CHAPTER 2.
PROPOSED ACTION AND ALTERNATIVES

2 PROPOSED ACTION AND ALTERNATIVES

2.1 Introduction

NEPA requires federal agencies to consider and evaluate a reasonable range of alternatives for a proposed action. The range of alternatives must meet the BLM's purpose and need while also minimizing or avoiding environmental impacts. This range of reasonable alternatives is formulated to address issues and concerns raised by the public and by agencies during scoping. The alternatives represent other means (methods, processes, locations, times, sequences, etc.), besides the Proposed Action, of satisfying the stated purpose and need for the federal action. Reasonable alternatives are defined by the CEQ as those that are technically, economically, and environmentally practical and feasible. NEPA also requires that a No Action alternative be evaluated for comparison to the other alternatives analyzed in the EIS. If unreasonable alternatives or alternatives that do not meet the purpose and need are suggested, a detailed analysis of these alternatives is not required. However, the rationale for eliminating them from detailed analysis must be explained.

This chapter presents four alternatives, one sub-alternative, and two options that were considered in detail for this EIS:

- The No Action alternative
- The Proposed Action
- Alternative A: Reduced Water Use (dry-cooled CST)
- Sub-alternative A1: Photovoltaic
- Alternative B: Reduced Footprint
- Brine Concentrator Option
- Gen-tie Line Option

Alternatives A and B were developed in response to issues raised during the agency and public scoping process. These alternatives would generally incorporate the same construction, operational, decommissioning, and reclamation components as the Proposed Action, but would either use alternative cooling technology or a reduced plant size to address resource issues raised in scoping. 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, to decrease the project footprint, and to avoid other sensitive resources raised as issues by the public and agency cooperators. The use of PV technology 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.

A supplemental EIS was not prepared because no supplemental documentation is needed for the BLM to make a reasoned decision between alternatives to the proposed federal action. Sub-alternative A1 would result in impacts either *within* the range of or *less than* those that would result from the alternatives considered in the draft EIS. Furthermore, Sub-alternative A1 was developed in direct response to public and agency comment on the draft EIS, and it was made possible by rapid advancements in PV technology.

Several other alternatives were identified and considered but were eliminated from detailed analysis. These alternatives are described in Section 2.11, which provides the rationale for eliminating them from detailed analysis.

The BLM has identified Sub-alternative A1 (which would use PV technology to reduce water consumption) as the agency-preferred alternative. This sub-alternative would reasonably accomplish the purpose and need for the federal action while fulfilling the BLM's statutory mission and responsibilities, giving consideration to economic, environmental, and technical factors. In particular, this sub-alternative best addresses public and agency concerns regarding groundwater use while meeting the purpose and need. Under Sub-alternative A1, approximately 33 acre-feet of groundwater reserves in the Rainbow Valley aquifer would be removed and used annually during operations. This is approximately 98% less than the estimated water requirements of the Proposed Action (the highest water use alternative, which would use wet-cooled solar thermal technology) and 72% less than the estimated water requirements of Alternative A (the lowest water use alternative after Sub-alternative A1, which would use dry-cooled solar thermal technology). No modeled detectable drawdown to previously existing wells would occur under Sub-alternative A1. In addition, the total estimated acreage of surface disturbance under Sub-alternative A1 (2,013 acres)—the least surface disturbance of all action alternatives—would be approximately 44% less than under the Proposed Action and approximately 15% less than under the reduced footprint of Alternative B. The smaller overall project footprint would also reduce adverse impacts to other resources and uses (e.g., wildlife, visual resources, soils, vegetation) compared to other action alternatives. Sub-alternative A1 would generate approximately 775,000 MWh per year of electricity, which is approximately 89% of the generation under the Proposed Action, 101% of the generation under Alternative A, and 144% of the generation under Alternative B.

Under the No Action alternative, the SSEP would not be developed in any configuration and existing land uses in the Project Area would continue as they are now.

2.2 Development of Alternatives

This section describes the method by which alternatives were initially identified to meet the purpose and need. To ensure a wide consideration of the possible range of alternatives, six primary categories of alternatives were identified for further consideration:

- The alternative of not pursuing the proposed energy development is required by NEPA (the No Action alternative).
- The use of other modes of generating solar electricity. It may be possible to use other means of generating electricity from solar energy.
- The use of alternate solar technology to reduce water use and other impacts.
- The use of alternative water sources. Alternative sources of water might be used to achieve the identified needs.
- Alternative layouts or sizes of the SSEP.
- Alternative locations for the SSEP.

An initial review of the broad range of alternatives, through these six categories, was conducted to identify those alternatives that were either not feasible or that clearly did not meet the purpose and need. Alternatives that might meet the purpose and need were carried forward for further evaluation relative to the applicable CEQ guidelines. Alternatives not carried forward to detailed analysis are described in Section 2.11.

2.3 Features, Management, and Considerations Common to Each Action Alternative

There are a number of management prescriptions and other considerations common to each action alternative for one or more of the following reasons: 1) they are already required by law or regulation for purposes of energy development; 2) they are BMPs or management techniques that could be readily applied to reduce impacts regardless of alternative; 3) they were developed to address issues specific to the Project Area and could be readily applied to reduce impacts regardless of alternative; 4) they pertain to actions and/or plans already occurring and/or over which the BLM has no jurisdiction; and 5) they pertain to BLM decisions related to the Project Area that are independent of decisions with respect to the action alternatives (i.e., BLM decisions regarding the action alternatives would not necessitate changes to decisions related to these items and vice versa).

2.3.1 Plan of Development

A POD would be required if the BLM decides to issue a ROW grant. Boulevard would prepare and submit a POD to the BLM that addresses all aspects of project development, including but not limited to road construction and maintenance; vegetation removal; natural, cultural, and biological resources mitigation and monitoring; and site reclamation. The POD would incorporate, as applicable, a variety of site-specific plans. Where applicable, these would be based on example plans developed as part of the *Draft Programmatic Environmental Impact Statement for Solar Development in Six Southwestern States* (BLM and DOE 2010). These may include a decommissioning and site reclamation plan; grading, drainage, erosion, and sedimentation control plan; vegetation management plan; habitat restoration and management plan; wildlife management plan; hazardous materials management plan; cultural resources management and mitigation plan; and visual restoration monitoring and compliance plan. These plans would be modified for the SSEP and incorporated into the POD, as appropriate.

2.3.2 Applicable Laws, Ordinances, Regulations, and Standards

Under all action alternatives, the proponent (Boulevard) would comply with all applicable LORS, and would obtain and meet the requirements of all needed permits. Because LORS are generally specific to a resource, they are generally presented in Chapter 3, which describes the current environment and its management. Where specific permit requirements would affect the environmental consequences to a particular resource, those requirements are discussed in Chapter 4.

All alternatives incorporate applicable BMPs and management stipulations from the *Lower Gila South Resource Management Plan* (BLM 1985), as amended (BLM 2005a; 2009a); these are described in Table 2.1 and included by reference. These stipulations would be included as conditions of approval for any ROW approved by BLM, and would be binding in the event that the facility were transferred or operated by another entity.

Table 2.1 Lower Gila South Resource Management Plan Management Stipulations and Best Management Practices

Resource	Stipulation
Air Quality	None applicable
Climate Change	None applicable
Cultural Resources	
Cultural Resources (1985:12)	Before proposals involving surface disturbance or transfer of title are approved, site-specific cultural resource evaluations will be completed within areas which have not been previously evaluated for cultural remains. A Class I literature review, as well as a Class III intensive field inventory (or an adequate Class II sample survey) will be conducted, as appropriate.
Cultural Resources (1985:12)	If any historic or archaeological properties are found, their eligibility for inclusion in the National NRHP will be determined in consultation with the SHPO (36 CFR 63).
Cultural Resources (1985:12)	Whenever feasible, BLM will avoid impacts to cultural resources by redesigning or relocating the project. If impacts are unavoidable, BLM will consult with the SHPO to develop mitigating measures to reduce or eliminate adverse impacts to cultural resources. In addition, BLM will consult with appropriate Native American groups which have aboriginal or historic ties to lands within the project area concerning known areas of traditional cultural and/or religious significance.
Cultural Resources (1985:12)	Impacts to cultural resources will be mitigated before construction begins.
Cultural Resources (1985:12)	If buried cultural remains are found during construction, the construction in the area will stop and the BLM will be notified. BLM Manual 8141 (Arizona Supplement) provides details on agency-specific guidelines for both long-term and interim physical and administrative protection of cultural resources. These measures will ensure compliance with the National Historic Preservation Act of 1966 and the National Environmental Policy Act of 1969.
Geology and Minerals	None applicable
Hazardous Materials and Hazardous and Solid Waste	None applicable
Land Use and Access	None applicable
Livestock Grazing	None applicable
Noise	None applicable
Paleontology	None applicable
Recreation and Wilderness Characteristics	
Wilderness Resources (1985:11)	Public lands within areas added by congress to the National Wilderness Preservation System would be managed in compliance with BLM's Wilderness Management Policy and the Wilderness Act of 1964.
Recreation Program (1985:12)	The recreation program will continue to participate in environmental assessments and resource activity plans in order to address and mitigate impacts on recreation resources.
Recreation Program (1985:12)	Visual resource management [VRM], management of off-road vehicle (ORV) use and other recreation resource management will continue as recreation programs.
Recreation Program (1985:12)	Wilderness areas established by the U.S. Congress in the Lower Gila South area would be closed to motorized vehicle use.
Recreation and Off-highway Vehicles (2005:15)	Existing visual resource inventory classes of the RMP will be adopted as management classes.
Socioeconomics	None applicable
Soils	None applicable

Table 2.1 Lower Gila South Resource Management Plan Management Stipulations and Best Management Practices

Resource	Stipulation
Special Designations	None applicable
Transportation and Traffic	None applicable
Vegetation and Special-status Species	
Protected Plants (1985:11)	Before construction or soil-disturbing activities are allowed, BLM conducted site evaluations for protected plants. If possible, projects are located to avoid impacts to large numbers of protected plants or their habitats. Where significant impacts to protected plants are poss ble, plants are salvaged and transplanted or the project is abandoned. BLM notifies the Arizona Commission of Agriculture and Horticulture 30 days in advance of actions that would affect plants protected under the Arizona Native Plant law (Arizona, State of, 1981).
Visual Resources	
Recreation Program (1985:12)	Visual resource management, management of ORV use, and other recreation resource management will continue as recreation programs.
Recreation Program (1985:13)	Visual resources will continue to be evaluated as a part of activity and project planning, and areas not presently designated according to BLM VRM Classification will be designated in the future. These evaluations would consider the significance of a proposed project and the visual sensitivity of the affected area. Stipulations are to be attached, as appropriate, to assure compatibility of projects with management objectives for visual resources.
Recreation Program (1985:13)	On BLM-administered lands in Arizona where classes have not been established, the lands will be managed as VRM Class III.
Water Resources	None applicable
Wildlife and Special-status Species	
Wildlife Program (1985:13)	Wildlife objectives will continue to be analyzed in environmental assessments or resource activity plans to ensure the consideration of wildlife needs and values and to mitigate any adverse impacts to wildlife habitat.
Wildlife Program (1985:13)	Specification No.2: Before installing facilities, BLM will conduct a site evaluation for state-protected animals and will develop mitigation to project these species and their habitats. Such mitigation might include project relocation, redesign, or abandonment.
Wildlife Program (1985:13)	Specification No.3: BLM will initiate Section 7 consultation with the U.S. Fish and Wildlife Service on all actions that may affect federal listed threatened and endangered species or its critical habitat as required by the Endangered Species Act of 1973 as amended.
Wildlife Program (1985:13)	Specification No.6: Fences proposed in big game habitat will be designed to reduce adverse impacts to big game movement. BLM will consult with the Arizona Game and Fish Department on the design and location of new fences.
Wildlife Program (1985:13)	Specification No.8: As a general practice, new roads will not be bladed for use in fence construction. Vehicle will travel overland, or fences will be built by hand.
Wildlife/Fisheries (2009:10)	Desert Tortoise Habitat Management. Desert tortoise habitat management will be standardized throughout the MFP and RMP planning areas. This management will be consistent with *Desert Tortoise Habitat Management on Public Lands: a Rangewide Plan* (BLM, 1988) and *Strategy for Desert Tortoise Habitat Management on Public Lands in Arizona* (BLM, 1990) ["strategy"].

Table 2.1 Lower Gila South Resource Management Plan Management Stipulations and Best Management Practices

Resource	Stipulation
Wildlife/Fisheries (2009:12)	Desert Tortoise Habitat Management. Comply fully with the Endangered Species Act of 1973, as amended, as it relates to tortoise population and habitat management on public lands. The Phoenix Field Office[1] will comply with Section 2 of the Endangered Species Act and BLM policy for managing habitat of candidate species to ensure that Sonoran population of the desert tortoise does not become threatened or endangered.
Wildlife/Fisheries (2009:12)	Desert Tortoise Habitat Management. Environmental decision documents for all actions occurring in desert tortoise habitat will address and include mitigation measures sufficient to offset, to the extent possible, any loss of tortoise habitat quantity or quality in category I, II, and III habitats.
Wildlife/Fisheries (2009:13)	BLM actions in desert tortoise habitats will be evaluated to assure that they do not encourage the proliferation or range expansion of predator populations.

[1] The "Phoenix Field Office" referenced in the 1985 RMP is now the "Phoenix District Office."

2.3.3 Applicant-committed Environmental Protection Measures Common to Each Alternative

Applicant-committed environmental protection measures are actions, practices, or design features that are part of the Proposed Action and all action alternatives and would be implemented by the proponent (Boulevard). Under all action alternatives, Boulevard would implement the applicant-committed environmental protection measures in Table 2.2 (as well as the management stipulations in Table 2.1) to minimize adverse impacts of the SSEP to sensitive environmental resources. These would be included as conditions of approval for any ROW approved by the BLM, and they would be binding in the event that the facility were transferred or operated by another entity.

Table 2.2 Applicant-committed Environmental Protection Measures and Best Management Practices

HAZARDOUS MATERIALS MANAGEMENT	
Hazardous material storage, handling, and use	All hazardous materials used during construction and operation would be stored on-site in storage tanks/vessels/containers that are specifically designed for the characteristics of the materials to be stored; as appropriate, the storage facilities would include the needed secondary containment in case of tank/vessel failure. All secondary containment would meet Occupational Safety and Health Administration (OSHA) requirements and would be sized to contain 110% of full tank/vessel volume. Secondary containment methods would include earthen bermed containment for the thermal energy storage (TES) system, concrete storage for other tanks, and polymer pallets for totes and drums. 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 personal protective equipment (PPE) and would be properly trained in the use of PPE and 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.
Heat transfer fluid leak detection	Leak detection of HTF would be accomplished in a combination of ways. Small leaks, poss ble at ball joints or other connections, would be located based on daily inspection of the solar field. Those small leaks can then be corrected via repacking of joints or valves or by minor repairs if needed. The ability to isolate loops and sections of the field allows for quick repairs. 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.

Table 2.2 Applicant-committed Environmental Protection Measures and Best Management Practices

Hazardous waste recycling	To the extent possible, both construction and operation-phase hazardous wastes would be recycled. The small quantities of hazardous waste that cannot be recycled will be accumulated for not more than 90 days in a designated area. Transport of the wastes and contaminated containers will be contracted to a qualified waste transporter, and the wastes will be taken, under manifest, to a permitted local landfill or treatment and disposal facility.
Thermal energy storage containment	To prevent a temperature hazard due to potential spills, the thermal storage area would be equipped with a berm of sufficient height to enable 110% storage capacity of one TES storage tank. Molten salt is not considered a hazardous material and containment is due to temperature hazard only. Salt freezes at ~450°F and quickly solidifies if a leak occurs.
Transformer containment	The generator step-up transformer would rest on a concrete pad with a perimeter berm designed to contain the transformer insulating oil in the event of a leak or spill.
HUMAN HEALTH AND SAFETY	
Fire protection	Fire protection systems are provided to limit personnel injury, property loss, and Project downtime resulting from a fire. The systems include a fire protection water system and portable fire extinguishers. Fire protection systems will be installed in operations and maintenance buildings and power block facilities.
Blasting safety	In the unlikely event that blasting is necessary, safeguards (e.g., blasting mats) would be employed when adjacent areas require protection. These measures would focus the explosive energy on the intended area to minimize material ejection from the blast.
Safe conductor installation	For public and existing line protection during wire installation, crossing structures would be erected adjacent to the existing transmission line and roadways or other structures requiring protection during conductor installation.
Hydrogen storage safety	Should Boulevard choose to use a hydrogen cooled generator, all standard industry practices would be employed to safeguard the system and minimize risks. Safeguards include leak detection, pressure/temperature monitoring, automatic generator shutdown, and fire detection/suppression systems.
Access restriction	In order to protect human health and safety, the entire site would be fenced appropriately to restrict public access during construction and operations.
BIOLOGICAL AND WATER RESOURCES	
Minimization of disturbance	To reduce the overall disturbance area of the SSEP, temporary construction laydown and parking areas would be provided in zones designated for long-term disturbance in the Project Area to the extent possible.
Clean-up and site reclamation	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. Oils or chemicals would be hauled to a disposal facility authorized to accept such materials. Open burning of construction trash would not be acceptable. 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 because of low amounts of precipitation, all practicable measures would be taken to minimize disturbance during construction.
Grading minimization	Each solar pad would be graded with the intent of balancing the cut-and-fill as much as possible to minimize earth movement on the site. Drainage diversion channels and protective berms would also be developed with a balance of cut and fill earthwork.

Table 2.2 Applicant-committed Environmental Protection Measures and Best Management Practices

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. 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. No vegetation would be restored or encouraged in the solar field because of the fire hazard. Vegetation in the land-treatment unit area would be controlled to prevent containment from being compromised. When construction of stormwater management structures is complete, contours would be carefully restored to the extent feasible.
Wading bird protection	The evaporation ponds would be designed with side slopes intended to discourage wading birds from accessing the ponds.
Wildlife protection	During nonworking hours, any open trench outside of fenced areas would be covered with wood or other material of sufficient strength to support wildlife (and people). Preconstruction wildlife surveys would include 100% surveys for burrowing owls. A qualified biologist would complete a pre-construction survey of the project area and a 200-meter (m) buffer (or as specified by the BLM AO) for burrowing owls according to the *Burrowing Owl Project Clearance Protocol* (Arizona Burrowing Owl Working Group [ABOWG] 2007). The biologist would possess a burrowing owl survey protocol training certificate issued by the AZGFD. Upon completion of the surveys, the contractor would contact the BLM to provide survey results. If any burrowing owl individuals are located during pre-construction surveys or during construction, the contractor would employ a biologist holding a permit from the USFWS to relocate burrowing owls from the Project Area, as appropriate, according to the *Burrowing Owl Project Clearance Protocol* (ABOWG 2007). The relocation site would be defined by BLM and relevant cooperating agencies. Pre-relocation surveys of the new burrow site(s) would be conducted to ensure its suitability as habitat and prevent significant resource conflicts. Preconstruction wildlife surveys would also include 100% clearance surveys for desert tortoise, kit fox (*Vulpes macrotis*), and badgers (*Taxidea taxus*). Boulevard would adhere to all funding requirements and stipulations of a memorandum of understanding (MOU) (once approved) regarding wildlife clearances and studies.
WATER/FLOODPLAIN/DRAINAGE	
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.
Site Drainage and runoff control	The post-development sediment/detention basin at the discharge points would provide stormwater pollution prevention BMP controls, along with detention time to reduce the peak off-site discharge and match pre-development conditions. The road berm 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 rip rap to provide for slope erosion protection during a heavy storm event.
AIR QUALITY	
Construction emissions	BMPs would be used to assure that construction of the project results in PM_{10} less than 70 tons per year (tpy), which is the threshold for minor sources in the nonattainment area. The final construction schedule and construction management would reflect this commitment.
Dust suppression	An approved dust suppression coating would be used on the dirt roadways in and around the solar field. The coating would not be applied to areas of the field between roads.
Road maintenance	Road maintenance would be performed as needed. Paved roads would be swept, sealed, and/or overlaid as needed. Grading and drainage would be maintained for gravel and earthen roads. Dust palliatives would be applied, as required, to limit fugitive dust.
VISUAL RESOURCES	
Lighting system	Lighting would be designed to provide the minimum illumination needed to achieve safety and security objectives and would be shielded and oriented to focus illumination on the desired areas and minimize additional nighttime illumination in the site vicinity.

2.3.4 Potential Mitigation Measures

All above applicant-committed environmental protection measures, management stipulations, and LORS would be incorporated into the ROD as terms and conditions of the ROW grant. Potential mitigation measures are discussed following the impact analysis for each resource or use (see Chapter 4) and could also be selected in the ROD as terms and conditions of the grant. Potential mitigation includes additional means, measures, or practices not incorporated into the Proposed Action or alternatives that would further reduce or eliminate impacts. These mitigation measures are specific to resource sections, and thus are considered following the impact analyses in Chapter 4. These mitigation measures will be considered as possible terms and conditions of the ROD, if and when an action alternative is selected. The effectiveness of potential mitigation measures is disclosed in the subsequent discussion of residual impacts, which are those impacts that would remain after the implementation of all potential mitigation measures.

The ROD will summarize the requirements for mitigation monitoring and enforcement to ensure compliance with the decision, per BLM NEPA Handbook H-1790-1 and 40 CFR § 1505.2(c).

2.4 No Action Alternative

Under the No Action alternative, Boulevard's ROW application to develop the SSEP under the Proposed Action, Alternative A: Reduced Water Use, Sub-alternative A1: Photovoltaic, or Alternative B: Reduced Footprint would not be approved. No ROW would be granted. The SSEP would not be developed, and existing land uses in the Project Area would continue. 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. No additional actions are assumed to occur in the absence of approval of any of the action alternatives.

Under the No Action alternative, the following ongoing actions and activities would be assumed to continue, and are accounted for in the analysis of impacts in Chapter 4:

- Livestock grazing in the Project Area would continue in two allotments. Authorized grazing would continue on approximately 2,649 acres of the Beloat grazing allotment in the Project Area, or approximately 78 AUMs. Approximately 1,053 acres of the Arnold allotment would continue to be used for ephemeral grazing. Ephemeral allotments are not grazed annually; they are only grazed when infrequent (ephemeral) precipitation allows the production of adequate forage. The Arnold allotment is grazed approximately 6 out of 10 years, and approximately 44 AUMs per year.
- Limited dispersed recreation across the Project Area would continue. The Project Area is currently used infrequently by hikers, mountain bikers, backcountry drivers, hunters, and birders. OHV use is limited to 13.1 miles of existing routes in the Project Area.

In order to compare the socioeconomic and environmental consequences of developing the Project Area versus not developing it, this EIS assumes that other ROWs would not be approved in the Project Area in the near future under the No Action alternative. However, selection of the No Action alternative would not preclude the approval of other ROWs for energy development or other projects in the future.

Several test wells have been drilled in the Project Area to assess the potential water supply for the SSEP. Under the No Action alternative, these wells would be filled, capped, and abandoned, and any associated site disturbance would be reclaimed.

2.5 Proposed Action

2.5.1 Introduction

The Proposed Action for the SSEP would consist of two independent, concentrated solar electric generating facilities with expected net electrical outputs of approximately 125 MW and 250 MW. This output represents the power that would be supplied to the utility grid after a 10% loss for use on-site for plant operations.

Parabolic trough solar thermal technology would be used to produce electrical power using steam turbine generators fed from solar steam generators. The solar steam generators receive heated HTF from solar thermal equipment comprising arrays of parabolic mirrors that collect energy from the sun. Each plant would use natural gas firing to supplement electrical output, auxiliary boilers to reduce startup time, and HTF freeze protection heaters to maintain the HTF at a minimum of 100 degrees Fahrenheit (°F) (see Figures 2.2 and 2.3).

Each plant would be designed to allow the use of TES, which would consist of a two-tank, molten salt system designed to provide approximately three hours of storage. The purpose of the TES would be to increase daily hours of operation, shift energy production into peak periods, and make up production during periods of extended cloud cover. The ultimate construction and use of TES would depend on the direct preference of customers (i.e., those entities purchasing the power from the SSEP), which could change over the life of the SSEP.

The Proposed Action would use a wet-cooling tower for power plant cooling. Water for cooling tower make-up, process water make-up, and other industrial uses (such as mirror washing) would be supplied from on-site groundwater wells, which would also be used to supply water for employees' use (e.g., drinking water, showers, sinks, and toilets). A package water treatment system would be used to treat the water to meet potable standards. A sanitary septic system and on-site leach field would be used to dispose of sanitary wastewater.

Based on publicly available sources (LAZARD 2008, Solar Energy Industries Association [SEIA] 2010, WorleyParsons Group 2008), the estimated capital cost of the facility under the Proposed Action would be between $1.7 and $2.4 billion (see Table 2.15). This cost includes capitalized interest costs during construction, as well as operation and maintenance costs and fuel prices .

2.5.1.1 FACILITY LOCATIONS AND COMPONENTS

The Project Area (see Map 1, Figure 2.1) is located at the west end of the Little Rainbow Valley, east of SR-85, and south of the Buckeye Hills and the Town of Buckeye, Arizona. Under the Proposed Action, the SSEP's facilities would be located almost entirely on BLM-administered lands and would encompass approximately 3,620 acres in western Maricopa County, Arizona. Approximately 1.5 miles of road improvements are proposed on private and state lands at the western edge of the Project Area, as well as approximately 0.5 mile of gen-tie line on private land.

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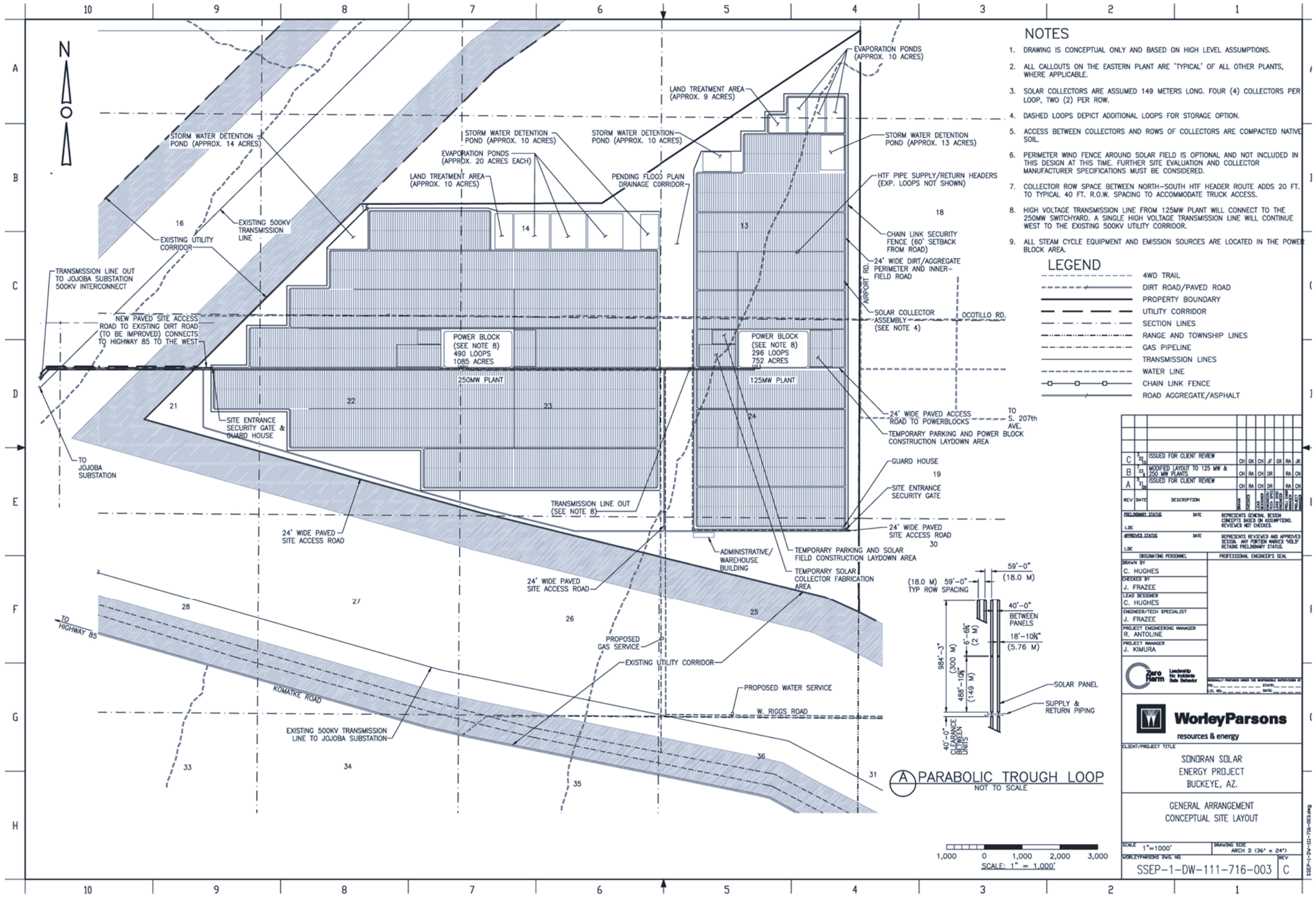

Figure 2.1 Conceptual site layout.

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Under the Proposed Action, the SSEP would consist of three major types of facilities: a well field, linear facilities, and power plants (the main project footprint). Each of these components is shown on Map 2 and Figure 2.1, and explained in detail in the following sections. The major components of these three facility types are outlined below. The amount of temporary (construction) and permanent (life of project) disturbance required for these facility components is described in detail in Section 2.12.

A well field would be developed to supply water for the SSEP during the construction and operation phases. The well field would be located approximately 1.2 miles east of the power plant area (see Map 2), and would include the following components:

- Four wells with on-site pumping facilities
- A booster pump station
- Supporting linear facilities including service roads, buried pipelines, and electrical service

A number of linear facilities would be developed externally from the main power plant footprint. These linear facilities are shown on Map 2, and would include the following:

- Access roads
- A generation tie (gen-tie) line to carry electricity to the Jojoba Switchyard
- A natural gas pipeline
- Water pipelines

The power plant facilities would be located in approximately 3,313 graded acres in the primary project footprint. The power plant facility footprint would be fenced and would function largely as a single facility. Specific components of the power plant facilities would include the following:

- Power block areas
- Administration buildings and local warehouses
- Solar collector field arrangements
- Evaporation ponds
- Land-treatment unit
- On-site transmission facilities
- On-site gas pipeline facilities
- Drainage collection and discharge facilities

Under the Proposed Action, power blocks (Figure 2.2; see Figure 2.1) and arrays of solar troughs (see grey areas surrounding the power blocks in Figure 2.1) would occupy approximately 2,300 acres of the approximately 3,620-acre site. Additionally, evaporation ponds, access roads, administration buildings, other support facilities, a land-treatment unit, drainage control, and open areas would occupy approximately 1,300 acres, for a total disturbance of approximately 3,600 acres (see Figure 2.1 and Map 2). The power blocks would include these major components:

- Solar steam generator heat exchangers
- Steam turbine-generators and condensers
- Wet-cooling towers
- Natural gas-fired auxiliary boilers
- HTF surge volume tanks
- Firewater pumps and pump houses with associated diesel fuel tanks
- Emergency diesel generators
- Two treated water storage tanks
- Demineralized water storage tanks
- Natural gas co-fired boilers/HTF heaters
- TES systems
- Ancillary equipment
- Control room buildings

Solar field size was maximized to the extent possible within the main project footprint and available land. The solar field was slightly oversized to allow for the collection of additional solar energy for the TES system. A conceptual engineering drawing of the main power plant footprint is shown on Figure 2.1. A simplified layout of the 125-MW power block is shown in Figure 2.2.

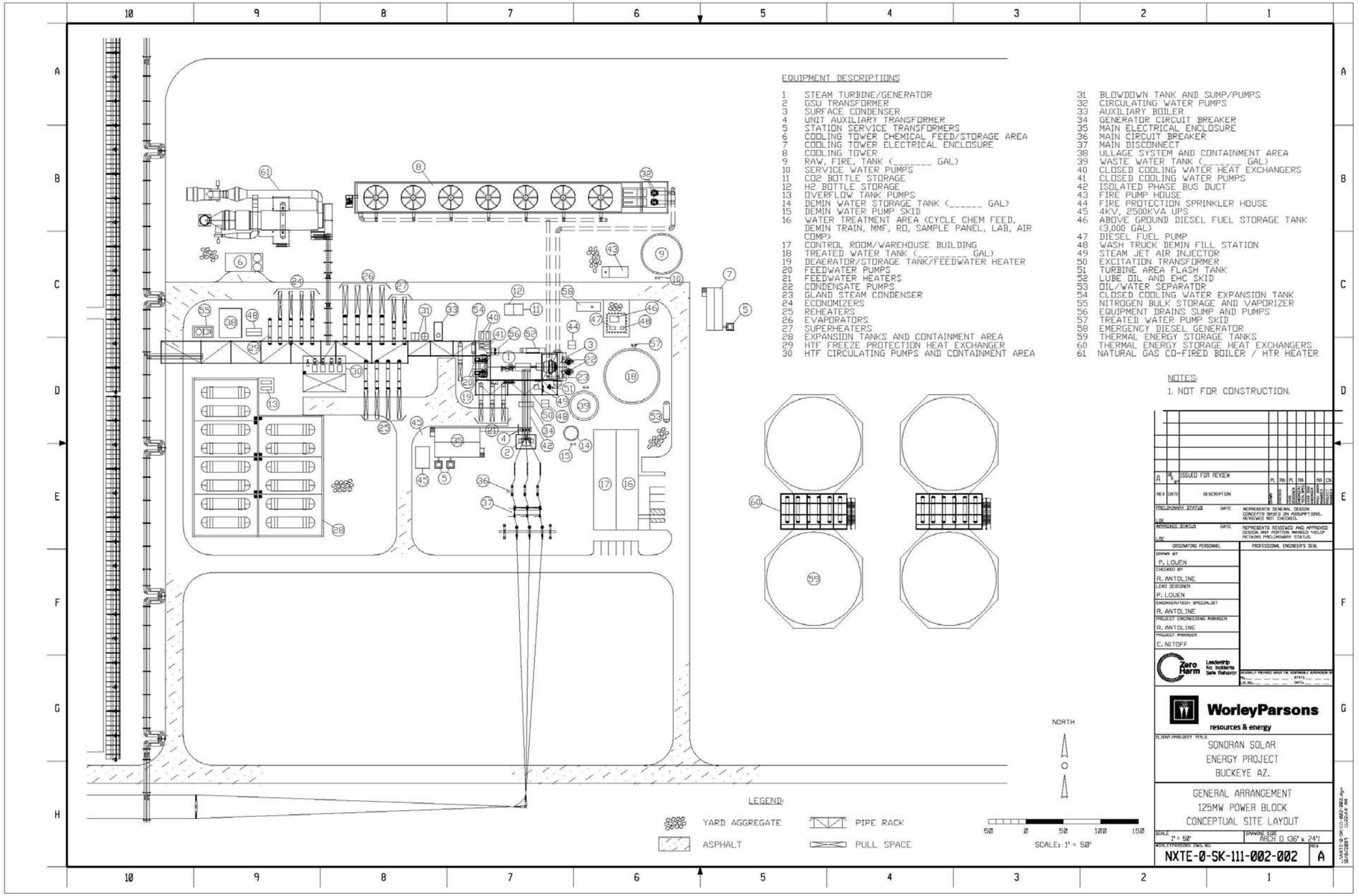

Figure 2.2 Generalized power block arrangement (125-MW example).

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2.5.1.2 PROCESS DESCRIPTION

The SSEP would generate electricity using the Rankine-with-reheat thermodynamic cycle, which is used primarily to convert heat into work. The heat is supplied externally to a closed loop, which usually uses water as the working fluid. This cycle generates about 80% of all electric power used throughout the world, including virtually all solar thermal, biomass, coal, and nuclear power plants.

