FACT SHEET	
Project name	Palen Solar Power Project (PSPP)
General site location State County: location (SW corner of ROW) Description:	 California Riverside 33°50'56"N latitude, 115°14'22"W longitude The site access road is immediately north of U.S. Interstate I-10, Corn Springs Road exit, ~10 miles east of Desert Center
Solar Technology	Solar thermal (utilizing parabolic troughs)
Nominal power output, per unit / total	250 MW / 500 MW
Number of units	2
Annual expected net electrical energy delivered to the grid, per unit / total	Approximately 500 GWh / 1,000 GWh
Type of turbine exhaust steam condensing	Air Cooled Condenser (dry cooling)
Source of water	2 onsite wells
Water consumption During Operation	300 afy
Energy source	radiant solar energy
Fossil fuel	Propane (for quick startup and heat transfer fluid freeze protection only, not energy generation)
Project ROW area	~5,200 acres
Facility footprint (area inside the fence line (Excludes gen-tie transmission line route outside the Project ROW)	~2,970 acres
Unit #1 (power block and solar field)– area	~1,380 acres
Unit #2 (power block and solar field)– area	~1380 acres
Transmission Line Tie-in ownership entity line name tie-in location line voltage length of gen-tie line	 Southern California Edison Devers-Palo Verde Red Bluff Substation (location not finalized; possibly near Desert Center) 230 kV, Uncertain; Desert Center site would be ~11.5-mile route

2.0 Project Description

2.1 Introduction and Overview

Solar Millennium, LLC and Chevron Energy Solutions (joint developers and hereafter referred to as the Applicants) are proposing to construct a utility solar thermal electric power generating facility named the Palen Solar Power Project (PSPP or Project). The Project will have a nominal output of 500 megawatts (MW), consisting of two adjacent, identical and independent 250 MW plants, Unit #1 and Unit #2. The PSPP will be located in the Southern California inland desert, approximately 10 miles east of the small community of Desert Center, in eastern Riverside County, California. Project facilities will occupy approximately 2,970 acres of public lands owned by the Federal government for which a right-of-way (ROW) lease is being obtained by the Applicants from the Bureau of Land Management (BLM).

The PSPP will utilize solar parabolic trough technology to generate electricity. With this technology, arrays of parabolic mirrors collect heat energy from the sun and refocus the radiation on a receiver tube located at the focal point of the parabola. A heat transfer fluid (HTF) is heated to high temperatures (750 degrees F [º Fahrenheit]) as it circulates through the receiver tubes. The heated HTF is then piped through a series of heat exchangers where it releases its stored heat to generate high pressure steam. The steam is then fed to a traditional steam turbine generator where electricity is produced.

Units #1 and #2 will be developed in phases with construction scheduled to begin in late 2010 and continue through the fourth quarter of 2013. Commercial operation of Unit #1 is expected to begin in mid-2013, with commercial operation of Unit #2 following by the end of 2013.

The main operational area (solar field and power block) of Units #1 and #2 will occupy about 1,380 acres. The two plants will share a main office building, a main warehouse / maintenance building, a parking lot, and a bioremediation/land farming area for HTF-contaminated soil, all located to the south of the solar fields. The two units will also share a storage tank for reverse osmosis (RO) concentrate (located in Unit #1) and a central internal switchyard located north of the solar fields. The main access road into the site will be located southwest of Unit #2.

Each power plant will have its own solar field, comprised of solar collector loops arranged in parallel groups connected to supply and return header piping. The power block will be located centrally within the solar field. Each power block will have its own administration, control, warehouse, maintenance, and lab buildings; HTF pumping and freeze protection system; solar steam generators; propane gas-fired auxiliary boiler; steam turbine generator; an air-cooled condenser; onsite transmission lines and electrical system; and various auxiliary equipment. The Project will generate electric power solely via solar energy. Propane will be used to fire an auxiliary boiler over night to support rapid start-up each morning. A second heater will be used on a limited basis, during the winter, to prevent freezing of the HTF.

Both Units #1 and #2 will have water pipelines from onsite wells to their respective water treatment units. Transmission lines will connect each turbine generator to a central internal switchyard. From this switchyard, a new double-circuited 230 kilovolt (kV) transmission line will interconnect with Southern California Edison's (SCE) regional transmission system at the planned Red Bluff substation. The location of this substation has not been finalized, and since the substation is the terminus of the Project transmission line, it is not possible to finalize the transmission line route. A possible route is described in this Project Description to a potential substation site near Desert Center, approximately 10 miles west of the Project site. Description of non route-related aspects of the Project transmission system, are also described below in Section 2.6, Transmission System.

While a potential transmission route is described, the Application for Certification (AFC) impact analyses in disciplines where site/route-specific field information are essential (biological, cultural, and paleontological resources, primarily), do not include the potential impacts resulting from construction and operation of a Project transmission line. When the route is finalized, the necessary environmental surveys and studies will be performed and the results reported to the regulatory agencies and stakeholders. Figure 2-1 (at the end of this AFC section), shows the overall layout of Project facilities including the potential transmission line route.

Studies of the regional electrical transmission system will be performed to determine whether additional downstream upgrades to the system will be required as a result of the Project. The California Independent System Operator (CalSO) and SCE initiated a Phase 1 Cluster Study in the fall of 2008. The Phase I Cluster Study was released on August 5, 2009. The Applicant will provide this document under confidential cover.

All thermal power plants (including solar) that utilize a steam cycle to generate electricity require cooling, which typically involves considerable amounts of cooling water. The PSPP is located in the arid desert of Southern California where water consumption is of concern. Consistent with State policy, the Project will drastically reduce water use by utilizing air cooled condensers (ACC), an alternative cooling method commonly referred to as dry cooling. Water will be used for solar mirror washing, feedwater makeup, firewater supply, dust control, and onsite domestic use. Total consumption for both units is estimated at approximately 300 acre-feet annually.

2.2 Project Objectives, Purpose and Need

2.2.1 Project Objectives and Purpose

The specific objectives and purpose of the PSPP are:

- To develop a utility-scale solar energy project utilizing parabolic trough technology.
- To construct and operate an environmentally friendly, economically sound, and operationally reliable solar power generation facility that would contribute approximately 1,000,000 megawatt hours (MWh) of clean, renewable solar energy per year to the State of California's renewable energy goals.
- To locate the project in an area with high solar insolation (i.e., high intensity of solar energy).
- To interconnect directly to the CAISO Grid through the SCE electrical transmission system while minimizing additions to electrical infrastructure (e.g., avoiding lengthy new transmission lines).
- Commence construction in 2010 to qualify for the American Recovery and Reinvestment Act (ARRA) of 2009's Renewable Energy Grant Program

2.2.2 Project Need

The Federal government and the State of California have clearly established the need for the nation and State to increase the development and use of renewable energy in order to enhance energy independence, meet environmental goals, and create new economic and employment growth opportunities. The PSPP will help meet these societal needs.

More specifically, the Project will further the development of renewable energy and thereby:

- Assist California in meeting its Renewable Portfolio Standard (RPS) goals of 20 percent of retail electric power sales by 2010 under existing law (Senate Bill 1078 – Chapter 516, Statutes of 2002) and 33 percent of electrical power retail sales by 2020 under pending legislation.

- Support U.S. Secretary of the Interior Salazar's Order 3285 making the production, development and delivery of renewable energy top priorities for the United States.
- Support Governor Schwarzenegger's Executive Order S-14-08 to streamline California's renewable energy project approval process and to increase the State's Renewable Energy Standard to 33 percent renewable power by 2020.
- Support the goals of Assembly Bill 832 (California Global Warming Solutions Act of 2006).
- Sustain and stimulate the economy of Southern California by helping to ensure an adequate supply of renewable electrical energy, while creating additional construction and operations employment and increased expenditures in many local businesses.

Two integral goals of the ARRA of 2009's Renewable Energy Grant Program are to enhance America's energy independence and create near-term employment opportunities for Americans. As noted above, the PSPP will help meet these vital societal needs.

2.3 Location of Facilities

The Project site is located approximately 0.5 mile north of U.S. Interstate-10 (I-10) and approximately 10 miles east of Desert Center, in an unincorporated area of eastern Riverside County, California (see Figure 2-1). Desert Center (population 125), is located along I-10 approximately halfway between the cities of Indio and Blythe, California, and is approximately three miles east of the southeast end of Joshua Tree National Park.

The overall ROW includes one privately-owned 40-acre parcel (under purchase option by the Applicants), which has been incorporated into the proposed eastern solar field. The remainder of the Project facilities will be entirely on Federal land, BLM ROW # CACA 48810, in Township 6 South, Range 17 East. A legal description is provided in Table 2-1. Ownership information for the properties surrounding the Project site is provided in Appendix A.

The ROW application covers 5,200 acres of open desert and extends to within about 1.7 miles of the southern edge of Palen Dry Lake. The area inside the Project's security fence, the footprint within which all Project facilities will be located, will occupy the southerly 2,970 acres of the ROW, the portion of the ROW furthest (about 2.2 miles) from the dry lakebed. Access to the site will be provided by a new 1,350-foot long, 24-foot wide paved access road from Corn Springs Road. This access road will run east from just north of the I-10 Corn Springs Road entrance/exit ramps to the Project site entrance. The new SCE substation is expected to be to the west of the Project site. A possible route for the new electrical transmission gen-tie line that will interconnect the Project to the regional grid is shown on Figure 2-1.

Table 2-1 Summary Legal Description of Parcels within the Plant Site Boundary

APN 810110022	APN 810110023	APN 810110007
APN 810110027	APN 810110028	APN 810110029
APN 810182002	APN 810190003	APN 810190004
APN 810170001	APN 810140021	
APN = Assessor's Parcel Number Source: Riverside County Assessor's Office		

2.4 Site Description

2.4.1 Existing Site Conditions

The 5,200-acre ROW is vacant and essentially undisturbed. Figure 2-2 is a representative photograph of the site in its present condition. The entire ROW is BLM land with the exception of a single 40-acre parcel, which will be Applicant-owned. There are no existing structures on the site, other than SCE's 161-kV Eagle Mountain - Blythe transmission line that traverses the southwestern portion of the site. The Applicants are working with SCE to try and accommodate both uses within the BLM ROW.

The site is mostly flat, with elevation ranging on United States Geological Survey (USGS) topographical maps from a high of about 200 feet above sea level at the southwestern limits of the site to a low of about 130 feet above sea level along the eastern site boundary. Three identified desert washes traverse the site; these washes originate from culverts built under the I-10 Freeway when the freeway was constructed in the late 1960s.

The ROW is in an area shown on maps as the Chuckwalla Valley, and is two to three miles northeast of the Chuckwalla Mountains and approximately two miles southwest of the Palen Mountains. The PSPP site is within General George Patton's World War II military training area that occupied much of the Southern California desert. Additional detail on historical use of the site is provided in the Phase I Environmental Site Assessment (ESA) provided in Appendix I.

2.4.2 Site Surveys and Engineering Design Criteria

Light Detection and Ranging (LIDAR) mapping of the site has been performed to obtain preliminary topographic information on the site to establish local benchmarks and site boundaries and to understand grading and drainage-related requirements and issues. Detailed land and topographic surveys will be performed during the final design of the Project. A preliminary geotechnical study of the Project plant site is currently in progress to evaluate general subsurface conditions, seismicity, and other geologic hazards and to provide recommendations for design and construction of the foundations for Project structures. Results of the study will be submitted for agency and stakeholder review when they are available. It is anticipated that the study will find that the site is geotechnically feasible for construction of the proposed Project.

Additional geotechnical investigations (e.g., additional soil borings at specific equipment locations), will be performed as part of the detailed facility design. Engineering design criteria for the Project, including seismic design criteria, are provided in Appendix C.

2.5 Generating Facility Description

The following sections describe the Project site arrangement and the processes, systems, and equipment that constitute the generation facilities. All plant facilities will be designed, constructed, and operated in accordance with applicable laws, ordinances, regulations, and standards (LORS). Figure 2-3a is a photograph that shows a current view of the Project site and surrounding area; Figure 2-3b is the same photograph with the proposed plant facilities added. All generating facilities described in this section will be located within the 2,970-acre facility fenceline. Project-related linear facilities located outside the Project plant site fence line are limited to the 1,350-foot long access road, and the 230 kV gen-tie line to the planned SCE substation whose location has not been finalized. The transmission system is described in Section 2.6 below.

2.5.1 Site Arrangement

Figure 2-4 shows the layout of Project facilities within the ROW area, which include:

- Units #1 (east) and #2 (west), each 250 MW
- Power blocks within the solar fields,
- Access road from existing I-10 exit to onsite office,
- Office and parking,
- Land Treatment Unit (LTU) for bioremediation / land farming of HTF-contaminated soil,
- Warehouse/maintenance building and laydown area,
- Onsite transmission facilities, including central internal switchyard,
- Dry wash rerouting, and
- Groundwater wells used for water supply.

A plot plan of the Project power block is included as Figure 2-5. Please note that the power blocks of Units #1 and #2 are the same and the descriptions below apply to both power blocks. As shown in this figure, major components of the power block include:

- Solar steam generators (SSG) including steam generation heat exchangers,
- HTF expansion and overflow vessels,
- One HTF freeze protection heat exchanger,
- One auxiliary boiler,
- One steam turbine generator (STG),
- One generator step-up transformer (GSU),
- Air-cooled condenser,
- One small wet cooling tower for ancillary equipment (no evaporation pond),
- RO concentrate/dust control water storage tank,
- Treated water tank,
- Water treatment system,
- Operations and maintenance buildings, and
- Transmission lines and communication lines exiting the power block.

Elevation and three dimensional views of the power block facilities are provided in Figure 2-6a and 2-6b, respectively.

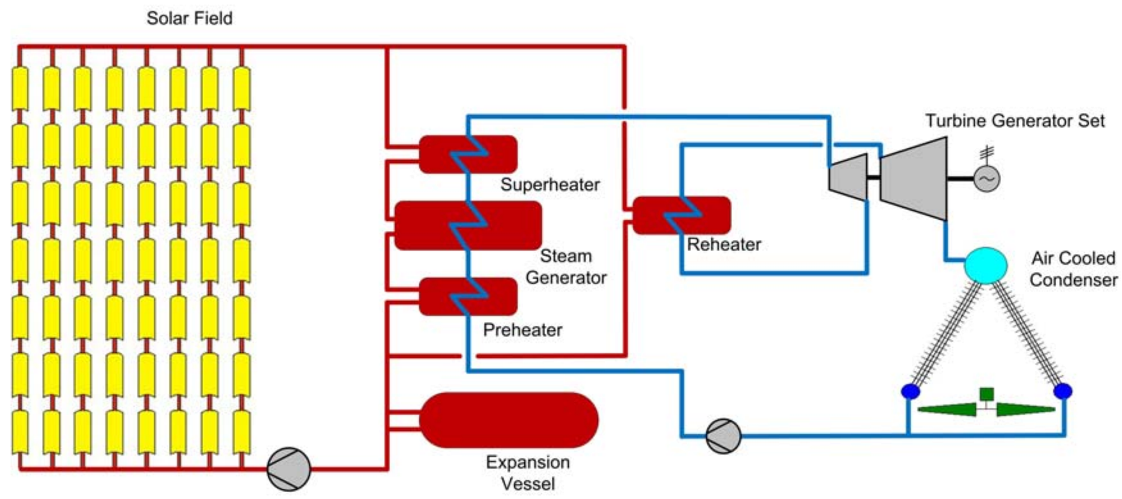
2.5.2 Process Description

This section describes the power generation process and thermodynamic cycle employed by the Project. Each power block is comprised of the following major components for power generation:

- Deaerator,
- Feedwater pumps,
- Feedwater heaters,
- Solar steam generator (SSG),
- Steam superheater,

- Steam reheater,
- Steam turbine generator,
- Air-cooled condenser,
- Approximately 1,380-acre parabolic trough solar collection field, and
- HTF piping, pumping, and conditioning system.

The thermodynamic cycle is illustrated in the diagram below and described in the steps that follow:



Red lines on the diagram represent HTF piping. Hot HTF flows from top to bottom in the figure, arriving from the solar field and transferring heat in the superheater and reheater, then to the steam generator, and lastly in the preheater before returning to the solar field to be heated again. The blue lines represent steam and water piping. Feedwater, the portion of the blue line between the ACC and the preheater, is heated in a series of feedwater heaters by steam turbine extractions (not shown here; see Figure 2-7) at various pressure levels.

- Step 1: The power cycle working fluid (water) from the de-aerator and feedwater heaters is pumped from low to high pressure and piped to the solar preheater. HTF provides heat to the preheater which heats the feedwater to its saturation temperature.
- Step 2: The high pressure saturated water enters the steam generator where it is heated by warmer HTF. The water changes phase (boils) and exits as saturated steam.
- Step 3: The saturated steam flows through to the superheater where hot HTF takes the saturated steam at constant pressure up to higher temperature prior to being fed to the high pressure section of the steam turbine.
- Step 4: The superheated steam expands through the high pressure (HP) section of the steam turbine turning the generator to produce electricity.
- Step 5: The steam let down from the turbine's HP section is then reheated in a solar reheater which is fed with hot HTF. The reheated steam is then fed to the intermediate pressure (IP) section of the steam turbine.
- Step 6: The IP steam exhausts into the low pressure (LP) section of the steam turbine. All sections of the STG decrease the temperature and pressure of the steam with the LP section extracting the last available power from the steam.

- Step 7: The wet steam from the LP section then enters the air-cooled condenser where it is cooled at a constant low pressure to become a saturated liquid. The condensed liquid returns to the feed water heater train and the beginning of the steam cycle to begin the process again.

A gas-fired auxiliary boiler with a capacity of 25,000 pounds per hour steam provides steam for maintaining steam cycle equipment vacuum over night and for startup. Sealing steam is used to prevent air from entering the steam turbine while the condenser is under vacuum. This method reduces startup time for the plant compared to relying on solar-generated steam as the sealing steam source. Unlike a gas-fired power plant, a solar thermal plant must wait for the sun to rise in the morning to start generating steam and has a finite time to generate electricity (i.e., the number of sunlight hours). If the plant does not have a secondary source of steam, plant startup is delayed (and thus total daily electrical generation reduced), while solar heat alone generates sealing steam and vacuum is established in the condenser. Estimates are that using an auxiliary boiler for seal steam reduces the daily startup time by 30 to 60 minutes. Conservatively assuming that the STG is on-line 30 minutes sooner each day, at a minimum of 25 MW, 350 days per year yields an additional 4.5 GWh of renewable electrical generation each year.

