportation as described under the Proposed Action, Alternative A, Sub-alternative A1, and Alternative B, except that the SSEP would not be constructed and would not contribute to changes in LOS. The transportation and traffic patterns and infrastructure in and around the Project Area would continue and grow, as described above, resulting in increased traffic volume and some change in LOS.

4.20.4.14 VEGETATION

4.20.4.14.1 Proposed Action, Alternative A, Sub-alternative A1, and Alternative B

The CEAA for vegetation is the Rainbow Valley, as described in Section 4.20.2. Vegetation communities on undeveloped lands in the valley include Sonoran Creosotebush-Bursage Scrub and Xeroriparian Wash. Vegetation communities on the foothills and mountain slopes of adjacent mountain ranges include Sonoran Palo Verde Mixed Cacti/Sonoran Creosote-Bursage. Agricultural lands are characterized by crops and pasturelands or fallow fields. Vegetation typical of residential and commercial properties is characterized by urban landscaping, both native and non-native species.

The past and present land uses in the CEAA have had a direct effect on the extent and composition of native vegetation communities in the CEAA. Low-density residential and agricultural developments have converted native shrub communities of the Rainbow Valley to urban landscaping and agricultural crops and pastures. Undeveloped lands retain their native vegetation communities, though some weeds have invaded. Commercial and residential developments have lead to clearing of vegetation and planting of urban vegetation species, both native and non-native.

RFAs in the Rainbow Valley CEAA over the next 30 years would be expected to result in the expansion of 56 acres of the Wesco Mine, development of 12,498 acres of lands for growth and expansion of master planned communities, construction of 132 acres of trails for the Town of Buckeye and Maricopa County, development of 3,569 acres of other solar energy facilities, and construction of 1,664 acres of freeways and parkways (see Table 4.119). These developments of public, state, and private land would result in further changes to the vegetation communities of the Rainbow Valley CEAA. Commercial development would result in the removal of vegetation communities (both native and agricultural). The growth of master planned communities would convert more lands to structures and urban landscaping. Construction of other solar facilities would result in the removal of further vegetation communities (both native and non-native). Construction of freeways and parkway would result in the removal and transformation of native vegetation communities to roadways, with a mixture of native and urban vegetation restoration in road ROWs. These RFAs would result in 17,918 additional acres of surface (including vegetation) disturbance in the CEAA, or an additional 6% of the CEAA.

Construction and operation of the SSEP under these alternatives would contribute to the removal of native and agricultural vegetation from the Rainbow Valley CEAA over the next 30 years, further reducing vegetation (both native and agricultural) cover in the CEAA. Under the Proposed Action and Alternative A, approximately 3,620 acres and 3,609 acres, respectively, of native vegetation communities would be removed for construction of the SSEP. That is an approximately 21% contribution to the anticipated disturbance of all RFAs in the next 30 years under both alternatives, which would impact an additional 1.2% of land within the CEAA. Under Sub-alternative A1, removal of 2,013 acres of native vegetation would contribute 11% of the anticipated vegetation disturbance of all RFAs over the next 30 years (an additional 0.6% of surface disturbance within the CEAA). Under Alternative B, removal of 2,394 acres of native vegetation would contribute 13% of the anticipated vegetation disturbance of all RFAs over the next 30 years (an additional 0.8% of surface disturbance within the CEAA).

4.20.4.14.2 No Action

Under the No Action alternative, the past, present, and reasonably foreseeable future land uses would have the same cumulative effect on vegetation as described under the Proposed Action, Alternative A, Sub-alternative A1, and Alternative B, except that the SSEP would not be constructed. Continuation of existing livestock grazing and dispersed recreation uses would result in the use of vegetation for forage, but maintenance of rangeland health standards would limit further impacts to vegetation communities.

4.20.4.15 VISUAL RESOURCES

4.20.4.15.1 Proposed Action, Alternative A, Sub-alternative A1, and Alternative B

The CEAA for visual resources is the Rainbow Valley, as described in Section 4.20.2. The CEAA includes the Project Area viewshed (White Tank Mountains on the north, Maricopa Mountains on the south, Gila Bend Mountains on the west, and Sierra Estrella Mountains on the east). A brief qualitative discussion of visual changes to the Sonoran Desert landscape is also included.