Figure 2.3 illustrates the SSEP's solar-generation process. The SSEP would operate between 3,200 and 3,800 hours per year, depending on local solar insolation and level of natural gas co-firing.

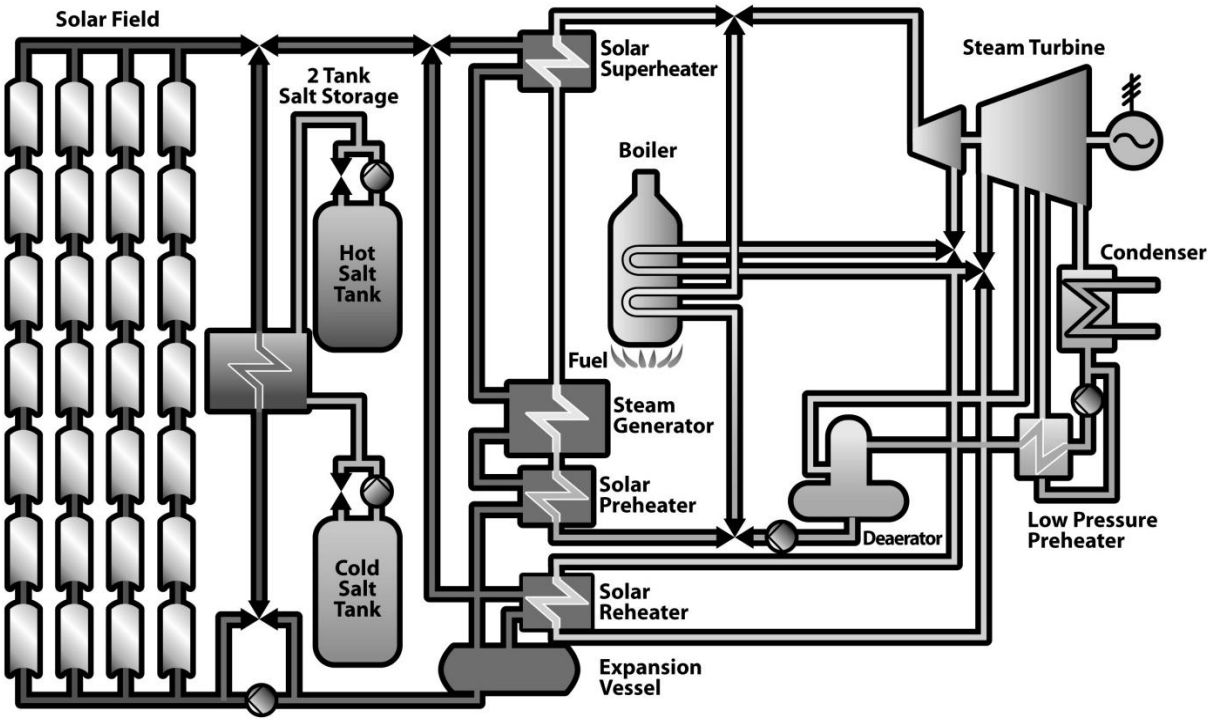

Figure 2.3 Solar-generation process illustration.

There are four processes in the Rankine cycle:

Process 1: Water is pumped from low to high pressure. To increase cycle efficiency, steam extracted from the steam turbine generator is used to preheat the water prior to entering the solar steam generating system.

Process 2: The high pressure water enters the solar steam generator system where it is heated by the HTF to become superheated steam.

Process 3: The steam expands through the various sections of the steam turbine, which causes the turbine blades to rotate around an axle that is connected to an electrical generator. The rotational energy is converted into electricity by the generator.

Process 4: The steam enters the surface condenser where it is cooled at a constant low pressure to become water. The water returns to Process 1.

As the HTF is circulated from the solar steam generator through the solar field, it absorbs solar energy and provides a high temperature (740°F) energy source for the Rankine cycle. The gas co-firing would supplement additional heat to obtain desired unit output during times of low solar insolation.

2.5.2 Proposed Facilities and Infrastructure

2.5.2.1 SOLAR FIELD

The collector field would consist of approximately 2,300 acres of multiple single-axis-tracking parabolic-trough solar collectors aligned on a north-south axis. Each solar collector has a parabolic-shaped reflector (mirror) that focuses the sun's direct normal radiation on the heat collection element located at the focal point of the parabola. See Figure 2.4 for a typical cross section of the solar collector.

The collectors track the sun from east to west during the day to ensure that the sun is continuously focused on the heat collection element. The HTF is heated to approximately 740°F as it circulates through the heat collection elements to the solar steam generator where the fluid is used to generate high-pressure steam.

2.5.2.1.1 Solar Collection Assemblies

The solar collection assemblies, shown in Figures 2.4 and 2.5, are dynamic structures that rotate around the north-south axis to track the sun as it moves through the sky. Each solar collector array would be supported by structures (stands) that connect the parabolic troughs to the drive mechanism. Each array would be supported by multiple, individual foundations with a foundation located approximately every 50 feet along the array. Solar collectors would be approximately 149 m, or approximately 489 feet long; there would be four collectors per loop and two rows per loop.

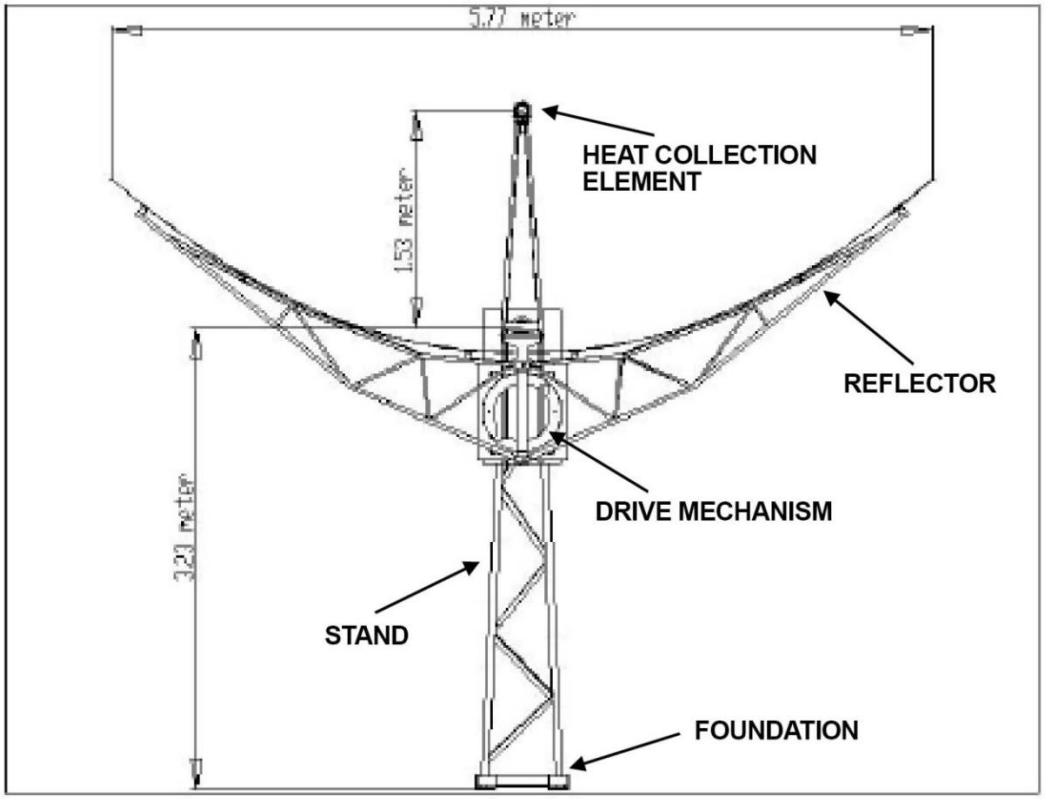

Figure 2.4 Typical parabolic trough solar collector cross section.

2.5.2.1.2 Heat Collection Elements

The heat collection elements (Figure 2.5; see Figure 2.4) consist of a steel tube with a selective (heat absorbing) coating, surrounded by an evacuated glass tube insulator. The HTF circulates though these tubes and gathers heat as it travels through the solar field.

2.5.2.1.3 Mirrors

The parabolic mirrors (Figure 2.5) that would be used to gather solar energy would be low-iron glass mirrors, which are known to be reliable components that show no long-term degradation in reflective quality.

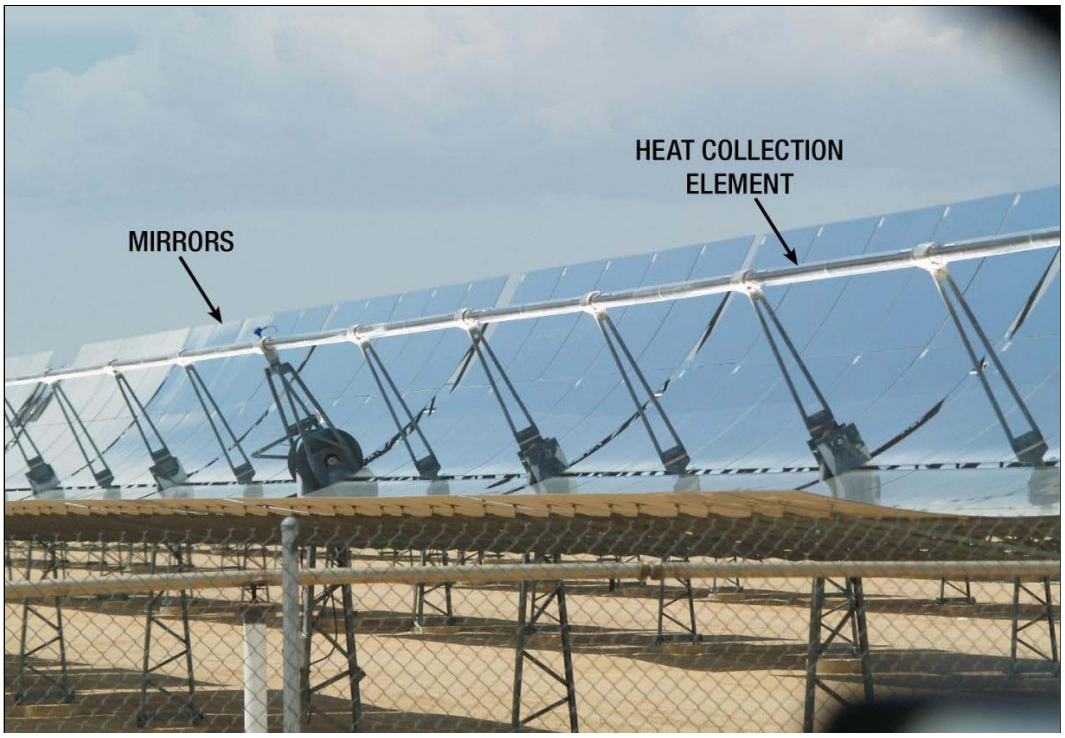

Figure 2.5 Typical parabolic trough.

2.5.2.2 POWER BLOCKS

Power blocks would be centrally located in each solar field (see Figure 2.1 and Map 2). Under the Proposed Action, they would occupy approximately 40 acres in the 250-MW plant area and 40 acres in the 125-MW plant area. Figure 2.6 shows an example of a solar facility power block.

2.5.2.2.1 Solar Steam Generator System

The solar steam generator system design circulates HTF through tubes and boils water to produce steam. The system includes heat exchangers for preheating the condensate, superheating the steam, and reheating steam, in addition to the boiler vessels.

2.5.2.2.2 Heat Transfer Fluid Specific Systems

The HTF consists of diphenyl ether (73.5%) and biphenyl (26.5%). The HTF freezes (becomes a solid) at temperatures below 54°F. To maintain the fluid above freezing temperature, a gas-fired direct-contact HTF heater would be used to keep the HTF at or above 100°F whenever the facility is offline. Expansion tanks are required to accommodate the volumetric change that occurs when heating the HTF to the operating temperature. Nitrogen would be used to blanket the headspace of the tanks. The nitrogen purge prevents oxidation or contamination of the HTF by reducing its exposure to atmospheric air. A system to remove contaminants caused by thermal degradation of the HTF would also be incorporated. Supply and return piping is routed to allow for balanced flow through all the heat collection elements.

2.5.2.2.3 Major Electrical Systems and Equipment

Roughly 10% of the steam turbine generator output would be used on-site for plant auxiliary loads such as motors, heaters, control systems, and general facility loads, including lighting and heating, ventilation, and air conditioning. Some of the power needed for on-site uses would be converted from alternating current (AC) to direct current (DC) for power plant control systems and emergency backup systems. Power would be generated by the steam turbine generator (size and generation voltage is dependent on the final generator selection) and stepped up by a fan-cooled generator step-up transformer.

Figure 2.6 Example of power block.

2.5.2.2.4 Administration Building, Control Room, and Warehouse Locations

A control building would be located in each power block. The SSEP would include a single common administration building and warehouse located in the southwest corner of the 125-MW solar field. The design and construction of the administration building and warehouse would be consistent with all applicable state and local building codes. Other plant site "buildings" would include the water treatment building as well as a number of pre-engineered enclosures for mechanical and electrical equipment. Building columns would be supported on reinforced concrete mat foundations or individual spread footings, and the structures would rest on reinforced concrete slabs. The total square footage of the various project buildings and pre-engineered enclosures (e.g., control rooms, administration building, warehouse, electrical equipment enclosures, fire pumps, and diesel generators) would be approximately 38,000 square feet for the 250-MW unit and 22,000 square feet for the 125-MW unit.

2.5.2.2.5 Natural Gas Co-firing

One of two co-firing methods—co-fired boilers or HTF process heaters—would be used to augment solar heating and allow the plant to operate at its full load if the solar resource varies or is insufficient to reach the desired plant output. Natural gas co-firing power production would be limited to up to 25% of annual total electrical production. The method selected would depend on customer preference and contract, costs,

and operational needs. For the purposes of analysis, it is assumed that 25% of the plants' annual power production would come from co-firing, although this total would likely be far less. Use of supplemental generation, if required, would likely occur during the early morning and late evening when solar resources are insufficient to produce maximum output.

The natural gas usage limitation (25% of total plant output) is driven by the Internal Revenue Service regulations related to the Investment Tax Credit (ITC) available to solar projects. This ITC equates to 30% of the eligible solar equipment costs. In general, a solar project that does not have any (0%) gas usage can qualify 100% of its solar equipment for the ITC. If a solar project has gas burn capability, the project costs must be separated into three categories, as follows:

- 100% of the cost of equipment used exclusively in the solar-generation process qualifies for ITC.
- Equipment used exclusively in the gas generation process does not qualify for ITC.
- Dual-use equipment used in both the solar and gas generation process qualifies to the extent it will be used for solar generation.

For example, if the facility produces 10% of its output using gas, then 90% of the cost of the dual-use property qualifies for ITC. The amount of dual-use equipment costs eligible for the tax credit decreases as the gas usage increases. However, if the unit generates more than 25% of its output using natural gas, the facility is no longer considered eligible for the ITC.

Natural Gas Co-firing Boilers Method

In this method, natural gas-fired boilers would provide steam to the steam turbine when solar energy is insufficient to produce at maximum plant capacity (125 MW or 250 MW). The co-fired boiler is a conventional steam generator that supplies steam to the steam cycle at flows, temperatures, and pressures similar to that supplied by solar energy. It would supplement solar-generated steam to the steam turbine, or independently provide steam to the steam turbine when solar-generated steam is not available.

Three co-firing boilers, one for the 125-MW unit and two for the 250-MW unit, would be sized to independently produce the maximum load and would also be able to operate simultaneously to produce a full load even if the solar resource varies slightly because of cloud cover. The co-firing boiler would comply with all the regulations under the SSEP's air permit. It would also comply with all local county regulations for the stack height. Although the final stack height has not been determined, this EIS has assumed a stack height of 150 feet for the purposes of air quality and visual analysis.

Heat Transfer Fluid Heaters Method

In this method, a series of natural gas-fired heaters would be used to heat the HTF to 740°F if the solar field is unable to perform this function. The hot HTF would then be used to generate steam in the same manner as the solar-generated steam operation. As with the boiler method, the HTF heater method could also be used to supplement solar-generated power by incrementally heating the HTF to full load, operating temperatures when the incoming solar radiation is insufficient to reach the desired plant output. The HTF heater system would also be designed to reach full load even if no solar heat was available.

Summary of Gas-fired Equipment

Table 2.3 provides a summary of the natural gas-fired equipment for each facility.

Table 2.3 Natural Gas-fired Equipment

Equipment	Burner Specification Capacity[3] (million British thermal units per hour (MMBtu/hr)	Number of Units
Natural gas co-firing[2]	depends on method, below[1]	
Co-fired boiler (both units)[1]	1,600	3
Co-fired HTF heater (125-MW unit)[1]	600	3
Co-fired HTF heater (250-MW unit)[1]	1,200	3
Auxiliary boiler[2]	30	2
HTF freeze protection heater[2]	30	2

Note: MMBtu = million metric British thermal units.

[1]Only one of the two me hods (co-fired boiler or co-fired HTF heater) would be used for natural gas co-firing.

[2]The total natural gas-fired equipment would include an auxiliary boiler, a HTF Freeze protection heater, and one of the co-firing methods.

[3] Burner specification capacity is greater than the fuel design capacity due to process factors.

Under the Proposed Action, the maximum, annual, natural gas usage is expected to be 3,900 million standard cubic feet per year for a maximum of 3,982,000 million metric British thermal units (MMBtu) per year. Table 2.4 shows the typical composition of the natural gas used to fuel the SSEP auxiliary boilers.

Table 2.4 Typical Gas Composition

Component	Molar Percent (%)
Methane, CH_4	94.90
Ethane, C_2H_6	2.54
Propane, C_3H_8	0.34
Butane, C_4H_{10}	0.0685
Pentane C_5H_{12}	0.0164
Hexane, C_6H_{12}	0.0326
Nitrogen, N_2	1.53
CO_2	0.51
Total	**100.00**
Higher heating value (Btu/standard cubic feet)	1,021

2.5.2.2.6 Thermal Energy Storage

TES would be designed as a component of the generation plant. Depending on requirements of the customer, TES may be installed and used to supplement electrical output during reduced solar activity (i.e., intermittent cloud cover). A TES system would 1) permit longer, daily plant run time, 2) support shifting of the morning solar resource to electrical generation during evening hours when system demand is higher, and 3) reduce effects of local cloud cover transients. The TES system would be designed to store the heat equivalent of rated plant capacity for up to three hours. The TES would be an indirect

storage system using molten salt as the energy storage material. A "two tank" system is the most proven TES technology and consists primarily of the following components:

- Hot salt storage tanks
- Cold salt storage tanks
- Salt-to-HTF heat exchangers
- Molten salt transfer pumps

During the "storage" process, the TES system transfers molten salt from the cold salt storage tanks (approximately 550°F) through the heat exchanger to the paired hot salt storage tanks (approximately 720°F). During this transfer process, the cold molten salt gains energy from the HTF in the heat exchanger and reaches a temperature of 720°F. The process used to release the stored energy is the reverse of the "storage" process, whereby thermal energy is transferred from the molten salt to the HTF. The molten salt would be a blend of approximately 60% sodium nitrate and 40% potassium nitrate. The thermal storage area would be equipped with a berm of sufficient height to enable 110% storage capacity of one TES storage tank. Molten salt is not considered a hazardous material and would quickly solidify if a leak occurred. The berm is designed to minimize the temperature hazard only.

2.5.2.3 EVAPORATION PONDS (NORTH SIDE OF SOLAR FIELDS)

Evaporation ponds are used to evaporate different types of wastewater from the plant's cooling operations. The 125-MW unit would have three approximately 10-acre, double-lined evaporation ponds (30 acres total), and the 250-MW unit would have three approximately 20-acre, double-lined evaporation ponds (60 acres total). Multiple ponds are planned to allow plant operations to continue in the event that a pond must be taken out of service for some reason (e.g., scheduled maintenance). Each pond would have enough surface area so that the evaporation rate exceeds the cooling tower blowdown rate at maximum design conditions and annual average conditions. The ponds would not require clean-out for the life of the project. At the end of the project, the ponds would be back-filled. The ponds would be located below site grade. Dirt gathered from digging the ponds would be used to berm the ponds to prevent unwanted inflows and add additional overflow protection.

2.5.2.4 LAND-TREATMENT UNIT (NEXT TO THE EVAPORATION PONDS)

The SSEP would include a land-treatment unit that would treat soils impacted by incidental spills and leaks of HTF. The unit would be designed and permitted as a Class II Land-treatment Unit in accordance with all Arizona state and federal requirements. Under the Proposed Action, the land-treatment unit for the 125-MW unit would cover approximately 5 acres. The 250-MW unit would have an approximately 10-acre land-treatment unit. Each land-treatment unit would be constructed with a prepared base consisting of 2 feet of compacted, low permeability, lime-treated material and surrounded on all sides by a minimum 2-foot-high compacted earthen berm with slopes of approximately 3:1 (horizontal: vertical).

2.5.2.5 ON-SITE SWITCHYARD AND TRANSMISSION FACILITIES

2.5.2.5.1 On-site Switchyard

The SSEP steam turbine generators would electrically connect to a 500-kV on-site switchyard. The steam turbine generators generate electricity at 13.8 kV, but this voltage would be increased in the switchyard to 500 kV via a generator circuit breaker and a generator step-up transformer. The generator step-up transformer would rest on a concrete pad with a perimeter curb designed to contain the transformer's insulating oil in the event of a leak or spill.

The plant site switchyard is currently expected to be located near the 250-MW power block, as previously shown in Figures 2.1 and 2.2 and would require an overhead steel-reinforced, aluminum conductor-unit tie line for the connection to each unit's generator step-up transformer. The switchyard would consist of

500-kV switchyard circuit breakers with 500-kV disconnect switches on each side of the breaker for breaker maintenance. The final location of the common switchyard would be determined by the final design.

Final design of the plant switchgear has not yet been completed; however, preliminary designs do not include the use of sulfur hexafluoride (SF_6) at the plant switchyard. In the event that it is used, all industry standard leak prevention measures would be employed.

2.5.2.5.2 Interconnection to the Jojoba 500-kV Switchyard

To deliver the energy produced by the SSEP to the grid, the SSEP would interconnect into the Jojoba Switchyard. The SSEP interconnection to the Jojoba Switchyard would require the addition and modification of equipment in the switchyard. All work would be performed in accordance with the applicable electric utility standards, and performed by the substation operating agent. No switchyard footprint expansion would be required as a result of SSEP interconnection.

2.5.2.5.3 Generation Tie Line

The following description of the gen-tie line was provided in the draft EIS. The generated electrical power from the SSEP switchyard would be transmitted through a gen-tie line for delivery at the Jojoba Switchyard. The gen-tie would be routed in a generally southwestern direction and would use an existing utility corridor. The gen-tie line would be constructed for the nominal operating voltage of the regional transmission system, which is 500 kV. Each circuit would be supported by lattice structures more than 140 feet tall (Figure 2.7) spaced at approximately 1,200- to 1,600-foot intervals. Final heights would be determined during the detailed design process. Between 25 and 35 structures would be required, depending on the final tower spacing interval. This number, along with tangent, angle, dead-end, pull-off structure, and hardware design would be determined during final engineering of the gen-tie and interconnection.

Since the publication of the draft EIS in April 2010, minor changes have been made to the design and alignment of the gen-tie line. The revised alignment allows crossing points under existing transmission lines without any modifications to the existing lines. The gen-tie line would be placed as close to an existing transmission structure as possible so that clearance between the lines and from the lower line to the ground is maximized. An approximately 100-foot-tall H-frame tower structure would be used due to its cost effectiveness (Figure 2.7) and its lower height when compared to the original 140-foot-tall lattice structure. This new H-frame structure would allow for the low crossings under existing lines while maintaining safe clearances. Three-pole towers would also be used at turning points in the alignment (Figure 2.8). Slight modification to the placement of the access road and spur road would also be required. These changes would affect all action alternatives equally and are further discussed in Chapter 4, Section 4.1.3. A supplemental EIS was not prepared because this revised gen-tie would result in impacts of the same nature and approximate extent (and to the same resources) as those considered in the draft EIS, and would not result in any unique site-specific impacts not considered 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 3,620 acres for the Proposed Action, this amounts to an overall increase in surface disturbance of approximately 0.01%.

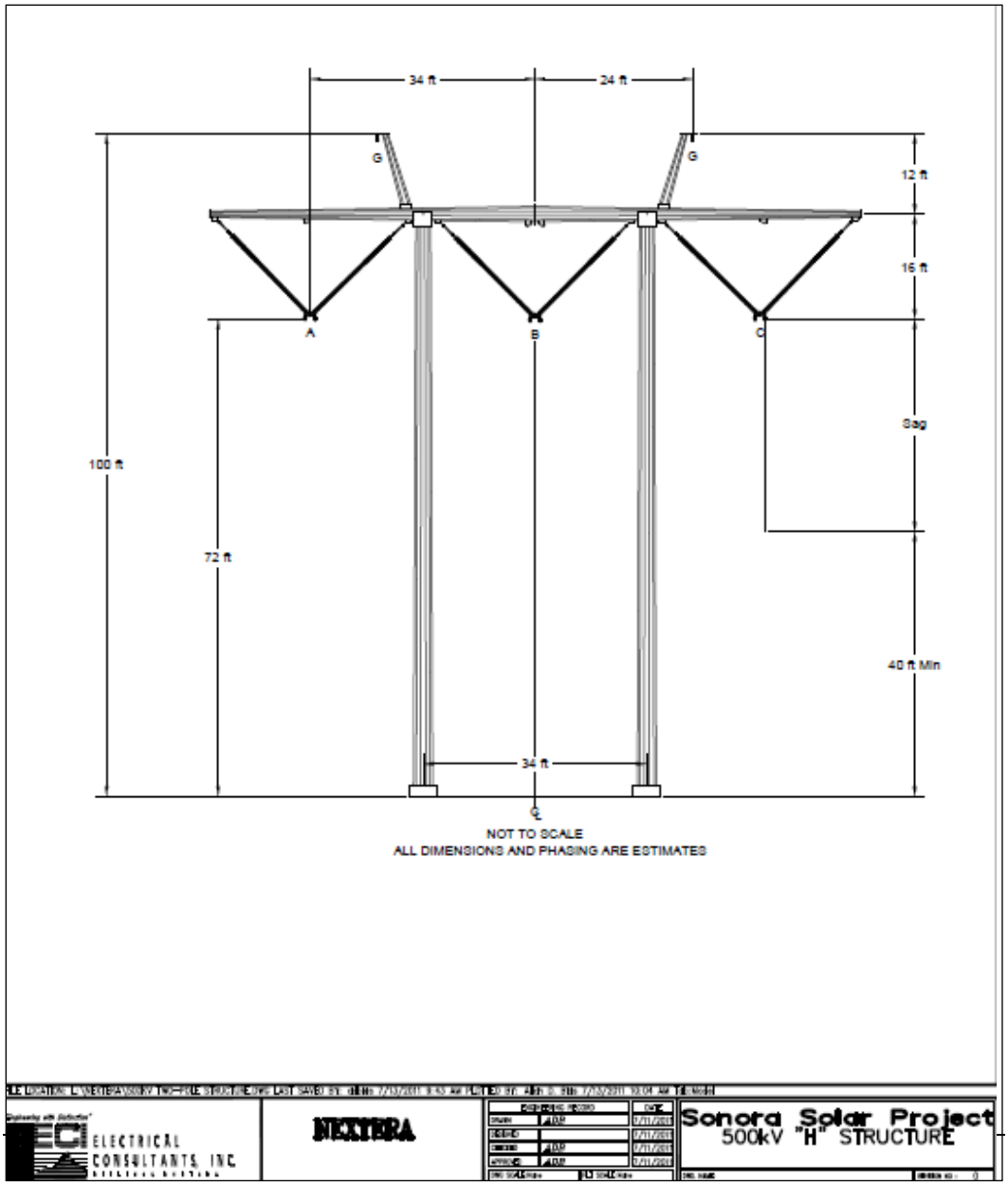

Figure 2.7 Typical H-frame structure.

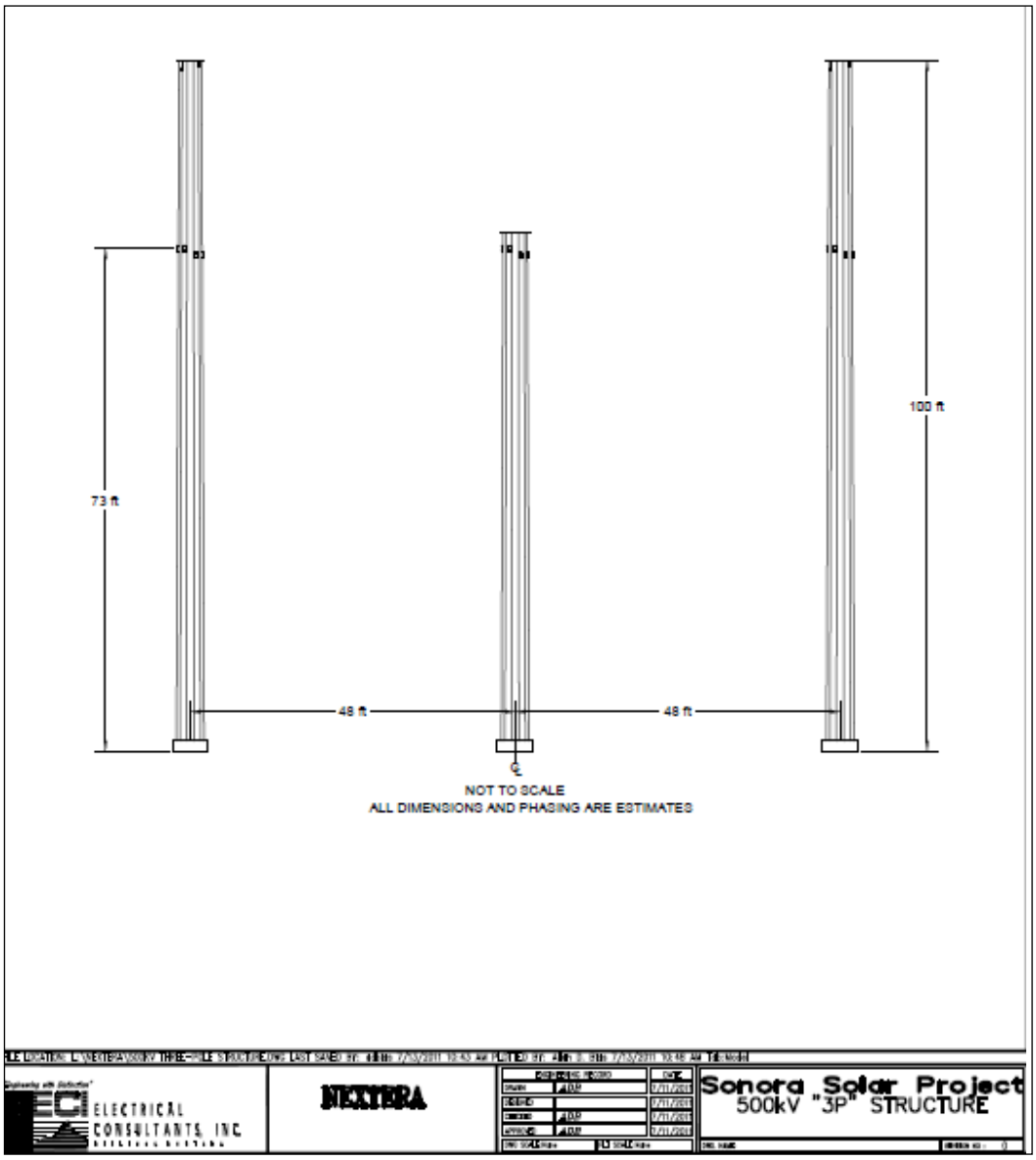

Figure 2.8 Typical three-pole structure.

2.5.2.6 NATURAL GAS PIPELINE

Natural gas is required for the auxiliary boilers, co-fired boilers/heaters, and HTF freeze protection heaters. Natural gas would be supplied to the site facilities via a new approximately 5-mile, approximately 8-inch pipeline (4 miles for 125-MW unit and a 1-mile extension for 250-MW unit) that would be connected to an existing pipeline located in the utility corridor 1 mile south of the SSEP facilities. A gas meter station would be required, and would most likely be located within the main power plant footprint.

2.5.2.7 OFF-SITE DRAINAGE COLLECTION AND DISCHARGE FACILITIES

The information described in this section is derived from the analysis available in the *Preliminary Master Drainage Report, SSEP* (Worley Parsons Group Inc. and Cardno WRG, Inc. 2010) and the *Preliminary Master Drainage Report, SSEP, PV Alternative* (WorleyParsons Group Inc. and Cardno WRG, Inc. 2011). During storm events, existing stormwater flows from south to north across the Project Area and collects in channelized and meandering washes. Collection channels would be constructed at the southern perimeter of the main project footprint (solar field) to collect the upstream stormwater drainage (Figure 2.9). The collection channels would be designed to collect and convey the 100-year, 24-hour storm event around the development without impacting the SSEP. The upstream flows would not be routed through the on-site drainage system (as described in Section 2.5.2.8), including the on-site detention basins. To maintain watershed integrity, the stormwater interceptor and diversion channel system would be configured to segregate the flows around the 250-MW unit contributing to Rainbow Wash and around the 125-MW unit contributing to the unnamed tributary to Waterman Wash. Off-site stormwater conveyed through the perimeter channels would be released back into natural washes in a manner similar to historic drainage patterns for those washes. There would be eight stormwater outfalls on the western edge of the Project Area and three stormwater outfalls to washes in the northeast portion of the Project Area (Map 2). The three stormwater outfall structures would discharge both off-site rerouted water and on-site stormwater discharged from the stormwater detention basins (see Section 2.5.2.8).

The channels would be designed in accordance with the requirements of the Flood Control District of Maricopa County (FCDMC) Drainage Design Manual. Detailed designs of the collection/distribution channels would be analyzed using the USACE Hydrologic Engineering Centers River Analysis System (HEC-RAS) hydraulic modeling program to ensure that these design criteria are met.

The upstream drainage collected by the diversion/collection channels would be conveyed around the development via open channels. 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 channels would have a 50- to 150-foot top width, with the larger widths being at the downstream end. The channel depths would range from 3 to 6 feet. The channel sides would have gentle slopes (6 feet horizontally to 1 foot vertically), and the channel walls would not be greater than 6 feet high, except in short sections where the outside bank of a curve would reach up to 8 feet (i.e., it would be super-elevated). The channel substrate would be either earthen or riprap. There would be riprap lining on sections of the channels where the velocity is anticipated to be erosive. This would typically be where natural washes are flowing into the channel or at the bends in the channel. Channel cross section, channel slope, channel width, and channel lining would be designed to control flow, velocity, and erosion/sediment transport. The channel bends would be rounded as much as practicable, given available land constraints. In addition, the channel banks would be super-elevated per standard drainage engineering practice. A channel on the northwest side of the Project Area would serve to distribute the flow back into the natural washes at a rate equal to or less than the existing condition for each wash.

Stormwater outfalls and their associated distribution channels would be constructed at the north/northwest perimeters of the solar field to distribute upstream stormwater drainage back into Rainbow Wash and the unnamed tributary to Waterman Wash. The distribution channels would be equipped with multiple outlet structures designed to release upstream flow back into the natural drainage ways (Rainbow Wash and the unnamed tributary to Waterman Wash) at or below the historic flow rate to the fullest extent possible. These structures are shown on Map 2, Figure 2.1, and depicted conceptually in Figure 2.9.