Once the plant begins generating electricity for delivery to the electrical grid, the fired auxiliary boiler is no longer needed and is held in stand-by mode until auxiliary heat is again required after plant shutdown. The auxiliary boiler requires approximately 36.7 MMBtu/hr of fuel at full load (design load is 34.4 MMBtu/hr). A heat balance diagram for the plant's steam cycle is provided as Figure 2-7.

2.5.3 Energy Conversion Facilities Description

This section describes the major energy conversion components of the Project including the solar collection system, SSG, STG, auxiliary boilers, and HTF freeze protection heat exchanger.

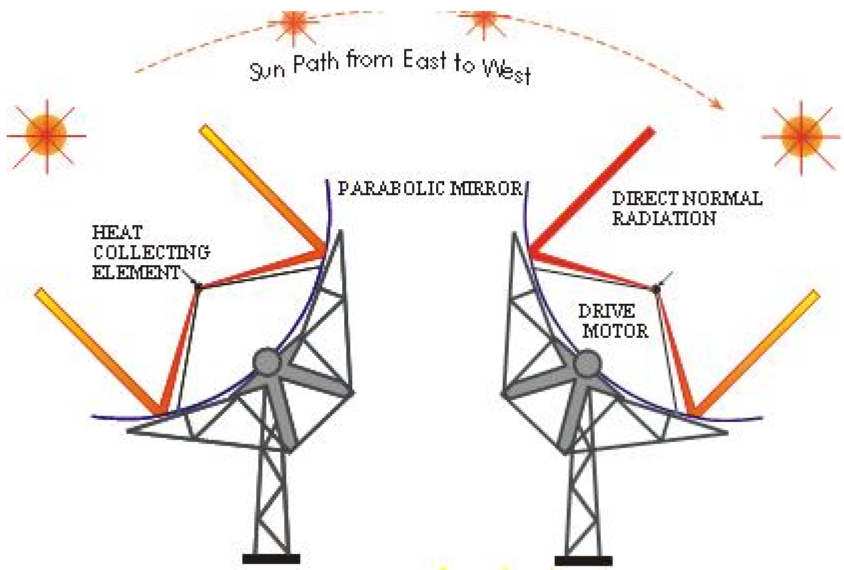
The Project will be a two-unit parabolic trough solar power plant, each unit having a nominal output of 250 MW. The plant will consist of a conventional steam Rankine-cycle power block, a parabolic trough solar field, a heat transfer fluid and steam generation system, as well as a variety of ancillary facilities (sometimes referred to collectively as "balance-of-plant"), such as conventional water treatment, electrical switchgear, administration, warehouse, and maintenance facilities, etc.

The electric output of the plant will be provided entirely by solar energy. No electricity will be generated by the use of fossil fuel. A propane-fired HTF heater will be used for freeze protection of the HTF in the solar field. The HTF is a synthetic hydrocarbon liquid mixture of diphenyl ether and biphenyl. Similar formulations are marketed by different manufacturers under the names of Therminol or Dowtherm. The HTF is not classified as a hazardous material by the United States Department of Transportation (DOT), and is not listed under United States Environmental Protection Agency Comprehensive Environmental Response, Compensation and Liability Act regulations; however, it is regulated as a hazardous material by the State of California. It has a crystallizing (freezing) point of 12 degrees Celsius (°C) (about 54degrees Fahrenheit [ºF]). Freeze protection is routinely accomplished by circulating HTF at a very low flow rate through the solar field using hot HTF from the vessel as a source. Performance model results indicate that the HTF heater may be required on very cold nights in the winter. See Appendix D for the Material Safety Data Sheet.

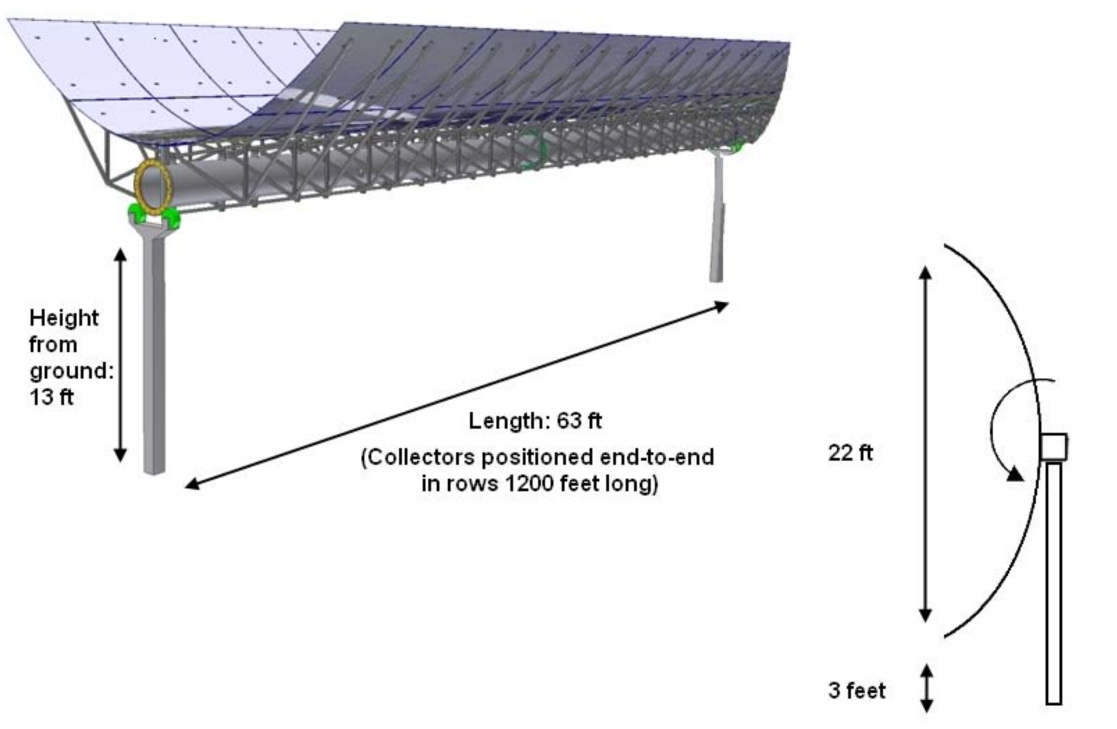
A propane-fired auxiliary boiler will be used to support rapid startup each morning, i.e., maintaining steam seals. Steam generated by the auxiliary boiler would be at a relatively low pressure, approximately 165 pounds per square inch gauge (psig).

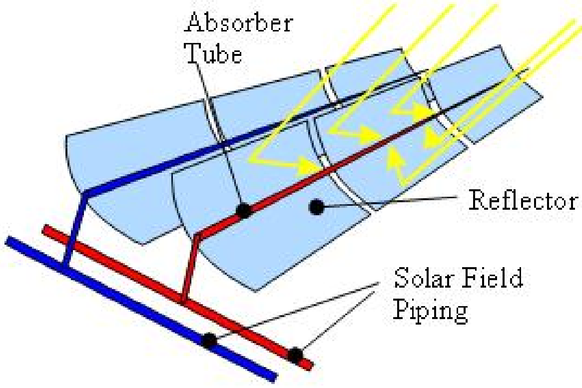
The solar field will be a modular, distributed system of solar collector assemblies (SCAs) connected in a series-parallel arrangement via a system of insulated pipes. The collectors will be equipped with a sun tracking mechanism that moves the reflecting panels toward the sun to the optimum angle for solar energy collection. The collectors will be aligned north-south to track the sun from east to west.

HTF will flow from the HTF pumping area in the power block to the cold HTF header that distributes it to the collector loops of SCAs in the solar field.



Parabolic Trough Collector Loop. Each of the collector loops consist of two adjacent rows of SCAs, each row about 1,300 feet long. The two rows are connected by a crossover pipe. HTF is heated in the loop and enters the hot header, which returns hot HTF from all loops to the power block where the power generating equipment is located. In normal operation, HTF enters the field at 296°C (565°F) and leaves the field at 393°C (739°F).





Solar Collector Assemblies. The SCAs are oriented north-south to rotate east-west to track the sun as it moves across the sky throughout the day. The SCAs collect heat by means of linear troughs of parabolic reflectors, which focus sunlight onto a straight line of Heat Collection Elements (HCEs) welded along the focus of the parabolic "trough." The HCE is mounted on a mechanical support system that includes steel, pylons and bearings. Each SCA includes local measurement instrumentation, a hydraulic drive system, and a controller which independently tracks the sun to maintain mirror focus on the HCEs, and protects the HCEs from overheating.

Mirrors. The parabolic mirrors to be used in the Project are low-iron glass mirrors, and are known to be one of the most reliable components in the solar collection assemblies. No long-term degradation of the mirrors has been observed, and older mirrors can be brought back to nearly full reflectivity with simple cleaning. Typical life spans of the reflective mirrors are expected to be 30 years or more. The HCEs of the solar plant are comprised of a steel tube surrounded by an evacuated glass tube insulator. The steel tube has a coated surface, which enhances its heat transfer properties with a high absorptivity for direct solar radiation, accompanied by low emissivity. Glass to metal seals and metal bellows are incorporated into the HCE to ensure a vacuum-tight enclosure. The enclosure protects the coated surface and reduces heat losses by acting as an insulator.

The glass tube cylinder has anti-reflective coating on both the inner and outer surfaces to reduce reflective losses off the glass tube, thereby increasing the transmissivity. Usually, to maintain the tube's insulating properties, getters, or scavengers, are installed in the vacuum space to absorb hydrogen and other gases that may permeate into the vacuum cylinder over time.

HTF System. In addition to the HTF piping in the solar field, the HTF system includes three elements: 1) the HTF heater, 2) the HTF expansion and overflow vessels and 3) the HTF ullage system. To eliminate the problem of HTF freezing, an HTF heater will be installed and used to ensure system temperature stays above 54° F whenever the unit is off-line. An expansion vessel is required to accommodate the volumetric change that occurs when heating the HTF to the operating temperature.

During plant operation, HTF will degrade into components of high and low boilers (substances with high and low boiling points). The low boilers are removed from the process through the ullage system. HTF is removed from the HTF surge tank and flashed, leaving behind high boilers and residual HTF. The flashed vapors are condensed and collected in the ullage system.

Solar Steam Generator System. The SSG system transfers the latent heat from the HTF to the feed water. The steam generated in the SSG is piped to a Rankine-cycle reheat steam turbine. Heat exchangers are included as part of the SSG system to preheat and boil the condensate, superheat the steam, and reheat the steam. Refer to the process schematic diagram above in Section 2.5.2.

Steam Turbine Generator

As described earlier, steam from the SSG is sent to the STG. The steam expands through the STG turbine blades to drive the steam turbine, which in turn drives the generator, converting mechanical energy to electrical energy. The Project's STG is expected to be a three-stage casing type with high pressure, intermediate pressure, and low pressure steam sections. The STG is equipped with accessories required to provide efficient, safe, and reliable operation, including the following:

- Steam stop and control valves,
- Gland seal system,
- Lubricating and jacking oil systems,
- Thermal insulation, and
- Control instrumentation.

2.5.3.1 Process Control of the Solar Field

The solar field system operates under the control of the Field Supervisor Controller (FSC), a computer located in the central control room that communicates with each SCA and with the plant's distributed control system. The FSC collects information from each SCA and from the distributed control system, and issues instructions to the field as a whole, and/or modular instructions to SCA loops or individual SCAs. It deploys the solar field during the day when weather and plant availability permit, and stows it at night and during high winds.

A weather station located in the power block area provides real-time measurements of weather conditions that affect the solar field operation. Radiation data are used to determine the performance of the solar field. Wind speed data are needed since under high wind conditions the solar field must be stowed. The FSC communicates with the plant's distributed control system (DCS), which coordinates and integrates power block, HTF system, and solar field operation.

The solar power plant cycle basically consists of two separate, coupled systems – the HTF loop and the power block steam loop. The HTF loop transfers accumulated solar heat from the parabolic trough solar field, as described above in the previous section for steam generation, to drive the turbine generator.

The HTF cycle is driven by two parallel pump stations. The nominal flow rate is about 2,800 kilograms per second (6,200 pounds per second). In operation the HTF temperature varies from 393°C (739°F) ["hot"] after heating by the solar field to 296°C (296°C (565°F) ["cold"] leaving the power block heat exchangers. The hot HTF flows to parallel steam generation trains. Each train includes a preheater, steam generator, superheater and reheater. In normal operation the hot HTF stream is split between the trains. It is also possible to remove each train from the loop via motor control valves.

At the basic level, the system distributes cold HTF from the power block to solar field collector loops, and collects hot HTF from the solar field, and inputs the collected heat to the feedwater/steam cycle. Due to the characteristics of HTF, several auxiliary systems are required to keep the HTF loop functioning. A system of reclamation and ullage vessels removes sludge, low boiler and high boiler distillates that develop over time in the HTF system.

As the solar field begins tracking the sun and the HTF heats up, its thermal expansion is accommodated in an expansion vessel. If the HTF in this vessel reaches its design working level it overflows into overflow vessels. If thermal input to the HTF stops, HTF begins to contract. The HTF level in the expansion vessel falls, and overflow return pumps transfer HTF from the overflow vessels back into the expansion vessel to maintain sufficient content there.

2.5.3.2 Operational Modes of the Solar Field

A DCS containing several automation units controls the HTF and steam loops and all auxiliary plant systems, and determines the appropriate operating sequences for them. It also monitors and records the primary operating parameters and functions as the primary interface for system control. It communicates with all subsystem controls, including electrical system equipment, steam cycle controllers, variable frequency drives and balance of plant system controllers via serial data communication. It receives analog and digital inputs/outputs from all instruments and equipment not served directly by dedicated local controllers. The DCS controls both the steam and HTF cycles directly, operating rotating equipment via relevant electrical panels. It includes a graphical user interface at an operator console in the main control room. Day-to-day, the following operation modes are usually passed in the HTF system:

- Warm up,
- Solar field mode (heat transfer from solar field to power block),
- Shutdown, and
- Freeze protection.

Warm up

Usually in the morning, this mode brings the HTF flow rate and temperatures up to their steady-state operating conditions by positioning all required valves, starting the required numbers of HTF main pumps for establishing a minimum flow within the solar field and tracking the solar field collectors into the sun. Normal operational conditions (296°C (565°F) at solar field inlet and 393°C (739°F) at solar field outlet) are usually reached within 30 minutes or less.

At the beginning of warm up, HTF is circulated through a bypass around the power block heat exchangers until the outlet temperature reaches the residual steam temperature in the heat exchangers. HTF is then circulated through the heat exchangers and the bypass is closed. As the HTF temperature at the solar field outlet continues to rise, steam pressure builds up in the heat exchangers until the minimum turbine inlet conditions are reached, upon which the turbine can be started and run up to speed. The turbine is synchronized and loaded according to the design specification until its power output matches the full steady state solar field thermal output.

Solar Field Control Mode

The DCS enters solar field control mode automatically after completing warm-up mode. It regulates the flow by controlling the HTF main pump speeds to maintain the solar field outlet temperature of approximately 393°C (739°F). Several HTF pumps will generally be operated in parallel, at the speed required to provide the required flow in the field, but in exceptional cases (e.g., during maintenance), lower numbers of pumps may be used alone, providing up to 70 percent of full flow at nominal pump capacity. If the thermal output of the solar field is higher than the design capacity of the steam generation system, collectors within the solar field are de-focused to maintain design operating temperatures.

Shutdown

If the minimal thermal input to the turbine required by the operating strategy cannot be met under the prevalent weather conditions, then shutdown is indicated. Operators would track all solar collectors into the stow position, reduce the number of HTF main pumps to a minimum, and stop the HTF flow to the power block heat exchangers.

Freeze Protection

During periods when the solar power generating facility is shutdown, HTF is circulated through the piping in the solar fields at low flowrate. For most of the year, under typical weather conditions, no supplemental heat is required to keep the HTF flowing freely. However, it is anticipated that on colder winter nights supplemental heat will be required to ensure the HTF doesn't freeze in the piping. A gas-fired HTF heater, with a rated capacity of 35 MMBtu/hr, will be provided as part of the HTF system. It is expected the HTF heater will need to operate approximately 50 hours per year to keep the HTF from freezing.

2.5.4 Electrical System Description

This section describes the Project's major electrical systems and equipment. All power produced by the Project is expected to be delivered to the SCE transmission grid through interconnection with SCE's Palo Verde-Devers transmission line at the proposed Red Bluff substation, as described in greater detail in Section 2.6.1.

Descriptions of major electrical systems and equipment provided in the following subsections refer to AC power unless otherwise noted. A single line diagram of the major electrical components of the power block is presented as Figure 2-8. A single line diagram of the interconnection between the Project and the SCE transmission system, including the Project's central internal switchyard and SCE substation, is presented as Figure 2-9.

2.5.4.1 Electrical Generation

The STG of each power block would generate electricity at 18 kV and would connect to the central switchyard described in the above paragraph. An oil-filled GSU would step up the voltage to 230 kV. Generator parameters are listed in Table 2-2 below.

Table 2-2 Generator Specification

Generator main data (rating)	Value
Rated apparent power	320.9 million volt amperes
Rated active power	272.8 MW
Rated terminal voltage (+ 5.0% / - 5.0%)	21000 volts (V)
Rated phase current	8824 amperes (A)
Rated power factor	0.85 per unit
Rated frequency (+ 2.0% / - 2.0%)	60 hertz (Hz)
Rated speed	3600 revolutions per minute
Cooling air inlet temperature	90°F
Air overpressure	2.9 psig
Generator output with one cooler out of service	67 %

2.5.4.2 Electrical System for Plant Auxiliaries

In addition to the text immediately below, please see the single line diagram in Figure 2-8.

DC Power Supply System

An uninterruptible power system (UPS) will be provided in the plants. The UPS will service emergency lighting, the DCS, electrical breakers, and relays. The DC power system will serve as a temporary bridge to the more robust emergency diesel AC power supply in the event external power is suddenly lost.