The CEAA is a mixture of BLM, state, and private lands. Public lands managed by BLM are used for a variety of purposes including dispersed recreation, livestock grazing, mining, and utility corridors for electric transmission lines and gas pipelines. These are lands that are managed for some degree of landscape change to provide for uses that alter the characteristic landscape. Public lands in the CEAA are also managed for retention of undeveloped landscapes, including the Sonoran Desert National Monument and wilderness resources. State lands are typically managed for commercial uses that generate revenue for the benefit of Arizona‘s schools, often resulting in development that changes the character of the landscape. Private lands in the CEAA have been developed for agricultural purposes, low-density residential development, and public purposes such as landfills and prisons. The lands in the CEAA are a mixture of undeveloped landscapes, interspersed with agricultural, mining, utility, public purposes, and residential development, uses that alter the land and its character. The past and present land uses in the CEAA have resulted in the current landscape character of the CEAA.

RFAs in the Rainbow Valley CEAA over the next 30 years would be expected to result in the expansion of 56 acres of the Wesco Mine, development of 12,498 acres of lands for growth and expansion of master planned communities, construction of 132 acres of trails for the Town of Buckeye and Maricopa County, development of 3,569 acres of other solar energy facilities, and construction of 1,664 acres of freeways and parkways (see Table 4.119). These developments of public, state, and private land would result in further alteration and development of a landscape that is a mixture of agricultural lands, residential development, commercial uses, roads and highways, and undeveloped lands (open space), resulting in 17,918 additional acres of landscape development, or alteration of an additional 6% the landscape area in the CEAA.

Construction and operation of the SSEP under these alternatives would contribute to the development of the Rainbow Valley CEAA over the next 30 years and the continued alternation of the landscape in the CEAA. Under the Proposed Action and Alternative A, approximately 3,620 acres and 3,609 acres, respectively, of semiprimitive desert landscape and existing (primarily native) vegetation communities would be disturbed (graded flat with all vegetation removed) for construction of the SSEP. The disturbance from those alternatives would equate to approximately 21% of the anticipated cumulative landscape disturbance from all RFAs over the next 30 years, resulting in an additional 1.2% disturbance within the CEAA. Under Sub-alternative A1, disturbance of 2,013 acres of the landscape would equate to an 11% contribution to the anticipated cumulative disturbance over the next 30 years and an additional 0.6% disturbance within the CEAA. Under Alternative B, disturbance of 2,394 acres of the landscape would equate to a 13% contribution to the anticipated cumulative disturbance over the next 30 years and

an additional 0.8% disturbance within the CEAA. There could also be glare visible from multiple facilities simultaneously, which could increase negative perceptions of visual impacts from the facilities, and in some situations, it could be distracting or cause visual discomfort to some viewers. On a larger spatial scale, the development of the SSEP would contribute to ongoing changes to the Sonoran Desert landscape of the southwestern United States and northern Mexico. Population growth in the region's communities (and in the southwest in general) continues to increase the amount of infrastructure (transmission lines, gas pipeline, water lines, roads, etc.) needed to support these communities. As the growth patterns of the desert southwest continue to evolve, the undeveloped character of the Sonoran Desert will likely continue to shift toward a greater composition of altered landscapes and a lesser composition of natural or undeveloped landscapes. The SSEP would contribute to that landscape change.

4.20.4.15.2 No Action

Under the No Action alternative, the past, present, and reasonably foreseeable future land uses would have the same cumulative effect on the characteristic landscape (visual resources) as described under the Proposed Action, Alternative A, Sub-alternative A1, and Alternative B, except that the SSEP would not be constructed. Continuation of existing livestock grazing and dispersed recreation uses would not result in any substantial further cumulative alternation of the characteristic landscape (to landform, vegetation, water, or structures).

4.20.4.16 WATER RESOURCES–SURFACE WATER

4.20.4.16.1 Proposed Action and Alternative A

The CEAA for surface water is the Rainbow Valley CEAA, as defined in Section 4.20.2. This CEAA includes the Waterman Wash watershed and the Rainbow Wash watershed, as some of the precipitation that falls in these watershed flows to drainages that cross the Project Area, and these watersheds would be affected by the SSEP under the Proposed Action and all action alternatives.