All surface disturbances associated with construction of the drainage and with diversion facilities are included as part of the grading and preparation of the solar field described in Section 2.5.3.3. All access roads would be designed and constructed with engineered stormwater crossings or culverts (see Map 2), allowing the more conservative flow from the 100-year, 24-hour or 100-year, 6-hour upstream storm event to pass without flooding the roadway. The east-west portion of the well field access road would be designed as an at-grade gravel roadway. The drainage crossings would be designed as low-water crossings (dipped crossings) to allow the low flow in the washes to cross the roadway in a manner similar to the existing conditions. The larger crossings may be designed with concrete inverts to prevent scour and maintain access after a significant event. The invert of these concrete dipped crossings would be designed to be at the same elevation (plus or minus 6 inches) as the natural flow line of the wash to allow for the conveyance of low flows across the access road. Maintenance of this access road may be necessary following a significant rainfall event to remove sediment from the surface of the dipped crossings.

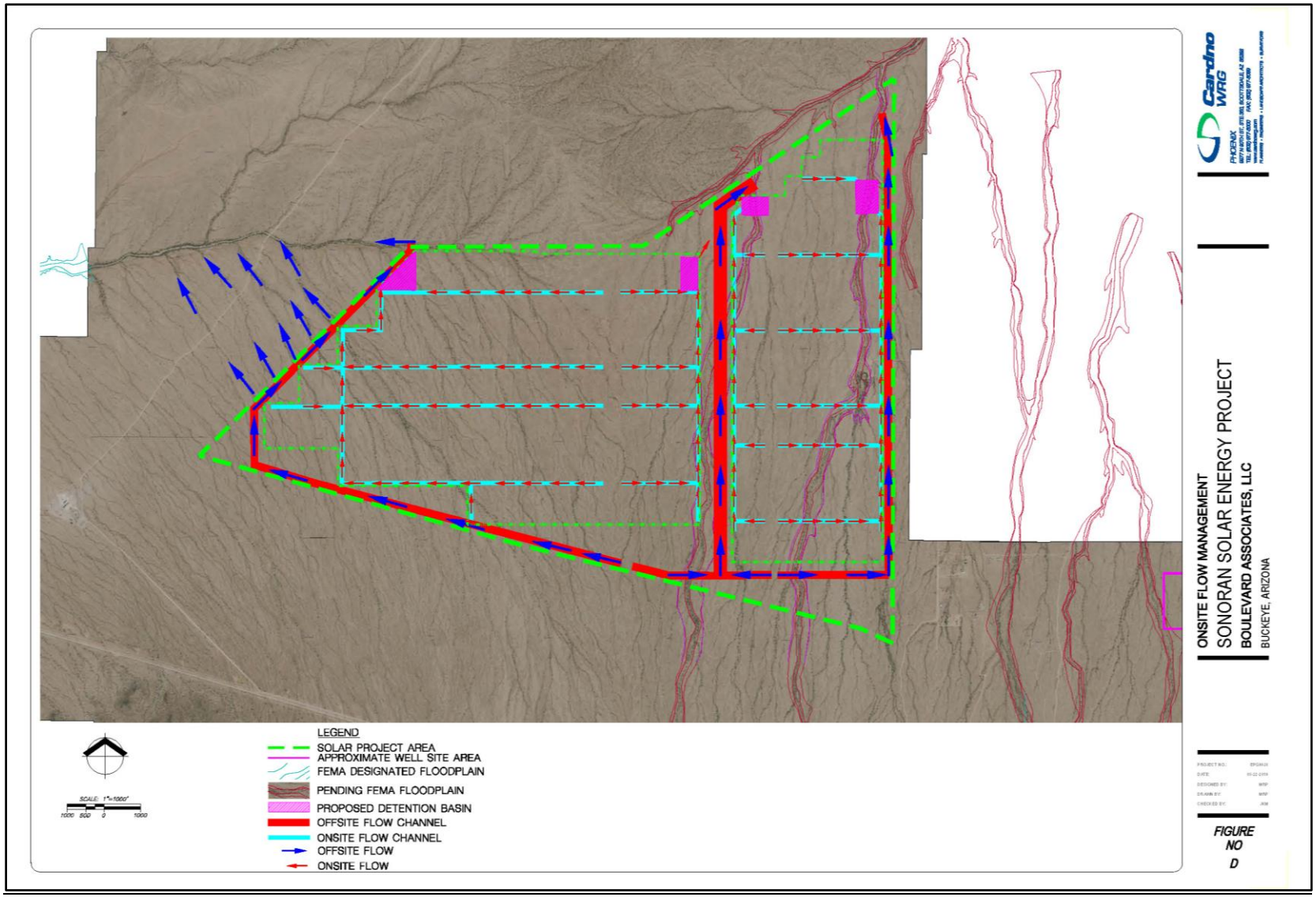

Figure 2.9 Conceptual post-construction drainage flow.
Note: the location and configuration of the basins in this figure are conceptual. Figure 2.1 shows a scaled configuration of the stormwater detention basins.

2.5.2.8 ON-SITE DRAINAGE AND DISCHARGE FACILITIES

2.5.2.8.1 Stormwater Detention Basins

The overall drainage concept for the Proposed Action is shown in Figure 2.9 and Maps 2 and 7. On-site stormwater runoff within the solar field would sheet flow into redirected smaller drainage channels, aligned east to west. The solar field interior access roads would act as drainage channels (see Figure 2.9). The earthen interior access roads would be compacted and stabilized to minimize erosion. Velocities within the drainage channels would also be minimized by designing the channel shape, slope, and material to match the allowable velocity. The unlined sections of the channel would be designed such that the longitudinal slope would be flat enough and the flow depth would be shallow enough to maintain a manageable non-erosive velocity. In areas where the velocity could not be maintained at a non-erosive level, a channel lining would be designed commensurate to the resulting velocity. The smaller channels would divert flows to larger drainage channels, aligned north to south adjacent to the plant perimeter road. The larger channels would divert flows into detention basins. The basins would be designed per the requirements of the FCDMC. Areas of the solar field that are in the Rainbow Wash watershed would be drained to a stormwater detention basin in the northwest corner of the Project Area. The area of the solar field currently in the Waterman Wash watershed would drain to the north and east. A small portion of the 250-MW block would drain to a stormwater detention basin in the northeast corner of that block. Runoff from the 125-MW block would drain to two stormwater detention basins on the north end of the Project Area.

Fences and other infrastructure would be designed to be consistent with the drainage plan to reduce the possibility of damage associated with large hydrologic events. Each detention basin would have an emergency spillway at the crest of the pond berm. In the unlikely event of a 100-year storm event or blockage at the detention pond outfall, the detention basin would release water through the emergency spillway. Fences near stormwater detention basins would include an adequately sized opening in the bottom of the fence to allow the emergency spillway flow to pass under the fence unimpeded.

2.5.2.8.2 Stormwater Outfalls

The stormwater detention basins would attenuate the post-development 100-year, 24-hour storm event runoff from each solar field, and they would discharge into the natural drainage system downstream (Rainbow Wash and the unnamed tributary to Waterman Wash) at or below the pre-developed 100-year, 24-hour storm event flow rate, to the fullest extent possible. The detention basins would discharge within 36 hours, while allowing sediments and on-site pollutants to settle out. The detention basins would be equipped with engineered outfall structures that would be designed to release the historic 100-year, 24-hour storm event at rates that would eliminate any significant negative impact to the downstream drainage system and properties. Outlet sizes would range from a 10 × 4–foot box culvert to a 36-inch reinforced concrete pipes. Peak outflow discharges would range from 46 to 840 cubic feet per second (cfs).

The detention basins would also have emergency spillways to discharge runoff generated from major rainfall events in excess of the 100-year, 24-hour storm. Emergency spillways would discharge into the proposed perimeter distribution channels, diverting the excessive flow away from the SSEP. Riprap outlet protection at the stormwater outfalls and basin emergency spillways would dissipate the flows and protect these outlets from scour of the soil. The outfall structures would be designed per the requirements of the FCDMC.

As with upstream (off-site) drainage, all on-site drainage would be released to the historic drainage ways (Rainbow Wash and unnamed tributary to Waterman Wash) at the downstream end of the SSEP's main project footprint (see Figure 2.1; Maps 2 and 7). The upstream diversion/collection channels, downstream distribution channels, and on-site stormwater storage system outlet structures would be designed and constructed to maintain historic drainage patterns and flow rates.

2.5.2.9 WELL FIELD (EAST OF THE SOLAR FIELDS)

Under the Proposed Action, as many as four high-capacity groundwater production wells would be needed to meet the water supply requirements of the SSEP at full build-out. This estimate is based on reported yields from wells east of the property (approximately 1,000 to 1,600 gallons per minute [gpm]) and an estimated total water demand of 2,305–3,003 afy, or 1,428 to 1,860 gpm, for a 375-MW project in an average year. Using a conservative assumption of 500 to 1,000 gpm per well, as many as three wells would be needed on a continuous basis, with a fourth well as a backup. A typical water duty cycle for a production well field (percentage of wells operating at a given time) ranges from 60% to 80%; therefore, this configuration (75%) falls within that range. These wells would draw groundwater from an aquifer in the Rainbow Valley Sub-basin of the Phoenix Active Management Area (AMA). More information about groundwater use can be found in Chapter 4's water resources section.

The well field design is still in the conceptual stage. Based on the expected design and operational needs, the following components are expected (see Map 2), and have been assumed for the purposes of analysis:

- Four production well sites of approximately 200 feet by 200 feet. Each area would include a well house, pumping facility, parking area, and ancillary facilities. Although the entire area may not be needed to house permanent facilities, it has been considered a permanent impact for analysis because it may be needed for safe equipment use during well maintenance.
- Linear connection facilities, including water pipelines and access roads. Buried water pipelines connecting each well site to a potential pumping booster station in the southwest well area (which is assumed to be 300 feet by 300 feet). Each pipeline is expected to share a 65-foot ROW (temporary disturbance) with a 24-foot-wide road (permanent disturbance) and electrical service line (estimated permanent disturbance up to 25 feet). A service road and pipeline (sharing a ROW) would be improved south from the well field to Riggs Road. These service road improvements may continue on to the plant area (see Map 2). If upgraded, the improvements to the service road would be coordinated with the organization having jurisdiction (Maricopa County or the Town of Buckeye depending on the portion of the road) and would be completed to applicable standards.
- Electrical service for the well field would be installed running from an existing 69-kV transmission line along Riggs Road to the well field. The transmission line would occupy the same 65-foot temporary disturbance buffer as the access road and pipeline. Because this service has not been fully defined, a conservative permanent disturbance ROW of 50 feet is assumed for the road and electrical service poles and access in all analysis.

The Proposed Action would use groundwater pumped from the Project Area and legally secured through a GIU Permit. Boulevard has already obtained a GIU permit and would obtain all applicable well permits from the ADWR. Because the Project Area is more than 3 miles outside of any city, town, or private water company's service area, and because no other water source or withdrawal authority is available pursuant to the requirements in A.R.S. § 45-515, the GIU permit was issued at this site for up to 50 years. As part of the GIU permit review process, ADWR required that Boulevard demonstrate the availability of groundwater for the requested permit timeframe.

Pursuant to ADWR's well spacing and well impact rules and as part of the well permit review process, ADWR required Boulevard to demonstrate that the proposed groundwater withdrawals would not cause unreasonable, increasing damage to surrounding land or other water users. Such damage could include declining groundwater levels in neighboring wells and subsidence of land due to groundwater pumping. Boulevard demonstrated that groundwater pumping to supply the SSEP would not cause water levels in neighboring wells to decline more than 10 feet over five years.

2.5.2.10 ROADS AND ACCESS

Regional access to the facility would be from SR-85 via an access road from the west. This roadway would improve on the existing Jojoba Switchyard access road (controlled by Arizona Public Service [APS]) and use the road currently servicing the Wesco mining operations as much as practicable. The junction of this road and SR-85 would be improved, and a new stop sign would be posted at the new westbound approach to the intersection of SR-85 northbound ramps and the SSEP access road (also known as Riggs Road) (Figure 2.10). This all-weather road would have one lane in each direction, with approximately a 24-foot paved width. The road would be sized to handle all potential vehicle traffic during construction. Access would be shared with APS/Salt River Project (SRP) and the Wesco mine. The primary access road running from SR-85 would cross several washes and would require culverts and crossings of undetermined width. For that reason, a temporary and permanent disturbance width of 50 feet is assumed for the primary access road. All other access roads (new or improved gen-tie, well field, or gas line access roads) are assumed to require a temporary disturbance of 50 feet and a permanent disturbance of 24 feet. Riggs Road east of the solar field would be used only for emergency purposes and to sporadically access the well field, and it would not be authorized as a secondary access point.

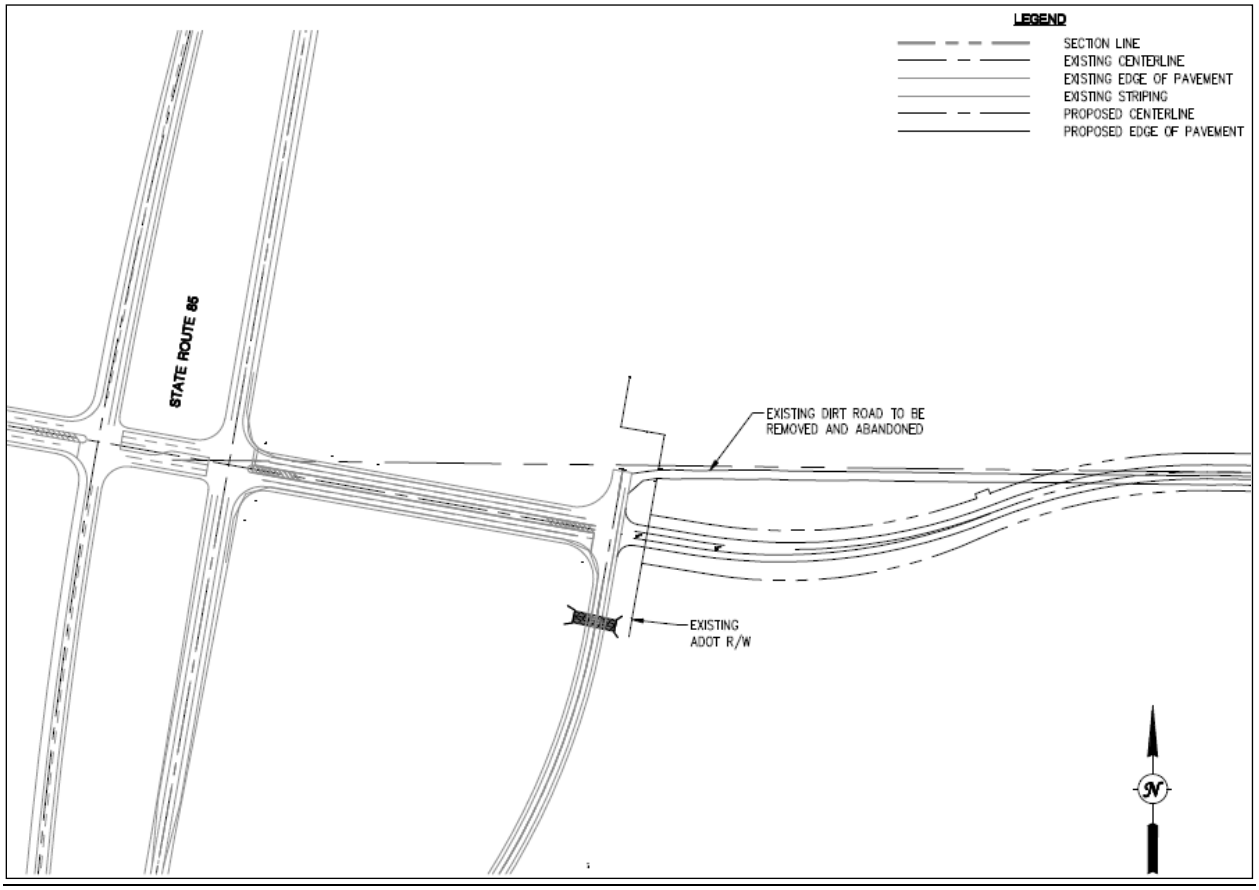

Figure 2.10 State Route 85 SSEP (Riggs Road) road intersection improvement.

Only a small portion of the overall plant site would be paved, primarily the site access road and portions of each power block (paved parking lot and roads encircling the steam turbine generator and solar steam generator). The remaining portions of the power block would be gravel surfaced. The solar field would remain unpaved and without a gravel surface in order to prevent rock damage to mirrors from mirror wash vehicle traffic; an approved dust suppression coating would be used on the dirt roadways in and

around the solar field. Potential dust coatings include magnesium chloride (MgCl) and commercially available polymers.

The entire site would be fenced appropriately to restrict public access during construction and operations. Chain-link security fencing would be installed around the site perimeter (approximately 10 miles), switchyard, and other areas requiring controlled access. The security fence would be approximately 8 feet tall, topped with approximately 1 foot of barbed wire (three strands) mounted on 45° extension arms. The fence posts would be set in concrete.

Controlled access gates would be located at the entrances to the facility. Site gates would be swing-or-rolling type access gates. Access through the main gate would require an electronic swipe card to prevent unaccompanied visitors from accessing the facility. All facility personnel, contractors, agency personnel, and visitors would be logged in and out of the facility at the main office during normal business hours. Visitors and non-SSEP employees (except agency personnel on government business) would be allowed entry only with approval from a staff member at the facility.

2.5.2.11 PLANT AUXILIARY SYSTEMS

The following plant auxiliary systems would control, protect, and support the power plant and its operation. All auxiliary systems would be located in the power block, except for the HTF leak detection system and certain features of the lighting and cathodic protection systems. Those systems would be located in both the solar field and power block areas.

2.5.2.11.1 Distributed Control System

The distributed control system provides control, monitoring, alarm, and data storage functions for power plant systems. This system would be operated from in the control building, which would be located between the two power blocks.

2.5.2.11.2 Lighting System

The SSEP's lighting system would provide operations and maintenance personnel with illumination in the power block area in both normal and emergency conditions. The system would consist primarily of AC lighting, but would include DC lighting for activities or emergency egress required during an outage of the plant's AC electrical system. The lighting system would also provide AC convenience outlets for portable lamps and tools. Lighting would be designed to provide the minimum illumination needed to achieve safety and security objectives, and it would be shielded and oriented to focus illumination on the desired areas and to minimize additional nighttime illumination in the site vicinity. Lighting would be fixed to buildings and other structural supports where possible, or affixed to ground mounted poles of approximately 15–20 feet. Lighting would be shrouded and aimed at the area of interest with the goal of reducing effects at night.

2.5.2.11.3 Cathodic and Freeze Protection Systems

Cathodic protection systems protect against electrochemical corrosion of underground metal piping and structures. Underground piping metal structures would have cathodic protection, as necessary, based on soil conditions. Depending on soil conditions, either a passive or impressed current system may be used.

Freeze protection systems (heat tracing) would be employed to protect small water and condensate piping systems that cannot be easily drained. Also, due to the high freezing temperature of the solar field's HTF (54°F), a direct-fired HTF freeze-protection heater would protect the system during the night hours and colder months (see Table 2.3).

2.5.2.12 FIRE PROTECTION

Fire protection systems would be provided to limit personnel injury, property loss, and SSEP downtime resulting from a fire. The systems would include a fire protection water system and portable fire extinguishers. Additional emergency response would be provided externally by local municipalities if required. The proponent would develop an escape fire plan in consultation with the BLM. This plan would be approved by the BLM and become a part of the authorization for the solar plant facility.

Each power plant's fire protection water system would be supplied from a dedicated 360,000-gallon portion of the raw water storage tank located on the plant site and would contain a minimum capacity to supply two hours of full flow runtime. One electric- and one diesel-fueled backup firewater pump, each with a capacity of 3,000 gpm, would deliver water to the fire protection water-piping network for each plant. A smaller electric motor-driven jockey pump would maintain pressure in the piping network. If the jockey pump is unable to maintain a set operating pressure in the piping network, the diesel fire pump starts automatically.

The piping network would be configured in a loop so that a piping failure can be isolated with shutoff valves without interrupting the supply of water to a majority of the loop. The piping network would supply fire hydrants located at intervals throughout the power plant site, a sprinkler deluge system at each unit transformer, HTF expansion tank and circulating pump area, and sprinkler systems at the steam turbine generator and in the operations and administration buildings. Portable fire extinguishers of appropriate sizes and types would be located throughout the plant site.

Fire protection for the solar field would be provided by zoned isolation of the HTF lines in the event of a rupture that results in fire. Because vegetation or other combustible materials would not be allowed in the solar field, the HTF would be allowed to extinguish itself naturally, because the remainder of the field is of nonflammable material (aluminum, steel, and glass).

2.5.3 Construction and Operations

2.5.3.1 CONSTRUCTION AND INSTALLATION

The following subsections describe civil/structural features of the SSEP. The power plant would be designed in conformance with the 2006 International Building Code and with applicable wind and seismic criteria for the site location.

2.5.3.1.1 Construction Schedule and Power-generation Facility

Major milestones of the planned SSEP construction schedule are as follows:

- Begin construction Unit 1: Month 1
- Startup and test Unit 1: Month 21–28
- Commercial operation Unit 1: Month 28
- Begin construction Unit 2: Month 7
- Startup and test Unit 2: Month 38–39
- Commercial operation Unit 2: Month 41

SSEP construction is expected to occur over 39 months. Start-up and testing would occur over approximately 2 months, for a total of 41 months of work on the site. The current schedule is staggered to take advantage of mobilization efficiencies. However, depending on negotiations with potential

customers, the timing of the second unit's construction schedule could be shifted. Construction would require an average of approximately 870 employees over the entire 39-month construction period, with labor requirements peaking at approximately 1,500 workers in month 24. The construction workforce would consist of laborers, craftsmen, supervisory personnel, support personnel, and construction management personnel. The socioeconomics section in the Chapter 4 contains more information regarding construction workforce by skill over the entire construction period.

Construction would be phased so that the 125-MW unit would be operational as soon as approximately one year before the separate 250-MW unit becomes operational. Construction of the 125-MW unit is expected to take approximately 25–28 months, whereas the 250-MW unit is expected to take approximately 30 to 32 months. Table 2.5 depicts a proposed construction plan for the SSEP. This plan is preliminary and could shift during project construction based on generation requirements, contractual milestones with off-takers, and emission thresholds from grading.

Table 2.5 Sonoran Solar Energy Project Construction Plan

Activity	Unit 1	Unit 2
Mobilization	Month 1	Month 7
Construct well field and water supply pipelines	Month 1	n/a
Delineate and mark the boundaries of the construction zone	Month 1	Month 7
Stabilize construction entrance/exit and roadway; install tire wash	Month 1	Month 7
Establish parking and staging areas for vehicle and equipment storage; maintenance	Month 1	Month 7
Establish laydown area(s) for materials storage/staging	Month 1	Month 7
Establish concrete washout area	Month 1	Month 7
Clear and grub; strip topsoil	Months 1–2	Months 7–8
Install certified weed-free fiber rolls or silt fence at the base of slopes adjacent to delineated sensitive areas (i.e., wetlands), if any.	Months 1–2	Months 7–8
Construct stormwater infiltration/evaporation areas	Months 4–8	Months 11-14
Assemble and erect parabolic troughs	Months 6–18	Months 12–26
Construct power block	Months 7–25	Months 13–38
Construct reinforced concrete foundations	Months 5–11	Months 12–18
Trench gas line corridor	Months 15–19	n/a
Construct gen-tie line	Months 24–28	n/a
Construct administration/warehouse building	Months 24–25	n/a
Commissioning and testing	Months 25–28	Months 37–41

Temporary construction laydown and parking areas would be provided in the Project Area. With the exception of linear facilities (gas/water lines and gen-tie line), construction laydown would remain in the overall facility footprint. Gas and water line laydown areas would be within the ROWs for their respective pipelines. The gen-tie would have separate laydown areas, pad construction areas, and pulling areas.

Construction power would be provided by the local distribution system and routed to the site along wood poles. Due to the size of the plant site, the solar field laydown area would be relocated periodically as the solar field is built out. The construction sequence for power plant construction includes the following:

Site Preparation: This includes detailed construction surveys, mobilization of construction staff, grading, and preparation of drainage features. Grading for the solar field, power block, and rerouted washes would be completed during the first nine months of the construction schedule. Site preparation would include the removal (and salvage, as required under the Arizona Native Plant Law) of all vegetation from the site for the duration of the SSEP. Vegetation removal would be maintained through the application of approved herbicides and where needed, mechanical removal.

Site grading would require a maximum cut depth of approximately 8 feet and an average cut depth of approximately 4 feet. These values are for site grading only and do not include depth for trenches or site drainage. Site grading is estimated to require approximately 4,238,535 cubic yards (CY) of cut and 1,071,536 CY of fill. Therefore, there would be excess cut of approximately 3,166,999 CY. Excess cut on-site would be used in the solar field, eliminating the need to export fill from the Project Area. Fill would be compacted as necessary, and appropriate dust abatement measures would be taken. A detailed breakdown of the site's expected cut and fill volumes is provided below:

- Solar fields: 3,808,165 CY cut, 1,003,535 CY fill
- Diversion channels: 430,370 CY cut
- Detention ponds: 68,001 CY fill

These values are preliminary and may vary with final design.

Foundations: This includes excavations for cooling tower, footings for the solar field, and ancillary foundations in the power block.

Major Equipment Installation: Once the foundations are complete, the larger equipment would be installed. The solar field components would be assembled in an on-site erection facility and installed on foundations. Equipment and materials would be delivered to the SSEP by truck; large components (e.g., the solar thermoelectric generator [STG]) would be brought by rail to the nearest rail siding and then trucked to the site.

Best Operating Practices: With the major equipment in place, the remaining fieldwork would be piping, electrical, and smaller component installations.

Testing and Commissioning: Testing of subsystems would be done as they are completed. Major equipment would be tested once all supporting subsystems are installed and tested.

2.5.3.2 CONSTRUCTION AND OPERATIONS TRANSPORTATION NEEDS

The SSEP would not provide on-site residential areas for construction workers. Construction workers would most likely commute from the Phoenix and Gila Bend areas. At the expected construction peak, 1,200 to 1,500 workers would be needed during a 16- to 18-month period. A more typical number for nonpeak construction workers would be 600 workers.

At the peak of construction, approximately 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. This number of vehicles assumes that due to the larger than normal commute times expected from population centers and the current price of fuel, some construction workers would carpool. In addition, although most of the workers would be expected to arrive and depart during peak hours, specialty workers would be expected to arrive on-site during nonpeak hours. Approximately 30 to 60 trucks per day would be required to deliver various materials and construction equipment during nonpeak periods.

With construction complete, the operation of the SSEP would require approximately 82 permanent employees working in four shifts. The day shift would consist of approximately 10 office employees with operators/maintenance technicians working 12-hour shifts of 18 operators per shift. Thus, it is estimated that traffic generated by the plant's employees would consist of 46 AM and PM peak hour trips. The typical employee traffic is not expected to occur until after the peak period of construction is completed.

Table 2.6 shows the expected trip generation for the new SSEP facility during the peak of construction and after buildout.

Table 2.6 Weekday Project Site 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**

Note: Vph = vehicles per hour.

2.5.3.3 CIVIL WORKS CONSTRUCTION SEQUENCE

The construction sequence for civil works includes the following general steps:

Site Disturbance: Once all areas are appropriately staked and signed and access to the site has been established, grading activities would occur over an extensive portion of site. Grading would commence with rough grading activities, including grubbing, clearing, moisture conditioning, bulk grading, and initial compaction. The first ground-disturbing activities to take place would be the initial clearing and grading to prepare the site for stormwater drainage, construction, and equipment foundation pads. Temporary drainage ditches and berms would also 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. The estimated temporary and permanent disturbance for the SSEP is detailed in Section 2.5.2.

Site Grading: The solar pad grading of the power plant footprint would have an average slope of 1% to 3% on the north-south direction. Each solar pad would be graded with the intent of balancing the cut-and-fill as much as possible to minimize earth movement on the site. Drainage diversion channels and protective berms would also be developed with a balance of cut and fill earthwork. Site grading would require a maximum cut depth of approximately 8 feet and an average of approximately 4 feet. These values are for site grading only, and do not include depth for trenches or site drainage.

Site Drainage: The post-development sediment/detention basin at the discharge points would provide stormwater pollution prevention BMP controls, along with detention time to reduce the peak off-site discharge to pre-development conditions. The detention ponds would be designed to drain within 36 hours. Sediment would be monitored and removed from the ponds as needed. Stormwater flows entering the detention basins would be from within the solar field only.

On-site drainage would be collected in channels and conveyed to the outer reaches of the solar field where they would flow down to the stormwater detention basins. All off-site stormwater would be conveyed around the solar field via diversion channels. All channels and detention ponds would be sized

to pass the 100-year return storm event. The road berm 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.

Internal Road System: A primary access road would be constructed to the power block areas. This road would run from an existing road terminating at the Jojoba Switchyard, and would require both new construction and improvement of existing road (see Map 2). This road would be 24 feet wide and paved with approximately 3,000 tons of imported asphalt concrete material per mile. Auxiliary roads would be 24 feet wide and use compacted native materials or gravel surface.

2.5.3.3.1 Generator Tie Line

The gen-tie line would be constructed with crews working continuously along the ROW, with construction of the entire gen-tie line requiring a peak workforce of approximately 34 workers. Gen-tie line construction would include the following activities:

- Preparation of marshalling yards
- Access road and spur road construction
- Clearing and grading of pole sites
- Foundation preparation and installation of poles
- Conductor installation
- Clean-up and site reclamation

Various construction activities would occur during the construction process, with several construction crews operating simultaneously at different locations. The following subsections describe in more detail the construction activities associated with the SSEP gen-tie line.

Marshalling Yards: Construction staging/laydown and parking areas are proposed in the Project Area. Construction materials such as concrete, wire and cable, fuels, and small tools and consumables would be delivered to the staging/laydown areas by truck. Mobile trailers or similar suitable facilities (e.g., modular offices) would be used for construction offices in the staging/laydown areas.

Road Work: The construction, operation, and maintenance of the proposed gen-tie line would require that heavy vehicles access structure sites along the ROW. The SSEP proposes to use the newly constructed site access road, Komatke Road, and Riggs Road for all construction, operation, and maintenance activities associated with the gen-tie line. If required, new spur roads approximately 14 feet wide and averaging 75 feet in length, would be constructed from the access roads to the structure sites. Each spur road would lead to a construction pad for a pole structure.

Pole Pads: At each site, a work area would be required for the structure footing location, structure assembly, and the necessary crane maneuvers. The work area would be cleared of vegetation only to the extent necessary, and the construction pad would be leveled to facilitate the safe operation of equipment, such as construction cranes.

Pole Erection: Transmission line pole structure foundations would be excavated with power drilling equipment. A vehicle-mounted power auger or backhoe would be used to excavate for the structure foundation. Although not expected, in some instances blasting could be necessary because of specific geologic conditions.

Installation of new pole structures to support the 500-kV bundled circuit would begin with the excavation of foundations approximately 4 feet in diameter and 12–20 feet in depth (depending on soil conditions). A truck-mounted auger, backhoe, or similar equipment would typically be used for excavation of this type. Once the foundation holes have been cleared, the poles with preassembled insulators, hardware, and stringing sheaves would be lifted into position and inserted into the foundation holes. Native soil, gravel, or concrete would be poured in to backfill the hole and create the support for the structure. The selection of backfill material would be determined during detailed design based on site-specific soil properties. In areas where loose sandy soils are encountered, culverts placed vertically in the open hole(s) may be temporarily or permanently required to keep the sides of the open hole from collapsing. Erecting each pole structure would take approximately two to three hours.

Conductor Installation: Typical conductor stringing activities are illustrated in Figure 2.11. Crossing structures would be erected adjacent to the existing transmission line and roadways or other structures requiring protection during conductor installation. Crossing structures would prevent ground wire, conductors, or equipment from falling on an obstacle, and would be removed following the completion of conductor installation. Equipment for erecting the crossing structures would be the same as the equipment discussed above for transmission pole installation. Crossing structures may not be required for small roads or other areas where suitable safety measures such as barriers, flagmen, or other traffic controls could be used.

Pilot lines would be pulled (strung) from structure to structure and threaded through the stringing sheaves at each structure. This phase of work may be accomplished through the use of helicopters to minimize or otherwise eliminate the need to traverse the ROW along the ground from structure to structure. Following the pilot lines, a larger diameter, stronger line would be attached to the conductors to pull them onto the structures. This process would be repeated until the ground wire or conductor is pulled through all sheaves.

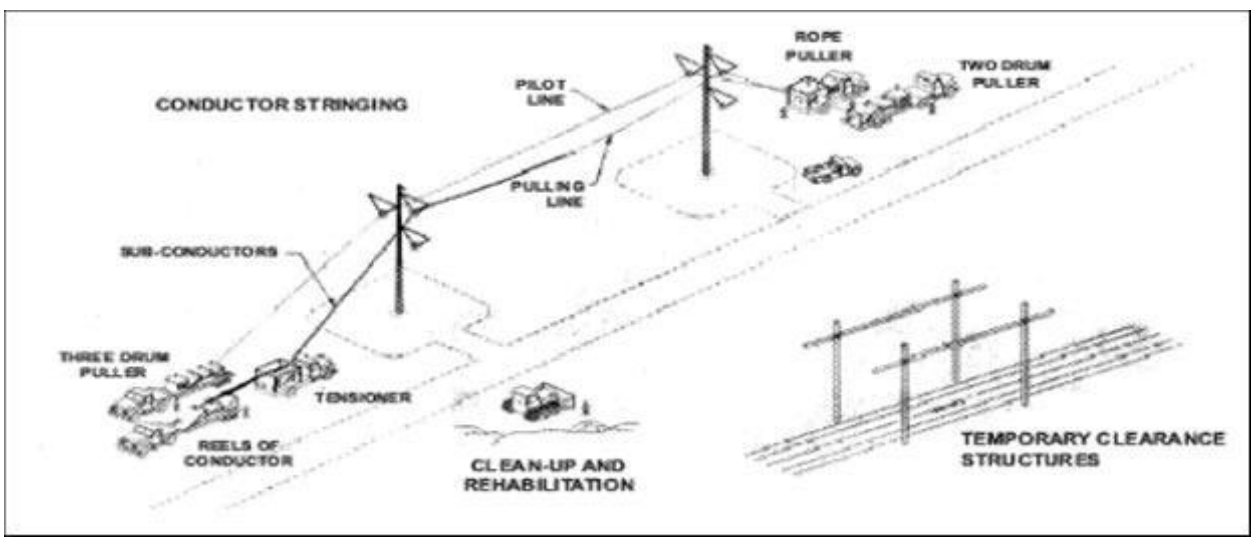

Figure 2.11 Illustration of transmission line conductor stringing.

Pulling Sites: The conductors would be strung using powered-pulling equipment at one end (see Figure 2.11). Powered braking or tensioning equipment would be approximately 1 mile apart. Tensioners and/or pullers, line trucks, wire trailers, and tractors needed for stringing and anchoring ground wire or conductor would be necessary at each pulling site. The tensioner, in concert with the puller, would maintain tension on the conductors while they would be pulled through the structures. There would be

approximately six pulling sites required to install the conductors along this segment of the gen-tie line. The sites would be accessed from SSEP access roads, Riggs Road, or SR-85.

The post-construction ROW would be restored, as required by the BLM. All practical means would be made to restore the land to its original natural drainage patterns.

2.5.3.3.2 Natural Gas and Water Pipelines

Construction of the 8-inch gas pipeline and water supply lines (see Map 2) would take approximately three to six months. Most major pieces of pipeline construction equipment would remain along the pipeline ROW during construction, with storage and staging of equipment and supplies either located in the Project Area or another acceptable site selected by the BLM at the time construction is underway. Excavated earth material would be stored in the construction ROW. During nonworking hours, any open trench would be covered with wood or other material of sufficient strength to support wildlife or people. All construction disturbances would take place within a 50-foot temporary disturbance ROW centered on the pipeline and trench. Where a pipeline or pipelines are coincident with a road, the total, temporary disturbance ROW width would be 65 feet. Although they would use the same ROW in some areas, the water supply pipeline would be installed early in the construction schedule, and would not share a trench with the gas pipeline.