Essential Service AC System

A 120 V essential service AC power distribution system serves critical equipment loads, lighting and alarms, and loads that protect equipment from potential damage in the event of sudden loss of station service. This system is served through an inverter that receives power from the DC power supply system.

2.5.5 Plant Auxiliary Systems

The following subsections describe the various power plant auxiliary systems (fuel supply, water supply, water treatment, cooling systems, waste management, etc.) associated with the Project.

2.5.5.1 Fuel Supply and Use

The auxiliary boiler and HTF heaters will be fueled by propane. Propane will be delivered to the plant site via truck from a local distributor and stored in 18,000-gallon above ground tanks (one in each power block). The estimated propane usage per unit for normal operations is eight MMBtu/hr overnight and 34 MMBtu/hr for one half-hour during startup each morning. The estimated maximum propane usage per unit is 70 MMBtu/hr when the HTF heater is in use during the winter.

2.5.5.2 Water Supply and Use

The Project will be dry cooled. The Project's various water uses include water for solar collector mirror washing, makeup for the SSG feedwater, dust control, water for cooling plant auxiliary equipment, potable water and fire protection water. A water balance diagram is presented in Figure 2-10.

Water Requirements

The estimated operational water requirements for the power plant are presented below in Table 2-3. The average total annual water usage is estimated to be about 300 acre feet per year (afy), which corresponds to an average flow rate of about 188 gallons per minute (gpm). Usage rates will vary during the year and would be higher in the summer months when the peak maximum flow rate could be as much as about 50 percent higher (about 275 gpm). Equipment sizing would be consistent with peak daily rates to ensure adequate design margin.

Table 2-3 Summary of Operational Water Usage

Rate of use	Annual Average (afy)
Power Cycle Makeup Water *	77
Mirror Wash Water	114
Domestic Potable Water	6
Dust Suppression Water	25
Ancillary Equipment Heat Rejection	82
Totals (rounded)	**300**
* Power cycle makeup will be recycled and is not included in the consumptive use total.	

Water Source and Quality

The Project water needs will be met by use of groundwater pumped from one of two wells on the plant site. Water for domestic uses by Project employees also will be provided by onsite groundwater treated to potable water standards. As discussed in Section 5.17, Water Resources, a well testing program is underway, using an existing onsite well, to allow determination of the optimum groundwater pumping program to provide the needed volumes of water with minimum impact to other groundwater users and the groundwater basin. The results of this well testing program will be made available to regulatory agencies and other stakeholders when the testing program is completed.

It is expected that two new water supply wells in the power blocks of the Project site will adequately serve the Project on a rotating basis. The second well will provide redundancy, an inherent backup water supply in the event of outages or maintenance of the first well.

2.5.5.3 Water Treatment

The peak load (summer) water balance diagram presented in Figure 2-10 shows the power plants' various water uses and water treatment processes. Power cycle makeup, mirror washing water, cooling water for ancillary equipment, and water for domestic uses all require onsite treatment, and this treatment varies according to the quality required for each of these uses.

Groundwater

As stated above, the planned water source for the Project is groundwater supplied by two wells located within the Project site boundary. No onsite well data are yet available, nor are there water quality data from local irrigation wells.

However, water quality information for wells serving the Chuckawalla and Ironwood State Prisons, located about 15 miles southeast of the Project site, show Total Dissolved Solids (TDS) of 700 to 2000 mg/L, with the majority of samples below 1,500 mg/L. These wells exhibit high fluoride concentrations of about 6 to 10 mg/L. No information is available on arsenic concentrations. Based on the information from the prison wells and the fact that the local well water is used for irrigation, it is assumed, for the purpose of analysis, that the average TDS of onsite water is no more than 1500 mg/L.

The groundwater will be piped directly from the wells to the treatment process without raw water storage. The Applicants currently are completing a well testing program that will provide data both on the quantity and quality of water that can be obtained from onsite wells. The groundwater will first be treated by the RO or electrodialysis reversal (EDR) process in a single treatment unit in Unit #1 prior to storage in two one million-gallon treated water (permeate) tanks, one each in Units #1 and #2. Excluding any use for firefighting, this volume of treated water would provide enough storage capacity for a three-day total interruption of water supply to the facility. Concentrate from the RO (or EDR) process would serve as water for dust control and would be stored in a single, 250,000-gallon tank located in Unit #1. This tank would be provided with a piping connection directly from the wells for supplemental raw water supply.

Water Treatment Process

As noted above, water used for power cycle feedwater makeup, mirror washing, ancillary equipment heat rejection, and domestic uses would require treatment for reduction of dissolved solids. This type of treatment process is known as desalination, and can be accomplished by either thermal processes (evaporation/condensation) or membrane processes such as RO or EDR. Given the concentration of TDS in the source water, it is unlikely that thermal processes would be cost effective. Accordingly, only membrane processes are considered here. Since RO and EDR produce similar product water quality and waste streams, further discussion here will reference only RO for simplicity. The proposed treatment process for the various water uses is presented schematically in Figure 2-10. Selection of the process to be used at the Project would be made during the final design process.

Membrane desalination processes split the feed stream into two streams: 1) a product water stream (permeate) with reduced salinity and 2) a concentrate stream containing the majority of the salts that were in the feed stream. Desalination processes are usually designed to operate with the highest safe recovery (recovery is the fraction of feed water recovered as permeate) in order to minimize water loss, since the concentrate would normally be considered a waste stream. In this case, it appears that the highest safe recovery is 92 percent.

The requirements for steam purity are given in Table 2-4. In order to provide the demineralized water quality needed for power cycle makeup, it would be necessary to provide ion exchange (IX) demineralization as a final treatment step after RO. IX demineralization can be done using either permanently installed equipment or portable demineralizers. Permanently installed equipment requires regeneration onsite, which requires storage and disposal of significant quantities of sulfuric acid and sodium hydroxide (caustic). Alternatively, portable demineralizers are taken offsite for regeneration at the supplier's facility, so no onsite storage of chemicals and disposal of regeneration wastes is required. Offsite regeneration is proposed for the Project. This would eliminate the need to store regeneration chemicals on site and minimize on site production of hazardous wastes. These demineralizers would be provided as forklift-moveable fiberglass "bottles" that would be traded out when exhausted and returned to the supplier for regeneration. Demineralization systems would be installed at each power block to minimize piping and provide the best water quality.

Table 2-4 Steam Purity Requirements

Parameter	Unit[3]	Normal operation	Startup
Conductivity after cation exchanger @ 25 °C[1]	µS/cm	<0.20	<1
Sodium (as Na) boiler water PO4 0 -2 mg/kg[2]	µg/kg	<5	<10
Sodium (as Na) boiler water PO4 > 2 mg/kg	µg/kg	<10	<20
Silica (as SiO_2)	µg/kg	<20	<100
Iron (as Fe)	µg/kg	<20	<100
Copper (as Cu) 150 bar	µg/kg	<3	<10
Copper (as Cu) > 150 bar	µg/kg	<1	<10

[1] Additional tolerance of maximum 2 µS/cm is given for carbon dioxide.

[2] In case of boiler water phosphate treatment > 2mg/kg PO4 a higher Na content in steam is tolerated as phosphates are considered as being non-corrosive to the turbine. For all other boiler water treatments, the lower limit is applicable.

[3] micro Siemens per centimeter (Siemens is a unit of electrical conductivity)

The steam purity specification is based on the VGB "Guidelines for Feed Water, Boiler Water, and Steam Quality for Power Plants / Industrial Plants" R450Le, issued in 2004. It is anticipated that all of the power cycle makeup water will be recycled and reused as feed to the RO system. This would reduce the salinity of the RO feed and improve the RO recovery.

Because of the very low TDS of the makeup to the ancillary equipment heat rejection cooling tower, it is expected that blowdown would not be required. Rather, drift (windblown mist) would provide the necessary salt removal. If blowdown is required, it would be recycled to the RO system. It may be more advantageous to recycle the power cycle makeup water to the IX demineralizer rather than to the RO. This modification will be evaluated during final design.

Water from the site groundwater wells may require treatment to meet public health requirements for domestic potable water supplies. Based on the assumed water quality, it is expected that both TDS and fluoride concentrations must be reduced, which indicates the need for a desalination process. Following desalination, the water would require addition of chlorine to prevent growth of pathogenic organisms. Use of a solid calcium hypochlorite system is recommended. Since the source water is groundwater there is no need to meet the requirements of the Surface Water Treatment Rule (and its amendments).[1]

Solar Mirror Washing Water

To facilitate dust and contaminant removal, water from the primary desalination process, RO water, would be used to spray clean the solar collectors on a weekly or as-needed basis, determined by the reflectivity monitoring program. This mirror washing operation is done at night and involves a water truck spraying treated water on the mirrors in a drive-by fashion. It is expected that the mirrors will be washed weekly in winter and twice weekly from mid- spring through mid-fall. The mirrors are angled down for washing therefore water doesn't accumulate on the mirrors. Wash water falls from the mirrors to the ground and, due to the small volume, soaks in with no appreciable runoff. Remaining rinse water from the washing operation is expected to evaporate on the mirror surface. The treated water production facilities would be sized to accommodate the additional solar mirror washing demand of about 114 afy and is shown on Figure 2-10, Water Balance Diagram.

2.5.5.4 Cooling Systems

The power plant includes two cooling systems: 1) the air-cooled steam cycle heat rejection system and, 2) the closed cooling water system for ancillary equipment cooling, each of which is discussed below.

Steam Cycle Heat Rejection System

The cooling system for heat rejection from the steam cycle consists of a forced draft air-cooled condenser, or dry cooling system. The dry cooling system receives exhaust steam from the LP section of the STG and condenses it to liquid for return to the SSG.

Auxiliary Cooling Water System

The auxiliary cooling water system uses a small wet cooling tower for cooling plant equipment, including the STG lubrication oil cooler, the STG generator cooler, steam cycle sample coolers, large pumps, etc. The water picks up heat from the various equipment items being cooled and rejects the heat to the cooling tower. This auxiliary cooling system will allow critical equipment such as the generator and HTF pumps to operate at their design ratings during hot summer months when the Project's power output is most valuable. An average of 73,000 gallons of water per day (82 afy) will be consumed by the auxiliary cooling water system; the maximum rate of consumption is 112,000 gallons per day (125 afy) in summer.

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[1] 40 C.F.R.§ 142 National Primary Drinking Water Regulations

2.5.5.5 Waste Generation and Management

Project wastes would be comprised of non-hazardous wastes including solids and liquids and lesser amounts of hazardous wastes and universal wastes. The non-hazardous solid waste would primarily consist of construction and office wastes, as well as liquid and solid wastes from the water treatment system. The non-hazardous solid wastes would be trucked to the nearest Class II or III landfill as discussed in Section 5.16, Waste Management. Non-hazardous liquid wastes would consist primarily of domestic sewage, and reusable water streams such as RO system reject water, boiler blowdown, and auxiliary cooling tower blowdown. To manage the non recyclable non-hazardous domestic sewage wastes, a septic tank and leach field would be installed.

Wastewater

The Project will produce two primary wastewater streams:

- Non reusable sanitary wastewater produced from administrative centers and operator stations.
- Reusable streams including: blowdown from the small ancillary equipment cooling tower for the ancillary equipment heat rejection system; RO reject water, and boiler blowdown.

As noted above, the power generation cycle will not produce cooling tower blowdown because the plant will be dry cooled. A small auxiliary cooling tower will generate a small amount of blowdown which will be reused on site.

Sanitary wastewater production will consist of domestic water use. Maximum domestic water use is expected to be less than 166,000 gallons per month (5,500 gallons per day). It is anticipated that the wastewater will be consistent with domestic sanitary wastewater and would have Biological Oxygen Demand and Total Suspended Solids in the range of 150 to 250 mg/L.

Wastewater Treatment

Sanitary wastes will be collected for treatment in septic tanks and disposed via leach fields located at the power block as well as at the administration and warehouse areas. Smaller septic systems will be provided for the control room buildings to receive sanitary wastes at those locations. Based on the current estimate of 5,500 gallons of sanitary wastewater production per day, a total leach field area of approximately 11,000 square feet would be required spread out among three or more locations.

Construction Wastewater

Sanitary wastes produced during construction would be held in chemical toilets and transported offsite for disposal by a commercial chemical toilet service. Any other wastewater produced during construction such as equipment rinse water would be collected by the construction contractor in Baker tanks and transported offsite for disposal in a manner consistent with applicable regulatory requirements.

On-Site Land Treatment Unit (LTU)

The two solar fields to be installed at the Project would share the same LTU to bioremediate or land farm soil contaminated from releases of HTF. The bioremediation unit will be designed in accordance with Colorado River Basin RWQCB requirements and is expected to comprise an area of about 800 feet by 200 feet (3.8 acres). The bioremediation facility would utilize indigenous bacteria to metabolize hydrocarbons contained in non-hazardous HTF contaminated soil. A combination of nutrients, water, and aeration facilitates the bacterial activity where microbes restore contaminated soil within two to four months. The California Department of Toxic Substances Control (DTSC) has determined for a similar thermal solar power plant that soil contaminated with up to 10,000 mg/kg of HTF is classified as a non-hazardous waste.[2] However, the DTSC has further indicated that site specific data will be required to provide a classification of the waste. Initially, in addition to sampling for HTF, samples would be analyzed for ignitability and toxicity using appropriate State and Federal methods to verify generator knowledge and characterize the waste as hazardous or non-hazardous. These data will be obtained to provide site specific information and verify this classification as discussed in Section 5.16.3.

The LTU will be constructed with a clay liner at least five feet in thickness as per Title 27 requirements. Unsaturated zone monitoring and/or groundwater monitor will be used to evaluate liner integrity. Nutrients including nitrogen and phosphorus would be added to the contaminated soil to encourage consumption of the HTF by the indigenous bacteria. The soil would remain in the remediation unit until concentrations are reduced to an average concentration of less than 100 mg/kg HTF. Soil contaminated with HTF levels of between 100 and 1,000 mg/kg will be land farmed at the LTU, meaning that the soil will be aerated but no nutrients will be added.

Other Non-Hazardous Solid Waste

Non-hazardous solid wastes may be generated by construction, operation, and maintenance of the Project which are typical of power generation facilities. These wastes may include scrap metal, plastic, insulation material, glass, paper, empty containers, and other solid wastes. Disposal of these wastes would be accomplished by contracted solid refuse collection and recycling services.

Hazardous Solid and Liquid Waste

Hazardous wastes will also be generated during Project construction and operation. During construction, these wastes may include substances such as paint and paint related wastes (e.g., primer, paint thinner, and other solvents), equipment cleaning wastes and spent batteries. During Project operation, these wastes may include used oils, hydraulic fluids, greases, filters, spent cleaning solutions, spent batteries, and spent activated carbon. Section 5.16, Waste Management provides greater detail of the anticipated hazardous waste streams in terms of quantities of waste, origin and composition, and waste management method. Both construction and operation-phase hazardous waste will be recycled and reused to the maximum extent possible.

2.5.5.6 Hazardous Materials Management

There will be a variety of hazardous materials used and stored during construction and operation of the Project, as summarized below. Section 5.6, Hazardous Materials Handling provides additional data on the hazardous materials that will be used during construction and operation, including quantities, associated hazards and permissible exposure limits, storage methods and special handling precautions.

Hazardous materials that will be used during construction include gasoline, diesel fuel, oil, lubricants, and small quantities of solvents and paints. 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. Aboveground carbon steel tanks with secondary containment also will be used to store diesel fuel (300 gallons).

[2] DTSC, 1995. Letter to Mr. David Rib, KJC Operating Company, re: Request for Reclassification of Therminol Contaminated Soil as Nonhazardous Pursuant to Section 66260.200(f), Title 22, California Code of Regulations (22 CCR) – Waste Evaluation Unit File # F143 (WEU File # F143). April 4.

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 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.

2.5.5.7 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.

The location of the Project is such that it will fall under the jurisdiction of the Riverside County Fire Department, specifically the Indio Office. Based on the requirements of Riverside County Ordinance No. 787.1, the piping system supplying the fire hydrants must be sized to convey a potential firewater flowrate of 5,000 gpm. Minimum firewater storage volume in each power block will be 300,000 gallons. Firewater will be supplied from the one million-gallon treated water (permeate) storage tanks located at the power blocks on the plant site. One electric and one diesel-fueled backup firewater pump, each with a capacity of 5,000 gpm, will deliver water to the fire protection piping network.

The piping network will be configured in a loop so that a piping failure can be isolated with shutoff valves without interrupting water supply to other areas in the loop. Fire hydrants will be placed at intervals throughout the plant site that would be supplied with water from the supply loop. The water supply loop will also supply firewater to 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 administration building.

Fire protection for the solar field will be provided by zoned isolation of the HTF lines in the event of a rupture that results in a fire. Since vegetation and other combustible materials will not be present in the solar field area, the HTF would be allowed to self extinguish.

2.5.5.8 Distributed Control System

The DCS provides control, monitoring, alarm, and data storage functions for power plant systems. These include:

- Control of the STG, SSG System and balance-of-plant systems in a coordinated manner,
- Monitoring of operating parameters from plant systems and equipment,
- Visual display of the associated operating data to control operators and technicians,
- Detection of abnormal operating parameters and parameter trends,
- Provision of visual and audible alarms to apprise control operators of such conditions, and

Storage and retrieval of historical operating data.

The DCS is a microprocessor-based system. Redundant capability is provided for critical DCS components such that no single component failure would cause a plant outage. The DCS consists of the following major components:

- Computer monitor-based control operator interface (redundant),
- Computer monitor-based control engineering work station,

- Multi-function processors (redundant),
- Input/output processors (redundant for critical control parameters),
- Field sensors and distributed processors (redundant for critical control parameters),
- Historical data archive, and

Printers, data highways, data links, control cabling, and cable trays.

The DCS is linked to the control systems furnished by the STG supplier and to the solar field controls. These datalinks provide STG control, monitoring, alarm, and data storage functions via the control operator interface and control technician workstation of the DCS.

2.5.5.9 Telecommunications and Telemetry

The Project will have telecommunications service from providers who serve the Desert Center area. Voice and data communications will be supported by a fiber optic system. This will be augmented with wireless telecom equipment, particularly to support communication with Project staff dispersed throughout the large Project site.

