DR-WASTE-239

Information Required:

Please provide a map depicting the location and acreage for the accumulation site (for soil with HTF concentrations above 10,000 mg/kg), bioremediation unit (for concentrations between 1,000 and 10,000 mg/kg), land farming area (for concentrations between 100 and 1,000 mg/kg), and stockpile area, respectively.

Response:

There is one Land Treatment Unit (LTU) for soil on site and there will be no separate bioremediation unit or stockpile area. The LTU is located in the portion of the site north of Brown Road and east of the warehouse (Figure DR-Waste-239, provided at the end of this section). The LTU comprises approximately eight acres and measures 500 feet in the north/south direction and 350 feet in the east/west direction. This unit will utilize indigenous bacteria to digest the hydrocarbon contamination (from HTF) in non-hazardous soils with hydrocarbon concentrations less than 10,000 milligrams per kilogram (mg/kg). The contaminated soils may be dosed with nitrogen and phosphorous fertilizers to provide nutrients to stimulate consumption of HTF by natural bacteria. If the soils are lightly contaminated, with about 1,000 mg/kg or less of HTF in the soil, the soils may be managed in the same manner as soils with higher concentrations of HTF, or they may just be placed in the land treatment unit, spread to an appropriate thickness, and left to naturally attenuate without the addition of nutrients. Soils will remain in the land treatment unit until concentrations are reduced to less than an average concentration of 100 mg/kg. The remediated soil will then be used as fill material on site.

When an HTF release occurs, the soil will either be placed on a 60-mil thick high-density polyethylene (HDPE) liner near the HTF release area or taken to the LTU for stock pile storage. Small amounts of such impacted soil may be placed in 20 cubic yard roll-off bins or directly into end dump trailers to be held for characterization Impacted soil will be temporarily staged until the level of contamination is determined. If soil has less than 10,000 mg/kg of HTF contamination, it will be moved to the LTU. Soil that contains more than 10,000 mg/kg of HTF is not suitable for land treatment and will be characterized to determine if it is hazardous waste. A waste profile will then be prepared based on the characterization and submitted for acceptance by an appropriate off-site facility. While the soil is being staged and characterized, the Applicant will follow the requirements for hazardous and other materials in the California Health and Safety Code (if a hazardous waste), the Water Code (for a designated waste), and applicable implementing regulations. From here, the soils will be loaded into roll-off bins or end dump trailers for transport to the designated hazardous waste receiving facility such as a landfill. If the soil is not a hazardous waste, it may also be transported to or to a thermal treatment facility to be treated before reuse. (See DR-240).

The LTU will be permitted through a Report of Waste Discharge with the Lahontan Regional Water Quality Control Board. The LTU will be constructed to be above the level of a 100-year storm event and designed to meet seismic hazard criteria. In addition, the base of the LTU will have a greater than 5-foot separation between it and the underlying groundwater. The LTU will be constructed with a prepared base consisting of two feet of compacted, low permeability, lime-treated material. This base will serve as a competent platform for land treatment activities, and will serve to slow the rate of surface water infiltration in the treatment area. The compacted lime-treated and native soil beneath the LTU is designated as a “treatment zone” to a depth of five feet. Although the LTU will be taking vehicle traffic, no hard surface will be required, as there is no liner system to protect. A staging area is allocated in the LTU for storage of HTF-impacted soils while they are being characterized. Soil characterized as hazardous will be removed from the site; therefore, no additional liner system is required in the LTU to cater for the hazardous waste.

The LTU will be surrounded on all sides by a 2-foot high compacted earthen berm with side slopes of approximately 3:1 (horizontal: vertical). These berms will control and prevent potential inflow (run on) of surface stormwater into the LTU or runoff of stormwater from the unit.

DR-WASTE-240

Information Required:

Please provide the name and address of the soil thermal treatment facility where soils with HTF concentrations above 10,000 mg/kg would be sent.

Response:

TPST Soil Recyclers of California (TPST), owned by Soil Safe Inc., is located approximately 75 miles south of the proposed RSPP at 12328 Hibiscus Road in Adelanto, California. TPST's phone number is (760) 246-8001. TPST takes non-hazardous soils with petroleum contamination and thermally treats the soil to drive off and destroy the hydrocarbons, leaving soil suitable for recycling. The facility is operated with permits from the Regional Water Quality Control Board - Lahontan Region and the Mojave Desert Air Quality Management District.

There are other suitable facilities, but they are located further away, for example in Azusa, California. Additionally, there are mobile treatment units that could be brought on site to thermally treat large quantities of hydrocarbon impacted soils that would exceed the ability of the LTU to process them. However, based on the release history from the NextEra LLC Kramer Junction Facility, which is a parabolic trough solar power plant that employs HTF in the same fashion as the RSPP it is not expected that mobile treatment facilities would be required.

DR-WASTE-241

Information Required:

Please provide a copy of the Report of Waste Discharge (ROWD) submitted to the Lahontan Regional Water Quality Control Board regarding the HTF land treatment units.

Response:

The ROWD is provided in Attachment DR-WASTE-241, at the end of this section.

DR-WASTE-242

Information Required:

Please provide information on the waste transport, recycling, and waste transfer facilities/services that may be used to transport, recycle or otherwise manage project wastes. The information provided should include, as appropriate, the following:

a. Facility/company name;
b. Phone number;
c. Location;
d. Class and/or type of service;
e. Materials accepted;
f. Permit or license for activity;
g. Recycling methods used;
h. Which project wastes will potentially be managed by the facility/service;
i. Permitted capacity;
j. Annual usage;
k. Remaining capacity;
l. Estimated closure date;
m. Expiration date for permit or license;
n. Approximate distance from site (in miles); and
o. Any special conditions or other comments pertinent to the facility or service.

Response:

Please refer to Tables DR-242-1 through DR-242-3 below. Table DR-242-1 assigns a code to the RSPP Project wastes using “C” for construction wastes and “O” for operational wastes. Table DR-242-2 provides the requested information for proposed hazardous waste treatment facilities and Table DR-242-3 provides the requested information for non-hazardous waste landfills.

Table DR-242-1 – Listing of Wastes Generated During Construction and Operation

Construction Wastes		Operational Wastes			
Code	**Description**	**Code**	**Description**	**Code**	**Description**
C-1	Construction waste – Hazardous - Empty hazardous material containers	O-1	Used hydraulic fluid, oils and grease – Non-RCRA hazardous	O-9	Spent exempt lead acid batteries
C-2	Construction waste – Hazardous - Solvents, used oil, paint, oily rags	O-2	Effluent from oily water separation system – Non-RCRA hazardous	O-10	Spent fluorescent bulbs or high-intensity discharge lamps – Universal waste
C-3	Heat exchanger cleaning waste – Hazardous - Chelant-type solution	O-3	Oil absorbent, and oil filters – Non-RCRA hazardous	O-11	Spent demineralizer resin – Non-hazardous
C-4	Spent batteries – Universal Waste - Batteries	O-4	Dirty shop rags – recyclable material	O-12	Reverse Osmosis (RO) Membrane Cleaning Waste – Non-hazardous
C-5	Aerosol cans – Universal Waste	O-5	Spent carbon – RCRA hazardous	O-13	RO system concentrate – Inert or liquid-designated waste
C-6	Non-hazardous construction waste – Scrap wood, concrete, steel, glass, plastic, paper, and insulating materials	O-6	Soil contaminated with HTF (> 10,000 milligrams per kilogram [mg/kg]) – Non-RCRA hazardous	O-14	Auxiliary cooling tower basin sludge – Non-hazardous
C-7	Sanitary waste – Non-hazardous - Portable chemical toilets	O-7	Soil contaminated with HTF (< 10,000 mg/kg) – Non-hazardous	O-15	Spent softener resin – Non-hazardous
C-8	Office waste – Non-hazardous - Paper, aluminum, food	O-8	Spent batteries – Universal Waste – Batteries	O-16	Damaged parabolic mirrors – Non-hazardous
C-9	Construction waste – Hazardous - Contaminated soil				
C-10	Construction waste – Hazardous - Flushing and cleaning wash water				