Past and present land uses in the CEAA have directly affected surface water. Construction of roads, railroads, mines, utilities, landfills, prisons, and residences, and the development of lands for agricultural purposes have resulted in surface and vegetation disturbances that affect drainages and floodplains. Construction of these various developments has resulted in vegetation removal and leveling of landforms that has resulted in filling and re-routing of surface water drainages, alteration of floodplains, and increased sedimentation. Agricultural practices have created similar changes to vegetation and landform and resulted in the same types of effects on surface drainages and floodplains. In addition, construction of irrigation features and stock watering facilities has created surface waters. Although construction of stock tanks have created additional surface water (though often only seasonal), damming an ephemeral drainages to capture stormwater runoff also reduces surface water flow. Although parts of the CEAA have been developed for human uses, with the resulting impacts to surface drainages and floodplains, large parts of the CEAA are still undeveloped and exhibit unaltered, or less altered surface water flow and function.

RFAs in the Rainbow Valley CEAA over the next 30 years would be expected to result in the expansion of 56 acres of the Wesco Mine, development of 12,498 acres of lands for growth and expansion of master planned communities, construction of 132 acres of trails for the Town of Buckeye and Maricopa County, development of 3,569 acres of other solar energy facilities, and construction of 1,664 acres of freeways and parkways. These developments of public, state, and private land, totaling 17,918 acres (6% of the CEAA), would result in further changes to surface drainages and floodplains in the CEAA.

Assuming a drainage density of 0.012 linear mile/acre for the CEAA (Moody and Frazee 2009), 17,918 acres of anticipated disturbance of RFAs in the CEAA over the next 30 years would be expected to disturb 215 miles of surface drainages. Construction and operation of the SSEP under the Proposed Action and Alternative A would be expected to disturb an additional 40 miles of drainages, an increase of 19% in the CEAA above the expected disturbance of the RFAs. Construction and operation of the SSEP would also be expected to disturb 219 acres of floodplains, contributing to the disturbance caused by the RFAs to other floodplains in the CEAA.

4.20.4.16.2 Sub-alternative A1

Under Sub-alternative Al, the past, present, and reasonably foreseeable future land uses would have the same cumulative effect on surface drainages and floodplains as described under the Proposed Action and Alternative A. Under this sub-alternative, however, construction and operation of the SSEP would be expected to disturb 20 miles of surface drainages, an increase of 9% above the expected disturbance to drainages from the RFAs in the CEAA. Under Sub-alternative A1, the SSEP would also disturb 4 acres of floodplains, contributing to the disturbance caused by the RFAs to other floodplains in the CEAA.

4.20.4.16.3 Alternative B

Under Alternative B, the past, present, and reasonably foreseeable future land uses would have the same cumulative effect on surface drainages and floodplains as described under the Proposed Action and Alternative A. Under this alternative, however, construction and operation of the SSEP would be expected to disturb 26 miles of surface drainages, an increase of 12% above the expected disturbance to drainages from the RFAs in the CEAA. Under Alternative B, the SSEP would also be expected to disturb 112 acres of floodplains, contributing to the disturbance caused by the RFAs to other floodplains in the CEAA.

4.20.4.16.4 No Action

Under the No Action alternative, the past, present, and reasonably foreseeable future land uses would have the same cumulative effect on surface water drainages as described under the Proposed Action, Alternative A, Sub-alternative A1, and Alternative B. However, under this alternative, the SSEP would not be constructed, and would not contribute to the cumulative effects to surface water drainages and floodplains in the CEAA. Continuation of existing livestock grazing and dispersed recreation uses would not result in any substantial cumulative effects to surface drainages or floodplains.

4.20.4.17 WATER RESOURCES–GROUNDWATER

4.20.4.17.1 Proposed Action

The CEAA for groundwater is the Rainbow Valley Sub-basin, as defined in Section 4.20.2. The Rainbow Valley Sub-basin contains the aquifer that would be affected by the development of the SSEP, and was used as the groundwater modeling domain for the cumulative assessment of groundwater impacts (Carr 2010).

Groundwater development in the sub-basin began in the early 1950s, and expanded through the 1960s to the early 1980s. In the 1980s, groundwater use began to decline as agricultural lands were taken out of production. Most of the groundwater use in the northern part of the sub-basin is currently used for agriculture irrigation, though less than in the 1960s and 1970s. Several wells are registered as domestic water supplies.