With respect to telemetry, the Project will utilize electronic systems to control equipment and facilities operations over a large site. Detailed information on Project use of the electronic spectrum has not yet been developed at the current stage of the Project engineering design process. Due to the remoteness of this site, interference with civil aeronautical or military operations is not expected.

2.5.5.10 Lighting System

The Project's lighting system will provide operations and maintenance personnel with illumination in normal and emergency conditions. AC lighting will be the primary form of illumination, but DC lighting will be included for activities or emergency egress required during an outage of the plant's AC system. AC convenience outlets will also be provided for portable lamps and tools. The lighting fixtures will be hooded to minimize night time glare in deference to the "dark skies" initiatives that strive to protect views of night skies. The minimum illumination required to ensure safety and security objectives will be provided and will be oriented to minimize additional illumination in areas not pertinent to the facility.

2.5.5.11 HTF Freeze Protection System

A freeze protection system will be used to prevent freezing of the HTF piping systems during cooler winter nights. Since the HTF freezes at a relatively high temperature (54°F), HTF will be routinely circulated at low flow rates throughout the solar field using hot HTF from the storage vessel as a source. During winter a fired HTF heater may be used when weather conditions dictate.

2.5.5.12 HTF Leak Detection

Leak detection of HTF will be accomplished in various ways. Visual inspection throughout the solar field on a daily basis will detect small leaks occurring at ball joints or other connections. Such leaks can be corrected via minor repairs or repacking of joints and valves. The configuration of the looped system, allowing different sections of the loops to be isolated, will facilitate the repair of small leaks. Since larger leaks are of a greater concern, detection of large leaks is being proposed by using remote pressure sensing equipment and remote operating valves to allow for isolation of large areas of the loops in the solar field. Details of the design will be developed in the design detail process.

2.5.5.13 Service Air and Instrument Air Systems

The service air system supplies compressed air to hose connections located at intervals throughout the power plant. Compressors deliver compressed air at a regulated pressure to the service air-piping network.

The instrument air system provides dry, filtered air to pneumatic operators and devices throughout the power plant. Air from the service air system is dried, filtered, and pressure regulated prior to delivery to the instrument air-piping network.

2.5.6 Project Civil/Structural Features

The following subsections describe civil/structural features of the Project, as illustrated in the site arrangement presented in Figure 2-4. The power plant has been designed in conformance with Uniform Building Code and California Building Code criteria for Seismic Zone 4, the zone of highest seismic risk.

2.5.6.1 SSG System, STG and Associated Equipment

The SSG System, STG and dry cool condensers will be located outdoors and supported on reinforced concrete mat foundations. The STG foundation will include a reinforced concrete pedestal. The one step-up transformer and GSU will be supported on reinforced concrete mat foundations. Balance-of-plant (BOP) mechanical and electrical equipment will be supported on individual reinforced concrete pads. BOP components/materials include piping, valves, cables, switches, etc., that are not included with major equipment and are generally installed or erected onsite.

2.5.6.2 Solar Collector Assembly Support Structures

Each SCA will be supported by structures (stands) that connect the parabolic troughs to the drive mechanism. Each array will be supported by multiple individual foundations with a foundation located approximately every 63 feet along the assembly. Foundation design will be based on site-specific geotechnical conditions to ensure that the SCA stands are able to support all loading conditions (including wind loading) at the Project site.

2.5.6.3 Buildings

The Project will include an administration building and warehouse adjacent to the solar field. The power block will include a number of buildings including a control building, maintenance shop, water treatment lab, electrical building, and office building. The design and construction of the administration building and warehouse will be consistent with normal building standards. Other plant site buildings will include the water treatment building, as well as a number of pre-engineered enclosures for mechanical and electrical equipment. Building columns will be supported on reinforced concrete mat foundations or individual spread footings and the structures will rest on reinforced concrete slabs. The total footprint area of the central warehouse and main office is approximately 122,000 square feet (SF). The footprint area of buildings in each power block is 31,200 SF.

2.5.6.4 Water Storage Tanks

There will be three covered water tanks onsite: one 250,000-gallon RO concentrate/dust control storage tank located in Unit #1, and two one million-gallon treated water storage tanks, one in each power block. Water storage tanks will be vertical, cylindrical, field-erected steel tanks supported on foundations consisting of either a reinforced concrete mat or a reinforced concrete ring wall with an interior bearing layer of compacted sand supporting the tank bottom.

2.5.6.5 Roads, Fencing, and Security

There is an existing highway exit near the southwest boundary of the Project site. As noted earlier, access to the Project site will be via a new, 24-foot wide paved access road starting at the existing short stretch of Corn Springs Road north of I-10. It is anticipated that no improvements to I-10 will be needed.

Only a small portion of the overall plant site will be paved, primarily the site access road, the service roads to the power blocks, and portions of the power block (paved parking lot and roads encircling the STG and SSG areas). The remaining portions of the power block will be gravel surfaced. In total, the power block will be approximately 18.4 acres with approximately six acres of paved area. The solar field will remain unpaved and without a gravel surface in order to prevent rock damage from mirror wash vehicle traffic; an approved dust suppression coating will be used on the dirt roadways within and around the solar field. Roads and parking areas located within the power block area and adjacent to the administration building and warehouse will be paved with asphalt.

The Project solar field and support facilities perimeter will be secured with a combination of chain link and wind fencing. Chain link metal-fabric security fencing, eight feet tall, with one-foot barbed wire or razor wire on top will be installed along the north and south sides of the facilities. Thirty-foot tall wind fencing, comprised of A-frames and wire mesh, will be installed along the east and west sides of each solar field. Tortoise exclusion fencing will be included. Controlled access gates will be located at the site entrance. As discussed below, the eastern and western drainage channels will be outside the plant facilities and the security fencing but still within the Project ROW.

2.5.6.6 Site Drainage and Earthwork

The existing topographic conditions of the Project plant site show an average slope of approximately one foot in 330 feet (0.3 percent) toward the northeast. The present undeveloped property has sheet drainage and during infrequent large precipitation events run-off may reach Palen Dry Lake, which is approximately two miles north of the site. In the 1960s, I-10 was constructed across the meandering flows from the Chuckwalla Mountains. As part of this construction, a series of dikes were constructed which direct the flows to three bridge structures upstream of the Project site. The westerly bridge structure conveys the flows from Corn Springs Wash toward the northwest corner of the site. The other two culverts convey the flows toward the center and southeast corner of the project site respectively. The elevated freeway prevents flows from crossing the site from any other locations.

Although the bridges concentrate the flows, the flat topography of the area causes the flows to spread out north of the freeway. Immediately downstream of each bridge structure there is an incised watercourse, but the bank heights rapidly diminish to 12 to 18-inches and the water then spreads into numerous rills. The existing vegetation patterns and rills indicate that the flows maintain a fairly straight path across the Project site toward Ford Dry Lake. Project site development plans include intercepting the storm flows at the Project boundaries, channelizing and rerouting the flows around and through the site and then returning the flows to their sheet flow regime on the north side of the site. The channel segments will be designed to meet Riverside County and/or Colorado River Basin RWQCB requirements. A drainage study and plan are included in Appendix L.

On the west side of the site, the vegetation and erosion patterns indicate that the majority of flows from Corn Springs Wash likely flow across the northwest corner of the site. However, due to the unpredictable nature of the potential flood flow patterns, a channel is being proposed along the entire west side of the site to ensure the solar field will be protected under any flood flow event from Corn Springs Wash. The channel will be designed for the 100-year flow rate with a minimum of one-foot of freeboard in the northwest portion of the site and for a lesser storm interval in the southwest portion of the site. Additional protection will be provided by an elevated roadway/berm on the east side of the channel. The channel will wrap around the northwest corner of the site and then spread the flows similar to the existing flow regime.

In the center of the site, the storm flows will be directed to a channel that will flow between the two proposed solar units. The channel will be designed for the 100-year flow rate with a minimum of one-foot of freeboard. This channel will also turn toward the east at the north side of the site and then spread the flows similar to the existing flow regime.

On the east side of the site, the storm flows will be directed to a channel on the south side of the eastern solar unit (Unit #1) that directs the flows to the southeast corner and then along the east boundary of the site. The storm flows will then be spread along the east boundary in a manner similar to the existing flow regime.

The solar units will be graded generally following the existing contours of the site in order to minimize the amount of disturbance and to allow a balanced distribution of material. The run-off from the units will be collected in a series of swales and small channels which will direct the flow to the appropriate channel. Culverts will be provided across the center channel for essential onsite roads.

The power block areas that are centrally located within the solar units will have their own detention/water quality basins within the block. The power blocks will generally drain by sheet flow or swales to the basins. The basins will be designed to mitigate the 25-year storm flow and to provide water quality mitigation. Oil and chemical storage areas within the power locks will have their own containment features. The basins will also be designed to retain for a short duration prior to outfall to the nearest downstream channel.

The preliminary site grading plan is designed to be balanced; no import or export of soil is expected for general earthwork. The grading plan does not currently allow for any soil shrinkage or other losses. When the geotechnical investigation report is available for the site, the grading plan will be adjusted to account for any loss in elevation that could occur. Engineered fill will be provided as required for equipment and structure foundations as/if recommended by the geotechnical report. Only soil material approved by the geotechnical engineer will be used for structural fill. Additionally, granular material may need to be imported for the use as road base and possible use below foundations. Grading of the site will commence at the beginning of the construction period and last over a period of approximately 24 months. Such an extended grading period will require less water on a daily basis for grading operations as well as for dust control over a smaller area. The total earth movement required is estimated to be approximately 4,500,000 cubic yards.

As summarized in Section 5.17, Water Resources, and described in the preliminary construction Storm Water Pollution Prevention Plan (SWPPP)/Drainage, Erosion and Sediment Control Plan (DESCP) provided in Appendix L, the Project will employ a comprehensive system of management controls, including site-specific Best Management Practices (BMPs), to minimize storm water contact with contaminants and thus pollutants in the storm water. These management controls may include:

- Erosion and sediment control,
- Employee training program,
- Good housekeeping programs,
- Preventive maintenance programs,
- Structural BMPs:
    - Temporary containment during maintenance activities
    - Permanent secondary containment structures at chemical storage and process areas

- Materials, equipment and vehicle management practices,
- Spill prevention and response programs, and
- Inspection programs.

2.5.7 Construction of Generating Facilities

Major milestones of the planned construction schedule are as follows:

- Begin construction: fourth quarter 2010
- Unit #1 start of commercial operations: mid 2013
- Unit #2 start of commercial operations: by end of 2013

2.5.7.1 Construction Schedule, Manpower, and Sequencing

Project construction is expected to occur over a total of 39 months. Project construction will require an average of 566 employees over the entire 39-month construction period, with manpower requirements peaking at approximately 1,140 workers in Month 17 of construction. The construction workforce will consist of a range of laborers, craftsmen, supervisory personnel, support personnel, and management personnel. Section 5.11, Socioeconomics, provides a breakdown of the construction workforce by skill over the entire construction period.

Temporary construction parking areas will be provided within the power plant site adjacent to the laydown area. The plant laydown area will be utilized throughout the build out of the two solar units. The construction sequence for power plant construction includes the following general steps:

- *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 drainage channels will be completed during the first 24 months of the construction schedule.
- *Linears:* this includes the site access road, telecommunication line and transmission line. The site access road and telecommunication line will be constructed during the first six months of the construction schedule in conjunction with plant site preparation activities. The transmission and telecommunications lines will be constructed during the first 18 months of the construction schedule.
- *Foundations:* this includes excavations for large equipment (STG, SSG, GSU, etc.), footings for the solar field, and ancillary foundations in the power block.
- *Major Equipment Installation:* once the foundations are complete the larger equipment will be installed. The solar field components will be assembled in an onsite erection facility and installed on their foundations.
- *BOP:* with the major equipment in place, the remaining field work will be piping, electrical, and smaller component installations.

Testing and Commissioning: testing of subsystems will be conducted as they are completed. Major equipment will be tested once all supporting subsystems are installed and tested.

2.5.7.2 Deliveries

Most equipment and materials will be delivered to the Project site by truck. Delivery of the STG, generator step up transformer, HTF, solar collector structural steel, and other materials for which rail transport is appropriate, will be by rail. The Applicants are exploring the possibility of utilizing an existing rail spur in Blythe about one-quarter mile south of I-10 and one block east of Lovekin Street. Alternatively, there are rail spurs in the Indio area that also may be usable. From either location, the materials will be trucked to I-10 by the most direct appropriate route and then trucked on I-10 either west (from Blythe) or east (from Indio) to the site.

2.5.7.3 Fire Protection

A Construction Fire Protection and Prevention Plan will be developed and followed throughout all phases of construction. The permanent facility fire protection system will be put into use during construction as soon as is practicable. Prior to the availability of this system, fire extinguishers and other portable fire fighting equipment will be available onsite. All equipment will be California Occupational Safety and Health Administration (Cal/OSHA) compliant. Locations of portable fire fighting equipment may include portable office spaces, welding areas, flammable chemical areas, and vehicles and other mobile equipment.

2.5.7.4 Construction Water

To meet Project construction water needs involves providing water for all construction related activities. These activities include:

- Dust control for areas experiencing construction work as well as mobilization and demobilization,
- Dust control for roadways,
- Water for grading activities associated with both cut and fill work,
- Water for soil compaction in the utility and infrastructure trenches,
- Water for soil compaction of the site grading activities,
- Water for soil stockpile sites,
- Water for the various building pads, and
- Water for concrete pours on site.

The predominant use of water will be for grading activities, which will have a steady rate of work each month. The grading schedule for the site has been spread to cover the total construction period. This will mean that water use will be steady and without definable peaks. Average water use at the site is estimated to be about 440,000 gallons (about 1.3 acre-feet) per working day. Total construction water use for the duration of the Project is estimated to be about 1,500 acre-feet). Construction water will be sourced from onsite wells. Potable water during construction will be brought onsite in trucks and held in day tanks.

2.5.8 Project Operation

While electrical power is to be generated only during daylight hours, the Project will be staffed 24 hours a day, seven days per week. A total estimated workforce of 84 full time employees will be needed to staff the first phase of the project (Unit #1). When the second of the two units comes online, the full-time staff will increase to 134. A breakdown of operational staff is provided in Section 5.11, Socioeconomics.

2.6 Transmission System

2.6.1 Transmission System Description

Three existing transmission lines parallel I-10 with one crossing I-10 immediately south of the plant site which transects the plant site area. In addition, two additional transmission facilities are in the final stages of completion. These facilities are as follows:

- SCE's existing Palo Verde - Devers No. 1 500-kV Line
- SCE's planned Palo Verde - Devers No. 2 500-kV Line (Colorado River to Devers Portion)
- SCE's existing Eagle Mountain 161-kV Line (Transects Palen Site)
- FPL Energy's Blythe – Julian Hinds 230-kV Line
- Desert Southwest Power/Imperial Irrigation District's planned Desert Southwest 500-kV Line

The PSPP will be connected to the SCE transmission system by constructing a double-circuit three-phase 230 kV transmission line that would interconnect at a new substation planned by SCE at a location that has not been finalized but is expected to be to the west of the Project site. The nominal 500 MW Project output produces 1260A at 230 kV. The conductor proposed for the gen-tie is a twin bundle of 795-thousand circular mil "Drake" capable of carrying 1814A at 75°C. SCE utilizes the nominal voltage of 230 kV. The use of 230 kV as the targeted design voltage in this AFC is consistent with the industry use of the 230 kV term to describe the nominal voltage for this class of system.

Each circuit will be supported by mono-pole structures at appropriate intervals based on a preliminary height of 120 feet. The lines will be insulated from the poles using porcelain insulators engineered for safe and reliable operation at a maximum operating voltage of 242-kV (nominal, plus ten percent). Shield wires will be included along the length of the lines to protect against lightning strikes (see Figure 5.14-1 in Section 5.14, Transmission Line Safety and Nuisance). These pole designs were engineered to provide conceptual design limits for purposes of the electromagnetic field (EMF) studies. Final transmission structure design including tangent, angle, dead end, and pull-off structures and associated hardware will be determined during the final engineering of the proposed interconnection. The proposed 220-kV line would be designed to meet the requirements of California Public Utilities Commission General Order 95 (GO-95).

The generator at each power plant will produce power at 18 kV. The 18 kV bus will provide service to on site electrical loads at various voltages. The power will step up immediately near the generator terminals within the power block to 230 kV via the GSU. Each of the two power plant units will be connected to the central switchyard located near the northwestern portion of the site. This central switchyard will be provided with system protection and relays, will be the location of the meters, and will also back-feed the house electrical loads at various voltages when the generator is off-line or the unit is shut down.

From the power block switchyards, located in each of the two power plant units, a single circuit 230 kV mono pole tie line will be provided that will carry power north from each power block to the Central Switchyard located in the northwesterly portion of the site. From the Central Switchyard a 230 kV double circuit gen tie line will run from the northern edge of the Project boundary to Southern California Edison's planned Red Bluff Substation. As noted previously, the substation location has not yet been finalized but is expected to be to the west of the site. A possible 11.5-mile gen-tie line route to a possible substation location is illustrated in Figure 2-1.

The precise equipment and interconnection configuration within SCE's proposed Red Bluff Substation is currently being defined by SCE. SCE will own and operate the substation, which is being planned to serve a variety of generating stations expected in the region.

2.6.2 Construction of Transmission Facilities

The transmission line will be constructed in accordance with the guidelines of Institute of Electrical and Electronics Engineers Guide 524 "Guide to the Installation of Overhead Transmission Line Conductors" with crews working continuously along the ROW, with construction of the entire transmission line requiring a peak workforce of approximately 20 workers. Transmission line construction will include the installation of tubular steel poles involving the following sequence of activities:

- *Marshalling Yards:* Staging areas for trailers, office personnel, equipment, material staging, laydown and employee parking for the project will be established in an approved area.
- *Road Work:* As needed, dirt roads for access along the transmission line route to provide access to the structure locations. These access roads will be installed in locations that avoid sensitive environmental resources identified in Project environmental surveys.
- *Pole Erection:* Each pole will be assembled on site and dressed out with insulators and conductor hardware.
- *Conductors:* From pulling sites, the conductors will be installed, sagged and permanently connected to the insulators.
- *Pulling Sites:* There will be approximately three (3) pulling sites required to install the conductors.
- *Communication System:* The overhead ground/fiber optic communications cable will be installed using the same pulling sites as were used for the conductor installation.