Table DR-242-2 - Potential Hazardous Waste Disposal/Treatment Facilities

a. Facility/company name	**Clean Harbors Buttonwillow, LLC /Clean Harbors**[1]	**Kettleman Hills Landfill MSW / Waste Management Inc.**	**Filter Recycling Services, Inc.**	**Siemen's Water Technology Carbon Regeneration Facility**
b. Phone number	661.762.6200	559.386.9711	909.873.4141	928.669.5758
c. Location	2500 West Lokern Road; Buttonwillow, CA 93206	35251 Old Skyline Rd. Kettleman City, CA 93239	180 W. Monte Ave., Unit A Rialto, CA 92376	2523 Mutahar Street, Parker AZ 85344
d. Class and/or type of service	Class I Landfill	Class I Landfill	Hazardous Waste Facility - Standardized Hazardous Waste Permit for Treatment and Recycling of certain non-RCRA hazardous wastes and transfer of RCRA hazardous wastes	Hazardous waste facility for thermal reactivation of activated carbon
e. Materials accepted	• Non-hazardous soil • California hazardous soil • Hazardous soil for direct landfill • Hazardous waste for treatment of metals • Plating waste • Hazardous and non-hazardous liquids • Debris for microencapsulation	The Facility accepts solid, semi-solid, and liquid hazardous and extremely hazardous wastes, <u>except</u>: Class 1, Division 1.1 or 1.2, or forbidden explosives; compressed gas cylinders (excluding aerosol cans); radioactive waste that is not exempt from regulation and licensing; biological agents or infectious wastes. The Facility also has a permit, issued by the California Integrated Waste Management Board, to receive municipal/solid wastes (i.e., non-hazardous wastes) into landfill Unit B-19. The Facility conducts the following activities: solar evaporation in three surface impoundments; disposal into two hazardous waste landfills; and stabilization, solidification and storage of bulk and drummed wastes. The Facility is also permitted to operate a drum decant unit and to construct and operate a neutralization/filtration unit and eight one-million gallon above ground evaporation tanks.	• Oily Debris • Used Oil • Used Oil Filters • Oil contaminated containers • Aerosol cans • Paint debris • Oily water • Hydrocarbon contaminated soil • Resin • Lab Pack	Spent activated carbon
f. Permit or license for activity	Part B Hazardous Waste Operating Permit ID No. CAD980675276 issued by Department of Toxic Substance Control April 6, 1996. Renewal application under agency review.	Part B Hazardous Waste Operating Permit No. 02-SAC-03; Facility ID No. CAT000646117	Series A Standardized Hazardous Waste Permit; Facility ID No. CAD98244481 Effective January 21, 2002	Interim Status pending final permit decision by US EPA Region 9 AZD982441263

Table DR-242-2 - Potential Hazardous Waste Disposal/Treatment Facilities

a. Facility/company name	Clean Harbors Buttonwillow, LLC /Clean Harbors[1]	Kettleman Hills Landfill MSW / Waste Management Inc.	Filter Recycling Services, Inc.	Siemen's Water Technology Carbon Regeneration Facility
g. Recycling methods used	Certain non-hazardous soils may be used for daily cover.	Certain non-hazardous soils may be used for daily cover.	Shredding and separation and recovery of metals, oils, and non-hazardous paper;	Thermal reactivation of spent carbon
h. Which project wastes will potentially be managed by the facility/service[1]	C-1; C-2; C-9; O-6; O-7	C-1; C-2; C-3; C-9; C-10; O-1; O-6; O-7	C-4; C-5; C-10; O-1; O-2; O-3; O-8; O-10; O-16	O-5
i. Permitted capacity	14,293,760 cubic yards	10,700,000 cubic yards	As defined by Permit (varies by waste type and management method)	2,760 lbs/hr of spent carbon
j. Usage	10,482 tons/day	8,000 tons/day	Treats more than 50,000 gallons or 100,000 pounds of waste in a month	Up to 2,760 lbs/hr
k. Remaining capacity	9,500,000	6,000,000	Not Applicable	Not Applicable
l. Estimated closure date	2040	2037-2038	Not Applicable	Not Applicable
m. Expiration date for permit or license	April 6, 2006 extended indefinitely while permit review in process. When granted, permit will be for 10 years.	June 16, 2013; renewal anticipated	January 21, 2012 subject to renewal	Review of application pending
n. Approximate distance from site (in miles)	140	190	120	350
o. Any special conditions or other comments pertinent to the facility or service	No	Also has surface impoundments for aqueous wastes.	No	No

[1] Clean Harbors website: http://clark.cleanharbors.com/ttServerRoot/Download/12381_FINAL_Buttonwillow_CA_Facility_FS_030108.pdf

1. Refer to Code description in Table DR-242-1

Table DR-242-3 - Potential Non-Hazardous Waste Disposal Facilities

a. Facility/ company name	**Ridgecrest-Inyokern Sanitary Landfill**	**Bakersfield Metropolitan (Bena) SLF**	**Shafter-Wasco Sanitary Landfill**	**Taft Sanitary Landfill**
b. Phone number	661.862.8900	661.862.8900	661.862.8900	661.862.8900
c. Location	3301 Bowman Road Ridgecrest, CA 93555	2951 Neumarkel Road, Caliente, CA 93518	17621 Scofield Ave. Shafter, CA 93263	13351 Elk Hills Road Taft, CA 93268
d. Class and/or type of service	Class III Landfill	Class III Landfill	Class III Landfill	Class III Landfill
e. Materials accepted	Agricultural, Industrial, Mixed municipal, Ash, Construction/ demolition. Non-friable asbestos and dead animals. Except - hazardous, radioactive, medical (as defined in Chapter 6.1 Division 20 of HSC), liquid, designated or other waste requiring special treatment or handling.	Non-hazardous MSW including residential, commercial, industrial, and agricultural and construction/demolition waste. Non-friable asbestos, treated wood and dead animals. Used motor oil, used motor oil filters and used antifreeze may be accepted for recycling. Except - hazardous waste as defined under CCR Title 27, hot ashes/burning material, materials containing greater than 1% friable asbestos, biohazardous waste which have not been treated as required by Section 118215 et. seq. of the California HSC, Radioactive materials requiring state or federal license and regulation, DOT Class I explosive.	Non-hazardous, construction/demolition, dead animals, green materials, inert, metals, mixed municipal waste. Treated wood and dead animals. Used motor oil, used motor oil filters and used antifreeze may be accepted for recycling. Except - hazardous, radioactive, medical (as defined in Chapter 6.1 Division 20 of HSC), liquid, designated or other waste requiring special treatment or handling.	Ash, Construction/demolition, Dead Animals, Green Materials, Industrial, Inert, Metals, Mixed municipal, Tires. Except - hazardous, radioactive, medical (as defined in Chapter 6.1 Division 20 of HSC), liquid, designated or other waste requiring special treatment or handling.
f. Permit or license for activity	Facility/Permit No. 15-AA-0059 issued by County of Kern Environmental Health Services Dept. Permitted operation include landfill disposal.	Facility/Permit No. 15-AA-0273 issued by County of Kern Environmental Health Services Dept. Permitted operation include landfill disposal.	Facility/Permit No. 15-AA-0057 issued by County of Kern Environmental Health Services Dept. Permitted operation include landfill disposal and composting.	Facility/Permit No. 15-AA-0061 issued by County of Kern Environmental Health Services Dept. Permitted operation include landfill disposal.
g. Recycling methods used	Sorting, segregation and size reduction. Recyclable waste is then packaged and hauled to specific recyclers/composting facilities/cogen facilities or used onsite (concrete for slope stability and roads, wood as mulch for wind erosion prevention).	Sorting, segregation and size reduction. Recyclable waste is then packaged and hauled to specific recyclers/composting facilities/cogen facilities or used onsite (concrete for slope stability and roads, wood as mulch for wind erosion prevention).	Sorting, segregation and size reduction. Recyclable waste is then packaged and hauled to specific recyclers/composting facilities/cogen facilities or used onsite (concrete for slope stability and roads, wood as mulch for wind erosion prevention).	Sorting, segregation and size reduction. Recyclable waste is then packaged and hauled to specific recyclers/composting facilities/cogen facilities or used onsite (concrete for slope stability and roads, wood as mulch for wind erosion prevention).