It is anticipated that the construction of the natural gas and water pipelines would generally consist of the following elements:

Trenching: The optimal trench would be approximately 48 inches wide and 4 to 10 feet deep. With loose soil, a trench up to 8 feet wide at the top and 3 feet wide at the bottom may be required. The trench depth would provide a minimum cover of 36 inches.

Stringing: The pipeline components would be staged along the trench on wooden skids in preparation for installation.

Installation: Consists of bending, welding, and coating the weld-joint areas of the pipe after it has been strung, padding the ditch with sand or fine spoil, and lowering the pipe string into the trench following nondestructive testing of all welds.

Backfilling: Consists of returning spoil back into the trench around and on top of the pipe, ensuring that the surface is returned to its original grade or level. The backfill would be compacted to protect the stability of the pipe and minimize subsequent subsidence.

Trenchless construction methods may be used for short crossings under existing water lines or other buried pipelines. Boring pits would be dug on each side of the crossing to accommodate the process. Clean up would consists of restoring the surface of the roadway or ROW by removing any construction debris, grading to the original grade and contour, and revegetating or repairing, where required.

Each 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. After hydrostatic testing, the test water would be chemically analyzed for contaminants and discharged to the surrounding area pursuant to the SSEP construction stormwater pollution prevention plan, unless the analysis shows that the water is contaminated; in which case, the water would be trucked to an appropriate disposal facility. Following hydrostatic testing, the gas pipeline would be cleaned and dried, purged of air, and filled with natural gas for operation. The water line would be put into use immediately following disinfection and testing.

2.5.3.4 OPERATIONS

2.5.3.4.1 Operations Staff and Vehicles

The operations workforce would consist of about 82 full-time employees for the entire facility, consisting of plant operators, maintenance technicians working 12-hour shifts per day, and administrative personnel working eight-hour shifts per day. The facility would be operated seven days a week, 24 hours a day, 365 days a year.

Operation and maintenance vehicles would include large trucks for on-site welding, refueling, lubricating, and watering (mirror washing). In addition, flatbed trucks, dump trucks, front-end loaders, and ¾-ton pick-up trucks are typical on-site vehicles operated regularly. Large heavy-haul transport equipment would be brought to the site as needed for major plant maintenance and equipment repair.

2.5.3.4.2 Operation and Maintenance Activities

The plant would be maintained by staff personnel for normal preventive maintenance. This would include daily inspection of field components, condition assessment of critical equipment, and routine lubrication of equipment. Some specialized maintenance would be performed by the technology provider or other outside specialist contractors. It is expected that long-term maintenance would be performed against a defined service and replacement schedule. It is expected that consumption of spare parts would be minimal. The SSEP would be repainted on a regular basis to maintain its appearance and protect it from the elements.

Periodic cleaning of the solar collectors with demineralized water would be necessary to maintain the desired mirror reflectivity. For a solar thermal facility, the mirrors would be washed during the off-peak hours for approximately 12 hours. Cleaning activities are a continuous process and would be conducted nightly. By washing a section of mirrors each night, the entire field can be cleaned over a period of two weeks. The process would then begin again.

Under normal circumstances, the plant switchyard would be controlled remotely, and routine inspections by personnel would occur on a monthly basis or as needed under emergency conditions. In addition, all of the switchyard structures would be annually inspected from the ground for corrosion, misalignment, and foundation condition. Ground inspection would include the inspection of hardware, insulator keys, and conductors. This inspection would also check conductors and fixtures for corrosion, breaks, broken insulators, and bad splices.

Road maintenance would be performed, as needed. Paved roads would be swept, sealed, and/or overlaid as needed. Grading and drainage would be maintained for gravel and earthen roads. Dust palliatives would be applied, as required, to limit fugitive dust.

Electric lines, support systems, and instrumentation and controls would be inspected regularly to ensure the safe, efficient, and economical operation of the SSEP.

The on-site wells would undergo periodic well workovers to remove sediment and other debris to maintain the flow. The pumps may also require periodic removal and servicing, which would require the occasional use of permanent service roads to the well sites.

The water storage tanks that would be installed as part of the SSEP would require frequent inspection and may need occasional repairs. This maintenance would include routine painting of the storage tanks to protect them from corrosion.

2.5.4 Water Use and Waste Management

2.5.4.1 WATER TREATMENT AND USE

2.5.4.1.1 Water Requirements

The SSEP would have various consumptive water uses, including the circulating water system, the solar steam generators, water for solar collector mirror washing, service water, potable water, and fire protection water. The estimated water requirements for the power plant are presented in Table 2.7. The average total annual water usage is estimated to range between 2,305 and 3,003 afy, depending on the amount of thermal storage and gas co-firing used (Table 2.7; see Figure 2.15). This corresponds to an estimated average daily usage of 6.3 to 8.2 acre-feet per day. Usage rates would vary during the year and would be higher in the summer months when the peak daily usage is estimated to be as high as 11.9 to 12.8 acre-feet per day.

Equipment sizing would be consistent with peak daily rates to ensure adequate design margin. The groundwater production well field would be designed with a capacity of 13.3 acre-feet per day to ensure that daily makeup water requirements would be met during the summer months. Higher instantaneous peak maximum flow requirements would be met by relying on the capacity of the raw water storage tank.

Table 2.7 Typical Water Usage Estimate – Proposed Action

Water Use	Annualized Average Daily Rate[1] (acre-feet/day)	Estimated Peak Daily Rate[2] (acre-feet/day)	Estimated Annual Use[1] (acre-feet)
Maximum (assumes 25% energy production by gas co-firing)	8.2	12.8	3,003
Minimum (assumes solar production only)	6.3	11.9	2,305

[1]The estimate of groundwater usage is based on an average daily consumption rate for one 125-MW power plant and one 250-MW plant.
[2]The peak rate is the instantaneous maximum for summer usage for one 125-MW power plant and one 250-MW power plant.

Solar Mirror Washing Water

To facilitate dust removal, water from a demineralized water storage tank is used to spray clean the solar mirrors on a periodic basis. The frequency of the washing operation is determined by the reflectivity monitoring program. This operation is generally done at night and involves a water truck spraying demineralized water on the mirrors in a drive-by fashion. The demineralized water production facilities, already in place for solar steam generator make-up water, would be sized to accommodate the additional solar mirror washing demand of about 11.8 afy (4.45 acre-feet for the 125-MW unit and 7.37 acre-feet for the 250-MW unit). Water from the washing operation is expected to mostly evaporate on the mirror surface with no appreciable runoff.

Cooling Systems

The cooling system for heat rejection from the steam cycle consists of a surface condenser, circulating water system, and a wet-cooling tower (wet-cooling towers generally stand approximately 45–50 feet above grade). The surface condenser receives exhaust steam from the low pressure section of the steam turbine generator and condenses it to liquid for return to the solar steam generator. The surface condenser is a shell-and-tube heat exchanger with wet, saturated steam condensing on the shell side and circulating water flowing through the tubes to provide cooling. The warmed circulating water exits the condenser and flows to the cooling tower to be cooled and reused.

The circulating water is distributed among multiple cells of the cooling tower, where it cascades downward through each cell and then collects in the cooling tower basin. The mechanical draft cooling tower employs electric motor-driven fans to move air through each cooling tower cell. The cascading circulating water is partially evaporated, and the evaporated water is dispersed to the atmosphere as part of the moist air leaving each cooling tower cell. Because of climatic conditions at the site, visible moisture plumes are expected to occur relatively infrequently and largely in winter months, and no need for a plume-abated cooling tower is expected. The circulating water is cooled primarily through partial evaporation and secondarily through heat transfer with the air. The cooled circulating water is pumped from the cooling tower basin back to the surface condenser and auxiliary cooling water system.

2.5.4.1.2 Water Treatment

The raw water, circulating water, process water, and mirror washing water would all require on-site treatment that varies according to the quality required for each of these uses. The power plant's design consists of a pre-treatment system upstream of the cooling tower, and a post-treatment system downstream of the cooling tower. The water treatment plan was developed based on initial water analyses from on-site test wells. This water treatment design would be further evaluated on receipt of additional site-specific water quality data.

Water would be cycled in the cooling tower until the concentration of chemical constituents rises to levels where it could affect heat transfer and then becomes a waste stream (blowdown). The increase in concentration of constituents in the blowdown compared to the make-up water is called "cycles of concentration". The number of cycles of concentration in the cooling tower is limited by the incoming water chemistry and behavior of chemistry constituents as the concentration increases. Calcium and magnesium concentrations in the water are relatively low and would allow up to 15 cycles of concentration before potentially forming calcite ($CaCO_3$). Silica would be limited to six to seven cycles of concentration due to the formation of silicon dioxide (SiO_2) and magnesium silicate. TDS are high in the source water and would limit the cooling tower to five to six cycles to remain within cooling tower design limits.

Due to the limitation of these constituents in the process, a multimedia filter and two-stage reverse osmosis (RO) unit would be used for pre-treatment upstream of the cooling tower. This would allow the possible cycles of concentration to be increased to the 15 cycles required by ADWR and reduces the quantity of makeup water required. The waste stream from the multimedia filter unit is discharged into the on-site evaporation ponds, and the waste stream from the second RO unit is discharged into the wastewater storage tank.

Some contaminants (e.g., chloride, sodium, and sulfate) and scale-forming substances (e.g., calcium, magnesium, and silica) would not be removed during pre-treatment. Post-treatment would be used to recover most of the wastewater for reuse, to decrease the quantity of make-up water required, and to decrease the size of the waste management units (evaporation ponds). Post-treatment would consist of a multimedia filter and RO unit. Similar to the pre-treatment process, the multimedia filter would remove solids from the cooling tower blowdown that may damage or reduce the efficiency of the RO membranes. Water treated by the RO units would be returned to the cooling tower for reuse. Ultimately, the waste streams from the multimedia filter and second-stage RO unit would be discharged into on-site evaporation ponds.

Several on-site tanks would contain the raw water, treated water, and wastewater. These would have the following capacity:

- Raw Water/Fire Water Storage Tank:
  - 125-MW unit: 500,000 gallons
  - 250-MW unit 1,000,000 gallons
- Treated Water Storage Tank:
  - 125-MW unit: 1,250,000 gallons
  - 250-MW unit: 2,500,000 gallons
- Wastewater Storage Tank:
  - 125-MW unit: 250,000 gallons
  - 250-MW unit: 500,000 gallons

Tanks would be sized to provide sufficient water to support operation of the plant during peak operating conditions, as well as to provide a 12-hour storage capacity to enable continued operation when a failure interrupts water or wastewater treatment capabilities. The tanks also allow the plant to level the water supply requirements on a 24-hour basis and accommodate mid-day demand peaks. The raw water/fire water storage tank provides water for plant operation and fire protection.

In addition to the treatment of water for the cooling tower, there is also a demineralizer treatment process for the high-purity water required for the steam cycle.

On-site groundwater wells would also be used to supply water for employees' use (e.g., drinking water, showers, sinks, and toilets). A package water treatment system would be used to treat the water to meet potable standards.

Circulating Water Treatment

Circulating water would be modified with chemical treatment to prevent the growth of bacteria, the formation of scale, and the minimization of corrosion of the cooling tower fill and the condenser tubes. These chemicals include a biocide, a pH-control solution, a scale inhibitor, and a corrosion inhibitor. Some of these chemicals could be hazardous. At a minimum, the pH-control chemicals would be treated as a safety hazard. All chemical tanks would have secondary containment. All chemical totes/drums would be placed on containment pallets. A full spill prevention plan (SPP) would be developed and implemented prior to delivery of any hazardous chemicals.

Steam Cycle Process Water

Make-up water for the steam cycle must meet stringent specifications for suspended and dissolved solids. To meet these specifications, water from the treated water tank of each unit is processed through a separate demineralized water make-up system, each consisting of mixed-bed demineralizers and an 75,000-gallon (for the 125-MW plant) to 125,000-gallon (for the 250-MW plant) demineralized water storage tank. Additional conditioning of the condensate and feedwater circulating in the steam cycle is provided by means of a chemical feed system.

2.5.4.2 WASTE MANAGEMENT

Project wastes would include wastewater, nonhazardous solid waste, hazardous solid waste, and hazardous liquid waste. Project waste streams and management details are discussed in Chapter 4's hazardous and solid waste section.

2.5.4.2.1 Wastewater

Wastewater would be segregated into two separate collection systems, one for industrial streams and the other for sanitary wastes. For the 125-MW facility, industrial wastewater from both the pre-treatment and post-treatment systems would be piped to three approximately10-acre evaporation ponds for disposal. The evaporation ponds would have a combined area of approximately 30 acres for the 125-MW unit. For the 250-MW facility, industrial wastewater from both the pre-treatment and post-treatment systems would be piped to three approximately 20-acre evaporation ponds for disposal. The evaporation ponds would have a combined area of approximately 60 acres for the 250-MW unit. There would be three primary streams and one occasional waste stream discharging into the evaporation ponds:

1) Pre-cooling tower water treatment multimedia filter waste stream
2) Post-cooling tower water treatment multimedia filter waste stream
3) Post-cooling tower water treatment second stage RO waste stream
4) Stormwater accumulated in the land-treatment unit used to treat contaminated soils (occasional)

Annual average blowdown to the evaporation ponds would be approximately 58,000 gallons per day (gpd) for the 125-MW unit and 116,000 gpd for the 250-MW unit (174,000 gpd total). This would increase to approximately 104,000 gpd and 209,000 gpd (313,000 gpd total), respectively, during peak summer conditions.

The SSEP's sanitary system would collect wastewater from sanitary facilities such as sinks and toilets. This waste stream would be sent to an on-site sanitary waste septic system designed and permitted in accordance with Maricopa County Department of Health Services standards.

2.5.4.2.2 Evaporation Ponds

The average pond depth would be 3 feet, and residual precipitated solids would be removed approximately every 30 years to maintain a solid depth of no greater than approximately 3 feet for operational and safety purposes. The pond liner system would consist of a 60-mil high density polyethylene (HDPE) primary liner and a secondary 40-mil HDPE liner. A synthetic drainage geonet and collection piping (that is used as part of the leachate collection and removal system) would be installed between the liners. There would be a hard-surface, protective layer on top of the 60-mil HDPE, which would consist of a nonwoven geotextile, a 1-foot-thick granular fill/free draining material and a 1-foot-thick hard surface such as roller-compacted concrete. The hard surface provides protection against accidental damage to the HDPE from falling objects, varying climatic conditions, and worker activities during cleanout and maintenance. The evaporation ponds would be monitored to detect the presence of liquid and/or constituents of concern. Based on the experience at other solar facilities, it is expected that the constituents of concern for this monitoring would include chloride, sodium, sulfate, TDS, biphenyl, diphenyl oxide, potassium, selenium, and phosphate. None of these constituents are classified as hazardous. The HTF is comprised entirely of Biphenyl and diphenyl oxide. These constituents and any listed or known breakdown products would be part of the monitoring program.

The evaporation ponds would be subject to design requirements pursuant to the Arizona APP program. The Arizona regulations related to hazardous wastes do not address the potential for leakage or leaching releases, but defer to the state APP program. The pond designs would be reviewed and approved as part of the APP. Design measures that would be adopted to ensure that leakage would not impact underlying soil or create a waste water release would include a dual polymer liner and leak detection systems.

2.5.4.2.3 Heat Transfer Fluid Land-treatment Unit

HTF-impacted soils would be characterized as hazardous or nonhazardous waste to determine whether the material could be treated in the land-treatment unit or must be removed for off-site disposal. HTF-impacted soils would be promptly excavated and relocated to a staging area and characterized in accordance with Arizona and federal law. Based on the proponent's past experience at other solar thermal plants, it is anticipated that soil containing 5,000 milligrams per kilogram (mg/kg) HTF or more would be managed as hazardous waste, and that soil containing less than 5,000 mg/kg HTF would be nonhazardous waste and can be managed at the site. If the soil is characterized as a hazardous waste, the impacted soils would be transported from the site by a licensed hazardous waste hauler for disposal at a licensed hazardous waste landfill. No HTF-impacted soils characterized as hazardous waste would be disposed or treated on-site.

If the soil is characterized as a nonhazardous waste, it would be placed in the land-treatment area (see Map 2). Treatment of the HTF-impacted soil in the land-treatment unit would involve spreading, turning, moisture conditioning, and may involve the addition of nitrogen and phosphorous nutrients (i.e., fertilizers), as needed, to stimulate consumption of HTF by the indigenous bacteria. In general, more highly impacted soil may be covered with plastic sheeting to prevent contact with stormwater and to control potential odors and emissions, as well as for moisture and temperature retention. Once the soil has been treated to a concentration of less than 100 mg/kg HTF, it would be moved from the land-treatment unit to another portion of the site until it is reused at the facility as fill material.

Based on available operation data from other sites, it is anticipated that approximately 30 CY (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. HTF-affected soil with less than 5,000 mg/kg HTF is anticipated to be approximately 2,250 CY per year. Larger or smaller quantities could be generated during some years, depending on the frequency and size of leaks and spills.

2.5.4.2.4 Other Nonhazardous Solid Waste

Construction, operation, and maintenance of the SSEP would generate nonhazardous solid wastes typical of power-generation or other industrial facilities. These wastes include scrap metal and plastic, insulation material, paper, glass, empty containers, and other miscellaneous solid wastes. These materials would be disposed of by means of contracted refuse collection and recycling services.

2.5.4.2.5 Hazardous Solid and Liquid Waste

Small quantities of hazardous wastes would be generated during SSEP construction and operation. Less than 100 kg/month would be generated during operations. Hazardous wastes generated during the construction phase would include substances such as paint and primer, thinners, and solvents. Hazardous solid and liquid waste streams generated during SSEP operations include substances such as used hydraulic fluids, oils, greases, filters, as well as spent cleaning solutions and spent batteries.

Herbicides would be used in the solar field to control vegetation during operation of the SSEP, with a maximum of approximately 37,000 pounds of herbicide used annually. Herbicide would not be stored on-site.

2.5.5 Termination and Reclamation

BLM IM No. 2011-003 (Solar Energy Development Policy) indicates that due to the substantial investment required for solar energy projects, it is in the public interest to provide a ROW authorization term that allows a reasonable period of time for construction, development, and continued operations. The IM states that the BLM will issue all solar energy ROW authorizations for a term not to exceed 30 years. This timeframe provides a reasonable period for the expected needs of a solar energy facility, as well as an operation period that allows for typical power purchase agreements. A 30-year ROW authorization is proposed under all action alternatives. The ROW authorization would include a specific provision allowing for renewal, consistent with 43 CFR § 2807.22. However, because the BLM cannot predict conditions 30 years into the future, this analysis assumes that 30 years would be the extent of the useful life of the project.

Boulevard would be required to post a performance and reclamation bond as a condition of authorization issuance. The value of this bond would be based on three components, as identified in BLM IM No. 2011-003. The first component would consider environmental liabilities, such as risks associated with hazardous waste and hazardous substances. The second component would address the decommissioning, removal, and proper disposal, as appropriate, of improvements and facilities. The third component would evaluate reclamation, revegetation, restoration, and soil stabilization activities associated with the Proposed Action. Bond amounts would be determined upon further project review by the BLM but could be reduced through limited herbicide use and hazardous waste production, a smaller project footprint, and/or decreased grading and vegetation removal in the Project Area

2.5.5.1 TERMINATION

The SSEP would have a useful life of at least 30 years. At the end of the useful life of the facility and the termination of the ROW grant, Boulevard would remove all improvements. During improvement removal, the site would be securely fenced and gated. Materials that could be reused or recycled would be hauled away from the site and sold. Materials that could neither be reused nor recycled would be dismantled and hauled to the nearest approved landfill. Hazardous materials that could not be reused or recycled would be disposed of at approved facilities. Boulevard would remove foundations to 3 feet below ground surface, restore contours over the foundations to pre-project conditions, remove the stormwater management berms, and restore the pre-project contours.

The transmission line and towers would be removed. Conductors and tower steel would be sold for reuse or recycling. The switchyard, including all structures and fencing, would be removed. Foundations for the towers and switchyard facilities would be removed to 3 feet below ground surface and contours restored.

Because removal of the natural gas pipeline would disturb more ground than abandoning it in place, it would be internally cleaned, purged free of gas, isolated from interconnections with other pipelines, and sealed without being removed from the trench. This approach generally minimizes surface disturbance and other potential environmental impacts. The aboveground pipeline at the meter station would be completely removed, including all related aboveground equipment and foundations, and the station sites would be restored to as near original condition as possible. Upon abandonment of the pipeline, the BLM ROW would be relinquished.

It is not possible to predict the conditions and management objectives that would exist at the time of decommissioning. Therefore, decommissioning details would be developed and provided to BLM when the time for permanent closure is closer and more information is available. The BLM would require Boulevard to submit an abandonment plan that would be reviewed and revised as needed in order to be approved by the BLM. The plan would include all activities required to dispose of or store all hazardous

and toxic materials and chemicals associated with the SSEP. This plan would discuss all currently applicable LORS associated with the safe storage or disposal of these materials. The plan would also include a description of procedures for notification of regulatory agencies. The BLM would review and approve the plan.

2.5.5.2 RECLAMATION

Site reclamation would be the responsibility of the entity holding the ROW grant at the time of closure and decommissioning of the project. To comply with current BLM guidance (BLM IM No. 2011-003), as a component of the POD, Boulevard would submit a decommissioning and site reclamation plan (DSRP) to define the general reclamation, revegetation, restoration, and soil stabilization requirements for the Project Area. The DSRP would require timely reclamation of construction areas and the revegetation of disturbed areas. It must be approved by the BLM prior to the grant of the ROW. The approved DSRP would be the basis for determining the standard for reclamation, revegetation, restoration, and soil stabilization of the Project Area and also for establishing the full bond amount.

A brief description of reclamation activities is provided below. Reclamation would take approximately six months following decommissioning, with the exception of on-going monitoring.

2.5.5.2.1 Soil Preparation

Following project termination and removal of all waste materials and equipment, Project Area soils would be prepared for re-seeding by removing large rocks; running an imprint roller (in areas where it is effective) to create stable, 4-inch-deep impressions; and conducting soil testing to determine nutrients, pH, toxicity, and biological activity. Areas low in essential nutrients or in need of amendment could be fertilized/amended before planting. The fertilizer/amendment would be drilled or harrowed into the soil. Nitrogen fertilizers would be selected to release at the time of seed germination to avoid nitrogen loss.

2.5.5.2.2 Re-seeding

Following soil preparation, reclamation areas would be seeded with a native seed mix. The seed mix would be selected to suit the soil type and climate and would contain a mixture of grasses, forbs, shrubs and other appropriate plants that provide for quick cover, embankment stabilization, litter production, nitrogen fixing, and other desirable qualities. Native plant species growing near the Project Area would be used as a guide in seed selection. A suggested seed mix is given in Table 2.8. This mix would be approved by the BLM prior to reseeding activities.

Table 2.8 Seed Mix for Reclamation Activities – Proposed Action

Species	Application (pounds/acres)
Grasses	
Aristida purpurea (purple three awn)	1
Wildflowers and Forbs	
Baileya multiradiata (desert marigold)	1
Cassia covesii (desert senna)	1
Eschscholzia mexicana (Mexican poppy)	1
Lupinus sparsiflorus (desert lupine)	2
Penstemon pseudospectabolis (desert penstemon)	1
Penstemon parryi (Parry penstamon)	1
Phacelia crenulata (phacelia)	1
Plantago insularis (wooly Indian wheat)	5
Sphaeralcea ambigua (desert globemallow)	1
Shrubs and Trees	
Acacia greggii (catclaw acacia)	2
Ambrosia deltoidea (triangle leaf bursage)	4
Atriplex canescens (four-wing saltbush)	1
Calliandra eriophylla (fairy duster)	2
Cercidium microphyllum (foothills palo verde)	2
Parkinsonia floridum (blue palo verde)	1
Encelia farinosa (brittlebush)	1
Erigonum fasiculatum (Arizona buckwheat)	1
Larrea tridentate (creosotebush)	3
Viguiera deltoidea (golden-eye)	1

Seedbed preparation and seeding would be done in the fall before the winter rains. Cellulose fiber mulch would be added to the seed mix at the rate of 200 pounds per acre on any slopes. A tackifier would be added to the solution to bind the soil and mulch, and supplemental watering of the seed mixture would be provided if seasonal rains are lacking.

2.5.5.2.3 Monitoring

Boulevard would be required to monitor reclamation quarterly for the first year to repair washouts and would re-seed as necessary. After the initial year, Boulevard would inspect the property annually for at least the following two years during the growing season and take remedial measures, as required, until plant survival is satisfactory to the BLM. The revegetation goal would be to establish ground cover with native species equal to that on adjacent undisturbed areas within three growing seasons. Achieving this goal would be measured by aerial photography or by line-intercept survey methods. Sampling would be sufficient to assure that the revegetated area achieved at least 80% of the true mean cover of the reference (undisturbed) site.

2.5.5.2.4 Evaporation Pond Remediation

The remediation activities for evaporation ponds would include the following processes.

Removal of Wastewater

Wastewater remaining in the evaporation ponds would be allowed to evaporate. As long as liquids remain in the evaporation ponds, the monitoring and reporting requirements included in the permit requirements would be followed.

Removal of Solids/Sludge

Samples of the precipitated solids/sludge would be collected from each evaporation pond for characterization and profiled for disposal. The characterized solids/sludge would then be loaded into containers and handled as appropriate by a licensed waste hauler and would be transported to an approved disposal facility.

Removal of Hard Surface/Protective Layer

The hard protective layer of roller-compacted concrete would be removed using best engineering practices. Three samples of concrete would be collected from each evaporation pond to determine if the concrete can be recycled. If recyclable, the concrete would be crushed on-site and transported to construction site(s) for use as road base material or as backfill material at depths of greater than 3 feet below final grade.

The granular fill beneath the hard surface protective layer would be removed. The material would be transported to an on-site facility to be washed. Water generated from the washing activities would be loaded in appropriate containers, handled, and transported by a licensed waste hauler to an approved disposal facility. The washed material would be reused on-site as granular fill.

Removal of High Density Polyethylene Liners, Drainage Layers, and Leak Detection System

In each evaporation pond, the HDPE liners, drainage layers, and leak detection, collection, and recovery sumps would be removed. The materials would be sent to a disposal facility. Confirmation sampling would be conducted on the clay layer of the evaporation pond liner system after the removal of the 40-mil HDPE geomembrane.

Site Restoration

The evaporation ponds would be backfilled with native soil to match the existing surrounding grade and to restore drainage function. The berm surrounding each evaporation pond and the washed granular material would be the primary backfill material. The upper 6 inches of soil would be decompacted as necessary and remediated to accepted conditions.

2.5.6 Disturbance Assumptions

The estimated disturbance requirement for the construction and operation of the Proposed Action are detailed in Table 2.9 and Table 2.10. Temporary disturbance areas would only be used during the SSEP's construction phase, and the areas would immediately be reclaimed following termination of their use (Note: temporary disturbances may result in short-term impacts [persisting five years or less] or long-term impacts [persisting greater than five years] depending on how and where they occur. This is discussed in

Chapter 4. Permanent disturbances are those that would persist for the life of the SSEP. Where temporary disturbances would occur in areas of permanent disturbance, they are not included in the acres presented. Several of the temporary and permanent disturbance areas in these tables overlap (such as gas and water pipeline ROWs), so these areas are not mutually exclusive. Please refer to Table 2.15 (Comparison of Alternatives) for the acres of temporary and permanent disturbance under the Proposed Action and the other alternatives.

Table 2.9 Temporary Disturbance Assumptions

Temporary Disturbance Areas	Assumed Dimension
Transmission line construction laydown/assembly	100’ × 200’
Transmission conductoring pulling area[a]	50’ × 140’
Transmission pole pad construction area[b]	50’ × 50’
Gas line construction ROW	50’ width
Water line construction ROW	50’ width
Site, spur, and well field access roads construction ROW	50’ width
Any shared ROW (e.g., road and pipeline)	65’ width

[a] Except three-pole structures, which would be approximately 75’ x 140’.
[b] Except three-pole structures, which would be approximately 50’ x 150’.

Table 2.10 Permanent Disturbance Assumptions

Permanent Disturbance	Assumed Dimension
Transmission pole pads[a]	40’ × 40’
Transmission line spur roads	24’
Switchyard expansion	n/a
Primary access road (from SR-85 to solar fields)	50’
Secondary access roads (improved existing roads and new roads)	24’
Gas line	n/a
Water line	n/a
Groundwater well area	200’ × 200’

[a] Except three-pole structures, which would be approximately 40’ x 140’.

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

2.6.1 Introduction

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 technology considered under the Proposed Action. Because no water would be used for primary cooling, consumptive evaporative losses would be considerably lower under this alternative than under the other action alternatives. Alternative A would require approximately 116 to 151 afy for operations, which would be supplied by two groundwater wells located in the same area as under the other action alternatives. Under Alternative A, dry cooling would be less efficient than wet cooling and would generate less electricity from the same sized solar field. There is no additional space within the SSEP layout to increase the solar field. The size of the solar field within the main project footprint was maximized to the extent possible; however, limitations in land availability precluded optimizing the dry-cooled solar field, resulting in a decrease in anticipated electrical production. Total solar generation under Alternative A would be approximately 9% less than the anticipated generation under the Proposed Action.

Based on publicly available sources (LAZARD 2008, SEIA 2010, WorleyParsons Group 2008), the estimated capital cost of the Alternative A facility would be between $1.8 and $2.5 billion (see Table 2.15). This cost includes capitalized interest costs during construction, operation and maintenance costs, and fuel prices. **In general, most aspects of Alternative A 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 under Alternative A.** The alternatives are quantitatively compared in Section 2.12, Table 2.15.

2.6.2 Proposed Facilities and Infrastructure

2.6.2.1 COOLING SYSTEM

Under Alternative A, the SSEP would use an ACC for power plant cooling (instead of a wet-cooling tower, as under the Proposed Action and Alternative B [Reduced Footprint]). ACCs generally stand approximately 95–100 feet above ground surface, compared to wet cooling towers, which generally stand 45–50 feet above grade. One ACC would be installed in each power block. In addition, each power block would include two "wet surface air coolers" that would be used for auxiliary cooling. Because this alternative would not employ a cooling tower, make-up and evaporative losses would be minimized.

The cooling system for heat rejection from the steam cycle would incorporate an ACC unit. Steam would exhaust directly from the steam turbine generator to an exhaust header that leads to a multi-cell ACC. In the ACC, the wet steam is converted to condensate in a series of tubes with external fins to facilitate better heat transfer. On the outside of the tubes, ambient air is forced over the tubes using large mechanical fans. The exhaust steam is distributed throughout the ACC through a series of smaller and smaller headers. At low points in each ACC, the condensate water is collected and returned to the solar steam generator. All cooling takes place by convective heat transfer to the air.

An auxiliary cooling system capable of providing lower cooling water temperatures than a dry-cooled system must be provided for multiple equipment heat loads. A wet surface air cooler (WSAC) would be installed to provide cooling of the auxiliary system circulating water. The closed-loop circulating water would pass through tubes the same way as the steam in the ACC. The WSAC would operate in the same

fashion as the ACC with the added feature of water being sprayed over the tubes to enable evaporative cooling and thereby lowering the attainable circulating water temperature in the tubes. Water sprayed over the tubes would fall into a water collection basin and then discharged to the evaporation ponds. The WSAC would be designed as a once-through system thereby not requiring additional circulating pumps for the spray water or a substantial basin to act as a hot well.

2.6.2.2 EVAPORATIVE PONDS

No cooling water blowdown (wastewater) would be generated under Alternative A. Therefore, the evaporation ponds would only handle wastewater from the WSAC blowdown and RO reject (see description of dry-cooling process below), and would be smaller than under the Proposed Action (Map 5). The same number of ponds (six) would be used, but each pond would be approximately 2 acres for 125 MW and 4 acres for 250 MW (instead of 10 acres and 20 acres, respectively, under the Proposed Action).

2.6.2.3 WELL FIELD

Water demands under Alternative A would require two groundwater wells (compared to four under the Proposed Action). Although the water needs of the SSEP could likely be met with the capacity of a single well, two wells would be drilled and developed to ensure redundancy and reliability. In addition, the groundwater production well field would be designed with a capacity of 1,000 gpm (compared to 3,000 gpm under the Proposed Action).

2.6.2.4 POWER BLOCKS

A slightly higher percent of the steam turbine generator output would be used on-site for plant auxiliary loads such as motors, heaters, control systems, and general facility loads (e.g., lighting and heating, ventilation, and air conditioning) under Alternative A than under the Proposed Action. For the purposes of analysis, this on-site load is still assumed to be approximately 10%.

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 per year, or 3,549 million standard cubic feet per year.

2.6.3 Construction and Operations

The construction schedule under Alternative A would be the same as under the Proposed Action. However, construction would require an average of 900 employees (instead of 870) over the same 39 month period due to the longer ACC construction time.

2.6.4 Water Use and Waste Management

2.6.4.1 WATER REQUIREMENTS

As described above, the cooling system used under Alternative A would use air rather than water for heat rejection from the steam cycle. The estimated consumptive water usage under this alternative is show in Table 2.11.

Table 2.11 Typical Water Usage Estimate – Alternative A

Water Use	Annualized Average Daily Rate[1] (acre-feet/day)	Estimated Peak Daily Rate[2] (acre-feet/day)	Estimated Annual Use[1] (acre-feet)
Maximum (assumes 25% energy production by gas co-firing)	0.4	0.4	151
Minimum (assumes solar production only)	0.3	0.4	116

[1] The estimate of groundwater usage is based on an average daily consumption rate for one 125-MW power plant and one 250-MW plant.
[2] The peak rate is the instantaneous maximum for summer usage for one 125-MW power plant and one 250-MW power plant.

2.6.4.2 WATER TREATMENT

A water treatment plan was developed based on initial water analyses from on-site test wells. The raw water, process water, and mirror washing water all require on-site treatment, which varies according to the quality required for each of these uses. The power plant's design would consist of a pre-treatment system upstream of the raw water, and a demineralized water system. This water treatment design would be further evaluated on receipt of additional site-specific water quality data.

A multimedia filter was selected for pre-treatment upstream of the raw water tank. The multimedia filter would remove solids or particulates from the make-up water that may damage or reduce the efficiency of the WSAC included for auxiliary cooling. The waste stream from the multimedia filter unit would be discharged into the on-site evaporation ponds. No cooling water chemical treatment would be required because the WSAC would be a "once-through" design with a cycle of concentration of one.

The demineralized water treatment system would consist of RO units followed by either mixed bed demineralizers (MBD) or electrodeionization units (EDI). The RO train would be fed by the raw water tank. RO product (permeate) would then be fed to the MBD or EDI train where demineralized water is generated and stored in the demineralized water storage tank for steam-cycle makeup and mirror washing. The RO waste stream would be combined with the multimedia filter waste stream and discharged to the evaporation ponds.

There would be several tanks on-site that would contain the raw water, RO feedwater, and demineralized water, which would have the following capacity:

- Raw Water/Fire Water Storage Tank:
  - 125-MW unit: 500,000 gallons
  - 250-MW unit 1,000,000 gallons
- RO Feedwater Storage Tank:
  - 125-MW unit: 100,000 gallons
  - 250-MW unit: 200,000 gallons
- Demineralized Water Storage Tank:
  - 125-MW unit: 75,000 gallons
  - 250-MW unit: 150,000 gallons

Tanks would be sized to provide sufficient water to support operation of the plant during peak operating conditions, as well as to provide a 12-hour storage capacity to enable continued operation when a failure

interrupts water or wastewater treatment capabilities. The tanks would also allow the plant to level the water supply requirements on a 24-hour basis and accommodate mid-day demand peaks. The raw water/fire water storage tank would provide water for plant operation and fire protection.