The transmission line description presented below is for typical desert transmission line construction. Although not route-specific, the description is expected to be applicable to the PSPP.

The transmission lines for this site will be 230 kV lines and will be placed on 120-foot high steel monopoles. The lines and monopoles will be placed both onsite and offsite. The placement techniques and the type of towers are the same regardless of whether the line is onsite or offsite. The poles have a base width of five to six feet and a top width of one to two feet depending on local conditions. The spacing between the poles will be approximately 1,100 feet. The construction corridor is generally 80 feet wide with a final easement width of 120 feet, subject to regulatory approval.

Using cranes, the towers will be placed on concrete foundations buried in the ground. The construction footprint at the tower locations is approximately 20 feet x 20 feet. The laydown area is contained within the construction corridor of 80 feet along the full alignment. Material will only be delivered to the offsite locations sufficient for each day's construction activities. A 15-foot wide access road will be constructed adjacent to the towers for the full length of the alignment. Pull sites are the same general locations as the tower sites. The pulls will originate from the end of the alignment and will progress from tower to tower for the full alignment using pulley rigs and cables.

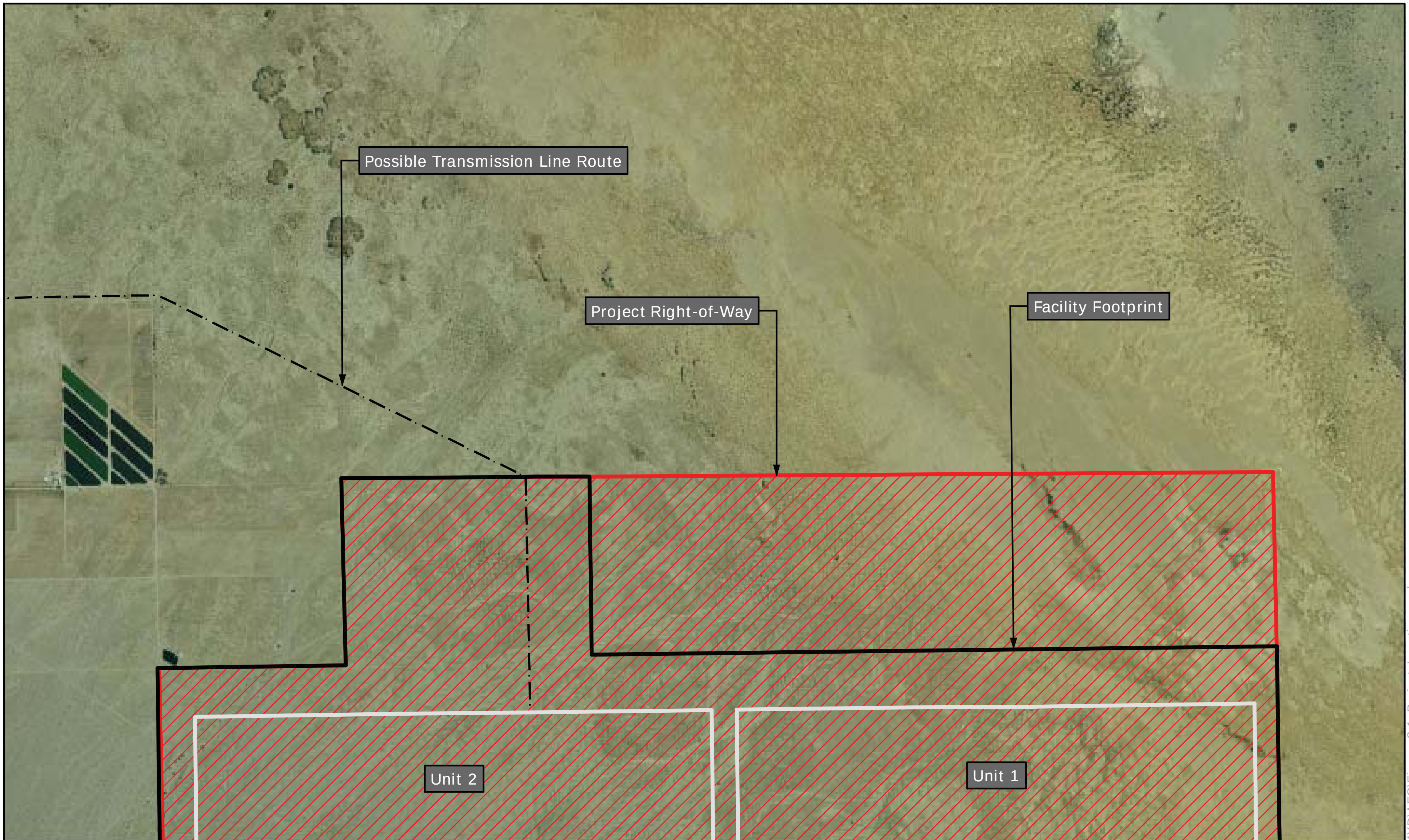
2.6.3 Interconnection Study

The California Independent System Operator (CalSO) and SCE initiated a Phase 1 Cluster Study in the fall of 2008. The Phase I Cluster Study was released on August 5, 2009. The Applicant will provide this document under confidential cover.

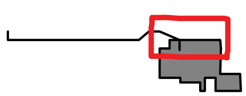
The final Phase 2 Study will commence in November 2009 and will be completed in 2010. An Interconnection Agreement for the project is expected to be concluded in the fourth quarter of 2010.

2.6.4 Existing SCE Distribution Line

SCE's existing 161-kV Eagle Mountain-Blythe power line presently runs in a northwesterly direction across the southwest portion of the Project site. The Applicants are working with SCE to try to accommodate both the solar facilities and the SCE line within the BLM ROW. The existing 161 kV line is on wood poles generally 35 to 40 feet above the ground. If the line is rerouted it likely would use poles similar in type as the existing poles, and would be at the same height and spacing as the existing lines if practicable.



Map Location



Legend

- Project Right-of-Way
- Possible Transmission Line Route
- Facility Footprint
- Possible Location: SCE Red Bluff Substation
- Solar Units

The PSPP transmission line route and the SCE substation location shown are preliminary, no environmental surveys have been conducted of the route or substation site.

1 inch = 2,000 feet — 0, 2,000, 4,000 Feet

N W E S

Palen Solar Power Project
Figure 2-1
Project Location

1 of 5

Solar Millennium

AECOM

Date: August 2009

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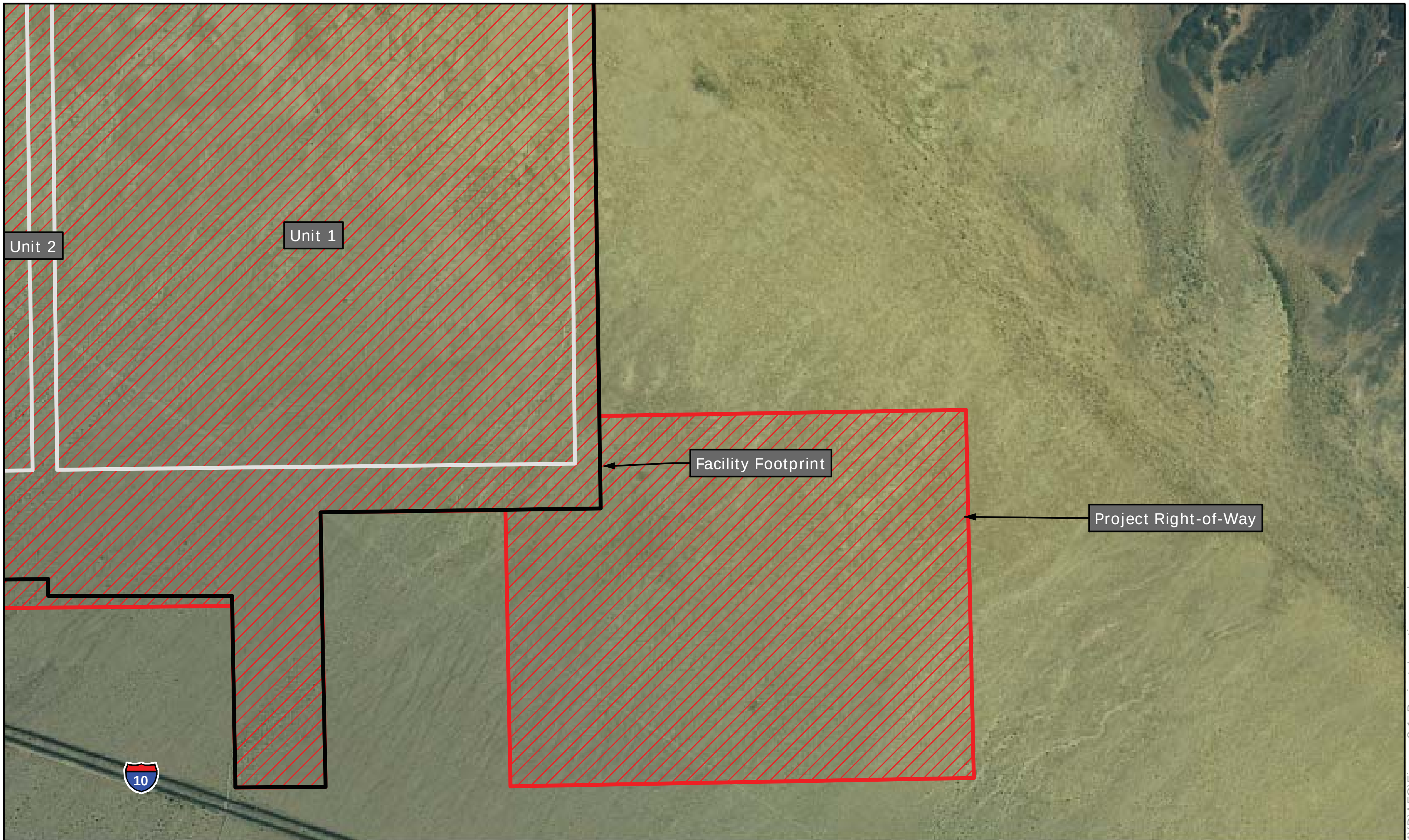

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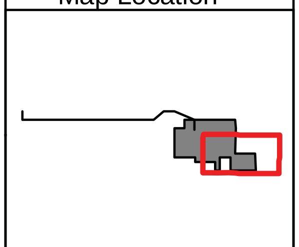

Legend

- Project Right-of-Way
- Possible Transmission Line Route
- Facility Footprint
- Possible Location: SCE Red Bluff Substation
- Solar Units

The PSPP transmission line route and the SCE substation location shown are preliminary, no environmental surveys have been conducted of the route or substation site.

1 inch = 2,000 feet — 0, 2,000, 4,000 Feet

N W E S

Palen Solar Power Project
Figure 2-1
Project Location

2 of 5

Solar Millennium

AECOM

Date: August 2009

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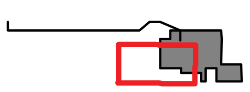
Map Location



Legend

Project Right-of-Way
Possible Transmission Line Route
Facility Footprint
Possible Location: SCE Red Bluff Substation
Solar Units

The PSPP transmission line route and the SCE substation location shown are preliminary, no environmental surveys have been conducted of the route or substation site.

1 inch = 2,000 feet — 0, 2,000, 4,000 Feet

N S E W

Palen Solar Power Project
Figure 2-1
Project Location

3 of 5

Solar Millennium

AECOM

Date: August 2009

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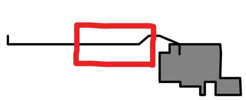
Map Location



Legend

- Project Right-of-Way
- Facility Footprint
- Solar Units
- Possible Transmission Line Route
- Possible Location: SCE Red Bluff Substation

The PSPP transmission line route and the SCE substation location shown are preliminary, no environmental surveys have been conducted of the route or substation site.

1 inch = 2,000 feet

0 2,000 4,000 Feet

N E S W

Palen Solar Power Project
Figure 2-1
Project Location

4 of 5

Solar Millennium

AECOM

Date: August 2009

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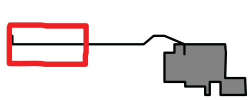
Map Location



Legend

- Project Right-of-Way
- Facility Footprint
- Solar Units
- Possible Transmission Line Route
- Possible Location: SCE Red Bluff Substation

The PSPP transmission line route and the SCE substation location shown are preliminary, no environmental surveys have been conducted of the route or substation site.

1 inch = 2,000 feet
0 2,000 4,000 Feet

N W E S

Palen Solar Power Project
Figure 2-1
Project Location

5 of 5

Solar Millennium

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Date: August 2009

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Figure 2-2 Photo Showing Representative Existing PSPP Site Conditions