The past and present land uses in the CEAA have had a direct effect on groundwater (aquifer) levels and trends. Records show steady water levels declines from the 1950s to the 1980s as a result of groundwater development for agricultural purposes. Water levels in the northern part of the sub-basin have stabilized or increased since the 1980s due to decreased groundwater pumping for agriculture and recharge to the sub-basin. However, in the southern part of the sub-basin, groundwater levels have continued to decline because of continued agricultural pumping. The average, long-term water level decline for the sub-basin is about 1 foot per year. The average decline for the northwestern part of the sub-basin (location of the SSEP) is about 0.75 foot per year.

The cumulative analysis of impacts to groundwater resources incorporated complex modeling (Carr 2010). RFAs were considered separately for groundwater to meet the needs of the modeling approach. The ADWR's database of current demand and committed demand were used to develop the list of reasonably foreseeable future groundwater pumping for the cumulative impacts analysis modeling for groundwater (Golder 2010).

Current demand is defined by ADWR as the most recent year with reported groundwater pumping data in the *Wells 55 Database*. Although 2008 data are currently being compiled, it typically takes more than one year before the data are considered complete and uploaded to the database; therefore, current demand for the purpose of the model was based on pumping data from 2007.

Committed demand is defined by ADWR as groundwater that has been approved for future development through the Assured Water Supply (AWS) Program under various types of determinations, as well as recorded lots that are not yet supplied water from within the basin. Although groundwater pumping for the SSEP does not fall under the AWS Program, ADWR typically applies AWS criteria to demonstrate physical groundwater availability under other programs. Seven AWS determinations have been issued by ADWR within the Rainbow Valley Sub-basin:

- One Certificate of Assured Water Supply (CAWS)
- One Physical Availability Determination (PAD)
- One Designation of Assured Water Supply (DAWS)
- Four Analyses of Assured Water Supply (AAWS)

The CAWS was issued for Tangier Acres, a small eight-lot subdivision, prior to 1990. The water demand for the subdivision is considered by ADWR to be reflected within the sub-basin's existing hydrologic conditions and is not classified as committed demand. Therefore, the water demand was not simulated in the model.

A PAD was issued to Estrella Mountain Ranch in October 2002 and represents an acknowledgement by ADWR regarding the physical availability of groundwater at that time. PADs are not classified by ADWR as committed demand. Therefore, the water demand for the Estrella Mountain Ranch PAD was not simulated in the model.

In 2006 the City of Goodyear was issued a modification of the city's DAWS, which are issued to water providers based on the projected 100-year demand. Although the city has expanded their boundaries into the Rainbow Valley Sub-basin, the city does not currently withdraw groundwater from the sub-basin. Therefore, groundwater pumping under the city's DAWS is not applicable and was not simulated in the model. However, a number of the developments simulated in the model are included as part of the city's master plan and pending DAWS application (which is not yet considered ―complete and correct", and was therefore not considered reasonably foreseeable).

The four AAWS, issued between 2005 and 2007, are for proposed master planned developments with a projected 100-year groundwater demand reserved for a period of 10 years while the project is under development. An AAWS is subject to specific conditions and restrictions which, if not met, will cause the AAWS to be revoked and/or expire if the groundwater is not committed. The four AAWS were issued for the Estrella Highlands, McRae Holdings, Madeira, and Broadstone Preserve developments.

Based on these RFAs, annual cumulative groundwater use in the CEAA would grow from 3,699 to 32,851 acre-feet per year over the life of the SSEP (30 years), not counting the additional withdrawal of the Proposed Action. The total cumulative withdrawal from the aquifer during the 30-year projected life of the SSEP would be 769,616 acre-feet, not counting the additional withdrawal of the Proposed Action.

As discussed in Section 4.18.2.11, groundwater is replenished into the Rainbow Valley aquifer from natural recharge at a rate of approximately 2,550 afy. At this rate, groundwater recharge would take approximately 1.5 years to naturally replenish one year's cumulative withdrawals under current conditions (not considering the SSEP project). Factoring in the reasonably foreseeable withdrawals expected over the life of the project (30 years), but not including SSEP withdrawals, it would take approximately 13 years to naturally replenish one year's cumulative groundwater withdrawals in the CEAA. For a discussion on replenishment rates associated with the groundwater withdrawals under each SSEP alternative, refer to Section 4.18.2.11 and Table 4.110.