Table DR-242-3 - Potential Non-Hazardous Waste Disposal Facilities

a. Facility/ company name	Ridgecrest-Inyokern Sanitary Landfill	Bakersfield Metropolitan (Bena) SLF	Shafter-Wasco Sanitary Landfill	Taft Sanitary Landfill
h. Which project wastes will potentially be managed by the facility/service[2]	C-6; C-7; C-8	C-6; C-7; C-8; O-7; O-11; O-12; O-14; O-15; O-16	C-6; C-7; C-8; O-7; O-11; O-12; O-14; O-15; O-16	C-6; C-7; C-8; O-7; O-11; O-12; O-14; O-15; O-16
i. Permitted capacity	5,992,700 Cubic Yards	53,000,000 Cubic Yards	11,635,500 Cubic Yards	8,787,547 Cubic Yards
j. Usage	701.00 Tons/day	4,500.00 Tons/day	888.00 Tons/day	419.00 Tons/day
k. Remaining capacity	5,000,898 Cubic Yards	44,818,958 Cubic Yards	7,901,339 Cubic Yards	6,679,433 Cubic Yards
l. Estimated closure date	2014	2038	2027	2123
m. Expiration date for permit or license	Next Permit review due by July 2, 2014	Next Permit review due by October 27, 2010	Next Permit review due by March 22, 2010	Next Permit review due by February 23, 2009
n. Approximate distance from site (in miles)	10	90	140	150
o. Any special conditions or other comments pertinent to the facility or service	Unless estimated closure date changes, can be used essentially only for Construction Wastes from RSPP.	No	No	No

2. Refer to Code description in Table DR-242-1

DR-WASTE-243

Information Required:

Please provide the historic aerial photographs and topographic maps referenced above.

Response:

The historical aerial photographs and topographic maps referenced in the Phase I Environmental Site Assessment are provided at the end of this section in Attachment DR-WASTE-243.

DR-WASTE-244

Information Required:

Please consult with the China Lake Naval Weapons Test Center, and/or applicable regulatory agencies, to locate the "orphan" sites and provide the Energy Commission staff the locations and aerial imagery compiled as a result of the orphan site study.

Response:

Table DR-Waste-244 below summarizes orphan sites near the RSPP ROW and provides a brief analysis of their concern level to the Project. None of the listed orphan sites are located within the RSPP survey area and thus do not have the potential to directly impact the RSPP. The orphan site study was not able to determine if activities from the China Lake Naval Weapons Test Center have left any Munitions and Explosives of Concern (MECs)[3] or Unexploded Ordnance (UXO) at the RSPP site. However, previous research performed by CH2MHill reported in *Reconnaissance-Level Geotechnical and Water Supply Assessment for Blythe Solar Projects* and dated October 2008) stated that "the BLM notes that many of the areas located at a distance from camps or established facilities were often used for live-fire training and … were also found to contain … unexploded ordnance." Therefore, it is reasonable to assume that the China Lake Naval Weapons Test Center may have impacted the RSPP site from various types of ground or airborne munitions. The possible presence of MEC or UXO and recommended procedures to detect and mitigate resultant hazards are described in response to Waste DR-245 through Waste DR-248.

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3. MEC is a broader term that includes UXO, discarded military munitions, and munitions constituents (e.g., TNT) present in high enough concentrations to pose an explosive hazard.

TABLE DR-WASTE-244 – SUMMARY OF ORPHAN SITES LISTED BY EDR

Site Name (as on EDR)	Site Address (as on EDR)	Direction from Site	Approx. distance from Site ROW	Database Listing(s)	Database Information	Concern Level and Analysis
Environmental Test Area	China LK Propulsion	Northwest	>5 miles	CA FID UST, SWEEPS UST	Reported with one 2,000-gallon tank of an unknown substance; both listings are taken from historical databases. Listing below indicates the site as a historical UST site.	None. Based on the historical database listing and the distance from RSPP (greater than 5 miles), this site is not expected to present a concern to the RSPP.
China Lake NWC	China Lake	Northwest	>5 miles	WMUDS/SWAT	Site is reported as part of the solid waste assessment test program and associated with the Environmental Branch of the Department of Public Works, located at China Lake, 93555.	None. Based on the distance from RSPP (greater than 5 miles), this site is not expected to present a concern to the RSPP.
NAWS, Naval Air Field (Site 27)	China Lake	Northwest	>5 miles	WMUDS/SWAT	Site is reported as part of the solid waste assessment test program and associated with the Environmental Branch of the Department of Public Works, located at China Lake, 93555.	None. Based on the distance from RSPP (greater than 5 miles), this site is not expected to present a concern to the RSPP.
NAWS, Lauritsen Road LF(Site 34)	China Lake	Northwest	Street located on and off China Lake >5 miles	WMUDS/SWAT	Site is reported as part of the solid waste assessment test program and associated with the Environmental Branch of the Department of Public Works, located at China Lake, 93555.	None. Based on the distance from RSPP (greater than 5 miles), this site is not expected to present a concern to the RSPP.
Environmental Test Area	China Lake Propulsion Lab Bldg	Northwest	>5 miles	HIST UST	Site is reported with one historic 2,000-gallon Product tank installed in 1945.	None. Based on the historical database listing and the distance from RSPP (greater than 5 miles), this site is not expected to present a concern to the RSPP.
CLPL Gas Station	China Lake NAWS	Northwest; 35.6055805 / -117.6776745	Cross Street Highway 178 (approximately 5 miles away)	LUST	A release of gasoline was reported to have impacted soils only. The case status is reported as No Action; closed case status is not reported. Responsible party reported as US Navy.	None. Based on impact to soils only, closed case status, and distance from RSPP (greater than 5 miles), this site is not expected to present a concern to the RSPP.
IOB Gas Station	China Lake NAWS	Northwest; 35.6055805 / -117.6776745	>5 miles	LUST	A release of gasoline was reported to have impacted a drinking water aquifer. The case status is reported as Post Remedial Action Monitoring; closed case status is not reported. Responsible party reported as US Navy.	Low. Based on the distance from the RSPP (greater than 5 miles), site is not expected to present a concern to the RSPP.
Randsburg Gas Station	China Lake NAWS	Northwest; 35.6055805 / -117.6776745	>5 miles	LUST	A release of gasoline was reported to have impacted soils only. The case is reported as closed. Responsible party reported as US Navy.	None. Based on impact to soils only, closed case status, and distance from RSPP (greater than 5 miles), this site is not expected to present a concern to the RSPP.