Figure 2-3a - Plant Site without Simulated Project Facilities

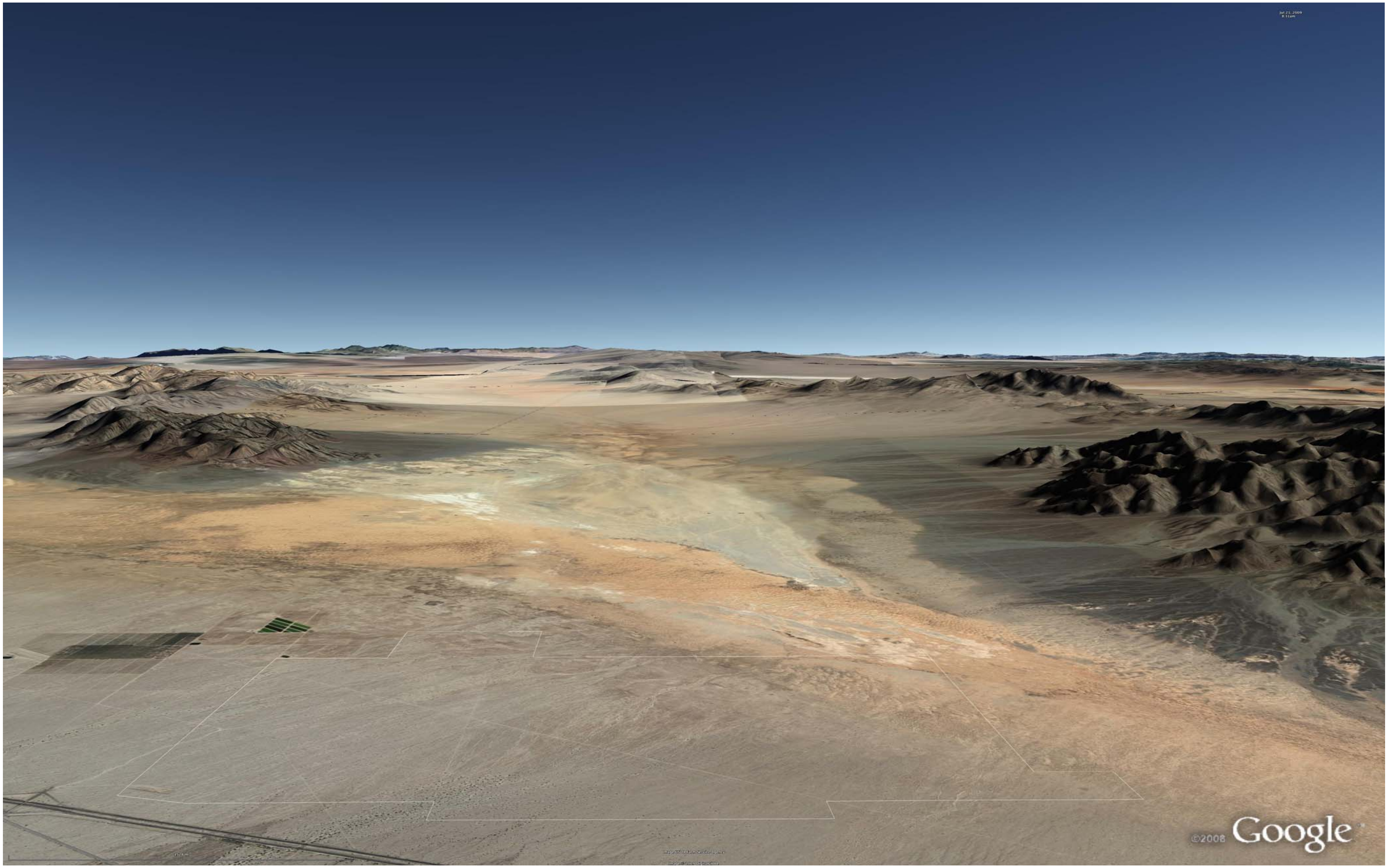
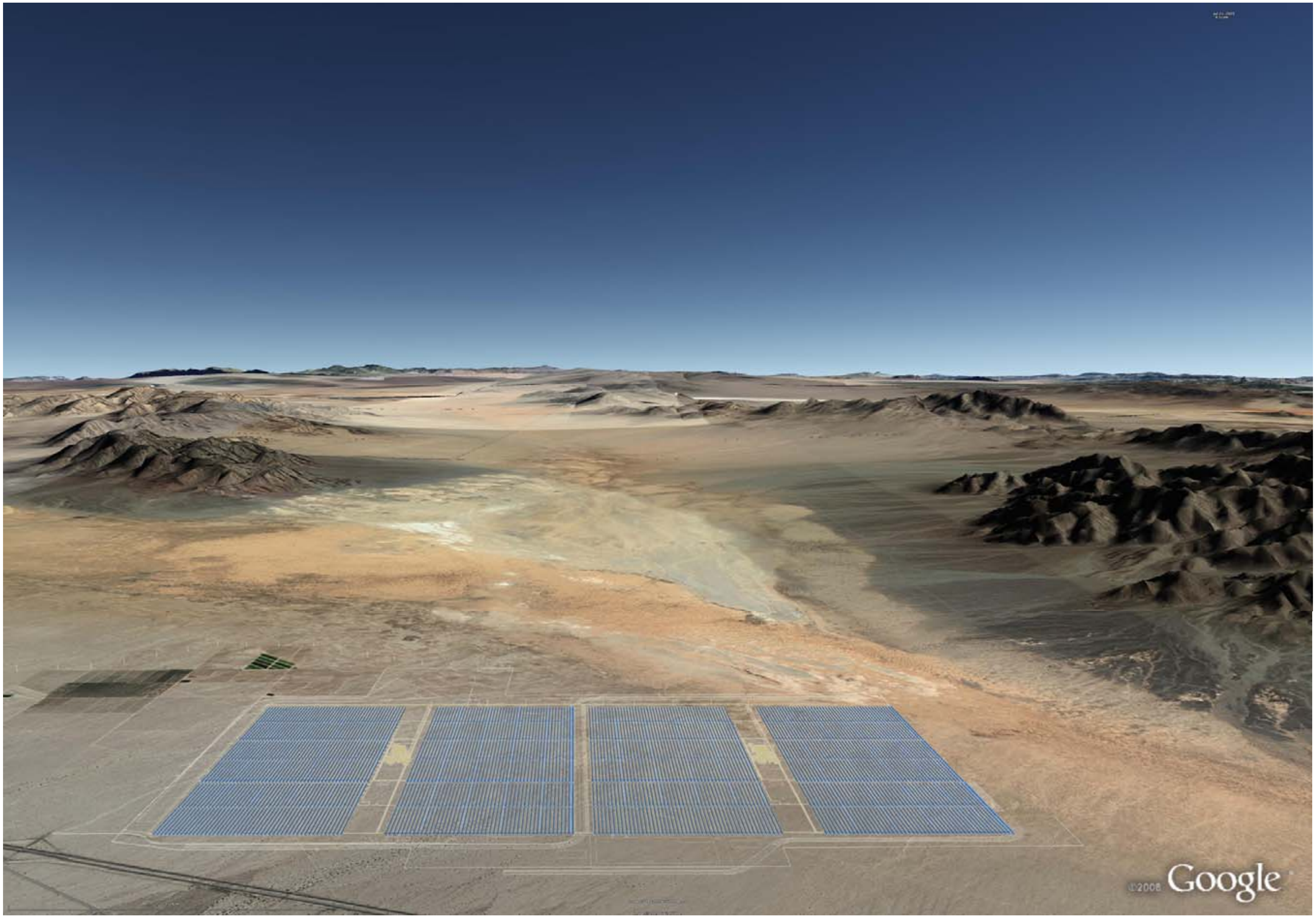
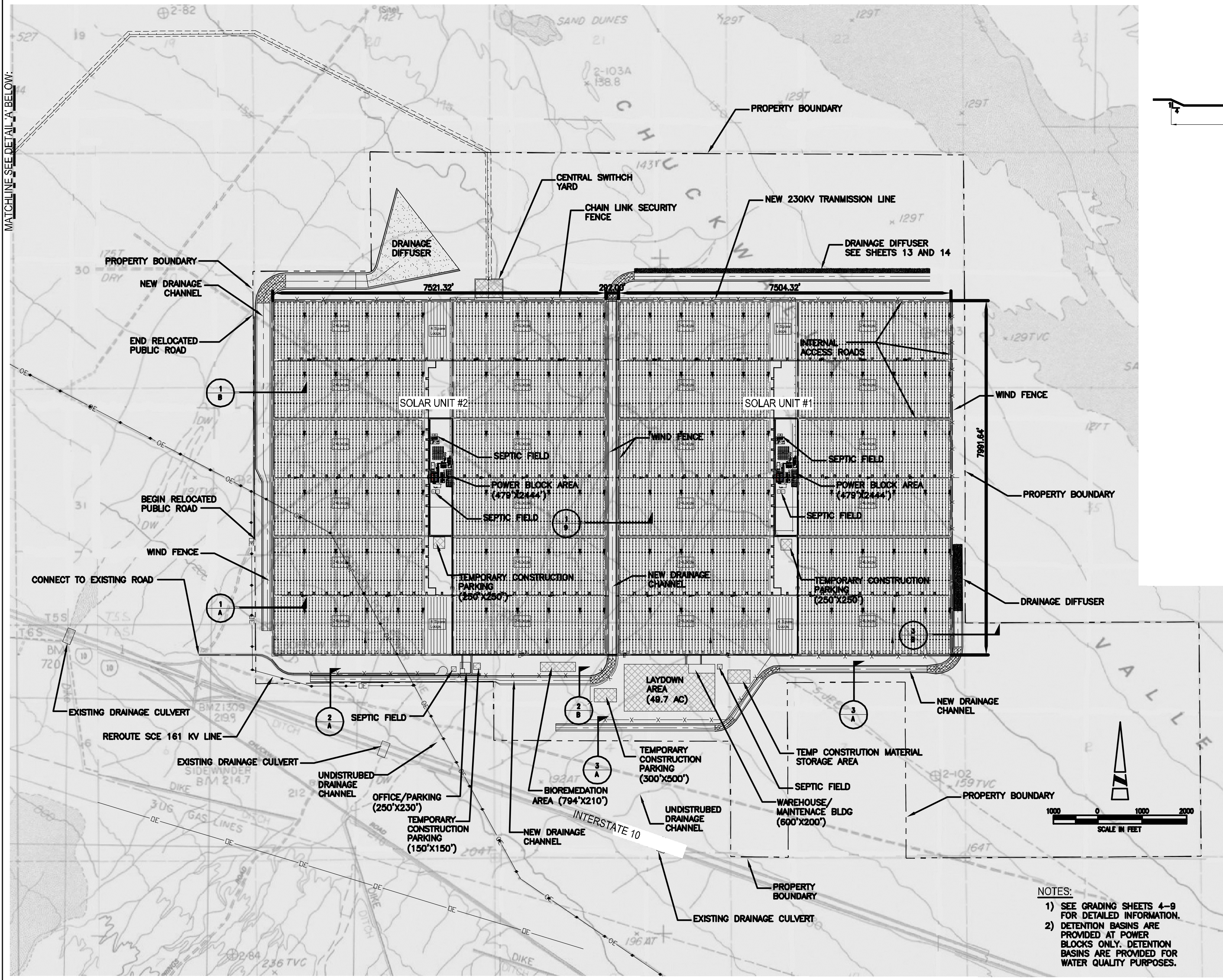
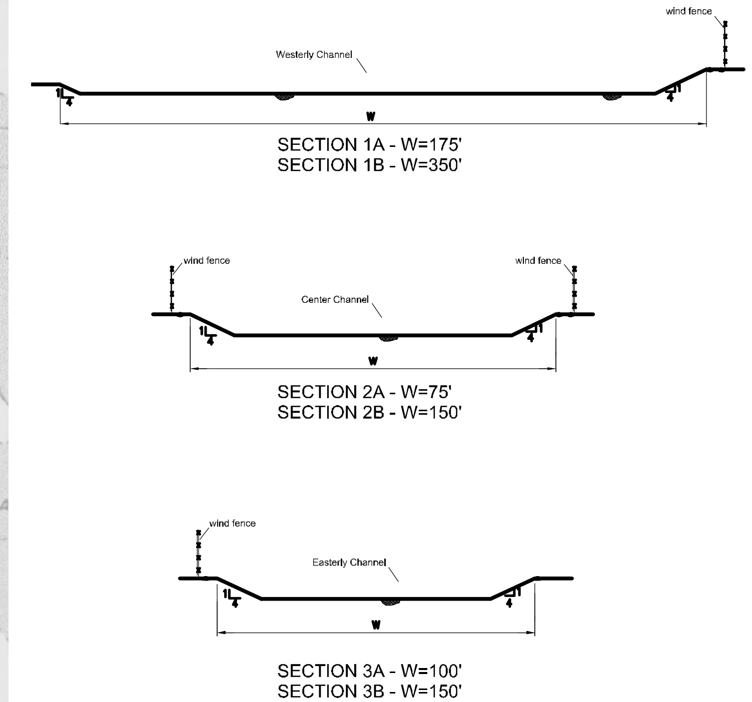
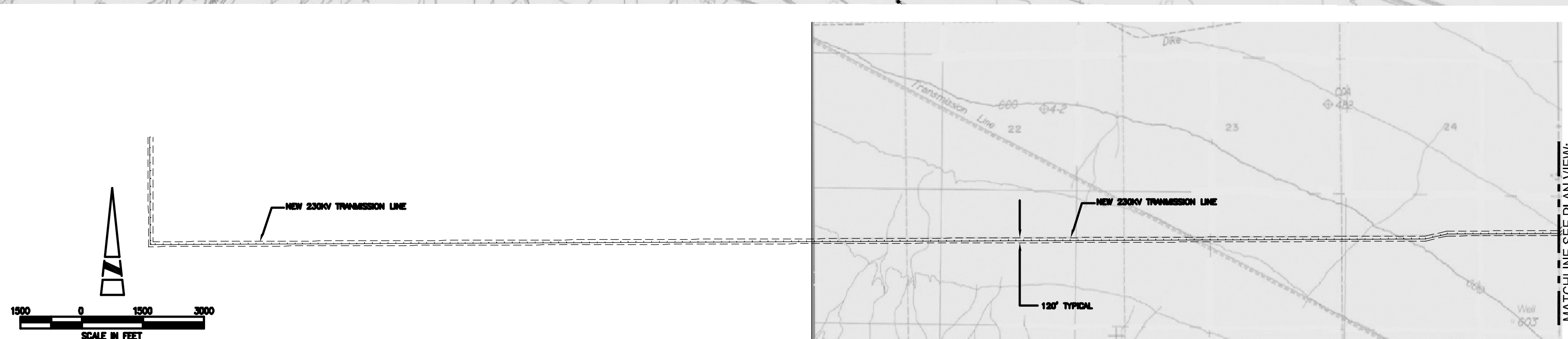


Figure 2-3b Plant Site with Simulated Facilities









DETAIL 'A' - 230 KV TRANSMISSION LINE

The PSPP transmission line route and the SCE substation location shown are preliminary, no environmental surveys have been conducted of the route or substation site.

30% Conceptual Engineering Plans
NOT FOR CONSTRUCTION
DATED: JULY, 2009

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999 Town & County Road
Orange, CA 92868
Phone 714.567.2618
www.aecom.com

Designed: Tomas Gonzales
Checked: Dennis Lucas
Drawn: Tomas Gonzales DTG
Record Drawing by/date: 5-18-09

Revisions:

#	DATE	DESCRIPTION
1	JULY,2009	REV SITE PLAN AND POWER BLOCK PER FLAGSOL DWG PD1_GEN_ARR 00103-2007

Prepared for:

Chevron
345 California Street
San Francisco, California 94104

Solar Millennium LLC

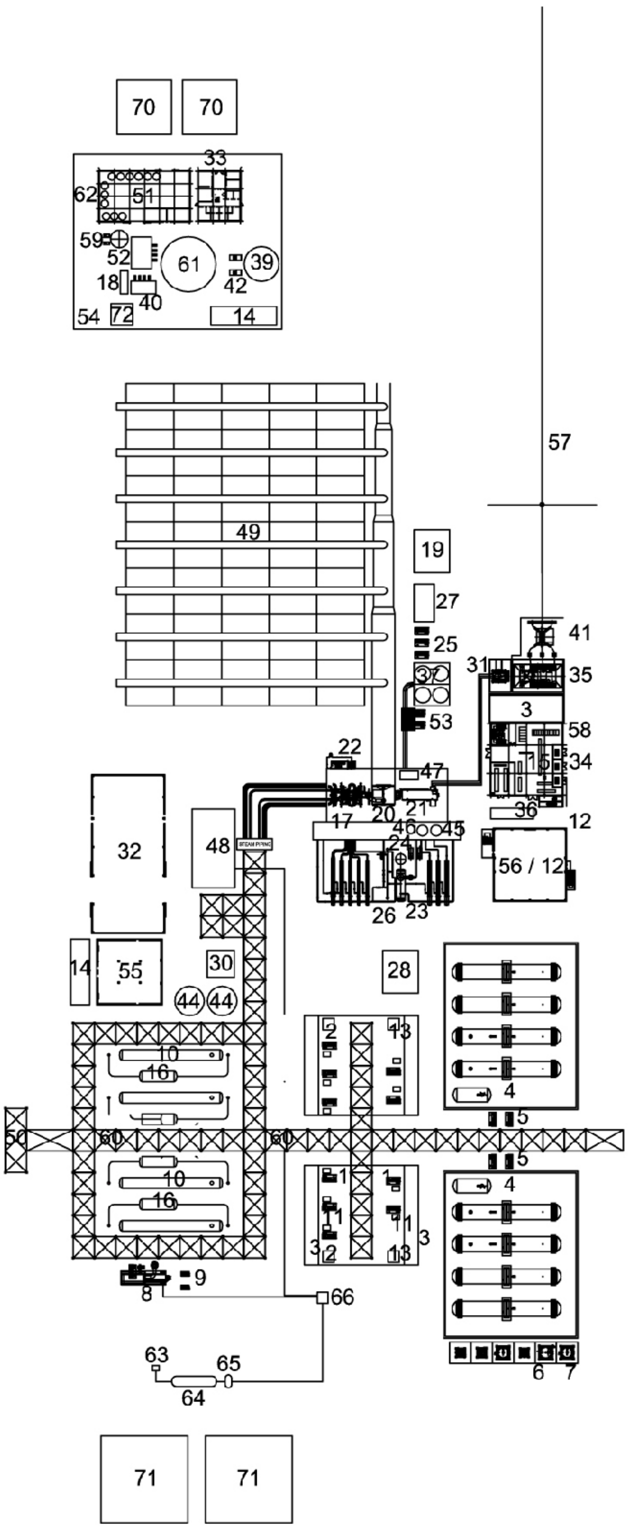
LEGEND:
- SOLAR BLOCK LOCATION
- BALANCE OF PLANT FACILITIES
- CHANNEL DIFFUSER
- PROPOSED CHANNEL
- PROPOSED ACCESS ROAD (PAVED)
- PROPOSED ACCESS ROAD (GRAVEL)
- PROPOSED WIND FENCE
- PROPOSED SILT FENCE
- PROPOSED FIBER ROLLS
- PROPOSED EARTH BERM
- PROPOSED SECURITY FENCE
- PROPOSED CONTOURS
- PROPOSED STREAM LINE
- PROPOSED FLOOD CONTROL
- EXISTING PAVED ROAD
- EXISTING GRAVEL ROAD
- EXISTING CONTOURS
- EXISTING STREAM LINE
- SITE BOUNDARY
- PUB. R. PUBLIC ROAD
- P.R. PRIVATE ROAD
- PROPOSED OVERHEAD ELECTRIC
- WATER LINE
- ELECTRICAL LINE
- GAS LINE
- COMMUNICATION LINE
- PROPOSED ELECTRICAL TOWER

Palen Solar Power Project

Riverside County, California

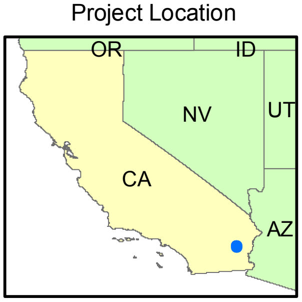
Figure 2-4
General Arrangement

Date: August 2009
Sheet: 3 22



#	LEGEND / NAME	DIMENSIONS (LxWxH) / CAPACITY	FTPRINT (S
1	HTF MAIN PUMPS	INCIDENTAL	
2	HTF PUMPS SEAL OIL UNIT	INCIDENTAL	
3	SWITCH YARD	13' X 92'	1200SF
4	OVERFLOW VESSEL AND EXPANSION VESSEL	124' X 154'	19KSF EA
5	OVERFLOW RETURN PUMPS	INCIDENTAL	
6	ULLAGE COOLERS AND VESSEL	59' X 20'	1200SF
7	NITROGEN SYSTEM	INCIDENTAL	800SF
8	HTF HEATER	50' X 22' X 80' STACK	1100SF
9	FREEZE PROTECTION PUMPS	INCIDENTAL	
10	STEAM GENERATORS	90' X 10' X 24' EA	900SF
11	VARIABLE FREQUENCY DRIVE SYSTEM	INCIDENTAL	
12	WEATHER STATION BUILDING	68' X 68' X 24' (TWO LEVEL BLDG)	4600SF
13	HTF PUMPS LUBE OIL UNIT	INCIDENTAL	
14	PARKING	18' X 60'	1080SF
15	BALANCE OF PLANT ELECTRICAL BUILDING	67' X 67' X 24' (TWO LEVEL BLDG)	4500SF
16	REHEATERS	32' X 10' EA	320SF
17	EXCITATION TRANSFORMER	NOT FOUND	
18	WATER TREATMENT MCCS	INCIDENTAL	
19	MCC COOLING TOWER	33' X 40' X 32' HIGH	1320
20	STEAM TURBINE	111' X 50' X 40' HIGH	5500SF
21	GLAND CONDENSER	INCIDENTAL	
22	LUBE OIL CONSOLE	INCIDENTAL	
23	DEAERATOR	125' X 57'	7100SF
24	FEEDWATER PUMPS	INCIDENTAL	
25	CONDENSATE PUMPS	INCIDENTAL	
26	LP/HP PRE-HEATERS	INCIDENTAL	
27	VACUUM SYSTEM	19' X 35' X 24' HIGH	665
28	DIRTY WASTE WATER SUMP, OIL WATER SEPARATOR	INCIDENTAL	
29	FREE FOR USE		
30	COMPRESSED AIR SYSTEM	25' X 25' X 24' HIGH	625 SF
31	GENERATOR CIRCUIT BREAKER	20' X 30' X 20'	600 SF
32	WAREHOUSE	68' X 146' X 30'	10K SF
33	CHEMICAL INJECTION SKID	46' X47' X 24'	2K SF
34	MAIN AUXILIARY TRANSFORMERS	INCIDENTAL	
35	GENERATOR STEP-UP TRANSFORMERS	48' X 32' X 24'	1,500 SF
36	EMERGENCY DIESEL GENERATOR	40' X 10' X 20'	400 SF
37	COOLING TOWER	33' X 40' X 32' HIGH	1,300 SF
38	FREE FOR USE		
39	WATER TANK (RO CONCENTRATE) (PS1 ONLY)	45' DIA X 24' HIGH / 250,000 GAL	1,600 SF
40	SERVICE WATER PUMPS	23' X 12' X 16'	275 SF
41	TAKE OFF TOWER	30' X 35' X 50'	1,000 SF
42	FIRE PROTECTION PUMPS	INCIDENTAL	
43	FREE FOR USE		
44	BLOWDOWN TANKS	28' DIA EA	570 SF
45	TURBINE DRAINS TANK	INCIDENTAL	
46	CONDENSATE TANK	INCIDENTAL	
47	STG PACKAGED ELECTRONIC AND ELECTRICAL CONTROL COMPARTMENT	INCIDENTAL	
48	AUXILIARY BOILER	40' X 73' X 32'	2900 SF
49	AIR COOLED CONDENSER	245' X 296' 150' HIGH	73K SF
50	HTF PIPING CONNECTION TO SOLAR FIELD	INCIDENTAL	
51	SAMPLE PANEL & LAB BUILDING	84' X 48' X 24' HIGH	4,000 SF
52	DEMINERALIZED WATER TANK	16' DIA X 24' HIGH	200 SF
53	AUXILIARY COOLING WATER PUMPS	INCIDENTAL	
54	WATER TREATMENT AREA	192' X 148'	28K SF
55	ADMINISTRATION BUILDING	60' X 60' 24' HIGH	3,600 SF
56	CONTROL BUILDING	68' X 68' 24' HIGH	4,600 SF
57	HIGH VOLTAGE LINE	4' DIA 120' HIGH POLES	
58	SUS TRANSFORMER & 480 V BUS	INCIDENTAL	
59	DEMINERALIZED WATER PUMPS	INCIDENTAL	
60	PIPE RACK	40' HIGH MISC.	
61	TREATED WATER TANK (also FIREWATER STORAGE)	91' DIA X 24' HIGH / 1 MILLION GAL	6,500 SF
62	CHEMICAL FEED CANOPY	NOT FOUND	
63	LPG TRUCK UNLOADING STATION	INCIDENTAL	
64	LPG STORAGE TANK	9' 4-3/4" DIA X 40' 9-3/8" X" LONG / 18,000 GAL	400SF
65	LPG PUMPS	6' DIA. X 12'-0" LONG	64SF
66	LPG VAPORIZER	10'-0" X 10'-0"	100SF
70	SEPTIC FIELD	50'-0" X 50'-0"	2,500 SF
71	SEPTIC FIELD	80'-0" X 80'-0"	6,400 SF