The cumulative changes in depth to groundwater of the existing wells in the sub-basin, based on both reasonably foreseeable and SSEP water use, are displayed in Tables 4.120 and 4.121. Cumulative drawdown in individual wells would range from 5 to less than 125 feet (see Appendix F for drawdown information on each individual well). However, it is important to note that the analysis and modeling include withdrawals from other water users in the sub-basin, including a large agricultural well in the southern end of the sub-basin. Therefore, the total (cumulative) drawdown for many wells would likely result exclusively (or almost exclusively) because of pumping by other users, without any SSEP contribution to the drawdown.

Table 4.120 30-year Groundwater Drawdown and Number of Wells Impacted (assuming 1,429 gpm SSEP pump rate)

Groundwater Drawdown (feet)	Number of Wells Impacted
120–<125	1
105–110	1
100–105	4
95–100	3
90–95	1
85–90	7
80–85	16
75–80	50
70–75	45
65–70	21
60–65	22
55–60	21
50–55	22
45–50	23

Table 4.120 30-year Groundwater Drawdown and Number of Wells Impacted (assuming 1,429 gpm SSEP pump rate)

Groundwater Drawdown (feet)	Number of Wells Impacted
40–45	3
35–40	10
30–35	1
20–25	1
15–20	1
10–15	2
<10	43

Table 4.121 30-year Groundwater Drawdown and Number of Wells Impacted (assuming 1,862 gpm SSEP pump rate)

Groundwater Drawdown (feet)	Number of Wells Impacted
120–less than 125	1
105–110	2
100–105	3
95–100	3
90–95	3
85–90	21
80–85	49
75–80	33
70–75	29
65–70	16
60–65	18
55–60	23
50–55	16
45–50	20
40–45	3
35–40	10
30–35	1
20–25	1
15–20	1
10–15	2
<10	43

Construction and operation of the SSEP under the Proposed Action would require an additional 2,305–3,003 acre-feet per year of groundwater withdrawal from the sub-basin aquifer, depending on the amount of supplemental natural gas-fired electrical generation. This would result in an additional withdrawal of 69,150–90,102 acre-feet of groundwater withdrawal over the life of the project (30 years), which would require approximately 27–35 years of natural aquifer replenishment to offset. These withdrawals would represent a contribution of approximately 2–32 feet of the total drawdown shown in Tables 4.120 and 4.121.

Projected groundwater withdrawals from SSEP are subject to compliance with ADWR's Arizona Groundwater Code (A.R.S. Title 45, Chapter 2). The key requirements for the SSEP project are the need to obtain either a groundwater right or a groundwater withdrawal permit to pump groundwater, and the need to comply with ADWR well spacing requirements and well impact requirements. The groundwater withdrawal permit pertinent to the SSEP is a GIU permit (A.R.S. § 45-515), which allows groundwater to be withdrawn ~~"~~from a point outside of the exterior boundaries of the service area of a city, town, or private water company for a GIU outside of the exterior boundaries of such service area," subject to specific conditions. In its application to ADWR for the GIU permit, SSEP demonstrated that the project would not cause the water level to decline to more than 1,000 feet bls over the planned life of the project, which is consistent with ADWR's assured water supply requirements for subdivisions. The SSEP GIU permit application has been approved by ADWR and includes stipulations to monitor and report groundwater withdrawals.

4.20.4.17.2 Alternative A

Under this alternative, past, present, and reasonably foreseeable uses of groundwater would have the same effect as described under the Proposed Action, except that construction and operation of the SSEP would require approximately 95% less water than the Proposed Action. The SSEP would require 116 to 151 acre-feet of groundwater withdrawal per year, or 3,484 to 4,549 acre-feet over the 30-year life of the project. The effects of the SSEP groundwater pumping under this alternative were not modeled, but can be expected to be considerably less than under the Proposed Action.