Site Name (as on EDR)	Site Address (as on EDR)	Direction from Site	Approx. distance from Site ROW	Database Listing(s)	Database Information	Concern Level and Analysis
Ridgecrest Sanitary Landfill	3301 Bowman Road	North	0.63 miles	CA WDS	The site is reported with an active NPDES permit, specifically regarding an active stormwater industrial (97-03-DWQ) permit. The waste facility is reported as a Class III (non-hazardous solid wastes) active solid waste site.	None. Based on the non-contamination related nature of the database listing, this site is not expected to present a concern to the RSPP.
Ridgecrest Sanitary Landfill	3301 Bowman Road	North	0.63 miles	FINDS	Listed on the National Emissions Inventory, California Solid Waste Integrating System, and California - Used Oil Recycling System databases. Reported with supplemental interests as Refuse Disposal and Used Oil Program. Alternative names reported to be Ridgecrest Sanitary Landfill and Ridgecrest-Inyokern Sanitary Landfill.	None. Based on the non-contamination related nature of the database listing, this site is not expected to present a concern to the RSPP.
Ridgecrest Justice Building	132 Cosoa Lake	Northeast	4.5 miles	Cortese	No pertinent information was provided in the database report.	None. Based on the distance from RSPP (4.5 miles) and that the site is not listed on additional contamination-related databases, this site is not expected to present a concern to the RSPP.
Ridgecrest Family Dentistry	815 N. Downs Ste. B	North-northeast	4.5 miles	HAZNET	Wastes disposed of from the site to transfer station(s) located in Kern County include other inorganic solid waste and liquids with mercury greater than 20 milligrams per liter.	None. Based on the distance from RSPP (4.5 miles) and non-contamination related nature of the database listing, this site is not expected to present a concern to the RSPP.
Located Downtown Ridgecrest Near China Lake Naval Weapons Center	100 Las Flores Avenue	Northeast	4.6 miles	FINDS	Listed on the US EPA Air Quality System database.	None. Based on the distance from RSPP (4.6 miles) and non-contamination related nature of the database listing, this site is not expected to present a concern to the RSPP.
Ridgecrest Sanitary Landfill	5M Southwest of Ridgecrest On	North	0.63 miles	FINDS	Database report did not load; specific database information not obtained.	None. Based on the non-contamination related nature of the database listing, this site is not expected to present a concern to the RSPP.
Ridgecrest Autoworks	1200 Ridgecrest Boulevard	North-northeast	3.4 miles	HAZNET	Wastes disposed of from the site to transfer station include aqueous solution with less than ten percent total organic residues.	None. Based on the distance from RSPP (3.4 miles) and non-contamination related nature of the database listing, this site is not expected to present a concern to the RSPP.

Site Name (as on EDR)	Site Address (as on EDR)	Direction from Site	Approx. distance from Site ROW	Database Listing(s)	Database Information	Concern Level and Analysis
PG&E Ridgecrest Service Center	126 Worjma	Unknown	Unknown	RCRA-SQG, FINDS	Listed on the RCRAInfo database. Site is listed as a small-quantity generator, and historically as a large-quantity generator. No violations were noted for its generator status.	None. Based on the non-contamination related nature of the database listings, no violations were noted, and that the site is not listed on other searched contamination-related databases this site is not expected to present a concern to the RSPP.
Oro LTD Mine/Mill	HWY 14 North of Mojave	West	8.2 miles	WMUDS/SWAT	Primary wastes at the site are reported as Process Waste (products as part of the industrial/manufacturing process), which include inert/influent or solid wastes types. The associated agency reported is ORO LTD at 1539 N China Lake Boulevard, Suite 561, Ridgecrest, CA 93555.	None. Based on the distance from RSPP, this site is not expected to present a concern to the RSPP.
Ridgecrest/ Inyokern Landfill	5 Mi SW of Ridgecrest	North	0.63 miles	WMUDS / SWAT, CA WDS, LDS	Site is reported as an open land disposal site, specifically a Class III solid waste landfill for non hazardous solid wastes. Primary wastes at the site are reported as Solid Wastes, which include nonhazardous solid waste/influent or solid wastes types. The associated agency reported is Kern County Department of Public Works located at 2700 M Street Suite 500, Bakersfield, CA 93301. Land owner is reported as the BLM.	None. Based on the non-contamination related nature of the database listings and the site not listed on other searched contamination-related databases, this site is not expected to present a concern to the RSPP.

** Request sent to Ms. Peggy Shoaf on Dec 16, 2009. Received a phone call that day indicated that she would forward the information to the real estate department.

DR-WASTE-245

Information Required:

Please identify any investigations or remedial actions underway as a result of the orphan site study.

Response:

Based on the response to DR-WASTE-244, no additional investigations or remedial actions are proposed. Investigations related to UXO or MECs are discussed below in DR-WASTE-246 through 248.

DR-WASTE-246

Information Required:

Please describe the timing and methodology for completing the geophysical surveys.

Response:

Some combination of on-call or onsite Construction Support and/or munitions response geophysical surveys will be provided for all intrusive activities at the planned sites approximately two to four weeks ahead of field work. For those construction areas where no MECs have been positively identified previously, but where MECs may be present, UXO Construction Support will be provided in accordance with guidance obtained by:

- USACE, 2004, *EP 75-1-2, Munitions and Explosives of Concern (MEC) Support during Hazardous, Toxic, and Radioactive Waste (HTRW) and Construction Activities*;
- USACE, 2007, *EM 1110-1-4009, Military Munitions Response Actions*;
- AECOM, 2009, *Program Safety Plan, Military Munitions Response Program (Draft Outline and Definitions attached)*, and
- AECOM, 2005, *Safe Work Procedure, Munitions and Explosives of Concern Construction Support (Example Site)*.

For those construction areas where MECs have previously been discovered, or where two or more MECs per acre were identified during Construction Support activities, Analog and/or Digital Geophysical Mapping surveys will be performed over the footprint of the planned construction area two to four weeks prior to initiation of ground-disturbing activities. Geophysical surveys will be followed-up by intrusive investigation of the 100 highest priority anomalies identified by the analog or digital mapping. If the geophysical anomalies are caused by MECs, the construction footprint will be cleared to depth of detection of the instrumentation of the most appropriate instrumentation deployed (as determined by the project design team). If the geophysical anomalies are not caused by MECs, i.e., anomalies are sourced by non-hazardous munitions debris or non-ordnance objects, then further development activities will be accompanied by the resumption of Construction Support, as provided above.

Analog Geophysical Mapping surveys will be provided in accordance with the most current version of AECOM *MRG-2009-003, Standard Operating Procedure for Analog Geophysical Mapping with Real-time Instrumentation and GPS anomaly Waypoint Mapping*.

Digital Geophysical Mapping surveys will be provided in accordance with the most current version of AECOM *MRG-2009-002, Standard Operating Procedure for Digital Geophysical Mapping, EM61 Mk2 and RTK GPS Navigation with Real-time Instrumentation and GPS anomaly Waypoint Mapping.*

UXO technician support during construction activities may require only MEC standby support or subsurface removal, depending on an assessment of the probability of encountering MEC and the level of confidence associated with the determination. If the probability of encountering MECs is low (e.g., current or previous land use leads to an initial determination that MECs may be present), only MEC standby support will be required. When a determination is made that the probability of encountering MECs is moderate to high (e.g., current or previous land use leads to a determination that MEC was employed or disposed of in the area of concern), qualified UXO technicians must conduct a subsurface removal of the known construction footprint and remove all encountered MEC.