2.6.5 Termination and Reclamation

The methods, timing, and requirements for termination and reclamation would be the same under Alternative A as under the Proposed Action. Because of differences in the design and layout of the well field, slightly different acreages would be reclaimed on termination of the SSEP.

2.7 Sub-alternative A1: Photovoltaic

2.7.1 Introduction

Sub-alternative A1 was developed to respond to public and agency comments on water consumption. It was developed after the draft EIS due to advancements in technology and a change in market conditions that allowed a reconsideration of PV technology as a viable alternative (see Section 1.2). As described in Section 2.1, the addition of this sub-alternative did not require supplementation of the EIS because it is within the spectrum of alternative impacts already considered. Under Sub-alternative A1, the SSEP would be constructed as a 300-MW PV power plant. The plant would generate electricity using multiple arrays of PV panels electrically connected to associated power inverter units. The current from the power inverters would be gathered by an internal electrical collection system and transformed to transmission voltage prior to leaving the Project Area (Figure 2.12). Sub-alternative A1 would not require any consumptive water use for the generation of electricity, although limited quantities of water would be required for potable use by employees, panel washing, and other general uses. Along with a reduction of generating capacity, this sub-alternative would allow a reduced project footprint and decreased water consumption relative to the Proposed Action. It would also avoid other resources raised as issues by the public and agency cooperators, including wildlife habitat and travel corridors, pending FEMA floodplains, air quality point sources and vapor plumes, and nearby residences.

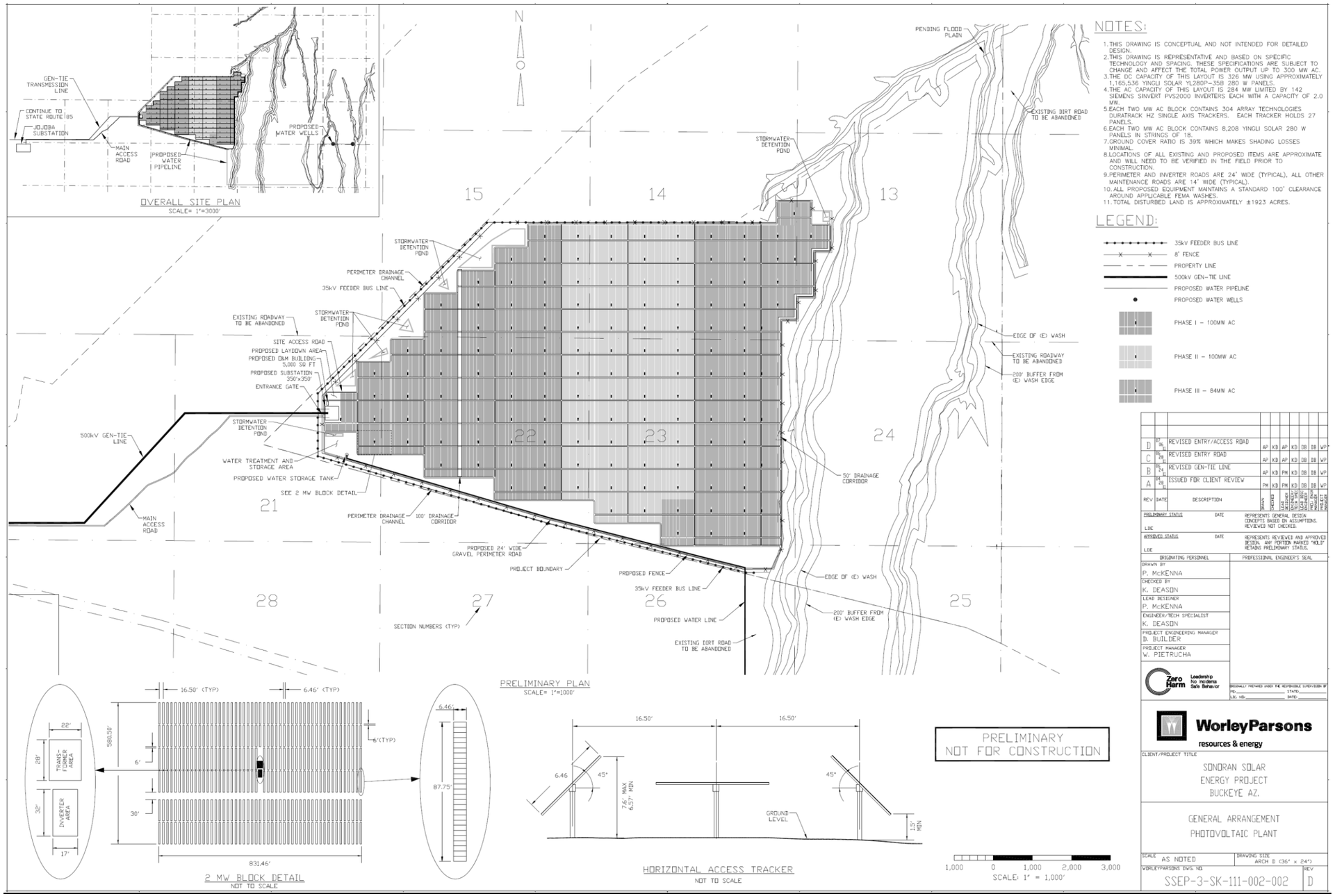

Figure 2.12. Conceptual site layout under Sub-alternative A1.

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The main project footprint (not including linear features such as roads, pipelines, or transmission lines) under Sub-alternative A1 would occupy approximately 1,907 acres, or 56% of the footprint under the Proposed Action (Map 4). Sub-alternative A1 would require approximately 33 afy of water for operations (and an annual average of 65 afy of water over the life of the project with construction use factored in), which would be supplied by up to two groundwater wells in the same area as under the other action alternatives. Total solar generation would be approximately 20% less than the anticipated generation under the Proposed Action. Based on publicly available sources (Barbose et al. 2011, SEIA 2010, and WorleyParsons Group 2008), the estimated capital cost of the Sub-alternative A1 facility would be between $1.1 and $1.3 billion (see Table 2.15). This does not include labor, land, or operation and maintenance costs.

2.7.1.1 FACILITY LOCATIONS AND COMPONENTS

Under Sub-alternative A1, the total project footprint (all temporary and permanent use areas) would be approximately 2,013 acres. All other location details would be the same as under the Proposed Action.

Sub-alternative A1 would consist of three major types of facilities: 1) PV panel arrays within a graded solar field (the main project footprint), 2) linear facilities, and 3) a well field. Each of these components is shown on Figure 2.12 and Map 4 and explained in detail in the following sections. The amount of temporary (construction) and permanent (life of project) disturbance required for these facilities is described in detail in Sections 2.5.6 (Disturbance Assumptions for the Proposed Action, which would be the same as for this sub-alternative) and 2.13. Road improvements would be similar to the Proposed Action.

The PV panel array facilities would be located in approximately 1,907 graded acres in the primary project footprint. The entire primary footprint would be enclosed by fences. The Sub-alternative A1 facilities would include the following major components or systems:

- PV modules/arrays
- Solar trackers and/or fixed support structures
- Electrical collection system
- Step-up transformation/on-site switchyard
- Generation tie-line/utility interconnection
- Administration buildings and local warehouses
- Drainage collection and discharge facilities

As under the Proposed Action, a well field would be developed to supply water for the sub-alternative during the construction and operation phases. The well field would include up to two wells with on-site pumping facilities. Linear facilities would be similar to the Proposed Action, although no natural gas pipeline would be required.

2.7.1.2 PROCESS DESCRIPTION

Sub-alternative A1would use state-of-the-art PV technology where the sun's light energy is converted directly into DC electrical energy within the PV panels. PV panels generate electricity using the photoelectric effect, whereby the materials in the panels absorb sunlight's energy in the form of photons and release electrons. The capture of these free electrons produces an electrical current that can be collected and supplied to the electrical grid.

2.7.2 Proposed Facilities and Infrastructure

Sub-alternative A1would not incorporate any type of co-fire generation or TES into its design. The SSEP would produce electricity only when the available solar resource is sufficient. Consequently, substantial facility differences exist between Sub-alternative A1 and other alternatives discussed in this chapter.

2.7.2.1 PV PANEL ARRAY FACILITIES

2.7.2.1.1 PV Modules and Arrays

Under Sub-alternative A1, one hundred and fifty 2-MW AC arrays would be constructed for a total generating capacity of 300 MW. Each array would consist of a group of PV panels, referred to as "modules," which are grouped together to form a solar array. The size of the array is based on the capacity of the equipment selected and desired overall voltage and current output. Currently, the 2-MW arrays are proposed for the sub-alternative. However, solar energy technologies continue to evolve at a rapid rate; as a result, the exact arrangement and nature of the PV systems would be determined during the final design. Preliminary design features of the PV modules and arrays are provided in Figure 2.12. Each 2-MW array would consist of a transformer and inverter area, surrounded by 88-foot-wide by 6-foot-high modules, for a total of approximately 11 acres.

2.7.2.1.2 Solar Trackers and/or Fixed Support Structures

Exact module support structure types would be determined during the final design. The single axis tracker configuration is more complicated and is discussed in more detail below. A fixed support structure is also possible. In this application, the fixed structure would orient the panels in a permanent position toward the south at a certain angle to optimize production throughout the year without any mechanical movement or drive motors.

The PV module rows would be oriented north-south on single-axis trackers spaced approximately 16.5 feet between rows (post to post) to accommodate 12-foot clearance for maintenance vehicles and panel access and to increase the energy production from the arrays. Two types of tracker systems could be selected for Sub-alternative A1: a ganged system or a stand-alone tracker system. A ganged tracker system uses one motor to control multiple rows of PV modules through a series of mechanical linkages and gearboxes. A stand-alone system uses a single motor and gearbox for each row of PV modules. The exact tracker manufacturer and model would be determined in the final design; however, both trackers would function identically in terms of following the motion of the sun.

On-site power requirements for Sub-alternative A1 would be dependent on the tracker technology and any other ancillary plant equipment (such as lighting, security, etc). The tracker used in the preliminary design has a parasitic load of ~350 kilowatt-hours (kWh) per MW per year. This correlates to ~12 kW, which is roughly 0.004% of the plant's total power rating. Total on-site power demands (including trackers) would be under 5% during operating hours and under 0.5% during nonoperating hours due to the tare losses of the inverters (power consumed by the devices themselves). Therefore, the parasitic power consumption would be lower than the 10% on-site power load for the Proposed Action.

2.7.2.1.3 Plant Auxiliary Facilities

Sub-alternative A1would include an operations and maintenance facility, located near the primary access road and the 24-foot-wide security gate. The operations and maintenance facility would be a pre-engineered metal building with metal siding and roof. The building would provide a small administrative area, a work area for performing minor repairs, and a storage area for spare parts, transformer oil, and

other incidental chemicals. The total square footage of the various SSEP buildings and pre-engineered enclosures (e.g., control rooms, administration building, and warehouse) would be approximately 3,000 square feet (the Proposed Action would use approximately 60,000 square feet for the 250-MW and 125-MW units, for a difference of approximately 57,000 square feet less than the Proposed Action).

2.7.2.2 ELECTRICAL COLLECTION SYSTEM

PV modules generate a low-voltage DC electrical output that is not suitable for direct connection to the AC utility grid used in the United States. The electrical collection system would be designed to 1) transform the output power from the PV modules from DC to AC and then from low voltage to transmission level voltage for connection to the grid, and 2) supply power to each tracker's auxiliary electrical equipment and systems.

The DC current from the PV arrays would be transmitted to voltage inverters through underground DC electrical cables. As currently configured, Sub-alternative A1 would use 150 power inverter packages to accomplish the DC to AC power conversion process. The number of modules connected to each inverter is dependent on the specific model of modules, inverters, and their capacities, which would be selected in the final design. In the current design, 8,208 280-W DC panels would be connected to each 2-MW AC inverter package. This design uses a small amount of over-paneling so that the maximum DC power for each array (2.298-MW DC) is greater than the inverter package's power (2.0-MW AC). This over-paneling design forces the inverters to "clip" a small amount of energy during peak production hours (this is the DC input that cannot be used by the inverter due to inverter capacity). However, this allows for greater electrical production in off-peak hours for an overall increase in power production. The resulting AC current from each individual inverter package would then be routed through underground AC cables to the corresponding medium voltage, step-up transformer. Based on the preliminary design, the output voltage from each inverter (265 volts) would be increased to the desired substation feed voltage (34.5 kV) by these step-up transformers.

2.7.2.3 EVAPORATION PONDS

No cooling water blowdown (wastewater) would be generated under Sub-alternative A1. Therefore, the evaporation pond would only handle wastewater from the RO reject and would be smaller than under the Proposed Action. Only one approximately 1-acre pond would be required (instead of one 10-acre and one 20-acre pond under the Proposed Action).

2.7.2.4 LAND-TREATMENT UNIT

PV would not use HTF; therefore, no land-treatment unit would be required for Sub-alternative A1.

2.7.2.5 ON-SITE SWITCHYARD AND TRANSMISSION FACILITIES

2.7.2.5.1 Step-up Transformation/On-site Switchyard

The AC current would leave the step-up transformers via underground 34.5-kV lateral lines, which would be routed into overhead electrical feeder lines along the perimeter of the main project footprint. The feeder lines would be supported by double circuit 34.5-kV poles (Figure 2.13) and would dead end at the SSEP substation (see Figure 2.12). The SSEP substation would be located on an approximately 2.8-acre area on the western side of the solar field. The substation would consist of parallel sets of internal power distribution systems, (i.e., 34.5-kV buses and circuit breakers, disconnect switches, and main step-up transformers) to increase the voltage to the 500-kV transmission line voltage.

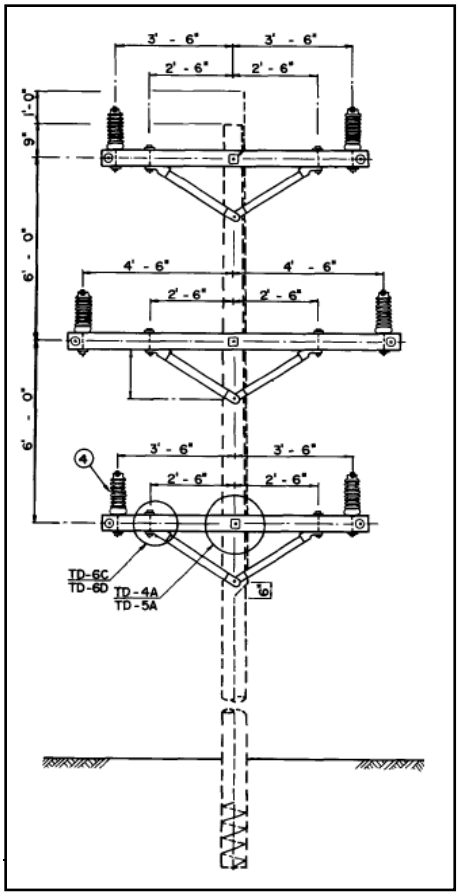

Figure 2.13 Typical feeder line structure.

The power from the combined solar arrays would be transformed from the medium distribution voltage (34.5 kV) to the 500-kV transmission line voltage. The substation and interconnections would be built for 500 kV and would operate at that nominal voltage.

2.7.2.5.2 Interconnection to the Jojoba 500-kV Switchyard

Transmission of electrical power to the grid under Sub-alternative A1 would be the same as under the Proposed Action.

2.7.2.5.3 Generation Tie Line

Transmission of electrical power through a gen-tie line under Sub-alternative A1 would be the same as under the Proposed Action.

2.7.2.6 NATURAL GAS PIPELINE

Sub-alternative A1, as a PV project, would not use natural gas co-firing. Consequently, no natural gas pipeline would be required as part of Sub-alternative A1.

2.7.2.7 OFF-SITE DRAINAGE COLLECTION AND DISCHARGE FACILITIES

Off-site drainage collection and discharge facilities for Sub-alternative A1 would be similar in concept to the Proposed Action. Off-site stormwater runoff would be collected and conveyed around the perimeter of the solar field, where it would be released back into the natural washes in a manner similar to the existing condition. The collection channels would be designed to collect and convey the 100-year, 24-hour storm event around the development, without impacting the SSEP. The channel bends would be rounded as much as practicable given available land constraints. In addition, the channel banks would be super-elevated per standard drainage engineering practice. A channel on the northwest side of the Project Area would serve to distribute the flow back into the natural washes at a rate equal to or less than the existing condition for each wash. There would be eight stormwater outfalls along the western edge of the Project Area and one stormwater outfall to a wash in the northeast portion of the Project Area (Map 4). The northeast stormwater outfall would discharge both rerouted water and water from the stormwater detention basins.

2.7.2.8 ON-SITE STORMWATER MANAGEMENT

Management of stormwater generated from Sub-alternative A1 would be similar in concept to the Proposed Action. The overall on-site drainage concept for Sub-alternative A1 is shown in Figure 2.14 and Maps 4 and 7. Stormwater generated on-site would sheet flow into smaller drainage channels, aligned east to west. These smaller east-west drainage channels would be compacted and stabilized trapezoidal earthen channels adjacent to (south of) the solar field interior access roads. The smaller channels would divert flows to larger drainage channels, aligned north to south adjacent to the solar field's perimeter road. The larger channels would be designed to be resistant to potential scour and would outfall into stormwater detention basins situated in the lower elevation areas of the solar field. Areas of the solar field that are in the Rainbow Wash watershed would be drained to a series of stormwater detention basins along the western side of the Project Area. The area of the solar field currently in the Waterman Wash watershed would drain to a detention basin in the north and east.

To the fullest extent possible, the detention basins would attenuate the post-development 100-year, 24-hour storm event runoff from the solar field and would outfall into the natural drainage system downstream (Rainbow Wash and the unnamed tributary to Waterman Wash) at or below the pre-developed 100-year, 24-hour storm event flow rate. The detention basins would discharge within 36 hours, thereby allowing sediments and on-site pollutants to settle out. The detention basins would also have emergency spillways to discharge runoff generated due to major rainfall events in excess of the 100-year, 24-hour storm. Emergency spillways would discharge into the proposed perimeter distribution channels, diverting the excessive flow away from the solar field. Riprap outlet protection at the stormwater outfalls and basin emergency spillways would dissipate the flows and protect these outlets from scouring the soil. The stormwater detention basins would outfall into the off-site conveyance channels (shown as dark blue arrows along the south and east perimeter of the Project Area on Figure 2.14) or directly into a natural wash at a rate at or below the pre-development 100-year 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.

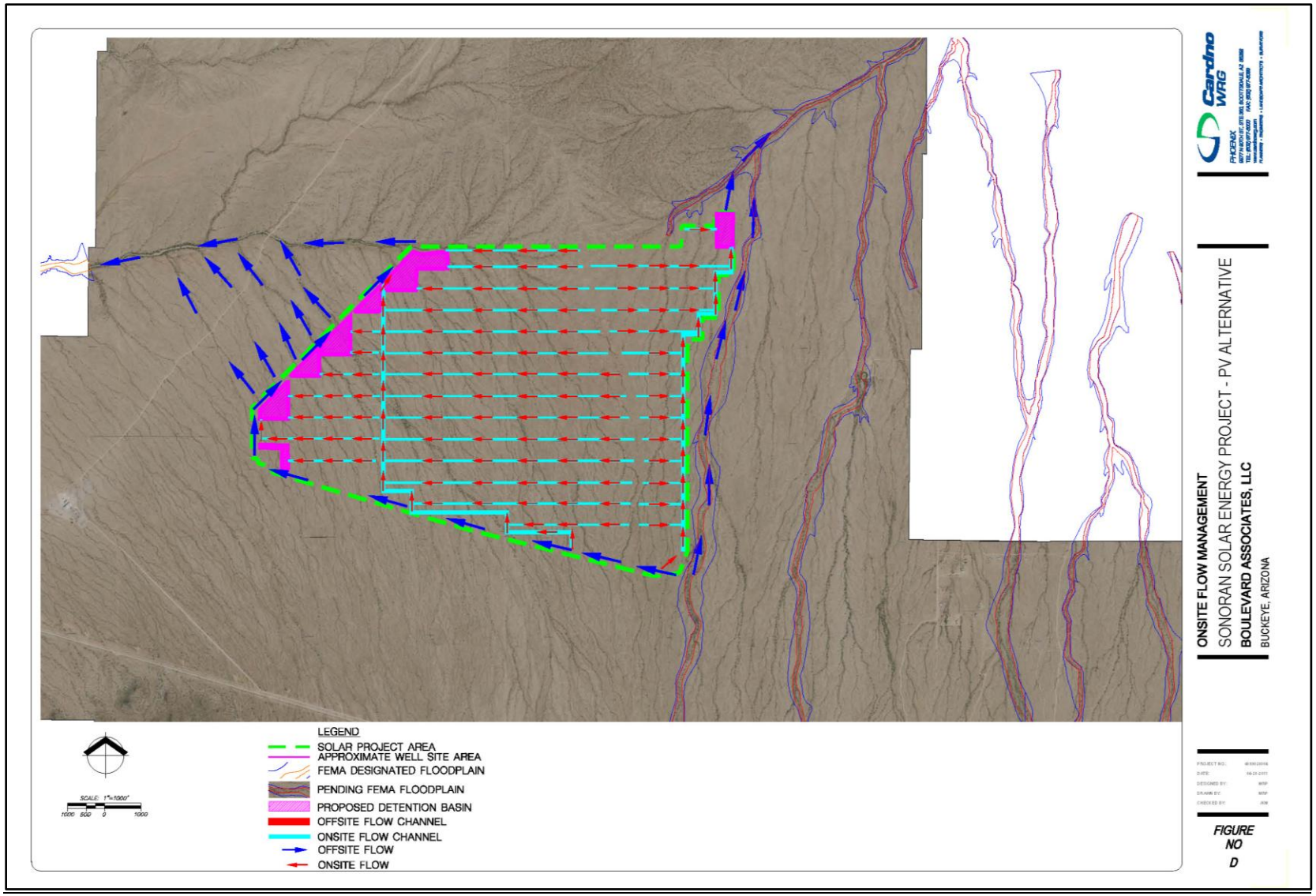

Figure 2.14 Conceptual post-construction drainage flow for Sub-alternative A1.
Note: the location and configuration of the basins in this figure are conceptual. Figure 2.12 shows a scaled configuration of the stormwater deten ion basins.

2.7.2.9 WELL FIELD

The groundwater production well field would be designed with up to two wells (and associated roads and pipelines) with a total capacity of 1,000–1,600 gpm (as compared to 3,000 gpm under the Proposed Action). Estimated total water demand would be 1,000 acre-feet during the 39-month construction period and 33 afy thereafter during plant operations. These wells would likely be operated individually on an as-needed basis because a PV facility does not require a continuous supply of water. The permanent water pipeline ROW would be 50 feet. All other design features would be similar to the Proposed Action.

2.7.2.10 ROADS AND ACCESS

Sub-alternative A1 access roads and transportation corridors would be the same as the Proposed Action.

2.7.2.11 PLANT AUXILIARY SYSTEMS

The following plant auxiliary systems would control, protect, and support Sub-alternative A1 and its operation.

2.7.2.11.1 Distributed Control System

The distributed control system under Sub-alternative A1 would be similar to that described for the Proposed Action.

2.7.2.11.2 Lighting System

Outdoor night lighting would be provided at the operations and maintenance building, water treatment areas, and the project substation. Some portable lighting could also be required for nighttime maintenance activities. All other lighting design features would be the same as the Proposed Action, other than having a smaller project footprint and two fewer wells.

2.7.2.11.3 Cathodic and Freeze Protection Systems

No cathodic and freeze protection systems would be used for Sub-alternative A1, because no HTF or underground metal piping would be needed.

2.7.2.12 FIRE PROTECTION

Regular project operations would have a low risk of introducing fires because of the lower temperatures compared to CST power and because most electric lines within the PV arrays would be buried, and most of the materials within the solar arrays would be noncombustible (aluminum, steel, or glass). To decrease the risk of fire, all vegetation underneath the solar modules would be managed with a BLM-approved herbicide. A pre-emergent herbicide would be applied in the spring, and spot foliar applications would be used throughout the year to limit vegetation.

During construction activities, a water truck or other portable trailer-mounted water tank would be kept on-site and available to workers for use in extinguishing small human-made fires. All vehicles working on-site would also carry a portable fire extinguisher. An emergency action plan (EAP) would designate responsibilities and actions to be taken in the event of an emergency during construction of the project. The EAP, including fire prevention and suppression, and a worker safety plan would be available to the BLM.

The fire protection systems for plant site operations could include a fire protection water system for protection of the operations and maintenance building, portable water tanks (e.g. "Buffalos"), and portable fire extinguishers. The project's fire protection water system would likely be supplied from a water storage tank located on the solar plant site near the main entrance.

Additional emergency response would be provided externally by local municipalities, if required. The proponent would develop an escape fire plan in consultation with the BLM. This plan would be approved by the BLM and become a part of the POD and authorization for the solar plant facility.

2.7.3 Construction and Operations

2.7.3.1 CONSTRUCTION AND INSTALLATION

Construction under Sub-alternative A1 would take the same amount of time as under the Proposed Action, although the construction would be staged in 100-MW-per-year increments. Initial construction activities, including mobilization, construction zone delineation, and establishment of temporary use areas, would be similar to the Proposed Action. Other construction phases would differ, however, as displayed in Table 2.12. This schedule is preliminary and could shift during project construction based on generation requirements, contractual milestones with off-takers, and emission thresholds from grading.

Table 2.12 Sub-alternative A1 Project Construction Plan

Activity	Month
Clear and grub; strip topsoil	Months 1–22
Install certified weed-free fiber rolls or silt fence at the base of slopes adjacent to delineated sensitive areas (i.e., washes), if any; Install or repair BMPs	Months 1, 11, 23, 35
Mass and finish grading	Months 1-29
Construct stormwater detention/evaporation areas	Months 1–3, 13–14, 25–26
Construct roads	Months 2–7
Construct reinforced concrete foundations	Months 7–8, 15–16, 27–28
Assemble and erect photovoltaic trackers and panels	Months 6–39
Construct gen-tie line	Months 8–12
Construct operations and maintenance building	Months 4-5
Construct substation	Months 4-7
Construct water storage tank	Months 6-7
Finish parking areas and roadways	Month 11
Commission and test	Months 11–12, 16–17, 21–22, 26–27, 31–32, 36–39

2.7.3.2 CONSTRUCTION AND OPERATIONS TRANSPORTATION NEEDS

Construction would require peak manpower of 378 people per day and an average manpower of 335 people per day. Peak daily trips to the Project Area under Sub-alternative A1 (deliveries and commuters) would total approximately 282 trips per day. Assuming approximately 30% of construction workers would carpool (on account of longer-than-normal commute times from population centers and the current price of fuel), 267 of these trips would be vehicles carrying construction workers to and from the Project Area each day during typical AM and PM peak hours. The remaining 15 trips would be truck deliveries of equipment and materials that would occur outside of the typical AM and PM peak hours. The average

daily construction travel to the Project Area would be approximately 247 trips per day (237 related to construction worker travel to and from the Project Area and 10 related to truck deliveries). The SSEP would require an operations staff of approximately 16 full-time employees, versus 82 full-time employees for the Proposed Action.

2.7.3.3 CIVIL WORKS CONSTRUCTION SEQUENCE

Temporary construction laydown, parking areas, and power source would be the same as the Proposed Action. The construction sequence for plant construction would also be similar to the Proposed Action and include site preparation, major equipment installation, and testing and commissioning. A detailed breakdown of the site's preliminary estimate of cut-and-fill volumes is provided below:

- Solar field, internal access roads, detention ponds, and diversion channels: 2,675,000 CY cut
- Solar field, internal access roads, detention ponds, and diversion channels: 2,145,000 CY fill
- Solar field, internal access roads, detention ponds, and diversion channels: 530,000 CY net cut (excess)
- Asphalt access road: 30 CY cut
- Asphalt access road: 390,000 CY fill
- Asphalt access road: 389,970 CY net fill (required)
- Project net: 530,000 CY cut – 389,970 fill = 140,030 CY cut (excess)

2.7.3.3.1 Generation Tie Line Construction Sequence

The gen-tie line construction sequence would be the same as under the Proposed Action.

2.7.3.3.2 Water Pipeline

The water pipeline would be designed to deliver groundwater pumped from the Sub-alternative A1 well-field to the main project footprint and would be completed early in the construction sequence to support other construction activities. Construction of water supply lines would take approximately three months. Pipeline design features and construction sequence would be the same as under the Proposed Action.

2.7.3.4 OPERATIONS

2.7.3.4.1 Operations Staff and Vehicles

Under Sub-alternative A1, the SSEP would be staffed by up to 16 operations personnel during the site's daytime working hours. Operations personnel would work a single shift from 7 AM to 4 PM, Monday through Friday. During time periods when the facility is not fully staffed, the facility would be monitored remotely from Boulevard's parent company's Fleet Performance and Diagnostic Center in Juno Beach, Florida. If emergency conditions are encountered, staff would be alerted and would return to the facility as required. Specialty personnel could also be located on-site during nonworking hours to perform specific maintenance functions as required. Operation and maintenance vehicles would include ¾-ton pick-up trucks and small utility vehicles to perform on-site welding, lubricating, panel washing, and other maintenance activities. In addition, flatbed trucks, dump trucks, front-end loaders may be present on-site at various times. Heavy-haul transport equipment would be brought on-site as needed for any major maintenance or equipment repair or replacement.

2.7.3.4.2 Operation and Maintenance Activities

Sub-alternative A1 facilities would be repainted on a regular basis to maintain their appearance and protect them from the elements. The PV panels would be washed approximately four times per year to increase the average optical transmittance of the flat panel surface. Panel washes would likely occur during off-peak hours. The demand for water to wash the panels is approximately 45,000 gpd. All other operation and maintenance activities would be similar to the Proposed Action.

2.7.4 Water Use and Waste Treatment

2.7.4.1 WATER TREATMENT AND USE

2.7.4.1.1 Water Requirements

Construction

During site preparation and grading activities, the main use of water would be for compaction and dust control. Smaller quantities would be required for preparation of the concrete required for foundations and other minor uses. Subsequent to the earthwork activities, water usage would provide dust suppression and normal water requirements that are associated with construction of the building, substation, internal access roads, and solar arrays.

The total water usage during construction would be approximately 1,000 acre-feet over a 39-month period. The total water usage during construction of the first 100 MW (Phase I) is estimated to be approximately 450 acre-feet. The water demand for Phase II and III construction should be reduced because most of the shared facilities and common infrastructure would have been installed as part of Phase I.

Operations

During operations, water use would be limited primarily to PV array washing with the potential for periodic dust control applications. The internal access roads would not be heavily traveled during normal operations, and a BLM-approved dust suppressant would be applied to control dust. Water could be used to supplement the dust suppressant in some areas on a limited basis.

The amount of water required to clean the PV modules four times per year is estimated to be approximately 10.5 million gpy (approximately 32 afy). Depending on site events and conditions, however, the cleaning frequency could be less. The water used for module cleaning would not require disposal due to the extremely high evaporation rate at the site.

Drinking (potable) water would also be supplied for workers on-site and is estimated to be approximately 10,000 gpm (approximately 0.5 afy), varying seasonally and by work activities. The potable water would be brought to the site by either tanker truck or via groundwater, using a water treatment system to treat the water to meet potable standards.

2.7.4.1.2 Water Treatment

All of the SSEP's nonpotable water needs under Sub-alternative A1 would be supplied from groundwater, which would require on-site treatment to ensure the necessary water quality for project activities.

The panel washing water would require an on-site demineralizer treatment process prior to use. A water treatment plan would be developed based on receipt of additional site-specific water quality data. However, the on-site demineralized water tank would have a capacity of 8 acre-feet, which is the approximate water usage for one wash of the entire project's PV panels.

On-site tanks would store the raw water, treated water, and potable water. Water storage tank volumes would total approximately 2,600,000 gallons and each would measure 50 feet tall and 100 feet in diameter.

2.7.4.2 WASTE MANAGEMENT

Project wastes would be similar to the Proposed Action. A variety of safety-related plans and programs would be developed and implemented to ensure safe handling, storage, and use of hazardous materials. Plant personnel would be supplied with appropriate PPE and would be properly trained in the use of PPE and the handling, use, and cleanup 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 cleanup materials would be stored on-site.

2.7.4.2.1 Wastewater

There would be two separate wastewater collection systems: one for the sanitary wastes and a second system to address the process wastewater for panel washing. Wastewater collection and disposal for the sanitary wastewater system would be similar to the Proposed Action. A trailer-mounted water treatment system would be used for panel washing. A small (approximately 1-acre) evaporation pond would be required for the RO reject water, whereas the demineralizer's spent resin could be transported off-site for regeneration.

2.7.4.2.2 Solid and Non-hazardous Waste

Generation and management of solid and nonhazardous wastes would be the same as under the Proposed Action.

2.7.4.2.3 Hazardous Solid and Liquid Wastes

Generation and management of hazardous solid and liquid wastes would be the same as under the Proposed Action.

2.7.5 Termination and Reclamation

Sub-alternative A1 would have a useful life of at least 20–25 years. All other termination and reclamation actions would be the same as under the Proposed Action.

2.7.6 Disturbance Assumptions

The estimated disturbance dimensions for construction and operation components of Sub-alternative A1 would be the same as described in Section 2.5.6 under the Proposed Action, except that no gas lines would be constructed.

2.8 Alternative B: Reduced Footprint

2.8.1 Introduction

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 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 reduction of generating capacity would allow a reduced project footprint and the avoidance of the eastern-most wash in the Project Area and an associated pond, which agency scoping identified as a wildlife habitat feature.

The main project footprint (not including linear features such as roads, pipelines, or transmission lines) under Alternative B would occupy approximately 2,136 acres, or 63% of the footprint under the Proposed Action (Map 6). Alternative B would require approximately 1,518–2,003 acre-feet of water per year for operations, which would be supplied by three groundwater wells in the same area as under the other action alternatives. Total solar generation would be approximately 33% less than the anticipated generation under the Proposed Action. Based on publicly available sources (LAZARD 2008, SEIA 2010, WorleyParsons Group 2008), the estimated capital cost of the Alternative B facility would be between $1.1 and $1.6 billion (see Table 2.15). This cost includes capitalized interest costs during construction, operation and maintenance costs, and fuel prices.

In general, most aspects of 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 under Alternative B. The alternatives are quantitatively compared in Section 2.12, Table 2.15.

2.8.2 Proposed Facilities and Infrastructure

Under Alternative B, the SSEP facilities and infrastructure would be scaled to two 125-MW facilities, rather than one 125-MW and one 250-MW facility as under the Proposed Action.

2.8.2.1 POWER BLOCK AND CO-FIRING BOILERS/HTF HEATERS

Under Alternative B, two co-firing boilers, one for each 125-MW unit, would be constructed. They would each have the same output as each of the boilers (three) under the Proposed Action.

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 per year or a maximum of 2,655,000 MMBtu per year.

2.8.2.2 ANCILLARY FACILITIES

The total square footage of the various SSEP buildings and pre-engineered enclosures (e.g., control rooms, administration building, warehouse, electrical equipment enclosures, fire pumps, and diesel generators) would be approximately 22,000 square feet for each 125-MW unit (the Proposed Action would use approximately 38,000 square feet for the 250-MW unit and 22,000 square feet for the 125-MW unit, for a difference of approximately 16,000 square feet less than the Proposed Action).

2.8.2.3 WELL FIELD

The groundwater production well field would be designed with three wells (and associated roads and pipelines) with a total a capacity of 2,000 gpm (as compared to 3,000 gpm under the Proposed Action).