4.20.4.17.3 Sub-alternative A1

Under this sub-alternative, past, present, and reasonably foreseeable uses of groundwater would have the same effect as described under the Proposed Action, except that construction and operation of the SSEP would require approximately 97% less groundwater withdrawal than the Proposed Action. This sub-alternative would cumulatively require approximately 2,165 acre-feet of groundwater over the life of the project (33.25 years), which would require approximately one year of natural aquifer replenishment to offset. Cumulative drawdown in individual wells would be less than 1 foot after five years.

4.20.4.17.4 Alternative B

Under this alternative, past, present, and reasonably foreseeable uses of groundwater would have the same effect as described under the Proposed Action, except that construction and operation of the SSEP would require approximately 34% less groundwater withdrawal than the Proposed Action. This alternative would cumulatively require 45,535 to 60,101 acre-feet of groundwater over the life of the SSEP (30 years), depending on the amount of supplemental gas-fire electrical generation, which would require approximately 18–24 years of natural aquifer replenishment to offset. The effects of the SSEP groundwater pumping under this alternative were not modeled, but can be expected to be somewhat less than under the Proposed Action.

4.20.4.17.5 Brine Concentrator Option

The addition of the brine concentrator to the solar-generating facility would reduce both annual and life of project groundwater withdrawals by approximately 7%. The effects of the SSEP groundwater pumping assuming the adoption of this option were not modeled, but can be expected to slightly reduce the level of drawdown in the sub-basin.

4.20.4.17.6 No Action

Under the No Action alternative, the past, present, and reasonably foreseeable future land uses would have the same cumulative effect on groundwater as described under the Proposed Action, Alternative A, Sub-alternative A1, and Alternative B, except that the SSEP would not be constructed. Continuation of existing livestock grazing and dispersed recreation uses would result in no changes to the groundwater reserves in the sub-basin or depth to groundwater of the existing wells.

4.20.4.18 WILDLIFE AND SPECIAL-STATUS SPECIES

4.20.4.18.1 Proposed Action, Alternative A, Sub-alternative A1, and Alternative B

The CEAA for wildlife is the Rainbow Valley, as described in Section 4.20.2. The lands in the CEAA are a mixture of undeveloped public lands, interspersed with agricultural, mining, utility, public purposes, and residential development. Vegetation communities on undeveloped lands in the valley include Sonoran Creosotebush-Bursage Scrub and Xeroriparian Wash. Vegetation communities on the foothills and mountain slopes of adjacent mountain ranges include Sonoran Palo Verde Mixed Cacti/Sonoran Creosotebush-Bursage. Agricultural lands are characterized by crops and pasturelands or fallow fields. Vegetation typical of residential and commercial properties is characterized by urban landscaping, both native and non-native species. All of these vegetation communities provide habitat for a variety of mammals (large and small), birds, reptiles, and amphibians (see Section 3.19).

The past and present land uses in the CEAA have had a direct effect on the presence, extent, and composition of wildlife populations and their habitat in the CEAA. Commercial, residential, and agricultural development have converted native vegetation communities of the Rainbow Valley to urban landscaping and agricultural crops and pastures, influencing their quality and availability to wildlife. Construction of roads and highways have reduced habitat, created barriers to wildlife movement, and increased the risk of mortality from vehicle collisions. The presence and noise of human habitation and activity throughout areas that have been converted to commercial, residential, and agricultural land uses (as described in Sections 4.20.4.8 [Noise] and 4.20.4.14 [Vegetation]) have reduced habitat quality for many wildlife species. However, much of the CEAA is still undeveloped and retains its native vegetation communities, including lands within the valley. These undeveloped valley lands provide important linkages between the mountain ranges in the CEAA, providing opportunities for dispersal, genetic viability, and continued habitat for many species.

RFAs in the Rainbow Valley CEAA over the next 30 years would be expected to result in the expansion of 56 acres of the Wesco Mine, development of 12,498 acres of lands for growth and expansion of master planned communities, construction of 132 acres of trails for the Town of Buckeye and Maricopa County, development of 3,569 acres of other solar energy facilities, and construction of 1,664 acres of freeways and parkways (see Table 4.119). These developments of public, state, and private land, totaling 17,918 acres (6% of the CEAA), would result in further changes to the quality of wildlife habitat of the Rainbow Valley CEAA, and the populations of species that depend upon that habitat. These developments would convert existing habitat (both native and human-modified) through vegetation clearing, construction of buildings, and construction of roads, power lines, and other utilities. Further, the RFAs would increase

human presence, noise, and activity on the landscape. All of these actions would change existing wildlife habitat and populations, diminishing the quality of habitat and wildlife populations dependent on those habitats for some species, and improving habitat and populations for others (i.e., those that favor some degree of human modified landscapes).