For construction activities on sites with known or suspected MECs, a UXO team consisting of a minimum of two qualified UXO personnel (UXO Technician II or above) is required. The UXO team may include additional UXO-qualified personnel, depending on site- and task-specific conditions and requirements, and the number of UXO teams will vary depending on the total level of effort.

If subsurface removal is required in support of construction activities, UXO team(s) will consist of no more than seven UXO personnel including the team leader. A Senior UXO Supervisor will be on site during operations and will not supervise more than 10 UXO teams. A UXO Safety Officer (UXOSO) is required on site during operations. A UXO Quality Control Specialist (UXOQCS) may or may not be required to be on site full time, and may be in a dual role as the UXOSO/UXOQCS if there are fewer than 15 field personnel on site.

The UXO team members have the following responsibilities for MEC support during construction on a site with known or suspected MEC:

- Provide the MEC identification, location, and safety functions for the prime contractor during construction activities.
- Conduct MEC safety briefings and UXO recognition training for all site personnel and visitors.

The UXOSO, or the senior UXO-qualified person on site if a UXOSO is not assigned, will act as the UXOSO and has final on-site authority for MEC procedures and safety issues.

DR-WASTE-247

Information Required:

Please provide the expertise and qualifications of those conducting the geophysical surveys.

Response:

All geophysical mapping surveys will be conducted under the direction of a California-registered professional geophysicist with at least 10 years of experience, including prior work on military munitions response projects.

DR-WASTE-248

Information Required:

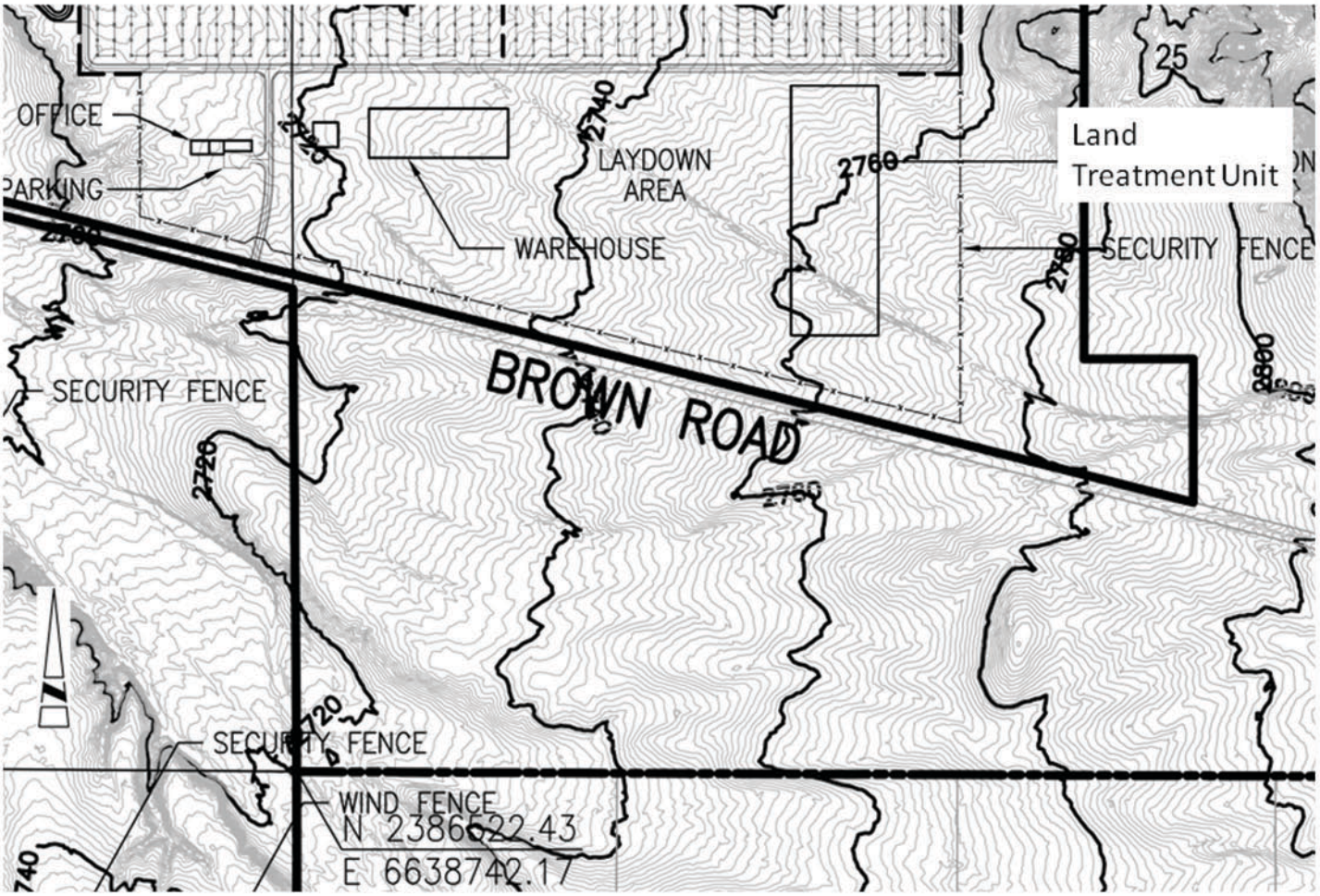
Please provide results of the geophysical survey.

Response:

Geophysical surveys, as appropriate, will be conducted two to four weeks prior to initiation of ground-disturbing activities. The geophysical survey results will be available within three to five days following actual data collection. A geophysical report documenting the survey activities and results will be provided 30 days after completion of the geophysical survey.

Attachment DR-WASTE-239

Land Treatment Unit Figure



Map Location

Not to Scale

Ridgecrest Solar Power Project
DR - Waste - 239
Land Treatment Unit

Solar Millennium

AECOM

Date: January 2010

Y:\Projects\Solar_Millennium\RSPP\MXD\Data_Adequacy\2010_01\DR-Waste-239_Land_Treatment_Unit.mxd

Attachment DR-WASTE-241

Report of Waste Discharge

AECOM
Environment

Prepared for:
Solar Millennium, LLC

RIDGECREST SOLAR POWER PROJECT
APPLICATION / REPORT OF WASTE DISCHARGE

January 2010

60139696-5450-ROWD

AECOM
Environment

Prepared for:
Solar Millennium, LLC

RIDGECREST SOLAR POWER PROJECT
APPLICATION / REPORT OF WASTE DISCHARGE

Prepared By Carmen Caceres-Schnell, PG

Reviewed By Mike Flack, PG, CEG

January 2010

60139696-5450-ROWD

Contents

1.0 Application Form 1

2.0 Introduction 4
2.1 Purpose 4
2.2 Project Description 5

3.0 Physical Setting 6
3.1 Site Location 6
3.2 Floodplain 6
3.3 Climatology 6
3.4 Seismicity 7
3.5 Hydrogeology 7
3.5.1 Hydrostratigraphy 8
3.5.2 Aquifer Characteristics 8
3.6 Water Supply 9

4.0 Waste Classification and Management 10
4.1 Heat Transfer Fluid – Physical, Chemical and Toxicological Characteristics 10
4.1.1 Degradation Rates 10
4.1.2 Potential Breakdown Products 10
4.1.3 Toxicity 10
4.1.4 Fate and Transport Information 11
4.2 Waste Classification 11
4.3 Waste Management 12