2.8.2.4 EVAPORATION PONDS

Each 125-MW unit would have three 10-acre, double-lined evaporation ponds (60 acres total for both units). This is 30 fewer acres than under the Proposed Action.

2.8.2.5 LAND-TREATMENT UNIT

The SSEP would be constructed with two 5-acre, land-treatment units (compared to a total of 15 acres under the Proposed Action).

2.8.3 Construction and Operations

Construction of each unit under Alternative B would take approximately 25 to 28 months, with a total construction period of approximately 37 months (2 months less than under the Proposed Action). Because the second unit constructed under Alternative B would have a 125-MW capacity, rather than the 250 MW described under the Proposed Action, the construction schedule for the second unit would be shortened. In particular, the following construction phases for the second unit would be shorter under Alternative B than under the Proposed Action (as shown for the Proposed Action in Table 2.5).

- Assemble and erect parabolic troughs: Months 12–24
- Construct power block: Months 13–31
- Construct reinforced concrete foundations: Months 12–18
- Commissioning and testing: Months 33–37

Construction would require peak manpower of 1,350 people per day and an average manpower of 750 people per day. Peak daily trips to the SSEP site under Alternative B (deliveries and commuters) would total approximately 950 trips per day, assuming a 70% carpool factor. The average daily construction travel to the site would be approximately 600 trips per day.

Under Alternative B, the SSEP would require an operations staff of approximately 70 full-time employees, versus 82 full-time employees for the Proposed Action.

2.8.4 Water Use and Waste Management

2.8.4.1 WATER REQUIREMENTS

Under Alternative B, the same cooling method would be used as under the Proposed Action. However, water usage would be reduced along with the size of the solar field and the capacity of the steam turbine generators. The estimated water use under Alternative B is shown in Table 2.13.

Table 2.13 Typical Water Usage Estimate – Alternative B

Water Use	Annualized Average Daily Rate[1] (acre-feet/day)	Estimated Peak Daily Rate[2] (acre-feet/day)	Estimated Annual Use[1] (acre-feet)
Maximum (assumes 25% energy production by gas co-firing)	5.5	10.2	2,003
Minimum (assumes solar production only)	4.2	7.8	1,518

[1] The estimate of groundwater usage is based on an average daily consumption rate for two 125-MW power plants.
[2] The peak rate is the instantaneous maximum for summer usage for two 125-MW power plants.

2.8.4.2 WATER TREATMENT

Treated water storage tanks would reflect the requirements for two 125-MW units (rather than one 125-MW unit and one 250-MW unit):

- Raw water/fire water storage tank: 2 × 125-MW units: 2×500,000 gallons
- RO feedwater storage tank: 2 × 125-MW units: 2 x 100,000 gallons
- Demineralized water storage tank: 2 × 125-MW units: 2×75,000 gallons

2.8.5 Termination and Reclamation

The methods, timing, and requirements for termination and reclamation would be the same under Alternative B as under the Proposed Action. Because of differences in the design and layout of the solar field and well field, different acreages would be reclaimed on termination of the SSEP.

2.9 Reduced Water Use Option: Brine Concentrator

An optional component, a brine concentrator, could be added to either of the action alternatives that would use a wet-cooling system (the Proposed Action and Alternative B); its effects are considered under each of these alternatives in Chapter 4. The water treatment design under the Proposed Action and Alternative B includes pre-treatment and post-treatment systems, which would consist of multimedia filters and a two-pass RO system. A brine concentrator is a piece of equipment that can be added to the post-treatment system. The brine concentrator is fed by the osmosis reject (concentrate) stream from the second pass osmosis train. A steam or electric heat source evaporates the pure water from this salty concentrate, which serves to increase the brine concentration of the remaining liquid. The additional heat requirement for this piece of equipment would result in a slight decrease in the SSEP's electrical output. The brine is recirculated until the salts reach their solubility limits. When the brine reaches this limit, a blowdown valve would open and dump the concentrated brine solution to the evaporation ponds. The pure water evaporated during this concentration process is condensed by a heat exchanger and recycled back to the cooling tower. The brine concentrator would be located in the power block area.

The use of a brine concentrator would reduce the volume of wastewater exiting the facility. Its use would also allow a reduction in evaporation pond sizes, and a reduction in plant water consumption. In general, the capital and operating costs of the brine concentrator exceed the costs of installing and operating larger evaporation ponds. The water savings from this type of system under the wet-cooled alternatives (the Proposed Action and Alternative B) would be approximately 7% or less (see Figure 2.16). The largest water consumers in a wet-cooled facility are the cooling towers, where a great deal of water is evaporated (greater than 85% of a plant's use). The use of a brine concentrator would have no effect on the evaporation rates in the cooling towers.

2.10 Generation Tie Line Option

As part of the Arizona Corporation Commission CEC process (see Section 1.6.3 for a description), Boulevard has developed an alternate gen-tie line alignment, which could be applied to any of the action alternatives. Because this optional route would meet the purpose and need for the project and could feasibly be implemented, BLM is considering it in this final EIS as an alternative (or optional) 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 near the project, as well as an alternate route through existing designated utility corridors that may be subject to future development.

The Gen-tie Line Option would be routed in a generally southwestern direction and would use an existing utility corridor, as described in Section 2.5.2.5.3. The Gen-tie Line Option would be initially routed directly south along a new road and then make a 90 degree turn to the west, also along a new road. It would then extend westward to the Jojoba Switchyard, as shown on Map 3, for a total of 3.4 miles under the Proposed Action. This represents an increase of approximately 13% as compared to the original gen-tie alignment (see Table 2.15). There would also be approximately 10 pulling sites (as compared to six in the original alignment) required to install the conductors.

A supplemental EIS was not prepared because no supplemental documentation is needed for the BLM to make a reasoned decision between alternatives to the proposed federal action. The Gen-tie Line Option would result in impacts of the same nature, to the same resources, and of the same approximate extent (within 1%) as those considered in the draft EIS, and it would not result in any unique site-specific impacts not considered in the draft EIS.

2.11 Alternatives Considered but Eliminated from Detailed Analysis

Several alternatives were considered during the EIS process but eliminated from detailed analysis. In general, the following reasons may be considered grounds for eliminating an alternative (BLM Handbook H-1790-1, 6.6.3):

- It is ineffective (it would not respond to the purpose and need).
- It is technically or economically infeasible.
- It is inconsistent with the basic policy objectives for the management of the area.
- Its implementation is remote or speculative.
- It is substantially similar in design to an alternative that is analyzed.
- It would have substantially similar effects to an alternative that is analyzed.

The specific alternatives that were eliminated from detailed analysis are discussed below, along with the rationale for their elimination.

2.11.1 Original Application/Larger Project

Boulevard originally filed an SF-299 application with the BLM's Lower Sonoran Field Office (LSFO) in June 2007. In October 2008, at the request of the BLM, Boulevard submitted a preliminary POD. Based primarily on the size and topography of the proposed project site and with limited field reconnaissance, the initial POD proposed a 500-MW solar facility consisting of two separate, 250-MW generating stations.

As proposed, the 500-MW site would have encroached on two significant (1-mile wide) utility corridors; one in the southern portion of the layout and the other on the northwest side of the site. As such, a Resource Plan Amendment would have been required to develop the SSEP as a 500-MW facility, as originally proposed. Additionally, constricting these corridors would pose significant challenges to the local utility providers and to the BLM, and the plan amendment process would add months to an already tight permitting schedule. As such, the original configuration was eliminated as an alternative to avoid encroachment into the utility corridors.

Early in the biotic and abiotic field reconnaissance process, Boulevard field crews noted the relatively large drainage features that traverse the northern portion of the requested ROW. Specifically, Rainbow Wash and an unnamed tributary to Waterman Wash are oriented in a generally east to west direction across the northern one third of the site, effectively creating a natural boundary. Rather than moving forward with an alternative that would require re-routing these natural drainage features to accommodate the facility footprint, Boulevard voluntarily elected instead to use these washes as a northern boundary and design the facility in such a way as to avoid any impacts to the washes and their associated xeroriparian vegetation.

In order to avoid the utility corridors to the south and north-west and the primary washes to the north, the original proposal was eliminated from further analysis. As a result, Boulevard reduced its design goals for the site and reduced the overall facility size from the originally proposed 500 MW, to a more compact 375-MW design.

2.11.2 Hybrid Cooling

In a hybrid cooling scenario, the wet cooling and dry-cooling technologies described under the Proposed Action and Alternative A would be combined and used in tandem. This combined system would result in partially reduced water use and a lower electrical generation penalty than would be seen with the use of the fully dry-cooled system in Alternative A. A hybrid cooling system essentially requires the construction and operation of both a dry-cooling system and a wet-cooling system in a single plant, as described below in Section 2.11.2.1. This would result in a higher capital expenditure to purchase and construct both systems and a higher cost over the life of the project to operate both systems. A hybrid system does not achieve the same level of water savings as a dry-cooled system for the associated costs. Because of the hybrid system's increased cost and because it would not provide environmental benefits comparable to a dry-cooled system (considered under Alternative A), this alternative has not been carried forward for detailed analysis.

2.11.2.1 TECHNOLOGY AND PRINCIPLES OF OPERATION

In a hybrid-cooled facility, the cooling duty-cycle for the wet and dry-cooling systems can be designed in almost any ratio. In a performance (electrical production) optimized hybrid cooled system, dry cooling would be used when performance penalties are lowest (winter months), and wet cooling would be used when ambient temperature is the highest (summer months). Ideally, each cooling system would be designed to handle the full cooling duty load for the power plant in its respective generation period, which means that a full-sized wet and a nearly full-sized dry-cooling system would be required. In this case, given that the SSEP would produce the highest output in the summer months when solar resource is the highest, the optimally designed hybrid application would require a wet-cooling system essentially identical to the wet-cooled Proposed Action. In the cooler winter months when generation is lowest and environmental conditions make most sense for dry cooling, a smaller dry-cooling system would be required than what was discussed in Alternative A (dry cooling). Because winter electrical generation is lower, the system would be sized to accommodate the cooling requirements during the low solar conditions.

Such a design and operational philosophy works extremely well in high capacity factor, combined-cycle generating facilities, especially in moderate climates and this approach can yield significant water savings.

In a hot, desert environment where a facility operates primarily during the day when temperatures are the highest (i.e., the Proposed Action), the benefits described above begin to erode. Assuming an optimal configuration, the dry-cooling system would operate at the SSEP during the winter months when the ambient temperatures and solar insolation are the lowest, and where impacts from a loss of turbine efficiency would be the least. This time period also coincides with the months when the smallest amount of solar generation is possible. During the summer months when temperatures and solar generation potential are at their peak, the SSEP would be primarily wet-cooled. Because most of the solar plant's water use and generation occurs during the summer, the plant would be using primarily wet-cooling during the period when water consumption is the greatest.

2.11.2.2 WATER CONSUMPTION COMPARISON

In a hybrid facility, water consumption figures would fall somewhere between a wet- and dry-cooled plant and be completely dependent on how the two cooling systems were sized and their operating schedule. In a preliminary analysis, Boulevard evaluated a system with equally sized wet and dry systems. The systems were sufficiently sized to operate entirely wet at full capacity in the summer and entirely dry at full capacity in the winter. This configuration results in a 27% reduction in water use compared with the Proposed Action and water savings occur almost exclusively during winter months. Generation losses resulting from the decrease in turbine efficiency associated with the use of the hybrid system were calculated at roughly 66% of the losses that would be experienced under Alternative A (or a 6% loss compared to the Proposed Action). In summary, a hybrid system would sacrifice significant electrical generation and absorb a large increase in capital costs to realize a comparatively small savings in water consumption. The costs and impacts to the price of electricity would be similar to the dry-cooled system discussed as Alternative A.

2.11.2.3 COMPARISON OF COSTS

The total capital costs of a hybrid project change in proportion to the cooling duty ratio and would depend on the sizing of the wet and dry components. The largest cost driver is generally the wet-cooling system and treatment costs required to operate the plant during the peak summer months. This equipment (water treatment systems, cooling towers, evaporation ponds, etc.) would be sized nearly identically to the Proposed Action. Additionally, a hybrid project would also bear the cost of the dry-cooled components described in Alternative A (ACC). A hybrid-cooled plant designed in an optimal fashion begins to mimic the costs of a dry-cooled plant.

The costs of a hybrid system mimic a dry-cooled system because when the costs of these two different cooling systems are combined, the resulting cost is very similar (if not higher) than a stand-alone dry-cooled project. However, only marginal water savings result because most of the water demand results from the operation of the wet-cooling system during the summer when electrical generation and water usage is highest. To significantly reduce water consumption in a hybrid-cooled plant, a larger ACC (and the increased capital costs and lower electrical generation) is required to assume cooling duties during periods other than the low-solar resource winter months. To maximize generation during the peak summer months, the plant would still require a full-sized wet-cooling system. As the size of the dry-cooling system continues to increase, the capital costs eventually become higher than a stand-alone dry-cooled system without any of the environmental benefits (reduced water use). In this case, the dry-cooled plant makes more sense from both economic and environmental perspectives.

This same principle holds true for impacts to generation. The more often the dry-cooling system is used, the more significant the impacts are to annual generation. In a hybrid facility optimized for a desert environment, the impacts to generation are only a few percentage points below the impacts in a dry-cooled facility. Again, a hybrid facility's generation profile begins to mimic that of a dry-cooled facility.

In summary, although a hybrid-cooling alternative is a technically viable option, it would be inefficient and expensive relative to other alternatives carried forward for analysis. A hybrid design would require the capital and operational expenses of both wet and dry-cooled systems and this facility would be impacted by annual generation losses. In a hot, desert environment, this type of cooling technology does not provide the water savings that might be realized in a moderate climate. In summary, the environmental benefits (water savings) of a hybrid facility would be less substantial than the benefits for a dry-cooled facility, even though the costs would be similar. A hybrid facility would be significantly more expensive than the Proposed Action and this cost would ultimately be passed on to the Arizona rate-payer.

2.11.3 Utility-scale Photovoltaic Energy Production (draft EIS only)

PV technology was eliminated from further analysis in the draft EIS because at that time, it would not have provided the level of dispatchable renewable energy that Arizona utilities were seeking. In addition, large-scale PV facilities on the scale of the Proposed Action had not yet been constructed anywhere in the world, and the advantages and challenges of such a facility had not been quantifiably studied, analyzed, or understood. However, advancements in technology and a change in market conditions have allowed a reconsideration of PV technology in the final EIS. It is considered in detail as Sub-alternative A1 (see Section 2.7).

2.11.4 Residential (Rooftop) Photovoltaic Energy Production and Energy Conservation

During scoping several commenters suggested the consideration of residential, rooftop, or distributed energy production, as well as the consideration of combining such distributed generation with increased energy efficiency. The use of distributed generation and/or energy conservation is beyond the scope of this EIS and is therefore not considered for detailed analysis. Distributed generation and energy conservation would not provide a response to the ROW application submitted by Boulevard for the SSEP because Boulevard and the BLM have no discretion or decision-making power regarding the use and implementation of distributed generation and energy conservation in private homes or commercial buildings. Decisions related to residential rooftop, or distributed energy production reside with the private homeowner, commercial building owner, and other entities (e.g., local, county, and state governments) because these entities control the use of their rooftop and other surfaces for potential energy production. Likewise, although the implementation of energy conservation measures would reduce the demand for all forms of energy regardless of the method of energy production, decisions with regard to energy conservation measures reside outside the authority of the BLM and Boulevard. The BLM's decision with respect to Boulevard's ROW application has no bearing on these private entities' decisions.

2.11.5 Alternative Solar Technologies

Alternative solar technologies, including Stirling engines and power towers, were considered during the alternatives development stage, but they were eliminated from further consideration because these technologies have not been commercially proven on a utility scale. To date, nearly all Stirling engine and power tower projects have been deployed on a pilot scale and funded by the technology developers. In order to ensure project financing, Boulevard's development efforts are focused on technologies with proven track records and successful operating histories.

2.11.6 Alternate Locations

In addition to the ROW application for the SSEP, Boulevard has submitted applications for five other BLM locations and assessed the potential for solar development on a number of private land locations. Boulevard's applications on BLM land were for sites that proved suitable for solar development based on a number of exclusion criteria Boulevard used to screen for, identify, and prioritize other land sites (both privately owned and BLM-administered) for future solar development. Some of these exclusion criteria were as follows:

- Solar indices less than 7.0 kWh per square meter per day. Higher solar indices translate to greater energy output per unit area. Screening sites based on this criterion means fewer acres of disturbance per kWh of energy production.
- Wilderness, wilderness study areas (WSA), areas of critical environmental concern (ACEC), parks, and military installations. These areas were avoided to avoid or minimize impacts to sensitive resources. However, "no development" buffer zones are generally not applied to Wilderness, WSAs, ACECs, parks, and military installations. Therefore, although potential sites were screened based on this criterion, a project adjacent to one of these areas is not reason by itself to preclude a proposal. In the case of the proposed SSEP location, the nearby monument is already adjacent to an occupied 1-mile-wide BLM-designated utility corridor, which would fall between the SSEP and the monument.
- Special-status species habitat conservation areas. These areas were avoided to minimize impacts to sensitive biological resources.
- Slope greater than 3%. Flatter slopes decrease cut/fill requirements and associated dust emissions and habitat loss and are easier to build on with lower costs.
- Floodplains. Sites were screened based on the presence of floodplains to avoid or minimize flood-related risks to project facilities, reduce the extent of drainage control structures needed, and minimize potential downstream impacts to habitat.
- Populated areas. Populated areas were avoided as much as possible to minimize noise and visual impacts to property owners.
- Land greater than 20 miles from major transmission and natural gas pipelines. Close proximity to existing transmission and gas pipelines minimizes acres of disturbance while at the same time reducing fixed project costs.

After identifying target areas, Boulevard identified and visited potential sites to confirm the following additional feasibility criteria:

- Size (minimum 1,600 acres)
- Available for sale or lease

The purpose of Boulevard's screening process was to identify and avoid areas with the greatest potential for adverse impacts or permitting issues and to focus instead on areas that would avoid as many land-use issues, visual and environmental impacts, and implementation challenges as possible. Boulevard also attempted to locate the SSEP near existing infrastructure to minimize the need for additional disturbance from roads, gas pipelines, and transmission lines and to reduce fixed project costs. By applying these criteria, significant portions of the State of Arizona were eliminated from further consideration by Boulevard.

At the conclusion of the screening process, the currently proposed SSEP location emerged as the best site for Boulevard to begin the permitting and environmental documentation process for a number of reasons, most notably its close proximity to transmission and natural gas infrastructure, potential for groundwater development, and the few anticipated environmental impacts.

In the draft EIS, the BLM eliminated from detailed consideration other locations on BLM (Section 2.11.6.1) and private lands (Sections 2.11.6.2 and 2.11.6.3) as alternatives to the SSEP location. The rationale, as presented in the draft EIS, for eliminating these locations from detailed analysis has been retained in this final EIS (with modifications based on public comments on the draft EIS). At the time the draft EIS was produced, the use of PV technology was not a viable alternative to CST technology. Many of the reasons for eliminating other locations from detailed analysis had to do with the operational requirements of CST technology, such as the use of natural gas for freeze protection and the use of water for cooling. Because PV technology is now a viable alternative to CST technology, many of the factors that contributed to eliminating other locations for detailed analysis under CST (necessary pipeline distances, etc.) would not apply to a PV project. Therefore, locations that were considered but eliminated from detailed analysis in the draft EIS may be viable locations (technically and economically) for a project using PV technology.

However, BLM has issued additional policy guidance in BLM IM 2011-059 since the publication of the draft EIS that further supports the elimination of alternative locations from detailed analysis. BLM IM No. 2011-059 provides guidance that BLM 1) may decide not to consider sites with active ROW applications as alternatives in a NEPA process for other ROW applications and 2) typically will not ~~"a~~nalyze a non-federal land alternative for a right-of-way application on public lands because such an alternative does not respond to the BLM's purpose and need to consider an application for the authorized use of public lands for renewable energy development." Because the alternative BLM locations discussed below are not locations suggested during scoping but are separate and distinct ROW applications, they are not considered as potential alternatives in the NEPA process for this ROW application. Likewise, alternative private land locations are not considered further by the BLM because they would not meet the BLM's purpose and need.

Additional reasons why alternative BLM and private land locations are not considered in detail in this final EIS consist of the following:

- No additional suitable BLM sites were suggested during scoping or during the public comment process on the draft EIS.
- The consideration of alternative locations was not necessary because the BLM was able to develop a range of alternatives responsive to identified resource conflicts at the proposed SSEP location by varying the size and design of the facility.
- Alternate locations for solar development on BLM lands are currently being considered in the *Draft Programmatic Environmental Impact Statement for Solar Energy Development in Six Southwestern States* (BLM and DOE 2010).

2.11.6.1 ALTERNATIVE BLM LOCATIONS

Using the site screening criteria described above, Boulevard identified six potential project locations (including the Proposed Action) within Arizona on BLM lands. As noted above, of these six locations the proposed site was superior although each of the remaining five sites has the potential for future development given an adequate permitting timeline. However, at the conclusion of the screening process described above, the SSEP site emerged as the most suitable to allow the completion of permitting in a timely fashion. ROW applications are still pending for each of these sites, with the exception of the Senator location. The other locations eliminated from consideration in this EIS are described in Table 2.14.

These sites were not considered as alternatives to the SSEP site for three primary reasons, as explained in more detail above. First, they are not locations suggested during agency and public scoping. No additional suitable BLM sites were suggested during scoping. Second, IM 2011-059 provides the BLM with

guidance that they may decide not to consider sites with active ROW applications as alternatives in NEPA processes for other ROW applications. Third, even if these sites were potential alternatives in the NEPA process for this ROW application, their consideration was not necessary for the BLM to develop a reasonable range of alternatives that address the resource conflicts identified in public and agency scoping.

Table 2.14 Alternative BLM Sites Considered

Site	General Description/Location
Aguila	BLM property located in northwestern Maricopa County, Arizona, approximately 3 miles south of the Town of Aguila, between the Harquahala and Vulture mountains
Burnt Mountain	BLM property located in western Maricopa County, Arizona, approximately 15 miles west of Tonopah, Arizona, and just north of Interstate 10, near the southern end of the Big Horn Mountains
Bouse	BLM property located in La Paz County, Arizona, on the western slope of the Plomosa Mountains within the La Posa Plain, approximately 16 miles north of Quartzsite, Arizona and 4 miles west of Bouse, Arizona
Mountain Spring	BLM property located in the western portion of Mohave County, Arizona, approximately 38 miles northwest of Kingman, and just southwest of Arizona Highway 93 at the eastern base of the Black Mountains
Senator	BLM property located in central Mohave County, Arizona, approximately 47 miles northwest of the Town of Kingman, and 3 miles east of Arizona Highway 93

The primary reasons for originally eliminating each of the five alternative sites are discussed below.

2.11.6.1.1 Aguila

The Aguila site was eliminated from further consideration primarily because of transmission and natural gas line constraints. Although there are high-voltage transmission lines adjacent to the Aguila site, there is currently not sufficient capacity on the lines to meet the needs of the project. The site would also require a gas pipeline at least 20 miles in length, which would create significant additional habitat disturbance, and add costs to secure easements. The uncertain availability and difficulty in acquiring groundwater or surface water rights also present challenges. Finally, the site's proximity to residences and a wilderness area were also considered. Development of this site is possible, but is not consistent with the SSEP's proposed timeline.

2.11.6.1.2 Burnt Mountain

The Burnt Mountain site was eliminated from further consideration because of its proximity to a wilderness area and its encroachment into a BLM-designated utility corridor. Construction of a power plant within this corridor would require a BLM plan amendment and additional notice and review time in the EIS process, extending the timeline beyond the desired December 2010 completion date. Development within this utility corridor would also constrain future transmission line development. Acquisition of sufficient water rights in a timely fashion also presents significant challenges.

2.11.6.1.3 Bouse

The Bouse site was eliminated from further consideration primarily because it would require a transmission line at least 29 miles in length and a gas pipeline over 13 miles in length. Although there are transmission lines adjacent to the Bouse site, there is currently not sufficient capacity on the lines to meet the needs of the project. The length of these linear facilities would require a significant investment of time and money to secure the required easements and these factors are not consistent with the goals of the SSEP. The Bouse site may also present various land-use, biological species, and water use challenges.

2.11.6.1.4 Mountain Spring

The Mountain Spring site was eliminated from further consideration due to insufficiencies in the quality and quantity of groundwater available at the site, and the uncertainty of acquiring surface water in a timely fashion. The site is also extremely remote from existing gas pipelines and would require the construction of a 38-mile pipeline to support the needs of the project. This distance would present significant timeline and budget challenges and create a comparatively larger amount of environmental disturbance compared with the SSEP. Although transmission is available in this area, delivery to a major load center would be challenging. The site is also within the Black Mountain Wild Horse and Burro Herd Management Area and development here has the potential to impact sensitive biological species.

2.11.6.1.5 Senator

The Senator site was eliminated from further consideration due to insufficiencies in the quality and quantity of groundwater available at the site, and the uncertainty of acquiring surface water in a timely fashion. The site is also extremely remote from existing gas pipelines and would require the construction of a 54-mile pipeline to support the needs of the project. This distance would present significant timeline and budget challenges and create a comparatively larger amount of environmental disturbance compared with the SSEP. Transmission in this area is available, but delivery to a major load center would be challenging. There are also approximately 36 active mining claims in the vicinity of this site.

2.11.6.2 ALTERNATIVE PRIVATE LAND LOCATIONS

Per BLM IM No. 2011-059, BLM policy is to "not typically analyze a non-federal land alternative for a right-of-way application on public lands because such an alternative does not respond to the BLM's purpose and need to consider an application for the authorized use of public lands for renewable energy development."

Although the BLM cannot require companies to construct on private lands, Boulevard did evaluate a number of privately owned properties as potential locations for the SSEP. When screening for private sites, Boulevard used screening criteria similar to those used to identify suitable BLM sites. However, because the purpose of this screen was to identify potential alternatives to the SSEP Project Area, the private site would need to meet additional criteria to accommodate the design assumptions of the SSEP. The additional criteria included:

- Comparable distance to both the Jojoba Switchyard and natural gas pipelines to minimize additional disturbance (fewer than 15 miles)
- Appropriately sized and shaped to support design and construction of a 375-MW CST facility
- Viable options for a physically and legally available water supply
- Zoned to allow for industrial development
- Reasonably priced
- Reasonable number of parcels/land owners

Boulevard explored two areas for potentially suitable, private properties on which to develop a solar facility, east and southwest of the proposed location.

2.11.6.2.1 Southwest of the Proposed SSEP Site

Boulevard evaluated a number of privately owned properties southwest of the Jojoba Switchyard and west of State Route 85. An area of farmland was the closest grouping of private property that was potentially available for purchase, since the city of Phoenix acquired a large amount of land for its landfill and there are other facilities located in the area. This area was eliminated from consideration because the length of gas and transmission lines would be significantly increased, and would require easements and rights of way to cross Arizona State Land, other privately owned land, and SR-85. A significant portion of this area also lies within 100 year floodplains of either the Gila River or Rainbow Wash. Finally, various complexities in Arizona water law and varied property restrictions present significant challenges and uncertainties in the acquisition of long-term access to a water supply.

2.11.6.2.2 East of the Proposed SSEP Site

Boulevard also evaluated private properties to the east of the SSEP BLM site. The majority of land parcels in this area are smaller than what would be required to construct a 375-MW CST plant, which would necessitate a considerable assemblage effort. This effort would require numerous, separate land owners to sell their land at competitive prices and could take a great deal of time to accomplish even if all landowners were willing to sell. This constraint renders the SSEP's proposed timeline untenable. Additionally, ancillary facilities (gas and transmission) would need to cover a significant amount of additional distance and would still require rights-of-way across BLM land in addition to the other easements across private and/or state lands to reach the points of interconnection. Traffic volumes in the area would also increase significantly and the existing road network could have issues in accommodating this increase. The combination of these factors dictated that this area be eliminated from further consideration.

2.11.6.3 BROWNFIELD LOCATIONS

"Brownfields" are real property. Their expansion, redevelopment, or reuse may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. During the land screening process for the SSEP, Boulevard identified a single brownfield site in the Tucson, Arizona area for potential development. The site's location severely limited potential transmission solutions and was not sized or sloped appropriately to accommodate the SSEP's design considerations. Because development on a brownfield site did not meet the design considerations of the project and did not address other environmental considerations, this alternative was not carried forward for additional analysis.

2.11.7 Alternative Water Sources

The use of water by the SSEP under any alternative would be required to comply with all applicable state laws and regulations, including the ADWR Third Management Plan: Industrial User Conservation Requirements. In order to ensure compliance with these requirements and also to complete a comprehensive due diligence review, Boulevard evaluated a wide array of potential water supply options that could potentially meet the water supply demands of the SSEP and considered their advantages and disadvantages. The consideration of each of these options and the reason that each was ultimately eliminated from detailed analysis are discussed below:

- Off-site Groundwater within the Rainbow Valley Sub-basin
- Off-site Groundwater within the West Salt River Sub-basin
- Reclaimed Water

- Industrial Waste Water
- Surface Water
- Central Arizona Project (CAP) Water

2.11.7.1 OFF-SITE GROUNDWATER WITHIN THE RAINBOW VALLEY SUB-BASIN

Off-site groundwater withdrawals could be legally authorized through a GIU Permit or through purchase of existing grandfathered groundwater withdrawal rights including Type 1 Non-Irrigation Grandfathered Rights (Type 1 Rights), Irrigation Grandfathered Rights (IGRs) eligible for retirement to Type 1 Rights, or Type 2 Non-Irrigation Grandfathered Rights (Type 2 Rights).

2.11.7.1.1 GIU Permit for Off-site Withdrawal

Under this alternative, groundwater would be withdrawn from wells located in the same groundwater sub-basin as under the Proposed Action, but would require additional pipeline installation, pumping infrastructure, and energy consumption to deliver the water to the plant's power blocks. Consequently, when evaluating the environmental impacts to the sub-basin in terms of water use and land disturbance, this alternative would increase environmental impacts to the sub-basin when compared to the Proposed Action. Although off-site wells may reduce localized well impacts in the immediate vicinity of the SSEP, similar impacts would be experienced at the off-site well locations. This alternative was therefore dismissed from further consideration.

2.11.7.1.2 Type 1 Rights

Under this alternative, the SSEP would use nearby Type 1 Rights in place of a GIU permit to supply water to the Project Area. Because the number of grandfathered rights within the Phoenix AMA is fixed, and Type 1 Rights are tied to certain lands, the use of Type 1 Rights for the SSEP would potentially reduce or transfer existing groundwater withdrawals in the Rainbow Valley sub-basin. IGRs can only be used for irrigation of crops on designated irrigation acres, but in some cases these IGRs can be converted to a Type 1 Right and water may be transported for use somewhere off of the original irrigation acres. When an IGR is converted from an irrigation use to a Type 1 nonirrigation use, the amount of authorized withdrawals is generally reduced, creating a potential net decrease in total groundwater pumped over time. Because an IGR and the Type 1 Right resulting from the conversion of that IGR cannot be severed from the appurtenant land, Boulevard would be required to purchase the farm property where the IGR or Type 1 Right is located and then physically pump the water from the farm property to the power plant facilities. The farm property must also be maintained for the duration of the project but irrigation could no longer occur on retired irrigation acres.

In order to obtain sufficient groundwater withdrawal authority to support groundwater withdrawals of 2,500 afy, Boulevard would need to purchase roughly 900 grandfathered irrigation acres from a farm or farms within a reasonable distance of the proposed facilities. The availability of these acres is dependent on the current owners' willingness to sell the land, and could conceivably require the purchase of additional acreage to consummate the transaction and make it worthwhile to the seller. The price of this acreage will also vary based on local and national market conditions and demand.

This alternative has been eliminated from further analysis primarily because this alternative would significantly increase the cost of the SSEP and ultimately, the price of energy. Potential environmental benefits gained by a net pumping reduction in the Rainbow Valley Sub-basin may be off-set by the construction of water pipelines and pumping facilities, and the increased use of energy to transport the water to the project site.

2.11.7.1.3 Type 2 Rights

The number of Type 2 Rights in the Phoenix AMA is also fixed, and their availability is extremely variable in terms of quantity, time to acquire, and cost. Type 2 Rights are not specified for use in any particular sub-basin of the Phoenix AMA, so use of Type 2 Rights by the SSEP may not cause any corresponding decrease in existing groundwater withdrawals elsewhere in the Rainbow Valley sub-basin. Under this alternative, Boulevard would require Type 2 Rights to support groundwater withdrawals of 2,500 afy. Several smaller Type 2 Rights have sold in the Phoenix AMA in recent years, priced at roughly $1,500-$1,600 per acre-foot. These prices can vary substantially and may be skewed by speculative investment. It is not possible to predict when Type 2 Rights of sufficient size might become available or how much they might cost. Because of the availability of sufficient Type 2 Rights at a reasonable cost within the SSEP project timeline is uncertain, their use is considered speculative and has been eliminated from further analysis.

2.11.7.2 OFF-SITE GROUNDWATER WITHIN THE WEST SALT RIVER SUB-BASIN

Boulevard evaluated potential groundwater supplies from the West Salt River Sub-basin obtained through the Buckeye Water Conservation and Drainage District (BWCDD), the Roosevelt Irrigation District (RID), the Arlington Canal Company, and the Town of Buckeye. Each of these alternatives would require the construction of lengthy water pipelines along secured easements to deliver water to the SSEP area. Because Boulevard does not have the ability to claim eminent domain or condemn properties, it is not clear if a complete and sensible pipeline route could be secured in the future.

2.11.7.2.1 Roosevelt Irrigation District

Groundwater is not legally available from the RID. The District's groundwater withdrawal rights apply only to users within its service area. This service area is located north of the Gila River and, if available, would require the construction of an approximately 18-mile long water pipeline and associated pumping facilities. Consequently, this alternative is infeasible and eliminated from further consideration.

2.11.7.2.2 Town of Buckeye

The Town of Buckeye has physical and legal access to reliable, suitable quality groundwater supplies within its service area in both the Rainbow Valley and West Salt River Sub-basins. Buckeye is authorized to provide groundwater to industries within its service area through its withdrawal permits as long it can demonstrate that this service is consistent with the Phoenix AMA Third Management Plan and ADWR approves of the action (see A.R.S. § 45-491 et seq.).

Although the use of West Salt River Sub-basin groundwater would alleviate any localized pumping effects in the Rainbow Valley Sub-basin, it would still create effects farther away in a sub-basin that has more stored groundwater. Any local benefit resulting from a change in pumping location would be greatly outweighed by the impacts associated with construction of a lengthy, 20-mile pipeline and the energy needed to pump water to the Project Area. These impacts would continue for the life of the SSEP. Because this alternative would not resolve environmental issues, it was dismissed from further analysis.

2.11.7.2.3 BWCDD and Arlington Canal Company

Part of the West Salt River Sub-basin to the north of the SSEP is currently waterlogged. This means that the water table is close enough to the ground surface to endanger farming. BWCDD and the Arlington Canal Company are both located within this waterlogged area. Water is physically available, although the water is poor in quality, with TDS approaching approximately 3,000 milligrams per liter (mg/L). A significantly more robust water treatment system would be required to use water of this quality, which would increase the overall cost of the SSEP.

BWCDD is currently permitted to withdraw 30,000 acre-feet of groundwater per year until December 31, 2019. This pumping is authorized by a Drainage Permit issued by ADWR. Currently, this water is either delivered to the Arlington Canal Company or drained to the Gila River. A.R.S. § 45-519(B) authorizes BWCDD to use or convey this groundwater for a nonirrigation use if the recipient user also holds a Type 1 Right, a Type 2 Right, a GIU permit, or a service area groundwater withdrawal right. In order to obtain its Drainage Permit, BWCDD demonstrated that the drainage of irrigated lands was necessary to provide a reasonable economic return on the BWCDD lands' agricultural production and that the withdrawal of drainage water was consistent with the Phoenix AMA's Management Plan and goals. (A.R.S. § 45-519). ADWR is authorized to terminate the drainage permit if these conditions are no longer satisfied.