Project Location



Palen Solar Power Project

Figure 2-5
General Arrangement
Power Block

Solar Millennium

AECOM

Project: 12944-001
Date: July 2009

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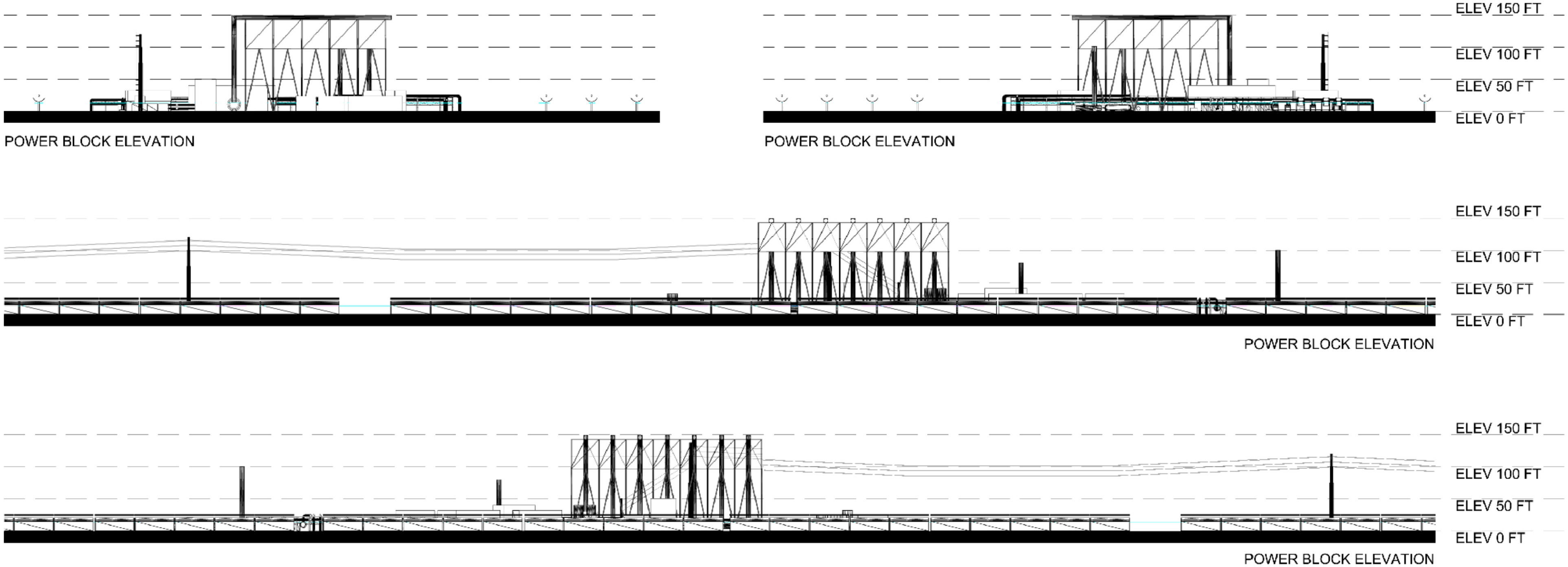
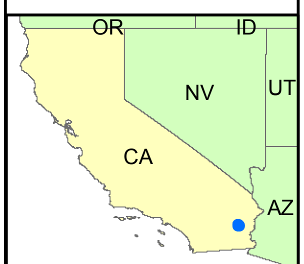


Project Location



Palen Solar Power Project

Figure 2-6a
Elevation View of Project Facilities

Solar Millennium

AECOM

Project: 12944-001
Date: July 2009

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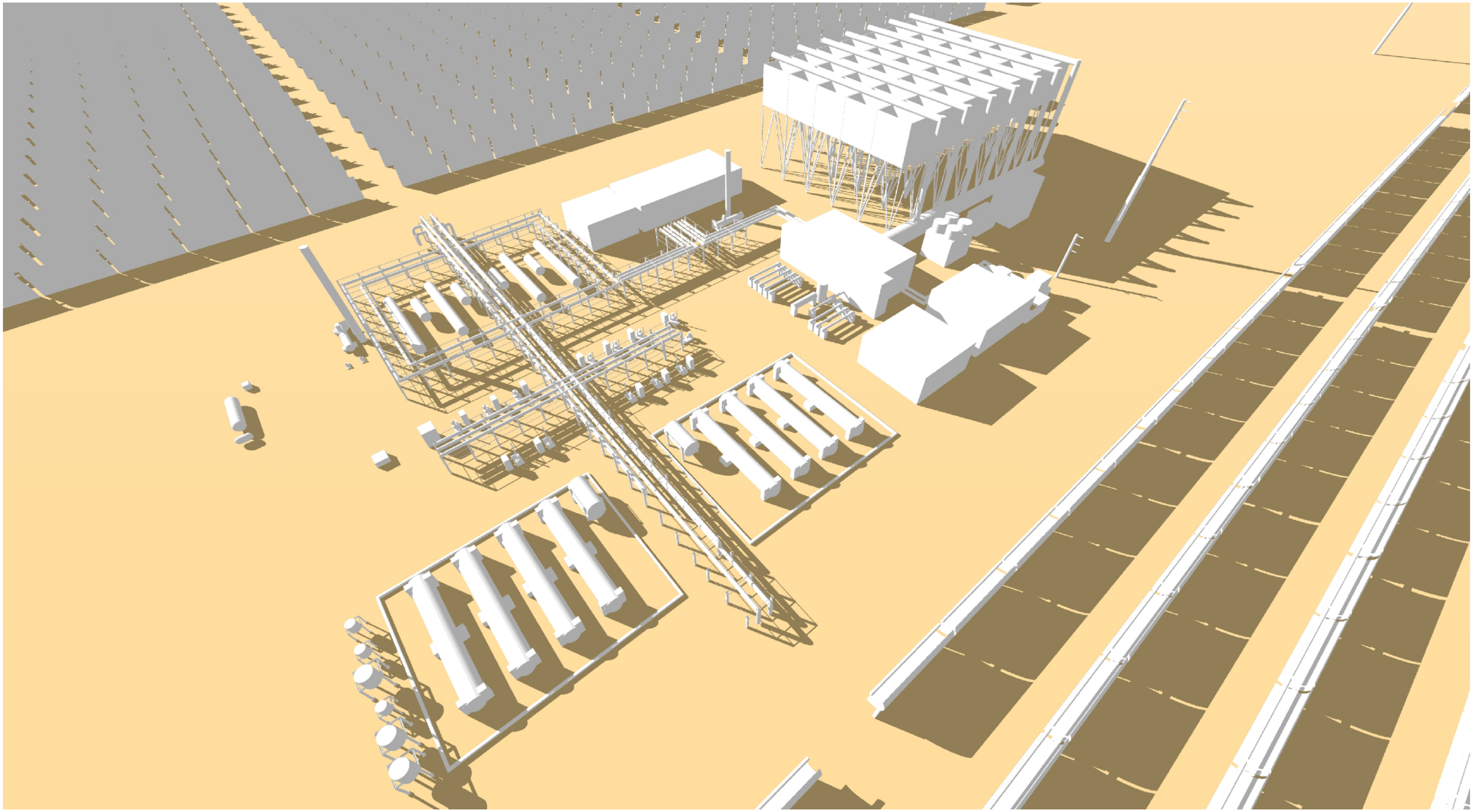

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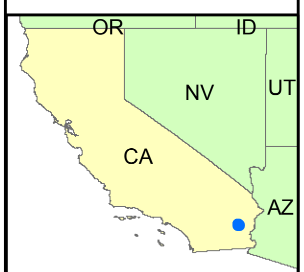

Palen Solar Power Project

Figure 2-6b
Three-Dimensional View of Project Facilities

Solar Millennium

AECOM

Project: 12944-001
Date: July 2009

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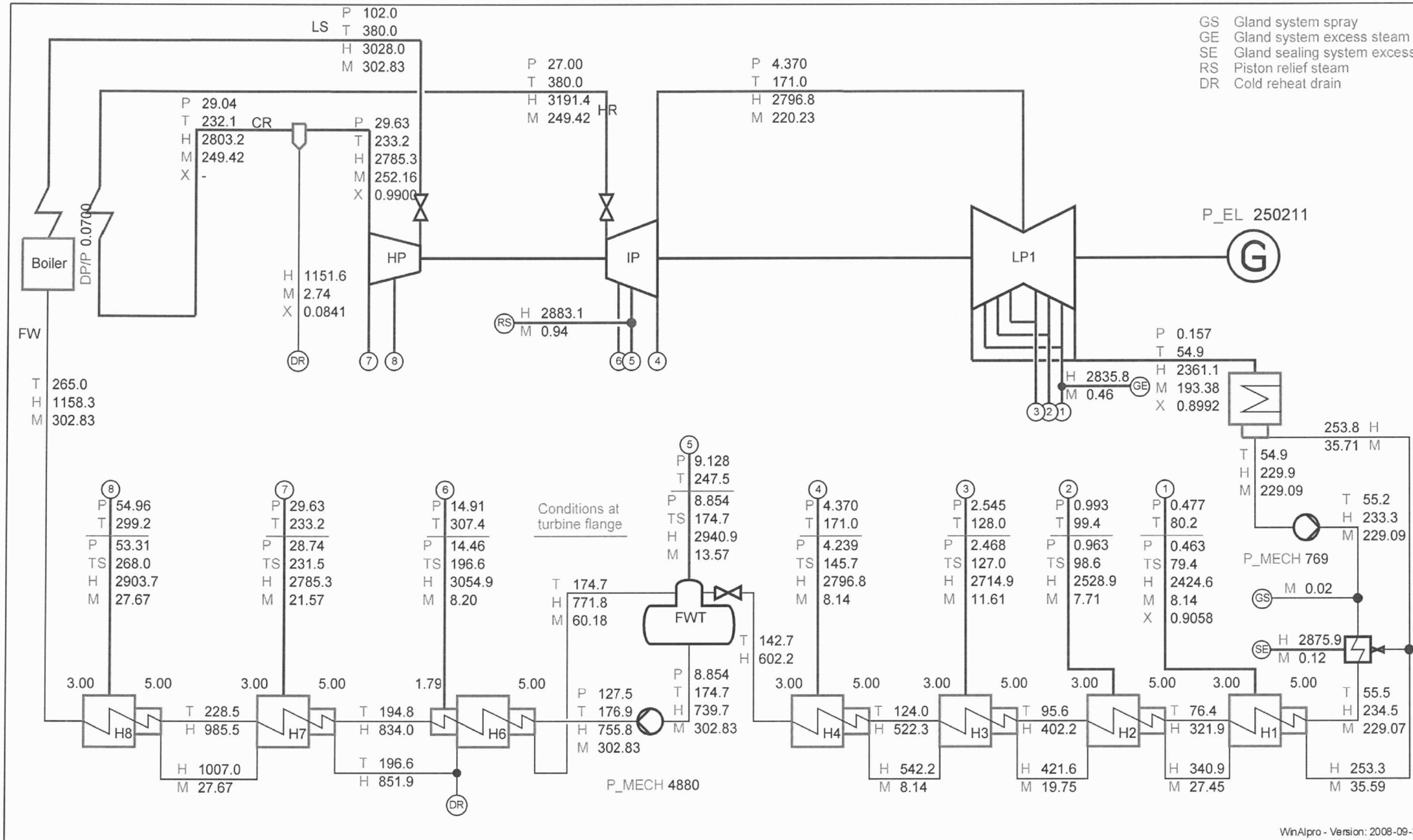


R:\PROJEKTE\Ridgecrest 2-2008\Dry_cooled\2008-12-05_GMD306RevA_HL\HBD_306_RevA_Lo.alg

P	Pressure	bar
T	Temperature	°C
H	Enthalpy	kJ/kg
M	Mass flow	kg/s
TS	Saturation temperature	°C
X	Mass fraction of vapor	-
P_MECH	Mechanical power	kW
P_EL	Electrical power	kW

HR = (Q.LS + Q.HR - Q.CR - Q.FW) / (P_EL.Gen)
= 9539 kJ/(kW*h)

Q_Solar 663000.0

Drawn: 2008-12-08
Checked:
Approved:
Doc | F | L E | Sh.No. 1 | N.o.Sh. 1

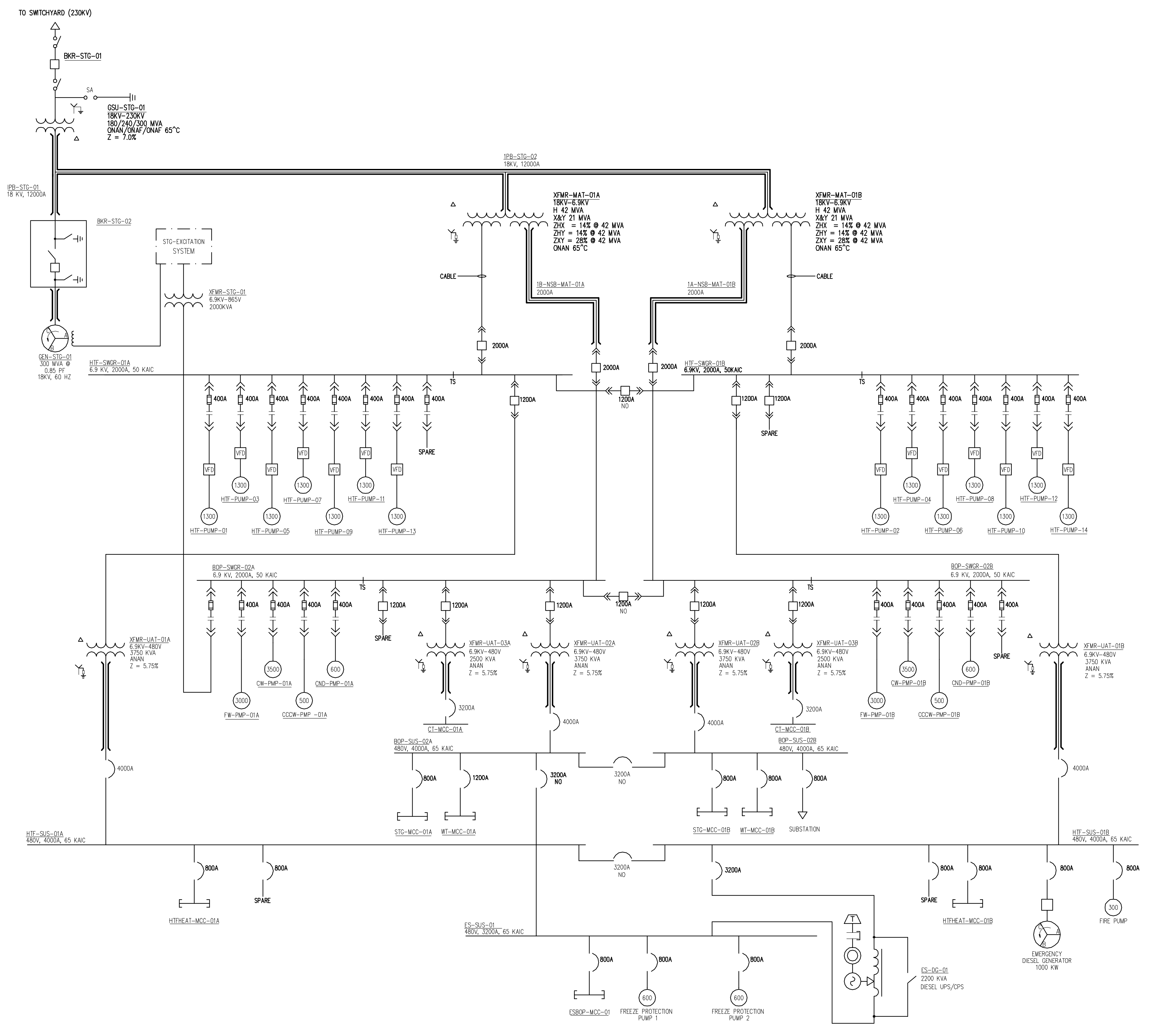
ALSTOM

HEAT BALANCE DIAGRAM
2 - ACC variant
100% Load

Figure 2-7

3600 rpm
cos phi = 0.9

Lohse
TSNSD-T1
2008-12-08/10:06
GMD 6 021306 - Rev.A



NOTES:

1. MAIN AUXILIARY TRANSFORMERS ARE ONLY SIZED FOR ½ THE FULL LOAD.

— PRELIMINARY —
NOT FOR CONSTRUCTION

CONFIDENTIAL

REV	DESCRIPTION	DWN	CHK	APP	DATE
D	ADDED EMER DIESEL GEN; RELOCATED FREEZE PROT, FIRE PUMP; DELETED ESHTF-MCC-01; REVISED STG TO 12000A, 1A-NSB-MAT-01A, 1B-NSB-MAT-01B TO CABLE				02-26-09
C	ADDED EMERGENCY BUS				01-30-09
B	MODIFIED TO 3-WINDING XFMRS AND OWNER'S COMMENTS				12-10-08
A	PRELIMINARY				10-28-08

KIEWIT-MSM JOINT VENTURE

SOLAR MILLENNIUM

PALEN SOLAR POWER PLANT

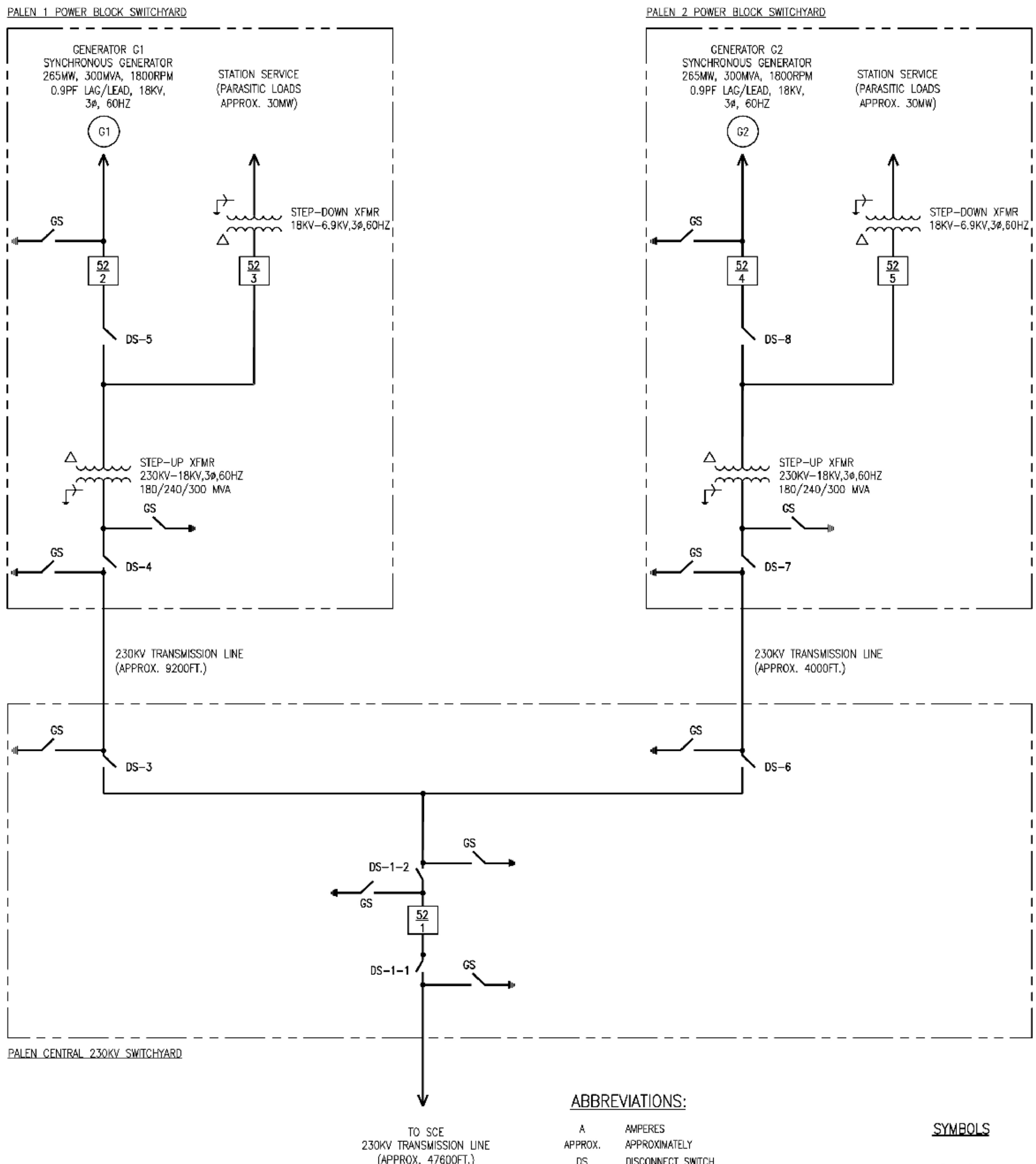
FIGURE 2-8
CONCEPTUAL ONE LINE DIAGRAM
POWER PLANT

ELECTRICAL ONE LINE DIAGRAM

	by	date
DESIGNED		
DRAWN		
CHECKED		
APPROVED		

DRAWING NUMBER

2008-045E-E0-001



NOT FOR CONSTRUCTION

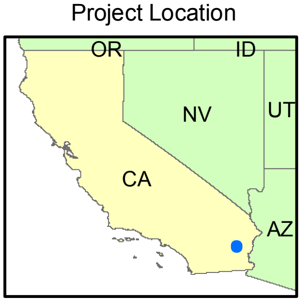
ABBREVIATIONS:

A	AMPERES
APPROX.	APPROXIMATELY
DS	DISCONNECT SWITCH
FT.	FEET
G	GENERATOR
GS	GROUND SWITCH
HZ	HERTZ
IC	INTERRUPTING CURRENT
KV	KILOVOLTS
KVA	KILO VOLTAMPERE
LA	LIGHTNING ARRESTER
MVA	MEGA VOLTAMPERE
MW	MEGA WATTS
NEUT,N	NEUTRAL
PF	POWER FACTOR
RES	RESISTOR
V	VOLTS
XFMR	TRANSFORMER

NOTE: ABBREVIATION MAY OR MAY NOT INCLUDE PERIOD/S, OR LETTER S FOR PLURAL FORM.

SYMBOLS	DESCRIPTION
52 X	CIRCUIT BREAKER X
	POWER TRANSFORMER
G	STEAM TURBINE GENERATOR SYNCHRONOUS GENERATOR 265MW, 300MVA, 1800RPM 0.9PF LAG/LEAD, 18KV, 3ø, 60HZ
	DISCONNECT SWITCH THREE POLE GANG OPERATED
GS	GROUND SWITCH

Project Location



Palen Solar Power Project

Figure 2-9
Project Interconnection
One Line Diagram

Solar Millennium

AECOM

Project: 12944-001
Date: July 2009

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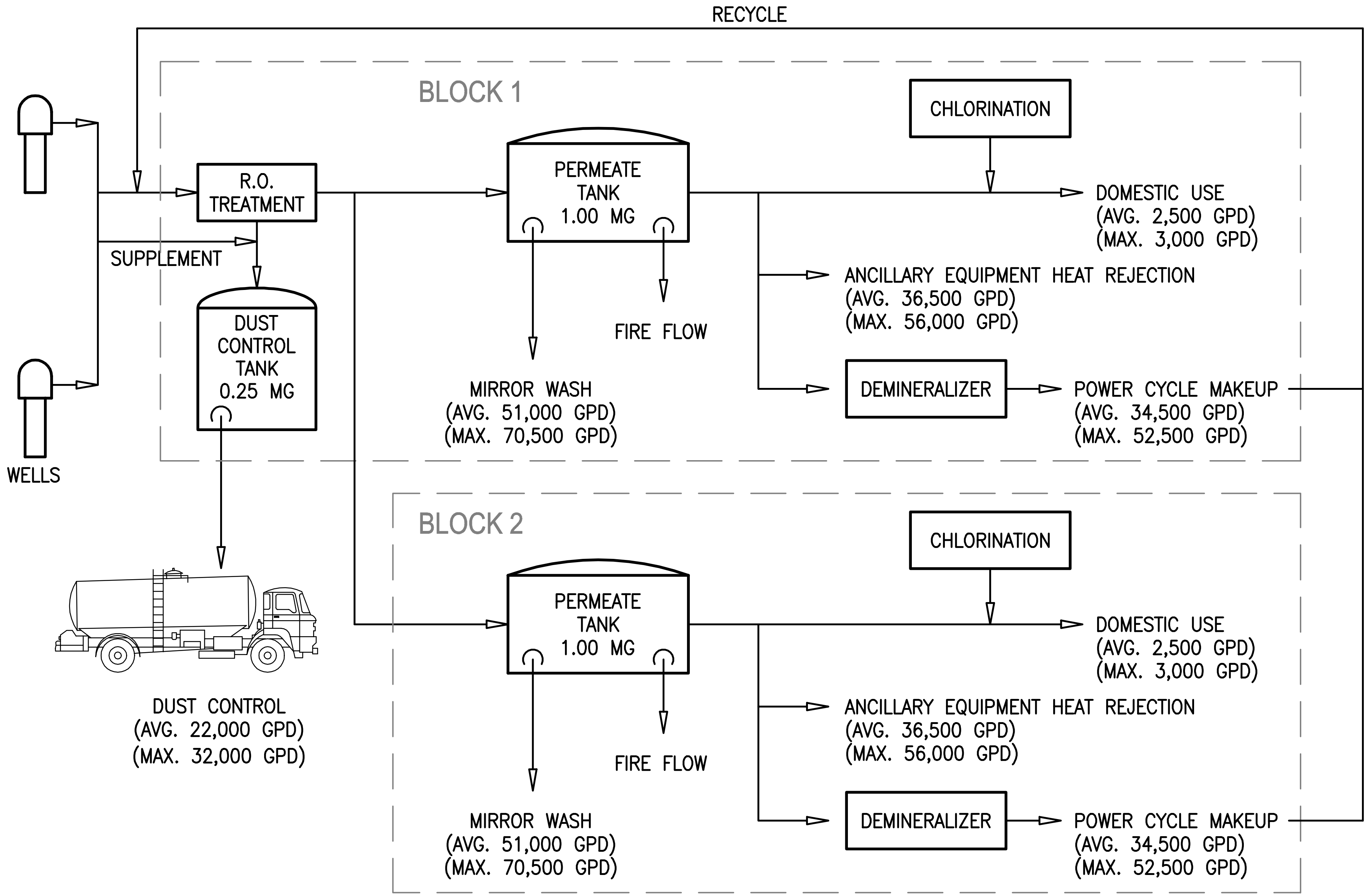


FIGURE 2-10
PALEN SOLAR POWER PROJECT
WATER SYSTEM SCHEMATIC

Figure 2-11a Photo Showing Transmission Line Route Existing Site Conditions

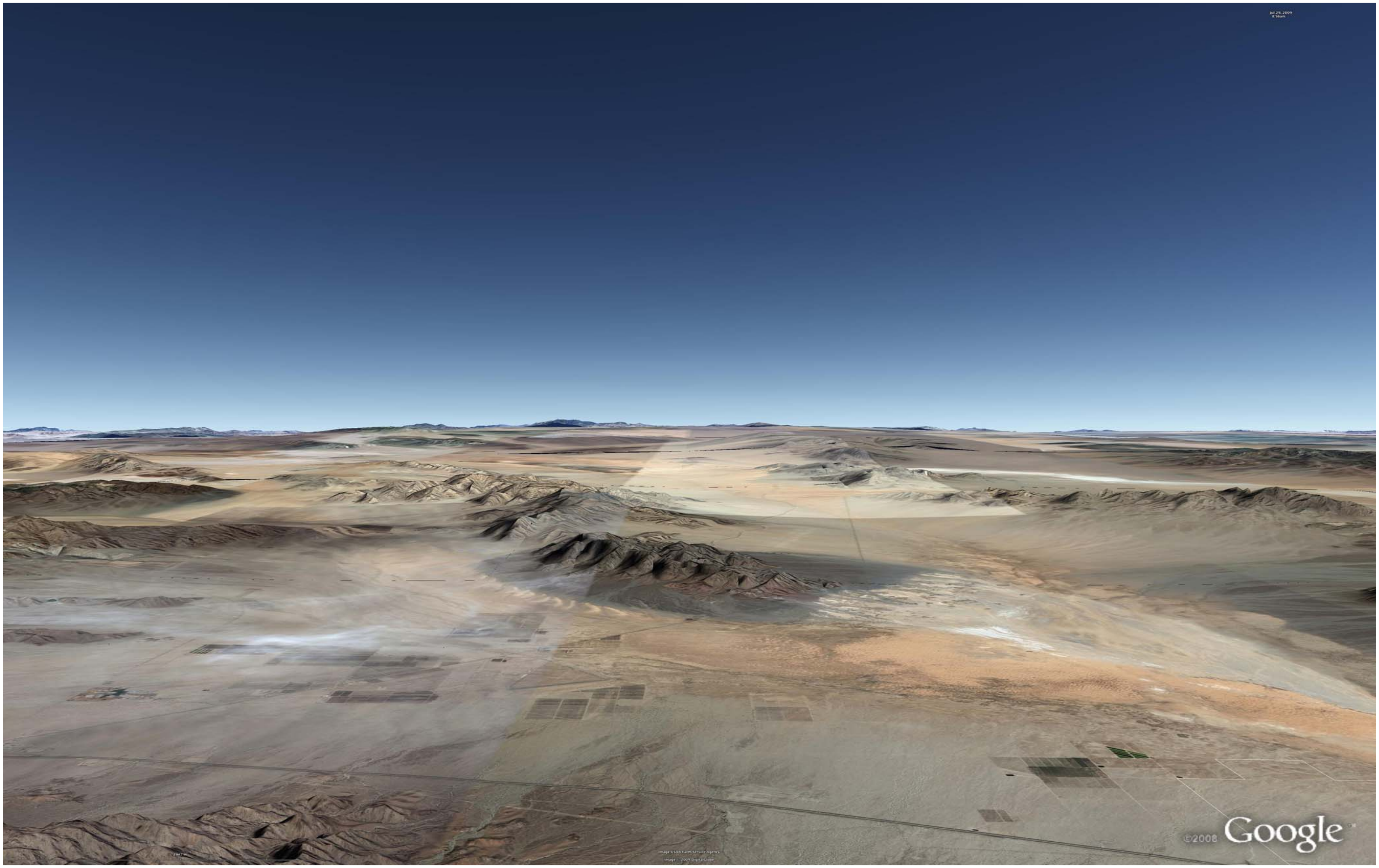
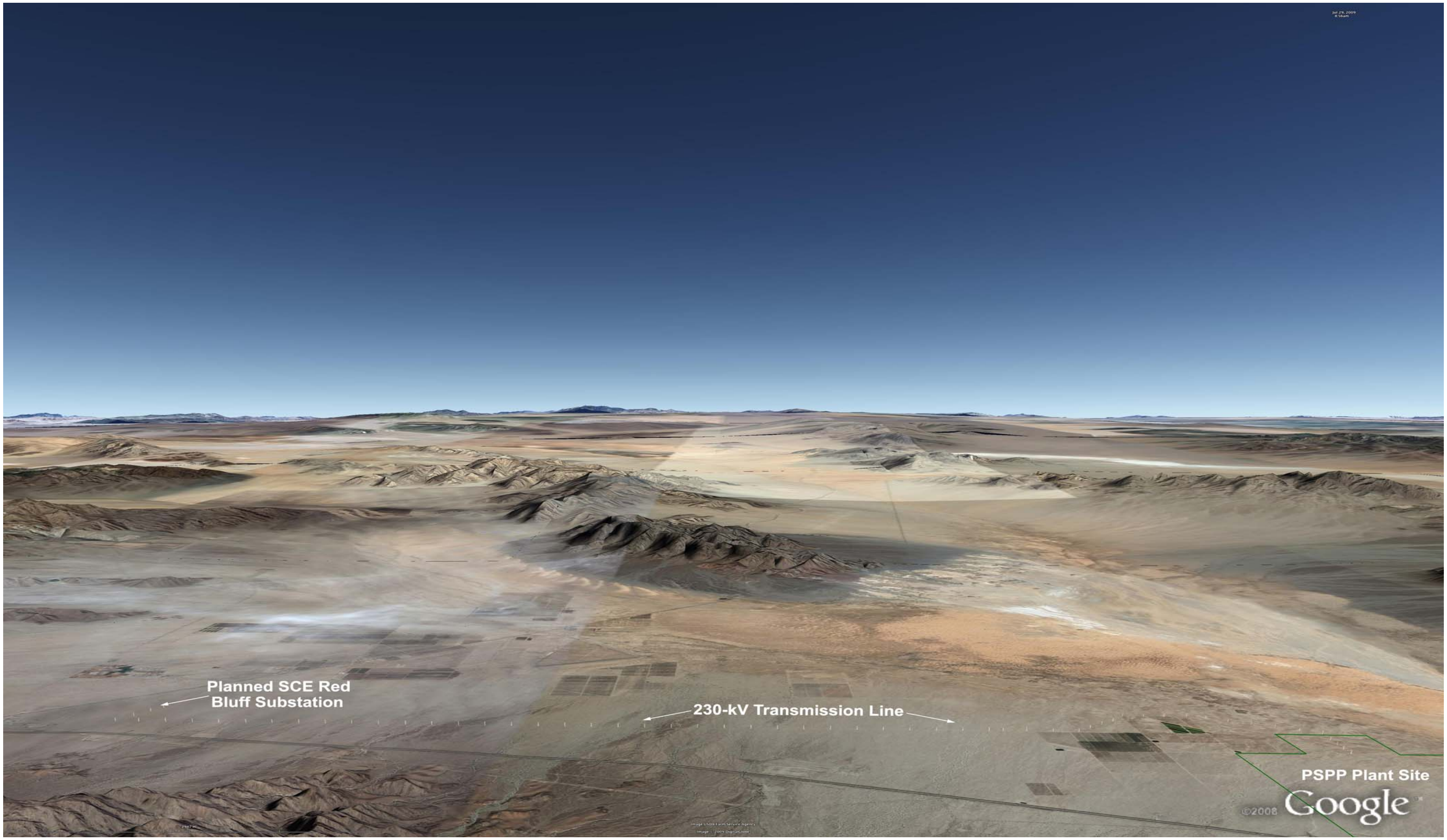


Figure 2-11b Photo Showing Transmission Line Route with Simulated Site Facilities



The PSPP transmission line route and the SCE substation location shown are preliminary; no environmental surveys have been conducted of the route or substation site.