5.0 Monitoring and Reporting Requirements 13
5.1 Heat Transfer Fluid-Affected Soil 13
5.2 Land Treatment Unit Detection Monitoring 13

6.0 Record Keeping and Reporting Program 14
6.1 General Reporting 14
6.2 Unscheduled Reports to be Filed with the Regional Board 14
6.2.1 Release Reporting 14
6.2.2 Heat Transfer Fluid Spill or Leak 15

7.0 Design and Construction Standards 16
7.1 Land Treatment Unit 16
7.1.1 Heat Transfer Fluid Treatment Process 17
7.1.2 LTU Construction Process 17
7.1.3 Site Preparation, Excavation and Grading 17
7.2 Grading Plans 17
7.3 Relevant Specifications 17

8.0 Construction Quality Assurance 18

8.1 Introduction 18
8.2 Performance Standard 18
8.2.1 Professional Qualifications 18
8.2.2 CQA Reports 19
8.2.3 Documentation 19
8.2.4 Laboratory Testing Requirements 20
8.2.5 Field Testing Requirements 21
8.2.6 Earthen Material Requirements 21

9.0 Storm Water Management 23
9.1.1 Offsite Drainage 23
9.1.2 Onsite Drainage 23
9.1.3 Storm Water Design for Land Treatment Unit 24
9.1.4 Best Management Practices 24

10.0 Operating Requirements 26
10.1 Site Records 26
10.1.1 Operating Record 26
10.1.2 Waste Discharge Volumes 26
10.1.3 Waste Manifests 27
10.1.4 Monitoring and Sampling Plan Results 27
10.1.5 Inspection and Operating Records 27
10.1.6 Record of Corrective Action Plan Implementation 27
10.1.7 Correspondence Regarding Arrangements with Local Authorities 27
10.1.8 Training Records 27
10.1.9 Design Documents 28
10.1.10 Other Required Technical Documents 28
10.1.11 Excavation Records 28
10.1.12 Operator/Responsible Party Records 28
10.2 Security 28
10.2.1 Barriers 28
10.2.2 Warning Signs 28
10.3 Sanitary Facilities 28
10.4 Communication Systems 28
10.4.1 Internal Communication 29
10.4.2 External Communication 29
10.5 Lighting 29
10.6 Safety Equipment 29
10.6.1 Required Equipment 30
10.6.2 Emergency Equipment 30
10.6.3 Water Supplies for Fire Equipment 30
10.6.4 Equipment Testing and Maintenance 30
10.7 Personnel Requirements 30
10.8 Personnel Training 31
10.9 Supervisory Structure 31

11.0 Environmental Controls 32
11.1 Nuisance Controls 32
11.2 Fire Control 32
11.3 Dust Control 33
11.4 Vector Control 33
11.5 Drainage and Erosion Control 33
11.6 Noise Control 33
11.7 Traffic Control 34

12.0 Inspection, Sampling and Maintenance Programs 35
12.1 Inspection Program 35
12.2 Sampling Program 35
12.2.1 Land Treatment Unit – Wastewater 35
12.2.2 Land Treatment Unit – Soil 35
12.3 Maintenance Program 36
12.3.1 Land Treatment Unit 36

13.0 Required Plans 37
13.1 Detection Monitoring Plan 37
13.2 Corrective Action 37
13.3 Closure and Post-Closure 37
13.4 Spill Prevention and Response Measures 37
13.4.1 Spill Reporting 38
13.4.2 Spill Response Record Keeping 38

14.0 References 40

List of Appendices

Appendix A Basin Plan Compliance and Antidegradation Analysis
Appendix B Material Safety Data Sheets for HTF
Appendix C DTSC Classification of HTF-Contaminated Soil
Appendix D Corrective Action Plan
Appendix E Detection Monitoring Plan
Appendix F Preliminary Closure Plan for Land Treatment Unit

List of Tables

Table 1: Site Climate Data
Table 2: Site Evaporation and Precipitation Data – Ridgecrest
Table 3: Water Quality Data in the Indian Wells Valley Water District (all values reported in mg/L)
Table 4: Land Treatment Unit Runoff Sampling Parameters
Table 5: Land Treatment Unit Soil Sample Analytical Parameters
Table 6: Annual Groundwater Monitoring Parameters
Table 7: Quarterly Groundwater Monitoring Parameters

List of Figures

Figure 1: Regional Location and Vicinity Map
Figure 2: Site Layout
Figure 3: Topography Map
Figure 3: Average Annual Precipitation (inches), California Period: 1961-1990
Figure 4: General Arrangement Site Plan
Figure 5: Wind Rose Plot Mojave ARB Monitoring Station, Mojave, CA
Figure 6A: Regional Geologic Map
Figure 6B: Regional Geologic Map Legend
Figure 7: Hydrologic Units
Figure 8: Land Treatment Unit Flow Diagram
Figure 9: Cross-Section Details of Land Treatment Unit
Figure 10 Land Treatment Unit Layout

List of Acronyms

°F	degrees Fahrenheit
AC	Alternating Current
AFC	Application of Certification
AP	Alquist Priolo
ASTM	American Society for Testing and Materials
bgs	below ground surface
BMP	Best Management Practices
CCR	California Code of Regulations
CEC	California Energy Commission
CFR	Code of Federal Regulations
cm/sec	centimeters per second
COC	constituents of concern
CQA	Construction Quality Assurance
CWC	California Water Code
DC	Direct Current
DTSC	Department of Toxic Substances Control
ECM	Environmental Compliance Manager
USEPA	U.S. Environmental Protection Agency
FEMA	Federal Emergency Management Agency
gpm	gallons per minute (rate)
HTF	heat transfer fluid
IWV	Indian Wells Valley
IWVWD	Indian Wells Valley Water District
LEA	Local Environmental Agency
LTU	Land Treatment Unit
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mgd	million gallons per day
MSDS	Material Safety Data Sheets
MW	megawatts
OSHA	Occupational Safety and Health Administration
PPE	Personal Protective Equipment
QA/QC	Quality Assurance/Quality Control
RSI	Ridgecrest Solar I, LLC
RSPP	Ridgecrest Solar Power Project

ROWD	Report of Waste Discharge
RWQCB	Regional Water Quality Control Board
SPCC	Spill Prevention, Control and Countermeasures
SSG	solar steam generator
STG	steam turbine generator
SWRCB	State Water Resource Control Board
TDS	total dissolved solids
WDR	Waste Discharge Requirement

1.0 Application Form

Page 6

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

State of California
Regional Water Quality Control Board

APPLICATION/REPORT OF WASTE DISCHARGE
GENERAL INFORMATION FORM FOR
WASTE DISCHARGE REQUIREMENTS OR NPDES PERMIT

II. TYPE OF DISCHARGE

Check Type of Discharge(s) Described in this Application (A or B):

☑ **A. WASTE DISCHARGE TO LAND** ☐ **B. WASTE DISCHARGE TO SURFACE WATER**

Check all that apply:

- ☐ Domestic/Municipal Wastewater Treatment and Disposal
- ☐ Cooling Water
- ☐ Mining
- ☐ Waste Pile
- ☐ Wastewater Reclamation
- ☐ Other, please describe: _____
- ☐ Animal Waste Solids
- ☑ Land Treatment Unit
- ☐ Dredge Material Disposal
- ☐ Surface Impoundment
- ☐ Industrial Process Wastewater
- ☐ Animal or Aquacultural Wastewater
- ☐ Biosolids/Residual
- ☐ Hazardous Waste (see instructions)
- ☐ Landfill (see instructions)
- ☐ Storm Water

III. LOCATION OF THE FACILITY

Describe the physical location of the facility.