A water supply from BWCDD may not be reliable for the life of the SSEP because of the uncertainty regarding the continuation of agricultural uses in this area. BWCDD's Drainage Permit also expires on December 31, 2019, and it is unknown whether the waterlogged condition will continue as other groundwater uses develop in the sub-basin. Finally, because this permit is conditional, if prevailing conditions in the area change, the permit could be revoked prior to 2019.

Utilization of this water supply would require a pipeline for delivery to the SSEP. Additional land disturbance and increased energy use would be caused by installation, operation, and maintenance of this pipeline infrastructure and it is unclear whether or not Boulevard could secure the necessary easements and rights-of-way to construct this pipeline. An additional consideration is the uncertainty of a continued assured supply for the life of the SSEP (30 years).

The Arlington Canal Company is also within the waterlogged area, but does not currently have a Drainage Permit. Otherwise, the legal analysis of this alternative is identical to the BWCDD. The Arlington Canal Company is located even farther away from the proposed project, and would require a 26-mile pipeline. For the reasons described above, these alternatives have been abandoned from further analysis.

2.11.7.3 RECLAIMED WATER

Boulevard evaluated the effluent from six wastewater treatment plants (WWTPs) as potential supplies for the SSEP. Currently, none of the plants have an available and sufficient discharge volume to supply all the project needs (as proposed). Effluent from each source can be legally obtained through a purchase contract with the each WWTP and the effluent would then need to be piped to the project site across authorized easements or ROW entitlements. Each of these alternatives has been eliminated from further consideration for the reasons described below.

The City of Phoenix reported that effluent generated by the 91st Avenue WWTP is not currently available for sale. Similarly, the City of Goodyear reported that their WWTP had no excess effluent for sale. In both cases, all effluent is allocated by the cities for other uses and it does not appear likely that sufficient supplies would be available in the foreseeable future.

The Town of Gila Bend has a small WWTP that was recently permitted for peak discharges of 0.7 million gallons per day (MGD), but currently operates at a fraction of this volume. Even if this plant expanded output to its permitted maximum and discharged continuously at peak conditions, which is unlikely, this source would only supply roughly 784 afy, or 30% of the SSEP's water needs as proposed. This option would require the construction of a 31-mile pipeline to deliver water to the project site.

The Lewis State Prison, located northwest of the project site, may have approximately 365 afy available for purchase. This amount is less than one-sixth of the amount needed for the project and is not expected to increase in volume over time. This water would require an 11-mile pipeline for delivery to the project site, and Boulevard would need to develop a second water source to meet the water needs of the project.

Additionally, effluent discharged from the prison has created a wetland area, which is supported only by continuing prison discharges. The wetland would likely disappear if discharges stopped. The benefits from using prison effluent would be outweighed by the additional environmental effects of a lengthy pipeline, the destruction of a wetland, and the substantial costs of securing an additional water supply.

The Town of Buckeye's Central Buckeye WWTP is located approximately 20 miles north of the proposed Project Area and across the Gila River. The Central Buckeye plant currently generates approximately 1,300 afy of effluent with a typical TDS concentration of less than 1,000 mg/L and discharges the effluent to the Gila River. Buckeye expects this amount to increase at a rate of approximately 100 afy. Utilization of this water supply would require a 20-mile pipeline for delivery to the SSEP. Additional land disturbance and increased energy use would be caused by installation, operation, and maintenance of this pipeline infrastructure and it is unclear whether or not Boulevard could secure the necessary easements and rights-of-way to construct this pipeline, especially because it would involve a crossing of the Gila River. Finally, because the effluent is currently discharged to the Gila River, the river flows would be reduced and the downstream impacts of this are uncertain.

The brine streams from existing City of Goodyear and Town of Buckeye potable water treatment plants (WTP) were also identified as possible water sources. Because the Town of Buckeye no longer operates its potable water desalination treatment process, no brine is currently available. Goodyear may have a small amount of brine physically available at a location roughly 24 miles from the project. This brine has a TDS concentration of approximately 8,000 mg/L. The extremely high water treatment costs, combined with the added costs of a significant pipeline and ROWs acquisition make this option cost-prohibitive.

2.11.7.4 INDUSTRIAL WASTE WATER

No industrial wastewater sources are present or available.

2.11.7.5 SURFACE WATER

The physical and legal availability and the reliability of surface water in the vicinity of the SSEP are extremely speculative and have therefore been eliminated from further analysis. The most significant surface water source anywhere near the Project Area is the Gila River. The Gila River, which flows past the City of Phoenix 91st Avenue WWTP, is largely dependent on the effluent from this plant. The City of Phoenix and other WWTP contributors and downstream users are not legally obligated to continue to discharge effluent to the Gila River and it is likely that discharges to the Gila River will decrease in the future as effluent is reused for other purposes. Without effluent discharges, Gila River flows will be intermittent and unreliable.

Rights to use surface water are appurtenant to the land where historic and beneficial use occurs. Older surface water right claims in this area generally belong to farms within irrigation districts. The legal certainties of most surface water claims in this area are also questionable due to an ongoing adjudication case that will define all rights to use the Gila River and its tributaries. In order to obtain a surface water right or claim with a sufficient priority to capture available Gila River water flows, Boulevard would need to purchase land with an associated surface water claim of sufficient age to ensure legal viability. The water right must then be severed from the land and transferred to the SSEP for use. Because this severance and transfer process (outlined in A.R.S. § 45-172(A)(4)) requires the irrigation districts to consent to such a transfer, it is unlikely a severance and transfer would be successful. Even if a severance and transfer were allowed, the time required by ADWR to process a severance and transfer may exceed the SSEP timeline. Because of the significant procedural challenges, and long-term uncertainty of a continued supply, the use of surface water is not feasible.

2.11.7.6 CENTRAL ARIZONA PROJECT WATER

There is currently no physical or legal access to CAP water. The main CAP aqueduct is far from the Project Area. Despite this, CAP water may be "wheeled" through irrigation district canals with sufficient physical capacity. This wheeling requires the payment of a wheeling charge and a mutual agreement with the irrigation district. The closest available canal systems capable of delivering CAP water end roughly 18 miles and 30 miles from the Project Area. The water would then require a pipeline for delivery to the SSEP. Additional land disturbance and increased energy use would be caused by installation, operation, and maintenance of this pipeline infrastructure and it is unclear whether or not Boulevard could secure the necessary easements and ROWs to construct this pipeline.

Even if transportation of CAP water to the Project Area through a pipeline became feasible, the supply of CAP water for duration of the SSEP is uncertain. Boulevard is currently unable to secure a municipal or industrial CAP water allocation for SSEP. Existing users use all excess CAP water during 2008 and 2009 and the amount of excess CAP water is expected to decrease steadily in future years. Although several Indian communities have the legal right to provide long-term leases of CAP water to private users, recent lease inquiries have not been successful. Use of CAP water is not a feasible alternative because of its questionable physical availability, and the difficulty in gaining a legal right to use CAP water over the long term.

2.11.8 Crystallizer

A crystallizer is a piece of equipment designed to heat waste water in order to concentrate its impurities. The water would be reused and the byproduct would be a cake of impurities. The use of a crystallizer would reduce the SSEP's water use by approximately 7%.The use of a crystallizer was considered as a means of eliminating the need for evaporative ponds and reducing the amount of groundwater required for the SSEP.

The use of a crystallizer would create environmental benefits similar to the use of a brine concentrator. Because this option would cost nearly four times as much and the effects are similar to a brine concentrator (which is being carried forward for analysis), this alternative has been eliminated.

2.11.9 Alternate Configurations

It was suggesting during scoping that the SSEP be configured into six to eight widely spaced north-south rows to allow wildlife migration between the rows. This configuration was not carried forward for detailed analysis for a number of reasons. It is not feasible to place fences around each row of solar troughs with sufficient space in between to allow wildlife movement, without also reducing the size of the solar field and the plant's output. Additionally, the field is spaced to allow plant personnel to access the troughs with vehicles for maintenance, mirror washing, and emergency response. Creating multiple layers of secure fencing would prohibit and slow access, especially in an emergency situation. These movement corridors would also greatly increase the distance over which the HTF would need to be pumped. In a solar field of this size, that distance and the increased parasitic load would be considerable and adversely affect the plant's output. The increase in capital costs, additional risks to health and human safety, and the increased risk of animal injury warrant that this alternative not be carried forward for additional analysis.

It was suggested during the draft EIS comment period that the SSEP be located further from the Sonoran Desert National Monument to minimize potential impacts to this sensitive resource. Given the constraints of available land parcels for sale or lease surrounding the Project Area, as well as increased visual and environmental impacts from moving the project further from existing infrastructure, it was not possible to locate the Project Area further from the monument under the Proposed Action or other action alternatives.

2.11.10 Underground Transmission Lines

Public comments during scoping suggested the use of underground transmission lines. High-voltage transmission lines similar to what are proposed for the SSEP generate a substantial amount of heat when energized. In a confined space like an underground duct, this heat would create immense engineering, maintenance, and safety challenges. In addition to being technically infeasible, this alternative would be considerably more expensive and likely render the SSEP economically infeasible. For these reasons, this alternative was not carried forward for additional analysis.

2.11.11 Reduced Project Footprint with Dry Cooling

Public comments on the draft EIS suggest that an alternative that both reduces the project footprint and uses dry cooling be analyzed. This alternative was considered but not carried forward for detailed analysis because it would be substantially similar in design to Alternative B, except for its cooling system, which would be substantially similar in design to Alternative A. Because of this design similarity, it would also have substantially similar effects to Alternative B, except for water use and disposal, which would be substantially similar to Alternative A, but reduced by approximately one third. For these reasons, this alternative was not analyzed in detail as a stand-alone alternative. However, the impacts of this alternative would fall within the range of impacts analyzed, and the BLM could consider selecting both a reduced footprint and dry-cooled alternative in the ROD.

2.12 Comparison of Alternatives

Table 2.15 Comparison of Alternatives

	No Action	Proposed Action	Proposed Action with Brine Concentrator Option	Alternative A: Reduced Water Use (dry-cooled CST)	Sub-alternative A1: Photovoltaic	Alternative B: Reduced Footprint	Alternative B: Reduced Footprint with Brine Concentrator Option
Total Project Footprint (solar field, linear, and well field uses)*							
Total disturbance area, including temporary and permanent use areas (acres)	–	3,620	3,620	3,609	2,013	2,394	2,394
Permanent use areas (acres)	–	3,589	3,589	3,580	1,984	2,363	2,363
Solar Field Components and Facilities*							
Solar field, internal roads, access areas, and internal linear facilities (acres)	–	3,313	3,385	3,385	1,907	2,136	2,184
Power blocks (acres)	–	80	80	80	0	80	80
Evaporation ponds (acres)	–	90	18	18	1	60	12
Land-treatment units (acres)	–	15	15	15	0	10	10
Stormwater detention basins (acres)	–	30	30	30	22	20	20
Linear Facilities (outside solar field)and Well field Facilities (permanent surface use areas)*							
New roads (miles/acres)	–	5.60/23.1	5.60/23.1	4.82/21.0	4.82/21.0	5.14/21.9	5.14/21.9
Upgraded roads (miles/acres)	–	4.62/20.4	4.62/20.4	4.23/18.7	4.89/20.8	4.62/20.1	4.62/20.1
Nonlinear groundwater well facilities (acres)	–	3.7	3.7	1.8	1.8	2.8	2.8
Generation tie line (miles/acres)	–	3.0/0.6	3.0/0.6	3.0/0.6	3.2/0.6	3.0/0.6	3.0/0.6
Gen-tie Line Option (miles/acres)	-	3.4/1.1	3.4/1.1	3.4/1.1	3.6/1.2	3.4/1.1	3.4/1.1
Electrical supply lines (miles/acres)	–	2.61/7.3	2.61/7.3	1.44/4.0	1.74/4.7	2.15/6.0	2.15/6.0
Pipelines (subsurface use only)*							
Water pipelines-outside solar field (miles/acres)	–	5.19/5.0	5.19/5.0	4.02/3.9	4.7/4.52	4.73/4.6	4.73/4.6
Water pipelines-inside solar field (miles/acres)	–	2.10/2.0	2.10/2.0	2.10/2.0	2.04/1.97	2.19/2.1	2.19/2.1
Gas pipelines-outside solar field (miles/acres)	–	1.06/1.0	1.06/1.0	1.06/1.0	n/a	1.06/1.0	1.06/1.0
Gas pipelines-inside solar field (miles/acres)	–	2.10/2.0	2.10/2.0	2.10/2.0	–	2.19/2.1	2.19/2.1

Table 2.15 Comparison of Alternatives

	No Action	Proposed Action	Proposed Action with Brine Concentrator Option	Alternative A: Reduced Water Use (dry-cooled CST)	Sub-alternative A1: Photovoltaic	Alternative B: Reduced Footprint	Alternative B: Reduced Footprint with Brine Concentrator Option
Electrical Generation							
Instantaneous generation capacity (MW)	–	375	375	375	300	250	250
Annual output, assuming solar generation only (MWh)	–	870,000	870,000	764,400	775,000	540,000	540,000
Annual output, assuming 25% generation from thermal storage and/or gas co-firing (MWh)	–	1,155,000	1,155,000	1,051,050	n/a	770,000	770,000
Generation storage capacity (hours)	–	3–4	3–4	3–4	0	3–4	3–4
Water Requirements							
Average annual water use (afy)	–	3,003–2,305	2,793–2,144	151–116	65	2,003–1,518	1,863–1,412
Peak daily water usage (acre-feet)	–	12.8–11.9	11.9–11.0	0.4	0.1	10.2–7.8	9.5–7.3
Annual water use in Gallons per MWh	0	1,125–863	1,046–803	57–43	24	750–569	698–529
Natural Gas Use and Co-firing							
Annual maximum co-firing generation (MW Hours)	–	274,000	274,000	250,000	n/a	180,000	180,000
Annual maximum natural gas usage (MMBtu)	–	3,982,000	3,982,000	3,623,620	n/a	2,655,000	2,655,000
Construction Workforce							
Construction workers at peak of construction	–	1,500	1,500	1,500	378	1,350	1,350
Max vehicle trips per hour at peak of construction	–	1,000	1,000	1,000	355	950	950
Estimated Capital Costs**							
Capital Cost ($ in billions)	–	1.69–2.36	–	1.76–2.46	1.14–1.32	1.13–1.58	–
Capital Cost per MWh ($)***		598–794	–	762–1,048	1,471–1,703	598–853	–

* Because of overlap between permanent and temporary features, and between linear, solar field, and well field facilities, the acreages presented in the table are not additive. Please refer to the "Total Project Footprint" rows for the sum or all project disturbance/use areas.

** Estimated capital costs are based on 2008 data from the Beacon Solar Energy Project Dry Cooling Evaluation, the 2008 LAZARD "Levelized Cost of Energy Analysis" presentation at NARUC, and the 2011 Historical Summary of the Installed Cost of Photovoltaics in the United States It should be noted that PV costs have likely decreased over the last three years. In addition, overall costs can vary significantly according to panel selection. These costs do not reflect forward pricing on panel costs for the 2013–2015 time frame.

*** For the Proposed Action, Alternative A, and Alternative B, the high end of the Capital Cost per MWh ranges was calculated using the annual output assuming solar generation only for each alternative. The low end of the ranges was calculated using the annual output assuming 25% generation from thermal storage and/or gas co-firing. For Sub-alternative A1, a solar generation-only output of 775,000 MWh was used to calculate both figures.

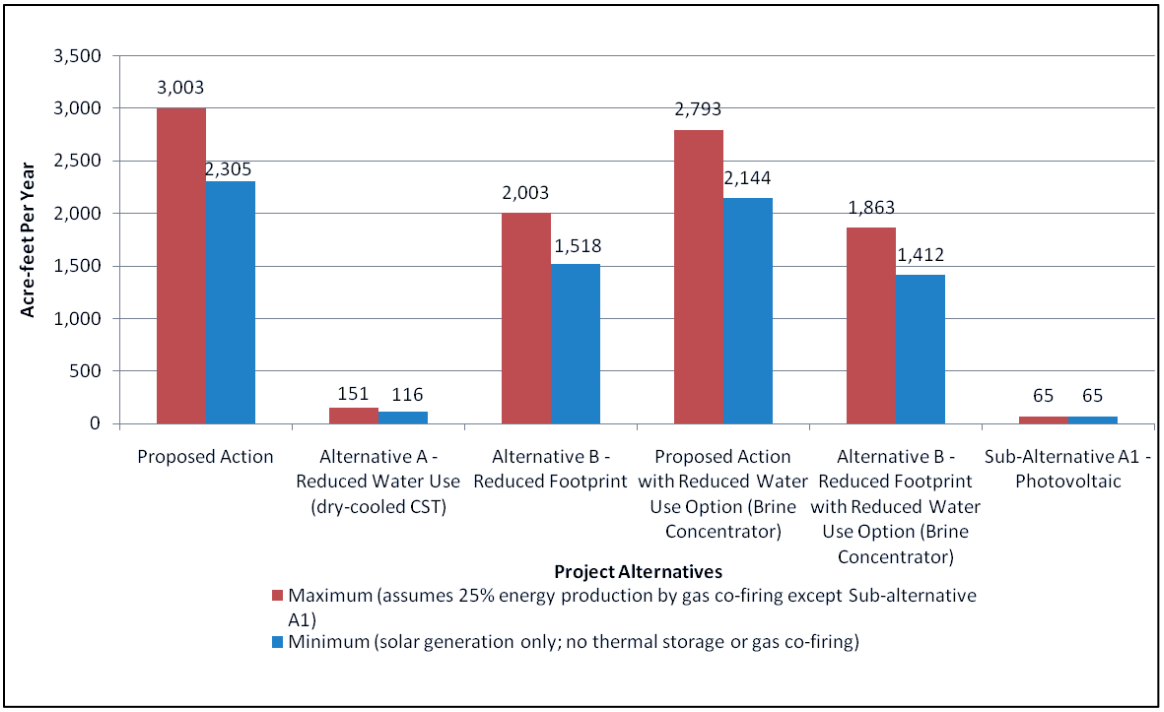

Figure 2.15 Average annual water use under each action alternative and option.

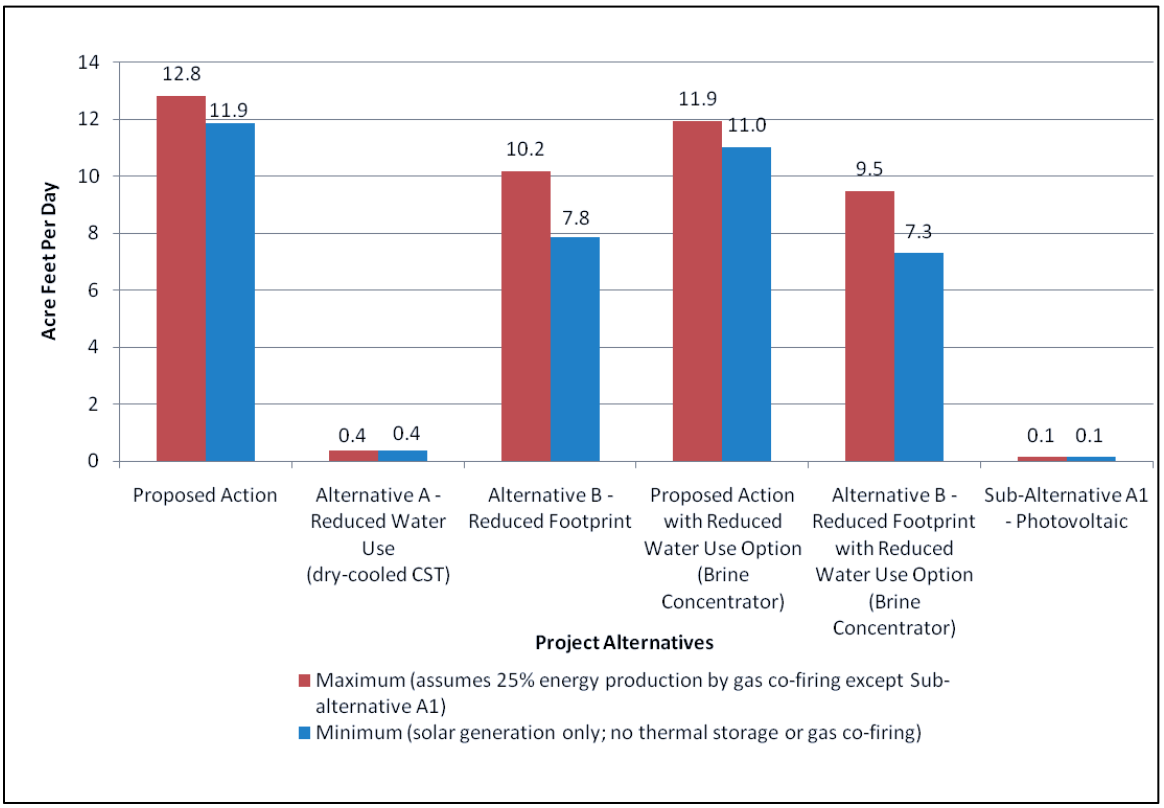

Figure 2.16 Peak daily water use under each action alternative and option.

2.13 Summary of Impacts

Please see the following table (Table 2.16).

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Table 2.16 Summary of Impacts

	No Action	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Alternative B: Reduced Footprint	Sub-alternative A1: Photovoltaic
AIR QUALITY					
Project emissions during construction	There would be no project construction emissions under the No Action alternative.	Emissions of criteria pollutants during construction would result from fuel combustion by construction equipment and vehicles, and from fugitive dust emissions. Maximum monthly construction emissions (in tons per month) under the Proposed Action would be • PM_{10}: 8.8 (0.12% over current emissions) • PM2.5: 2.3 (0.15% over current emissions) • NOx: 14.7 (0.14% over current emissions) • CO: 6.1 (0.01% over current emissions) • VOC: 1.6 (0.01% over current emissions)	Emissions of criteria pollutants during construction would result from fuel combustion by construction equipment and vehicles and from fugitive dust emissions. Maximum monthly construction emissions (in tons per month) under Alternative A would be • PM_{10}: 8.8 (0.12% over current emissions) • $PM_{2.5}$: 2.3 (0.15% over current emissions) • NO_x: 14.7 (0.14% over current emissions) • CO: 6.1 (0.01% over current emissions) • VOC: 1.6 (0.01% over current emissions)	Emissions of criteria pollutants during construction would result from fuel combustion by construction equipment and vehicles and from fugitive dust emissions. Maximum monthly construction emissions (in tons per month) under Alternative B would be • PM_{10}: 8.6 (0.12% over current emissions) • $PM_{2.5}$: 2.1 (0.14% over current emissions) • NO_x: 9.7 (0.09% over current emissions) • CO: 3.7 (<0.01% over current emissions) • VOC: 1.1 (0.01% over current emissions)	Emissions of criteria pollutants during construction would result from fuel combustion by construction equipment and vehicles and from fugitive dust emissions. Maximum monthly construction emissions (in tons per month) under Sub-alternative A1 would be • PM_{10}: 6.1 (0.09% over current emissions) • $PM_{2.5}$: 1.4 (0.10% over current emissions) • NO_x: 7.2 (0.07% over current emissions) • CO: 1.57 (<0.001% over current emissions) • VOC: 0.40 (0.002% over current emissions)
Project emissions during operations	There would be no project operational emissions under the No Action alternative.	Emissions of criteria pollutants during operation of the SSEP would result from the cooling towers, windblown dust, and combustion sources associated with components of the gas-fired supplemental electrical generation, emergency generators, and fire water pumps. Maximum annual emissions under the Proposed Action would be • PM_{10}: 40.9 tpy (0.05% over current emissions) • $PM_{2.5}$: 22.2 tpy (0.13% over current emissions) • NO_x: 28.9 tpy (0.02% over current emissions) • CO: 95.8 tpy (0.01% over current emissions) • SO_2: 0.1 tpy (<0.01% over current emissions) • VOC: 14.2 tpy (0.01% over current emissions) • HAPs: 3.5 tpy	Emissions of criteria pollutants during operation of the SSEP would result from windblown dust and combustion sources associated with components of the gas-fired supplemental electrical generation, emergency generators, and fire water pumps. Maximum annual emissions under Alternative A would be • PM_{10}: 20.2 tpy (0.02% over current emissions) • $PM_{2.5}$: 9.5 tpy (0.05% over current emissions) • NO_x: 26.4 tpy (0.02% over current emissions) • CO: 87.2 tpy (0.01% over current emissions) • SO_2: 0.1 tpy (<0.01% over current emissions) • VOC: 12.9 tpy (<0.01% over current emissions) • HAPs: 3.2 tpy	Emissions of criteria pollutants during operation of the SSEP would result from the cooling towers, windblown dust, and combustion sources associated with components of the gas-fired supplemental electrical generation, emergency generators, and fire water pumps. Maximum annual emissions under Alternative B would be • PM_{10}: 27.6 tpy (0.03% over current emissions) • $PM_{2.5}$: 15.1 tpy (0.09% over current emissions) • NO_x: 22.8 tpy (0.02% over current emissions) • CO: 68.5 tpy (0.01% over current emissions) • SO_2: 0.1 tpy (<0.01% over current emissions) • VOC: 9.6 tpy (<0.01% over current emissions) • HAPs: 2.5 tpy	Emissions of criteria pollutants during operation of the SSEP would result from fugitive dust. Maximum annual emissions under Sub-alternative A1 would be • PM_{10}: 15.8 tpy (0.02% over current emissions) • $PM_{2.5}$: 1.6 tpy (0.009% over current emissions) • NO_x: 0 tpy (0% over current emissions) • CO: 0 tpy (0% over current emissions) • SO_2: 0 tpy (0% over current emissions) • VOC: 0 tpy (0% over current emissions) • HAPs: 0 tpy
Incremental contributions to existing NAAQS	There would be no additional contribution to NAAQS under No Action. Background data at the Buckeye monitoring station indicate routine exceedances of the 24-hour PM_{10} NAAQS (150 μg/m^3), the annual PM_{10} NAAQS (50 μg/m^3), and the 24-hour $PM_{2.5}$ NAAQS (35 μg/m^3). All of the current emissions in Maricopa County would continue to contribute to these.	Operation of the SSEP under the Proposed Action would contribute, at most, 0.562 μg/m^3 of PM_{10} and 0.557 μg/m^3 of $PM_{2.5}$ to the 24-hour PM_{10} NAAQS (150 μg/m^3), and 0.113 μg/m3 to the annual PM_{10} NAAQS (50 μg/m^3). Construction emissions would also contribute to all PM NAAQS; however, the proponent has committed to ensuring that emissions would not exceed major source thresholds.	Operation of the SSEP under Alternative A would contribute, at most, 0.28 μg/m^3 of PM_{10} and 0.24 μg/m^3 of $PM_{2.5}$ to the 24-hour PM_{10} NAAQS (150 μg/m3), and 0.06 μg/m^3 to the annual PM_{10} NAAQS (50 μg/m^3). Construction emissions would also contribute to all PM NAAQS; however, the proponent has committed to ensuring that emissions would not exceed major source thresholds.	Operation of the SSEP under the Alternative B would contribute, at most, 0.38 μg/m^3 of PM_{10} and 0.38 μg/m^3 of $PM_{2.5}$ to the 24-hour PM_{10} NAAQS (150 μg/m3), and 0.08 μg/m^3 to the annual PM_{10} NAAQS (50 μg/m^3). Construction emissions would also contr bute to all PM NAAQS; however, the proponent has committed to ensuring that emissions would not exceed major source thresholds.	There would not be any point sources of emissions under Sub-alternative A1; therefore, the SSEP would not result in any substantive contributions to NAAQS.

Table 2.16 Summary of Impacts

	No Action	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Alternative B: Reduced Footprint	Sub-alternative A1: Photovoltaic
Visibility of emissions plumes	Under No Action, there would be no visible plumes from the Project Area.	The Proposed Action would result in a visible emissions 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. A vapor plume would also be visible during early morning hours, less than ten days per month, from December through February, and less than five days per month in November and March.	Plume vis bility associated with Alternative A would be the same or less than the impact descr bed for the Proposed Action. Under Alternative A, there would not be any vapor plumes associated with the cooling towers.	Plume vis bility associated with Alternative B would be the same or less than the impact described for the Proposed Action. There would be a slightly smaller likelihood of vapor plumes under Alternative B as compared to the Proposed Action.	There would not be any plumes under Sub--alternative A1.
CLIMATE CHANGE[1]					
Lifetime GHG emissions from vegetation removal, construction, and 30-year operation (Mt CO2e)	0	6,885,050	6,312,914	4,751,754	25,203
Lifetime GHG emissions avoided from grid electricity (Mt CO2e)	0	-20,714,872	-18,850,534	-13,809,915	-13,899,589
Net lifetime GHG emissions before potential mitigation measures (Mt CO2e)	0	-13,829,822	-12,537,620	-9,058,160	-13,874,386
Net lifetime GHG emissions after potential mitigation measures (Mt CO2e)	0	-13,841,033	-12,548,809	-9,063,469	-13,879,425
[1] Climate Change Note: GHG savings and emissions levels less than zero indicate an overall reduction in GHGs. Net lifetime GHG emissions levels less than zero also indicate an overall net mitigation of climate change.					
CULTURAL RESOURCES					
Recorded Site AZ T:10:238 (ASM)	No impacts	AZ T:10:238 (ASM) is eligible for the NRHP. Under all action alternatives, the site would be 100% disturbed by construction of the power plant, and the project would result in short- and long-term direct adverse effects to the site. Through a program of data recovery, this adverse effect (as determined under Section 106) could be mitigated. Additionally, the new transmission line would have an indirect adverse visual effect on the site; however, because the site's NRHP eligibility is based on its potential to supply important information about the past, any effects to setting would not change its NRHP eligibility.			
Recorded Site AZ T:14:165 (ASM)	No impacts	AZ T:14:165 (ASM) is eligible for the NRHP. Under all action alternatives, no ground disturbance of the site would occur. The new transmission line would have an indirect adverse visual effect on the site; however, because the site's NRHP eligibility is based on its potential to supply important information about the past, any effects to setting would not change its NRHP elig bility.			
Recorded Site AZ T:14:167 (ASM)	No impacts	AZ T:14:167 (ASM) is eligible for the NRHP. Under all action alternatives, no ground disturbance of the site would occur. The new transmission line would have an indirect adverse visual effect on the site; however, because the site's NRHP eligibility is based on its potential to supply important information about the past, any effects to setting would not change its NRHP elig bility.			
GEOLOGY AND MINERALS					
Geologic Formations Affected		3,620 acres of disturbance would occur within two geologic units: 3,616 acres within undivided Quaternary alluvium acres and 4 acres within younger Quaternary alluvium.	3,609 acres of disturbance would occur within two geologic units: 3,605 acres within undivided Quaternary alluvium acres and 4 acres within younger Quaternary alluvium.	2,394 acres of disturbance would occur within two geologic units: 2,390 acres within undivided Quaternary alluvium acres and 4 acres within younger Quaternary alluvium.	2,013 acres of disturbance would occur within two geologic units: 2,010 acres within undivided Quaternary alluvium and 3 acres within younger Quaternary alluvium.
Potential Preclusion of Minerals Use		3,620 acres of potentially salable sand and gravel would be precluded from use for the life of the project.	3,609 acres of potentially salable sand and gravel would be precluded from use for the life of the project.	2,394 acres of potentially salable sand and gravel would be precluded from use for the life of the project.	2,013 acres of potentially salable sand and gravel would be precluded from use for the life of the project.

Table 2.16 Summary of Impacts

	No Action	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Alternative B: Reduced Footprint	Sub-alternative A1: Photovoltaic
HAZARDOUS MATERIALS AND HAZARDOUS AND SOLID WASTE					
Hazardous materials, hazardous waste, and solid waste used/stored on-site	No impacts from construction or operation of the SSEP. Current activities in the area would not result in the generation, use, or disposal of hazardous materials and hazardous and solid waste within the Project Area.	Under all these action alternatives, SSEP construction and operation activities would generate certain hazardous and nonhazardous solid waste streams, increasing the risk of leaks and spills with the potential to affect human health or contaminate surrounding soils, surface waters, and groundwater. Hazardous materials and wastes and regulated, nonhazardous solid wastes are governed by all applicable LORS and a full spill prevention plan (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 and implementation of the SPP, there would be no impacts to human health and safety or surrounding soils, surface water, and groundwater. In addition, 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., a hazardous material business plan). The following is a list of materials generated or used under the Proposed Action: • Hydrogen: 63,000 standard cubic feet (335 pounds) at one time • Compressed gas: 800 cubic feet each of acetylene, argon, and oxygen at one time • Petroleum products Lube oil: 10,000 gallons (used); 550 gallons (on-site) Mineral insulating oil: 32,000 gallons Diesel fuel: 300 gallons • Activated and spent carbon 4,000 pounds activated (on-site) 400,000 pounds spent/year (generated) • Herbicides: approximately 37,000 pounds/year (24,050 pounds/year for Alternative B) • Waste mirror glass: unquantified • Hydraulic fluids, oils, greases Fluids and oils: 70,000 gallons/year Oily effluent: 5,000 gallons/year Oily rags and filters: six 55-gallon drums/month • Solvents and cleaning solutions: 500 gallons/year • Soil stabilizer: used immediately • Universal wastes: 75 items/month • Construction wastes Containers of hazardous waste: 2 cubic yards/week Solvents, oil paint, rags: 200 gallons/90 days Heat exchanger/boiler fluids: 1,000 gallons Batteries: 20 Herbicides: 50 gallons Wood, concrete, steel, plastic: 40 cubic yards/week Paper, aluminum, plastic, food: 200 gallons/ day Generation of electric and magnetic fields (EMF) would occur under all action alternatives.			Under Sub-alternative A1, no activated and spent carbon or hydrogen volumes would be required. No waste mirror glass would be generated. Approximately 20,350 pounds of herbicides would be used annually. PV panels, which may contain hazardous materials sealed within the panels, will be used onsite. The generation of other hazardous and nonhazardous solid waste streams would be the same as the Proposed Action.
Heat transfer fluid (HTF)	No HTF would be within the Project Area under the No Action alternative.	1,500,000 gallons of HTF would be in use under the Proposed Action.	No change from the Proposed Action.	1,050,000–1,125,000 gallons of HTF would be in use, which is a reduction of 375,000–450,000 gallons when compared to the Proposed Action.	No HTF would be required under Sub-alternative A1.
Natural gas	No natural gas would be used within the Project Area under the No Action alternative.	3,982,000 MMBtu/year would be used within the Project Area.	3,623,620 MMBtu/year would be used within the Project Area, a reduction of 358,380 MMBtu/year when compared to the Proposed Action.	2,655,000 MMBtu/year would be used within the Project Area, a reduction of 1,327,000 MMBtu/year when compared to the Proposed Action.	No natural gas pipeline would be required under Sub-alternative A1.
Water treatment Chemicals	No natural gas would be within the Project Area under the No Action alternative.	Under all action alternatives the following water treatment chemicals would be used and stored on site: • 8,500 gallons sodium hydroxide, 50% solution • 17,000 gallons sodium hypochlorite, 12.5% solution • 16,000 gallons sulfuric acid, 93% solution			No sodium hydroxide, hypochlorite, or sulfuric acid would be required under Sub-alternative A1. Daily water treatment chemicals would consist of one 55-gallon tote of bisulfate and one 15-gallon tote of anti-scalant.