The Rainbow Valley CEAA is potential foraging habitat for migratory and nonbreeding golden eagles. The disturbance of an additional 17,918 acres of habitat, as described above, would decrease the availability of eagle prey populations (e.g., jackrabbits, snakes, small mammals), thereby potentially decreasing the presence of eagles in the CEAA. Although golden eagles are currently not known to nest within a 10-mile radius of the Project Area, power poles that would be erected concomitant with the type of development planned for the Rainbow Valley could be used as nesting structures, thereby benefiting local golden eagle populations by creating nesting habitat.

Construction and operation of the SSEP under the Proposed Action and Alternative A would contribute approximately 3,620 acres and 3,609 acres, respectively, to the anticipated future disturbance of wildlife habitat in the CEAA, or approximately 21% of the expected total disturbance, resulting in an additional 1.2% disturbance within the CEAA. They would also result in the loss of approximately 9 acres of the Gila Bend-Sonoran Desert National Monument linkage corridor, and 1,149 acres of the Buckeye Hills-Sonoran Desert National Monument linkage corridor, and their permanent bisection by a relatively low-use road (during operations). Both of these linkages would also be bisected by the proposed Hassayampa Freeway, with would result in an additional (and far less permeable) barrier to wildlife movement through these linkages. The cumulative effects of the RFAs are generally understood, but further research would be beneficial to fully understand the effects of various human developments on linkage corridors and wildlife movement through these corridors. Opportunities exist to study the effects of the SSEP and other development on wildlife and use of the corridors. This research would be helpful in defining measures needed to mitigate impacts to wildlife.

The cumulative impacts of displacement, habitat fragmentation, and barrier effects inside wildlife linkages could negatively affect the metapopulation of bighorn sheep located in southwestern Arizona. This metapopulation consists of small localized populations in islands of habitat located in the Buckeye Hills, Sierra Estrella Mountains, Gila Bend Mountains, and other nearby ranges. It is essential that bighorn individuals are able to move between populations for the purposes of genetic mixing. Blocking or otherwise affecting these movement patterns would further isolate populations and could ultimately lead to local extinctions if the degree of isolation were great enough. Presently, the Gila Bend-Sonoran Desert National Monument linkage is bisected by linear features such as SR-85 that likely impede bighorn sheep movement. The construction of additional linear features in this and the Buckeye Hills-Sonoran Desert National Monument linkage corridors, such as from the Proposed Action and the Hassayampa Freeway, would serve to further impede bighorn sheep movement. Movement could be impeded by increasing the probability of mortality from vehicle strikes and by generally increasing human noise and activity, which would displace bighorn sheep from an area surrounding the disturbance.

Under Sub-alternative A1, the SSEP would contribute 2,013 acres to the anticipated future disturbance to wildlife habitat in the CEAA, or approximately 11% of the expected total disturbance over the next 30 years (yielding an additional 0.6% disturbance within the CEAA). Sub-alternative A1 would result in the same cumulative impacts to wildlife linkage corridors as described for the Proposed Action because 100% of the linkage width would be impacted.

Under Alternative B, the SSEP would contribute 2,394 acres to the anticipated future disturbance to wildlife habitat in the CEAA, or approximately 13% of the expected total disturbance over the next 30 years (yielding an additional 0.8% disturbance within the CEAA). Alternative B would result in the same cumulate impacts to wildlife linkage corridors as described for the Proposed Action.

4.20.4.18.2 No Action

Under the No Action alternative, the past, present, and reasonably foreseeable future land uses would have the same cumulative effect on wildlife and their habitat as described under the Proposed Action, Alternative A, Sub-alternative A1, and Alternative B, except that the SSEP would not be constructed. Continuation of existing livestock grazing and dispersed recreation uses would result in maintenance of habitat for wildlife and intermittent human disturbance to the wildlife using that habitat.