1. Assessor's Parcel Number(s)	2. Latitude	3. Longitude
Facility:	Facility: 35 33' 21"	Facility: 117 43' 59"
Discharge Point:	Discharge Point:	Discharge Point:

IV. REASON FOR FILING

- ☑ New Discharge or Facility
- ☐ Change in Design or Operation
- ☐ Change in Quantity/Type of Discharge
- ☐ Changes in Ownership/Operator (see instructions)
- ☐ Waste Discharge Requirements Update or NPDES Permit Reissuance
- ☐ Other: _____

V. CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA)

Name of Lead Agency: California Energy Commision

Has a public agency determined that the proposed project is exempt from CEQA? ☐ **Yes** ☑ **No**

If Yes, state the basis for the exemption and the name of the agency supplying the exemption on the line below.

Basis for Exemption/Agency: _____

Has a "Notice of Determination" been filed under CEQA? ☐ **Yes** ☑ **No**

If Yes, enclose a copy of the CEQA document, Environmental Impact Report, or Negative Declaration. If no, identify the expected type of CEQA document and expected date of completion.

Expected CEQA Documents:

☐ **EIR** ☐ **Negative Declaration**

Expected CEQA Completion Date: _____

Form 200 (6/97)

Page 5

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

State of California
Regional Water Quality Control Board

APPLICATION/REPORT OF WASTE DISCHARGE GENERAL INFORMATION FORM FOR WASTE DISCHARGE REQUIREMENTS OR NPDES PERMIT

I. FACILITY INFORMATION

A. Facility:

Name: Ridgecrest Solar Power Plant			
Address: Southwest of US highway 395 and approximately 4.5 miles southwest of the City of Ridgecrest			
City: Ridgecrest	County: Kern	State: CA	Zip Code: 92226
Contact Person: Rachel Gold		Telephone Number: (510) 524-4517	

B. Facility Owner:

Name: Ridgecrest Solar I, LLC			Owner Type (Check One) 1. ☐ Individual 2. ☐ Corporation
Address: 1625 Shattuck Ave., Suite 270			3. ☐ Governmental Agency 4. ☐ Partnership
City: Berkeley	State: CA	Zip Code: 94709-1611	5. ☑ Other: Limited liability company
Contact Person: Rachel Gold		Telephone Number: (510) 524-4517	Federal Tax ID: 26-2611825

C. Facility Operator (The agency or business, not the person):

Name: Ridgecrest Solar I, LLC			Operator Type (Check One) 1. ☐ Individual 2. ☐ Corporation
Address: 1625 Shattuck Ave., Suite 270			3. ☐ Governmental Agency 4. ☐ Partnership
City: Berkeley	State: CA	Zip Code: 94709-1611	5. ☑ Other: Limited liability company
Contact Person: Rachel Gold		Telephone Number: (510) 524-4517	

D. Owner of the Land:

Name: Bureau of Land Management			Owner Type (Check One) 1. ☐ Individual 2. ☐ Corporation
Address: 300 S. Richmond Rd.			3. ☑ Governmental Agency 4. ☐ Partnership
City: Ridgecrest	State: CA	Zip Code: 93555	5. ☐ Other:
Contact Person: Hector Villalobos		Telephone Number: (760) 384-5405	

E. Address Where Legal Notice May Be Served:

Address: 1625 Shattuck Ave., Suite 270		
City: Berkeley	State: CA	Zip Code: 94709-1611
Contact Person: Rachel Gold		Telephone Number: (510) 524-4517

F. Billing Address:

Address: 1625 Shattuck Ave., Suite 270		
City: Berkeley	State: CA	Zip Code: 94709-1611
Contact Person: Rachel Gold		Telephone Number: (510) 524-4517

Form 200(6/97)

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

State of California
Regional Water Quality Control Board

APPLICATION/REPORT OF WASTE DISCHARGE
GENERAL INFORMATION FORM FOR
WASTE DISCHARGE REQUIREMENTS OR NPDES PERMIT

VI. OTHER REQUIRED INFORMATION

Please provide a COMPLETE characterization of your discharge. A complete characterization includes, but is not limited to, design and actual flows, a list of constituents and the discharge concentration of each constituent, a list of other appropriate waste discharge characteristics, a description and schematic drawing of all treatment processes, a description of any Best Management Practices (BMPs) used, and a description of disposal methods.

Also include a site map showing the location of the facility and, if you are submitting this application for an NPDES permit, identify the surface water to which you propose to discharge. Please try to limit your maps to a scale of 1:24,000 (7.5' USGS Quadrangle) or a street map, if more appropriate.

VII. OTHER

Attach additional sheets to explain any responses which need clarification. List attachments with titles and dates below:

See attached document.

You will be notified by a representative of the RWQCB within 30 days of receipt of your application. The notice will state if your application is complete or if there is additional information you must submit to complete your Application/Report of Waste Discharge, pursuant to Division 7, Section 13260 of the California Water Code.

VIII. CERTIFICATION

"I certify under penalty of law that this document, including all attachments and supplemental information, were prepared under my direction and supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment."

Print Name: JOSEF EICHHAMMER **Title:** CEO

Signature: **Date:** 1/15/10

FOR OFFICE USE ONLY

Date Form 200 Received:	Letter to Discharger:	Fee Amount Received:	Check #:

Form 200(6/97)

2.0 Introduction

This Report of Waste Discharge (ROWD) is presented to the California Regional Water Quality Control Board (RWQCB) – Lahontan Region for a proposed Land Treatment Unit (LTU) at the Ridgecrest Solar Power Project (RSPP or Project) in Kern County, California. The Project is proposed by Ridgecrest Solar I, LLC (RSI) a wholly owned subsidiary of Solar Millennium, LLC. The Project site is located southwest of U.S. Highway 395 and approximately five miles southwest of the City of Ridgecrest, California in northeastern Kern County.

It is RSI's understanding, based on prior projects of a similar nature and discussion with the California Energy Commission (CEC), that the RWQCB will not be issuing any permits (e.g., Waste Discharge Requirements [WDR]) for the Project. Rather, the CEC, pursuant to its authority under State law (Warren Alquist Act), will issue its permit/certification (and act as California Environmental Quality Act lead agency) for the Project in lieu of any RWQCB permits. Under the Warren-Alquist Act and the Governor's Executive Order S-14-08, the CEC has the authority to streamline permitting for renewable energy generation facilities. The CEC implements an "in lieu" permit process by incorporating the regulatory requirements and conditions of the various local and State agencies in its certification process. All necessary State and local permits for this facility, including those permits typically issued by the Water Board, are issued to the applicant through the CEC's certification process. This document is provided to the RWQCB to allow for Board input and to make sure that the CEC's Conditions of Certification (COCs) contain all substantive requirements that the RWQCB would otherwise have put into the WDRs.

To support the formulation of those substantive requirements, RSI is submitting the necessary information required for the RWQCB to support the preparation of COCs and issue what would otherwise be a draft WDR. The information has been provided in a ROWD format, including an application, and complies fully with the requirements set forth under the California Code of Regulation (CCR) and California Water Code (CWC) for non-hazardous LTUs. This ROWD application will also provide full compliance with the requirements of the Porter-Cologne Water Quality Control Act and relevant regulations established under the CWC.

As discussed in detail below, the Project will not cause or contribute to an exceedance of water quality standards established for surface water and groundwater under the Colorado River Basin Plan. An analysis showing compliance with the RWQCB anti-degradation objective is provided in **Appendix A**.