Table 2.16 Summary of Impacts

	No Action	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Alternative B: Reduced Footprint	Sub-alternative A1: Photovoltaic
LAND USE AND ACCESS					
Current land uses precluded by SSEP development	Current land uses such as grazing, mining, utility corridors, dispersed recreation, low-density residential, and transportation would continue with no change to use type.	Preclusion of grazing and recreational land uses on approximately 3,6200 acres. No impact to utility corridors, commercial and industrial use, and other existing ROWs. Potential conflict with 69 acres of mining claims if BLM issues an overlapping ROW for SSEP. Potential conflict with future Hassayampa Freeway if BLM issues overlapping ROW for SSEP. Adverse impacts to residential use within 0.6 mile of the Project Area. When combined with the Gen-tie Line Option, 1.1 more acres (1.6% increase) of the Wesco Mining Claim would be disturbed compared to this alternative when combined with the proposed gen-tie alignment.	Same as Proposed Action.	Preclusion of grazing and recreational land uses on approximately 2,363 acres. No impact to utility corridors, commercial and industrial use, and other existing ROWs. Potential conflict with 15 acres of mining claims if BLM issues an overlapping ROW for SSEP. Potential conflict with future Hassayampa Freeway if BLM issues overlapping ROW for SSEP. Adverse impacts to residential use within 0.6 mile of the Project Area. When combined with the Gen-tie Line Option, 1.1 more acres (7.3% increase) of the Wesco Mining Claim would be disturbed compared to this alternative when combined with the proposed gen-tie alignment.	Preclusion of grazing and recreational land uses on approximately 1,983 acres. No impact to utility corridors, commercial and industrial use, and other existing ROWs. Potential conflict with approximately 12 acres of mining claims if BLM issues an overlapping ROW for SSEP. Potential conflict with future Hassayampa Freeway if BLM issues overlapping ROW for SSEP. Adverse impacts to residential use within 0.6 mile of the Project Area. When combined with the Gen-tie Line Option, 1.1 more acres (7.3% increase) of the Wesco Mining Claim would be disturbed compared to this alternative when combined with the proposed gen-tie alignment.
Consistency with other land-use plans	Not applicable.	Under all action alternatives, land use would be consistent with the *Lower Gila South Resource Management Plan* (BLM 1985), *Maricopa County Comprehensive Plan* (Maricopa County 2002), *Goodyear General Plan* (City of Goodyear 2003), *and Town of Buckeye General Plan* (Town of Buckeye 2008a).			
LIVESTOCK GRAZING					
Grazing	No change to number of acres in the Beloat or Arnold grazing allotments. No loss of forage or AUMs in either allotment.	Conversion of 2,649 acres of the Beloat grazing allotment and 971 acres of the Arnold grazing allotment from grazing to an industrial site. Loss of 78 AUMs and 44 AUMs of forage in the Beloat and Arnold grazing allotments, respectively. Removal of the CCC stock pond would reduce available water sources for livestock and would impact foraging ability.	Same as the Proposed Action.	Conversion of 1,397 acres of the Beloat grazing allotment and 966 acres of the Arnold grazing allotment from grazing to an industrial site. Loss of 38 AUMs and 41 AUMs of forage in the Beloat and Arnold grazing allotments, respectively. CCC stock pond would remain available for livestock use.	Conversion of 1,051 acres of the Beloat grazing allotment and 932 acres of the Arnold grazing allotment from grazing to an industrial site. Loss of 31 AUMs and 39 AUMs of forage in the Beloat and Arnold grazing allotments, respectively. CCC stock pond would remain available for livestock use.
NOISE					
Construction Noise	No project-related noise impacts would occur.	Construction-related noise would range from 34 to 54 dBA during the busiest periods of activity at each of the receptor locations.	Impacts would be the same as those descr bed under the Proposed Action.	Increased ambient noise levels from construction-related noise would be similar to that described under the Proposed Action, but would occur over a shorter duration. The reduced footprint under Alternative B would result in reduced aud ble construction noise at nearby residences (Receptors ST-2, LT-1, and LT-2) when compared to the Proposed Action.	Increased ambient noise levels from construction activities would be discernible during the busiest periods of construction activity. This would be comparable but typically lower than predictions for the Proposed Action. Construction traffic noise for Sub-alternative A1 would be the same as the Proposed Action.
Exterior Noise in Goodyear	No project-related noise impacts would occur. Other activities would produce minimal noise.	Exterior noise levels in the range of 51–54 dBA would be experienced at the noise receptor in the Goodyear Planning Area (ST-2) for intermittent short-term periods when construction activities are occurring in that area.	Impacts would be the same as those descr bed under the Proposed Action.	Construction activities would occur further from residential areas to the east, represented by ST-2. The increased distance would result in reduced aud ble construction noise at nearby residences when compared to the Proposed Action.	Exterior noise levels in the range of 38–46 dBA would be experienced at the noise receptor in the Goodyear Planning Area (ST-2) for intermittent short-term periods when construction activities are occurring.
Temporary Venting Noise	No project-related noise impacts would occur.	During commissioning and initial start-up, the frequency, length, and noise intensity of 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 20–30 dB.	Impacts would be the same as those descr bed under the Proposed Action.	Impacts would be essentially the same as those described under the Proposed Action.	No venting would occur during start-up of Sub-alternative A1.

Table 2.16 Summary of Impacts

	No Action	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Alternative B: Reduced Footprint	Sub-alternative A1: Photovoltaic
Operational Noise	No project-related noise impacts would occur.	In the Goodyear Planning Area (ST-2), SSEP daytime contributions would be 5–7 dBA above hourly average noise levels (L_{eq}).	Impacts would be the same as those descr bed under the Proposed Action.	Because operation noise levels would be primarily controlled by the power block equipment and not by 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.	The SSEP under Sub-alternative A1 would have no major rotating equipment, no fired heaters, no cooling facilities, and no pressurized systems. Operational noise levels would be below ambient noise levels under this alternative.
PALEONTOLOGY					
	No impacts.	Low probability that the 3,620-acre Project Area subject to surface disturbance contains vertebrate fossils or scientifically significant nonvertebrate fossils. Therefore, no impacts to paleontological resources are l kely.	Low probability that the 3,609-acre Project Area subject to surface disturbance contains vertebrate fossils or scientifically significant nonvertebrate fossils. Therefore, no impacts to paleontological resources are likely.	Low probability that the 2,394-acre Project Area contains vertebrate fossils or scientifically significant nonvertebrate fossils. Therefore, no impacts to paleontological resources are l kely.	Low probability that the 2,013-acre Project Area contains vertebrate fossils or scientifically significant nonvertebrate fossils. Therefore, no impacts to paleontological resources are l kely.
RECREATION AND WILDERNESS CHARACTERISTICS					
Recreation	No change in acres of public lands managed as semiprimitive motorized in the Recreation Opportunity Spectrum (ROS). No lost opportunities for solitude and primitive recreation or effects to nearby recreation areas. No loss of acres of wilderness characteristics.	Removal (and conversion to an industrial use setting) of approximately 3,500 acres of extensive recreation management area classified as ROS semiprimitive motorized. Loss of 3,500 acres with opportunities to participate in recreational activities such as h king, biking, backcountry driving, hunting, and horseback riding. Reduced recreational experience and setting in the Sonoran Desert National Monument, North Maricopa Mountains Wilderness, Sierra Estrella Wilderness, and the Buckeye Hills Regional Park by alteration of the viewshed from a more natural setting to an industrial setting and by introduction of noise that would affect the recreational experience for a typical visitor seeking solitude near the perimeter of these areas. However, as visitors venture deeper into the adjacent recreation areas and further from the Project Area, noise intrusions would lessen and eventually cease.	Same as the Proposed Action.	Same as the Proposed Action except there would be approximately 2,300 acres (1,200 acres less than the Proposed Action) converted from an extensive recreation management area (ERMA) and ROS category semiprimitive to an industrial site.	Same as the Proposed Action except there would be approximately 2,013 acres converted from an ERMA and ROS category semiprimitive to an industrial site (approximately 1,500 acres less than the Proposed Action).
Wilderness characteristics	No change to the area under consideration as having wilderness characteristics because opportunities for solitude and primitive recreation would not be diminished. There would be no impacts to the natural character because no component of the project would be constructed in the area being considered for wilderness character.	Under all action alternatives, there would be no impacts to the size or naturalness of the unit under consideration for having wilderness characteristics. Reduction of the recreational setting and experience (e.g., solitude, isolation) for sensitive viewers due to the visual impacts of project components would occur. Effects from visual disturbances on the desired setting would dissipate as visitors ventured farther into the core of the area.			
SOCIOECONOMICS					
Social	Current land uses (livestock grazing and recreation) would continue to contribute to the current quality of life in the local communities.	Under all action alternatives, the SSEP would result in a population increase of less than 0.3% in Goodyear, Buckeye, or Maricopa County. Potential short-term decrease in property values of up to 14.9% in houses located within 0.15 mile of SSEP. Residential properties located more than 0.6 mile from SSEP would have no discernable effect on property values. Changes to quality of life could be experienced by local residents and/or visitors to the area who have traditionally identified with the rural, undeveloped landscape. The change in setting to a more industrial feel could adversely impact these individuals throughout the life of the project.			

Table 2.16 Summary of Impacts

	No Action	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Alternative B: Reduced Footprint	Sub-alternative A1: Photovoltaic
Economic	Economic contr butions generated from grazing operations and dispersed recreation would remain similar to current conditions.	**Construction**: Annual employment (direct, indirect, and induced) would total 1,606 full-time jobs. Annual labor income would total approximately $84,402,211. Annual output (gross sales or revenues) would total $221,622,804. **Operations**: Annual employment would total 208 full-time jobs. Annual labor income would total approximately $16,857,069. Annual output would total approximately $71,454,759. **Maximum annual electricity output:** 1,155,000 MWh; this is equivalent to the supply needs for approximately 87,899 residential units.	Same as Proposed Action. **Maximum annual electricity output**: 1,051,050 MWh; this is equivalent to the supply needs for approximately 79,988 residential units.	**Construction**: Annual employment would total 1,445 full-time jobs. Annual labor income would total approximately $75,961,990. Annual output would total approximately $199,459,652. **Operations**: Annual employment would total 183 full-time jobs. Annual labor income would total approximately $14,749,935. Annual output would total approximately $62,533,914. **Maximum annual electricity output**: 770,000 MWh; this is equivalent to the supply needs for approximately 58,599 residential units.	**Construction**: Annual employment would total 639 full time jobs. Annual labor income would total approximately $36,118,518. Annual output would total approximately $88,753,140. **Operations**: Annual employment would total 42 full time jobs. Annual labor income would total approximately $3,371,414. Annual output would total approximately $14,290,951. **Maximum annual electricity output**: 775,000 MWh; this is equivalent to the supply needs for approximately 58,980 residential units.
Fiscal	Grazing fees collected by the BLM for the two allotments would generate amounts similar to current contr butions, totaling approximately $5,362.	**Construction**: State and county tax revenue from local purchases would total approximately $1.1 million and $133,000, respectively. Additional city sales tax revenues would total up to $570,000. Transaction privilege tax and payroll tax would contribute approximately $8.8 million throughout construction. City-levied privilege taxes would generate up to $5.6 million. A 7.1% decrease in AUMs, compared to No Action, would result in an approximately $381 decrease in revenue generated from BLM grazing fees. **Operations**: Annual state and county tax revenues would total approximately $17,920 and $2,227, respectively. Transaction privilege tax and payroll tax base would contribute approximately $158,000 in state and county revenue. City-levied privileged taxes would generate up to $80,000 annually. Annual property taxes would total up to $25 million and decrease as equipment depreciates. BLM annual rental fees would total $696,858. The BLM MW capacity fee would be approximately $164,250 in 2013 and increase to $2,463,780 annually.	Same as Proposed Action.	**Construction**: State and county tax revenue would total approximately $1.04 million and $126,350, respectively. Transaction privilege tax and payroll tax would contribute $7.9 million. City-levied privilege taxes would generate up to $5 million. A 5.5% decrease in AUMs would result in an approximately $294 decrease in revenue generated from BLM grazing fees. **Operations**: Annual state and county tax revenues would total approximately $10,752 and $1,344, respectively. Transaction privilege tax and payroll tax base would contr bute approximately $138,250 to state and county revenue. City-levied privilege taxes would generate up to $70,000 annually. Annual property taxes would total up to $17.5 million and decrease as equipment depreciates. BLM annual rental fees would total $436,948. The BLM MW capacity fee would be approximately $821,250 in 2013 and increase to $1,642,500 annually.	**Construction**: State and county tax revenue would total approximately $798,000 and $98,000, respectively. Transaction privilege tax and payroll tax would contr bute $3.1 million. City-levied privilege taxes would generate up to $3 million. A 5% decrease in AUMs would result in an approximately $93.00 decrease in revenue generated from BLM grazing fees. **Operations**: Annual state and county tax revenues would total approximately $15,400 and $1,925, respectively. Transaction privilege tax and payroll tax base would contribute approximately $61,425 to state and county revenue. City-levied privilege taxes would generate up to $39,000 annually. Annual property taxes would total up to $15.5 million and decrease as equipment depreciates. BLM annual rental fees would total $376,680. The BLM MW capacity fee would be approximately $105,120 in 2013 and increase to $1,576,800 annually.
Environmental justice	No impacts.	Under all action alternatives, no impacts were identified that would disproportionately affect potential EJ populations living within a 5-mile radius of the SSEP.			
SOILS					
Acres of long-term soil disturbance	No new impacts to soils would occur under No Action, although some soil impacts associated with current livestock grazing practices would continue in the Project Area. Impacts under this alternative would include soil compaction due to grazing, but it would generally be limited to discrete paths or livestock congregation areas. Recreation in the Project Area, including mostly hiking, horseback riding, and OHV travel, would not be expected to impact soils due to its limited use.	Long-term disturbance to soils would occur from the clearing of vegetation, grading of the project footprint to a 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 3,589 acres. Long-term disturbance to soils and biological soil crusts (BSCs) would occur from the loss of soil biota due to the use of 37,000 pounds of herbicide annually to control vegetation in the solar field.	The type of disturbance to soils would be the same as under the Proposed Action; however, there would be 3,580 acres of long-term disturbance, a reduction of 9 acres when compared to the Proposed Action. Long-term impacts to soils and BSCs from herbicide use in the solar field would be the same as under the Proposed Action.	The type of disturbance to soils would be the same as under the Proposed Action; however, there would be 2,363 acres of long-term disturbance, a reduction of 1,226 acres when compared to the Proposed Action. Long-term impacts to soils and BSCs would be of the same nature as under the Proposed Action, but would entail 24,050 pounds of herbicides applied annually, or 35% less herbicide than under the Proposed Action.	The type of disturbance to soils would be the same as under the Proposed Action; however, there would be 1,984 acres of long-term disturbance, a reduction of 1,605 acres when compared to the Proposed Action. Long-term impacts to soils and BSCs would be of the same nature as under the Proposed Action, but would entail 20,350 pounds of herbicides applied annually, or 45% less herbicide than under the Proposed Action.

Table 2.16 Summary of Impacts

	No Action	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Alternative B: Reduced Footprint	Sub-alternative A1: Photovoltaic
Acres of short-term soil disturbance	Same as above.	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.	The type of disturbance to soils would be the same as under the Proposed Action; however, there would be 29 acres of short-term disturbance, a reduction of 2 acres when compared to the Proposed Action.	The type of disturbance to soils would be the same as under the Proposed Action; however, there would be 30 acres of short-term disturbance, a reduction of 1 acre when compared to the Proposed Action.	Same as Alternative A.
Disturbance to sensitive soils	Same as above.	• 0.6% of long-term disturbance and 33.8% of short-term disturbance would occur in soils that are moderately restrictive for excess sodium. • 8.2% of long-term disturbance and 46.8% of short-term disturbance would occur in soils that are moderately restrictive for droughty conditions. • 99% of both total long-term and short-term disturbance under the Proposed Action would occur in soils with moderate alkalinity. • No disturbance would occur in soils with limited rooting depth or high salinity. • 21.4% of long-term disturbance and 15.8% of short-term disturbance would occur within soils with moderately high wind- and water-erosion potential.	The slight reduction in acres of disturbance would not affect the relative percentage of impact to soil types (as compared to the total acreage of soil disturbance).	• 0.7% of long-term disturbance and 32.1% of short-term disturbance would occur in soils that are moderately restrictive for excess sodium. • 2.0% of long-term disturbance and 0% of short-term disturbance would occur in soils that are moderately restrictive for droughty conditions. • There would be no change in the total long-term and short-term disturbance in soils with moderate a kalinity when compared to the Proposed Action. • No disturbance would occur in soils with limited rooting depth or high salinity. • 29.7% of long-term and 16.2% of short-term disturbance would occur within soils with moderately high wind- and water-erosion potential.	• 0.8% of long-term disturbance and 31.1% of short-term disturbance would occur in soils that are moderately restrictive for excess sodium. • 2.6% of long-term disturbance and 1.7% of short-term disturbance would occur in soils that are moderately restrictive for droughty conditions. • 99% of both total long-term and short-term disturbance would occur in soils with moderate a kalinity. • No disturbance would occur in soils with limited rooting depth or high salinity. • 26.5% of long-term and 30.0% of short-term disturbance would occur within soils with moderately high wind- and water-erosion potential.
SPECIAL DESIGNATIONS					
	No acreage within special designation areas would be disturbed. No effects on wildlife or their habitat, or to recreation opportunities in the Sonoran Desert National Monument and wilderness.	No acreage within special designation areas would be disturbed. Presence and view of the facility on 3,620 acres would degrade desired primitive recreation setting and experience (e.g., solitude and isolation) for some distance into the adjacent wilderness. The facility and associated linear facilities (roads, water and gas pipelines, and power lines) would create barriers to wildlife movement to and from the adjacent wilderness and the Sonoran Desert National Monument. Construction and operation of the facility would create increased noise levels.	Same as the Proposed Action.	Same as the Proposed Action, but to a lesser degree, as the facility would remove 37% less footprint than the Proposed Action.	Under Sub-alternative A1, the facility would present less of a landscape change and less of an adverse impact to visitors in special designation areas than under the Proposed Action, because 45% less vegetation would be removed from the project footprint. Vehicle trips would be reduced by 73%, reducing barriers to wildlife movement. Construction noise would be similar to that predicted for the Proposed Action. Operational noise levels would be below ambient noise levels under this alternative and would not affect the recreational experience. Sub-alternative A1 would be less reflective and have a lower profile than the Proposed Action, reducing visual impacts to special designations.
TRANSPORTATION AND TRAFFIC					
Level of Service (LOS)	LOS for the SR-85/Riggs Road intersection would continue at existing levels.	The LOS for the SR-85/Riggs Road intersection would be rated lower. Traffic at the SR-85/Riggs Road intersection would increase by approximately nine times during peak construction. LOS would go from LOS B or better to LOS B or worse ranging to LOS F.	Impacts would be similar to the Proposed Action except for a slight increase in the amount of worker vehicles traveling to and from the SSEP during the peak construction period. This slight increase would not affect the LOS during peak construction.	Impacts would be similar to the Proposed Action except for a shorter duration of peak construction traffic. This shorter duration would not affect the LOS during peak construction.	The LOS for the SR-85/Riggs Road intersection would be rated higher than the other action alternatives. Traffic at the SR-85/Riggs Road intersection would result in a lower LOS during the morning commute at peak construction only. LOS would go from LOS B to LOS C during peak construction.
Routes	Public use of the existing route network (13.1 miles of primitive roads) would continue at existing levels. No new routes would be constructed. No existing routes would be upgraded.	Construction of the SSEP would close 7.4 miles of primitive roads currently available for public use.	Same as the Proposed Action	Construction of the SSEP would close 3.7 miles of primitive roads currently available for public use.	Construction of the SSEP would close 3 miles of primitive roads currently available for public use.

Table 2.16 Summary of Impacts

	No Action	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Alternative B: Reduced Footprint	Sub-alternative A1: Photovoltaic
VEGETATION AND SPECIAL-STATUS SPECIES					
Vegetation communities	Reclamation of several test well sites would have long-term beneficial impacts on native vegetation through restoration of the structural diversity and functioning of vegetation communities.	Direct impacts to vegetation communities from the removal of 3,600 acres of Sonoran Creosotebush-Bursage Scrub (including 38,555 linear feet of Xeroriparian Wash). Indirect impacts to native vegetation communities from fugitive dust and increased risk of weed introduction associated with 1,000 vehicle round-trips per day on paved roads during peak construction, and 46 vehicle round-trips per day during regular operations.	Direct impacts to vegetation communities from the removal of 3,590 acres of Sonoran Creosotebush-Bursage Scrub (including 38,478 linear feet of Xeroriparian Wash). Indirect impacts to native vegetation communities from fugitive dust and increased risk of weed introduction associated with travel would be the same as under the Proposed Action.	Direct impacts to vegetation communities would result from the removal of 2,374 acres of Sonoran Creosotebush-Bursage Scrub (including 22,122 linear feet of Xeroriparian Wash). Indirect impacts to native vegetation communities from fugitive dust and increased risk of weed introduction associated with 950 vehicle round-trips per day on paved roads during peak construction and 46 vehicle round-trips per day during regular operations.	Direct impacts to vegetation communities would result from the removal of 1,992 acres of Sonoran Creosotebush-Bursage Scrub (including 22,461 linear feet of Xeroriparian Wash). Indirect impacts to native vegetation communities from fugitive dust and increased risk of weed introduction associated with 267 vehicle round-trips per day on paved roads during peak construction and 16 vehicle round-trips per day during regular operations.
Special-status plant species	No project-related impacts to special-status plant species.	Direct adverse impacts to 12 Arizona Department of Agriculture (ADA)-protected special-status plant species from salvage or loss of all plants on 3,600 acres (including 38,555 linear feet of Xeroriparian Wash).	Direct adverse impacts to 12 ADA-protected special-status plant species from salvage or loss of all plants on 3,590 acres (including 38,478 linear feet of Xeroriparian Wash).	Direct adverse impacts to 12 ADA-protected special-status plant species from salvage or loss of all plants on 2,374 acres (including 22,122 linear Feet Of Xeroriparian Wash).	Direct adverse impacts to 12 ADA-protected special-status plant species from salvage or loss of all plants on 1,992 acres (including 22,461 linear feet of Xeroriparian Wash).
Noxious and invasive plant species	Reclamation of several test well sites would reduce the risk of invasion by noxious and invasive plant species.	Increased risk of introduction and spread of noxious and invasive plant species into native vegetation communities along 198,182-foot project perimeter. When combined with the Gen-tie Line Option, there would be a 7% increase in the perimeter of the SSEP compared to when this alternative is combined with the proposed gen-tie alignment.	Increased risk of introduction and spread of noxious and invasive plant species into native vegetation communities along 184,906-foot project perimeter. When combined with the Gen-tie Line Option, there would be a 7% increase in the perimeter of the SSEP compared to when this alternative is combined with the proposed gen-tie alignment.	Increased risk of introduction and spread of noxious and invasive plant species into native vegetation communities along 178,400-foot project perimeter. When combined with the Gen-tie Line Option, there would be a 7% increase in the perimeter of the SSEP compared to when this alternative is combined with the proposed gen-tie alignment.	Increased risk of introduction and spread of noxious and invasive plant species into native vegetation communities along 171,309-foot project perimeter. When combined with the Gen-tie Line Option, there would be a 10% increase in the perimeter of the SSEP compared to when this alternative is combined with the proposed gen-tie alignment.
VISUAL RESOURCES					
Visual contrast	Current landscape in the area is characterized by flat to low desert hills and plains with low vegetative diversity. 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.	The regular geometric forms and strong horizontal and vertical lines associated with the SSEP would contrast with the irregular, organic forms and colors of the existing landforms and vegetation. In addition, color contrast associated with the reflective solar troughs would vary throughout the day as the mirrors rotate to track the sun. The visual contrasts from the SSEP rank from weak to strong depending on the time of day and viewing location. The solar 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 gray-green vegetation.	Similar to the Proposed Action, except that the use of an ACC in each power block (instead of cooling towers) would result in reduced visual contrast to the irregular forms and lines of the current landscape from KOPs with level views. A reduction in the size of the evaporative ponds would result in less reflective color contrast vis ble from some KOPs.	Similar to the Proposed Action, except that visual contrasts would occur over a smaller geographic area and be less visible from surrounding KOPs Contrasts in form, line, and color would diminish more over distance than those under the Proposed Action. 30% fewer solar troughs associated with Alternative B would result in a smaller area of color contrast visible from elevated KOPs.	Similar to the Proposed Action, except that visual contrasts would be less due to the reduction in project footprint. Contrast levels would change from predominantly moderate (with strong contrasts at a few locations) under the Proposed Action to predominantly weak (with moderate contrasts at a few locations) under Sub-alternative A1. Visual changes due to the geometric forms, vertical lines, and concentrated light associated with 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 when viewed from slightly elevated to superior viewing positions at certain times of the day.
Changes to the visual inventory	No change would occur to the existing visual inventory.	Construction and operation of the Proposed Action would occur exclusively within lands with low visual sensitivity and Class C scenic quality, and in the foreground/middleground distance zone. The Proposed Action 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.	Changes to the visual inventory would be the same as the Proposed Action, except that the project would occupy slightly fewer acres.	Changes to the visual inventory would be the same as the Proposed Action, except that the project would occupy fewer acres.	Changes to the visual inventory would be the same as the Proposed Action, except that the project would occupy fewer acres.
Consistency with BLM VRM objectives	BLM VRM Class IV objectives would continue to be met.	Under all action alternatives, 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.			

Table 2.16 Summary of Impacts

	No Action	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Alternative B: Reduced Footprint	Sub-alternative A1: Photovoltaic
Night sky conditions	There would be no change to the Bortle Dark-Sky Scale Class V rating.	Under all action alternatives, there would be no change to the Bortle Dark-Sky Scale Class V rating.			
Potential Glint and Glare	No new glint and glare impacts would occur.	The Proposed Action would produce glint and glare that could be vis ble 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 may be affected by glint and glare throughout the day, because larger portions of the project area would be visible. Contrast associated with glint and glare is anticipated to decrease as distance between the SSEP and the viewer increases. When the solar troughs of the Proposed Action are moving into or out of stow position (shortly before dawn or after dusk), they have the potential to produce glint and glare. 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 reflect the sky.	Impacts from potential glint and glare would be the same as the Proposed Action.	Potential glint and glare impacts would be the same under Alternative B as under the Proposed Action, except that they would be reduced by approximately 30% due to the smaller project footprint.	Potential glint and glare impacts would be reduced under Sub-alternative A1 when compared to the Proposed Action. Sub-alternative A1 would use PV panels rather than solar troughs. PV panels do not have the same stow position as solar troughs and are designed specifically not to reflect light, reducing potential glint and glare impacts. In addition, the PV panels would have a lower profile than the solar troughs of the Proposed Action, which would also reduce visibility when viewed from level viewing positions. The smaller footprint of this alternative would also reduce glint and glare impacts.
WATER RESOURCES					
Surface Water	No impacts to surface water resources would occur.	Within the solar field, 39.6 linear miles of surface water drainages would be filled and 215 acres of floodplains would be filled. These drainages' water and sediment loads would be diverted around the solar field.	Same as Proposed Action.	Within the solar field, 25.8 linear miles of surface water drainages would be filled and 112 acres of floodplains would be filled. These drainages' water and sediment loads would be diverted around the solar field.	Within the solar field, 19.8 linear miles of surface water drainages would be filled and 1.9 acres of floodplains would be filled. These drainages' water and sediment loads would be diverted around the solar field.
Groundwater use	No changes in the groundwater reserves stored in the Rainbow Valley aquifer would occur because groundwater would not be used for the SSEP.	2,305 to 3,003 acre-feet of produced groundwater would be used annually. Direct impact to the groundwater reserves in the Rainbow Valley aquifer would result in a reduction of 69,150 to 90,0902 acre-feet of groundwater at the completion of the project. **Reduced Water Use Option: Brine Concentrator** 2,144 to 2,793 acre-feet of produced groundwater would be used annually with the Brine Concentrator Option (7% less than under the Proposed Action). Direct impact to the groundwater reserves in the Rainbow Valley aquifer would result in a reduction of 64,311 to 83,812 acre-feet of groundwater at the completion of the project.	116 to 151 acre-feet of produced groundwater would be used annually (an approximately 95% decrease compared to the Proposed Action). Direct impact to the groundwater reserves in the Rainbow Valley aquifer would result in a reduction of 3,484 to 4,549 acre-feet of groundwater at the completion of the project.	1,518 to 2,003 acre-feet of produced groundwater would be used annually (an approximately 34% decrease compared to the Proposed Action). Direct impact to the groundwater reserves in the Rainbow Valley aquifer would result in a reduction of 45,535 to 60,101 acre-feet of groundwater at the completion of the project. **Reduced Water Use Option: Brine Concentrator** 1,412 to 1,863 acre-feet of produced groundwater would be used annually with the Brine Concentrator Option (7% less than under Alternative B). Direct impact to the groundwater reserves in the Rainbow Valley aquifer would result in a reduction of 42,341 to 55,891 acre-feet of groundwater at the completion of the project.	On average, 65 acre-feet of produced groundwater would be used annually (an approximate 98% decrease compared to the Proposed Action). Direct impact to the groundwater reserves in the Rainbow Valley aquifer would result in a reduction of 2,165 acre-feet of groundwater at the completion of the project.

Table 2.16 Summary of Impacts

	No Action	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Alternative B: Reduced Footprint	Sub-alternative A1: Photovoltaic
Groundwater drawdown	No changes in the depth to groundwater in the Rainbow Valley aquifer would occur because groundwater would not be used for the SSEP.	Direct impact to the depth-to-groundwater from pumping up to 3,003 afy would result in drawdown in registered wells of up to: • 32 feet in one well, • 30–32 feet in five wells, • 28–30 feet in six wells, • 26–28 feet in four wells, • 24–26 feet in 10 wells, • 22–24 feet in 7 wells, • 20–22 feet in 24 wells, • 18–20 feet in seven wells, • 16–18 feet in 14 wells, • 14–16 feet in 10 wells, • 12–14 feet in eight wells, • 10–12 feet in 17 wells, • 8–10 feet in eight wells, • 6–8 feet in seven wells, • 4–6 feet in 20 wells, and • 2–4 feet in 20 wells. **Reduced Water Use Option: Brine Concentrator** Direct impact to the depth to groundwater was not modeled and is unknown, but expected to be less because this option would reduce water use by approximately 7%.	Direct impact to the depth to groundwater was not modeled and is unknown but expected to be much less than the Proposed Action because this alternative would use approximately 95% less water.	Direct impact to the depth to groundwater was not modeled and is unknown but expected to be less than the Proposed Action because this alternative would use approximately 33% less water. **Reduced Water Use Option: Brine Concentrator** Direct impact to the depth to groundwater was not modeled and is unknown but expected to be less because this option would reduce water use by approximately 7%.	Direct impact to depth to groundwater from pumping 33 afy during operations would result in a maximum drawdown of less than 1 foot in registered wells in the Rainbow Valley aquifer. Maximum depth to groundwater decline of less than 1 foot over the life of the project.
WILDLIFE AND SPECIAL-STATUS SPECIES					
General wildlife	Low-intensity impacts related to ephemeral grazing and limited OHV use would continue.	A total of 3,600 acres of wildlife habitat in the Sonoran Creosotebush-Bursage Scrub vegetation community would be removed, along with 38,540 linear feet of Xeroriparian Wash habitat. Impacts include wildlife displacement; habitat degradation due to human noise and activity and weed invasion; road mortality and road barrier effects; exposure of wildlife to selenium and other potentially toxic constituents in evaporation ponds; and the removal of the CCC stock pond.	A total of 3,590 acres of wildlife habitat in the Sonoran Creosotebush-Bursage Scrub vegetation community would be removed (<1% less than under the Proposed Action), along with 38,478 linear feet of Xeroriparian Wash habitat (<1% less than under the Proposed Action).	A total of 2,374 acres of wildlife habitat in the Sonoran Creosotebush-Bursage Scrub vegetation community would be removed (34% less than under the Proposed Action), along with 22,122 linear feet of Xeroriparian Wash habitat (43% less than under the Proposed Action). When compared to the Proposed Action, this alternative would retain the CCC stock pond for wildlife use.	A total of 2,013 acres of wildlife habitat in the Sonoran Creosotebush-Bursage Scrub vegetation community would be removed (44% less than under the Proposed Action), along with 22,461 linear feet of Xeroriparian Wash habitat (42% less than under the Proposed Action). When compared to the Proposed Action, this alternative would retain the CCC stock pond for wildlife use and reduce the size of the evaporative pond from approximately 90 acres to 1 acre.

Table 2.16 Summary of Impacts

	No Action	Proposed Action	Alternative A: Reduced Water Use (dry-cooled CST)	Alternative B: Reduced Footprint	Sub-alternative A1: Photovoltaic
Special-status wildlife species	Low-intensity impacts related to ephemeral grazing and limited OHV use would continue.	Displacement of burrowing owl from breeding habitat in the long term due to project construction and operations. Potential interruption of Sonoran desert tortoise dispersal between suitable habitats. Evaporation ponds and human refuse may attract ravens, which would increase the potential for predation on juvenile desert tortoise populations. Impacts to golden eagles (*Aquila chrysaetos*) would include a loss of foraging habitat if prey species decline and the potential for electrocution on the gen-tie power line. Special-status bat species have the potential for exposure to selenium and other potentially toxic constituents in the evaporation ponds. The removal of the CCC stock pond would reduce available breeding habitat for the Great Plains toad.	Impacts from this alternative would be identical to those described for the Proposed Action.	When compared to the Proposed Action, this alternative would disturb less burrowing owl habitat. Golden eagle prey populations would be impacted to a lesser degree than the Proposed Action due to the reduced footprint. The CCC stock pond would remain as potential breeding habitat for the Great Plains toad.	Impacts from this alternative would be similar to those described for Alternative B.
Wildlife linkages	Low-intensity impacts related to ephemeral grazing and limited OHV use would continue.	In the Gila Bend-Sonoran Desert National Monument linkage, a total of 8.9 acres of wildlife habitat in Sonoran Creosotebush-Bursage Scrub vegetation community would be removed, including associated xeroriparian wash habitat. In the Buckeye Hills-Sonoran Desert National Monument linkage, a total of 1,149 acres of wildlife habitat in Sonoran Creosotebush-Bursage Scrub vegetation community would be removed, including associated xeroriparian wash habitat. Impacts in these linkages consist of road barrier effects leading to reduced habitat connectivity and potentially reduced genetic exchange between populations. Species active at dusk and dawn, species that use Xeroriparian Wash habitat for movement corridors, and the Sonoran desert tortoise have the highest potential to be adversely affected.	Impacts from this alternative would be identical to those described for the Proposed Action.	Impacts to defined linkages from this alternative would be identical to those described for the Proposed Action. Fewer adverse impacts to wildlife movement outside of defined linkages would result under Alternative B than under the Proposed Action because it retains more desert wash habitat for wildlife movement. This alternative would not impact one of the larger riparian washes along the east side of the Project Area that l kely functions as a wildlife travel corridor.	Impacts from this sub-alternative would be the same as those described for the Proposed Action, except that there would be reduced road barrier impacts to wildlife due to fewer vehicle trips. Fewer adverse impacts to wildlife movement outside of defined linkages would result than under the Proposed Action because it would retain more desert wash habitat for wildlife movement. This sub-alternative would not impact one of the larger riparian washes along the east side of the Project Area that likely functions as a wildlife travel corridor.

Note: If the Gen-tie Line Option were selected in combination with any action alternative, the increase in total surface disturbance would be less than 1% in all cases. Impacts as a result of implementing the Gen-tie Line Option are not included under the resource headings in this summary table. Land Use and Access and Vegetation and Special-status Species are two exceptions because the Gen-tie Line Option would affect components of these resources differently than noted here.

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