2.1 Purpose

RSI is proposing to construct, own, and operate the Project. The Project is a concentrated solar thermal electric generating facility located in the high northern Mojave Desert in northeastern Kern County, California, about five miles southwest of the City of Ridgecrest, California **(Figure 1)**. The Project right-of-way (ROW), for which RSI has applied to the Bureau of Land Management (BLM), will extend across approximately 3,995 acres of public lands owned by the Federal government and managed by BLM. The Project facilities will occupy 1,448 acres of the 3,995-acre site, and there will be a total disturbance area (including areas outside the facility fence line), of approximately 1,944 acres. The Project will use proven parabolic trough solar thermal technology to produce electrical power using a steam turbine generator (STG) fed from a solar steam generator (SSG). The SSG receives heat transfer fluid (HTF) from solar thermal equipment comprised of arrays of parabolic mirrors that collect energy from the sun.

RSI proposes to use an LTU as part of the Project to manage any release of HTF to the environment. The LTU is the facility that receives and temporarily stores any soil contaminated with HTF. This application fulfills the regulatory requirements to obtain the needed approvals for this Project component.

2.2 Project Description

The Project will have a nominal electrical output of 250 megawatts (MW) consisting of two solar fields, Southern Field and Northern Field **(Figure 2)**. Commercial operation is planned to commence by the third quarter of 2013, subject to timing of regulatory approvals and RSI achievement of project equipment procurement and construction milestones. The solar thermal technology will provide 100 percent of the power generated by the Project; no supplementary energy source (e.g., natural gas to generate electricity at night) is proposed to be used for electric energy production. The Project will utilize an auxiliary boiler fueled by propane to reduce startup time and for HTF freeze protection. The auxiliary boiler will supply steam to the HTF freeze protection heat exchangers during nighttime hours to keep the HTF in a liquid state when ambient temperatures are not sufficient to keep the temperature of the HTF above its relatively high freezing point (54 degrees Fahrenheit [°F]). In order to fuel the boiler and HTF heat exchanger, propane will be delivered to the site via truck from a local distributor and stored in a 18,000 gallon above ground tank. The Project will also have one electric and one backup diesel-fueled fire water pump for fire protection.

The Project proposes to use a dry cooling condenser for power plant cooling. Water for the cooling tower makeup, process water makeup, and other industrial uses such as mirror washing will be supplied by the local municipal water district via a new pipeline. This source will also be used to supply water for employee use (e.g., drinking, showers, sinks, and toilets). Water received from the Indian Wells Valley Water District (IWVWD) will meet the requirements of the California Department of Health Services for potable water supplies and will not require further treatment for this purpose. Power cycle makeup, mirror washing water, and cooling of ancillary equipment will require onsite treatment for reduction of dissolved solids, and this treatment varies according to the quality required for each of these uses. A sanitary septic system and onsite leach field will be used to dispose of sanitary wastewater.

The power generation cycle will not produce cooling tower blow down because the plant will be dry cooled. A small auxiliary cooling tower will generate a small amount of blow down which will be reused onsite. No off-site backup cooling water supply is planned at this time.

A sanitary septic system and onsite leach field will be used to dispose of sanitary wastewater and will be permitted through the County of Kern. Based on a current estimate of 2,700 gallons of sanitary wastewater production per day, a total leach field area of approximately 5,500 square feet will be required. It is expected that the leach fields will satisfy the needs of the Project for its entire service life. There is no process or operational wastewaters that will be connected to the septic system and leach field.

The Project will include a LTU to treat soil contaminated with HTF. Based on the release history from the NextEra LLC Kramer Junction Facility, which is parabolic trough solar power plant that employs HTF in the same fashion as proposed for the RSPP and also has a LTU for treatment of HTF-contaminated soil, the LTU has been designed in accordance with CCR Title 27 requirements and designed to receive about 3,332 cubic yards of impacted soil on an annual basis. There is one LTU proposed for the Project. The LTU will cover about four acres and measures 500 feet in the north/south direction and 350 feet in the east/west direction **(Figure 2)**. The LTU will use indigenous bacteria and amendments to the soil to bioremediate HTF-affected soils to levels acceptable for reuse on the site. Characterization of the hazardous characteristics of HTF-affected soil will be established by the Department of Toxic Substances Control (DTSC) prior to operation and LTU use for soil remediation. Soils in excess of the criterion established by the DTSC will be removed from the site and transported to an appropriate treatment storage and disposal facility. Soil with HTF concentrations below this criterion will be managed in the LTU and remediated to acceptable levels for reuse as fill onsite.

The estimated project life for the Project is 30 years. Personnel will staff the facility 24 hours per day/seven days per week. Even when the solar power plant is not operating, personnel will be present as necessary for maintenance, to prepare the Project for startup, and/or for site security.

3.0 Physical Setting

3.1 Site Location

The Project site is located southwest of U.S. Highway 395 and approximately five miles southwest of the City of Ridgecrest, California in northeastern Kern County **(Figure 1)**. The Applicant-owned facilities will be entirely on public land, BLM ROW # CACA 49016, in Township 28 South, Range 39 East and Township 27 South, Range 39 East. Ridgecrest is at the southern boundary of the northernmost of two discrete sections of China Lake Naval Air Weapons Station (NAWS).

3.2 Floodplain

The Project site is located in the Indian Wells Valley in the southern end of the Basin and Range province. The Valley is east of the Sierra Nevada, south of the Caso range, north of the El Paso Mountains, and the west of the Argus Range. Topography at the RSPP site slopes gently away from the El Paso Mountains from the south to the north-northwest across the site **(Figure 3)**. The topography shows an average slope of about one foot in 80 feet (1.2 percent) on the west side of the central drainage (El Paso Wash) crossing the Project site. There are steeper grades east of the El Paso Wash on the Project site. Grades of 1.5 percent to 2.3 percent to the north and northwest are measured from an unnamed topographic high on the eastern boundary of the Project site.

Surface water in the Indian Wells Valley drains from the surrounding mountains toward China Lake just north of Ridgecrest, a dry lake or playa, which is located approximately 12 miles northeast of the RSPP site. There are no perennial surface water bodies in Indian Wells Valley. During wet years, some surface flow enters the Valley through the Little Lake Gap. The major watercourse in the project area is El Paso Wash which drains approximately 20 square miles from the El Paso Mountains and exits the mountains to the south of the site.

According to the Federal Emergency Management Agency (FEMA) flood insurance rate map, the Project Site contains areas predisposed for minimal flooding and areas within the 100-year flood zone (FEMA 2006). The 100-year flood zones onsite follows the trend of the El Paso Wash and other unnamed drainages through the Project site **(Figure 3).**

The proposed solar field improvements will not change the existing offsite drainage patterns. The El Paso Wash and an unnamed wash on the west will not be altered as a result of the Project. Storm Water Pollution Prevention Plans (SWPPPs) and a CEC-mandated Drainage, Erosion, and Sediment Control Plan (DESCP) were provided in the September 2009 RSPP Application for Certification (AFC), and contain Best Management Practices (BMPs) that will be implemented to avoid significant drainage/storm water runoff and water quality impacts to surface waters.

3.3 Climatology

The Project site is located in the Mojave Desert, which is classified as a “high desert”. It is a transition between the “hot” Sonoran Desert to the south and the “cold” Great Basin Desert to the north. Characteristic of a desert climate, the Mojave Desert has extreme daily temperature changes, low annual precipitation **(Figure 4)**, strong seasonal winds, and mostly clear skies. Evaporation rates tend to be higher than precipitation rates even in the wettest months, which last from November to March.

The area is characterized by very hot summer temperatures, with the mean maximum temperatures in July and August exceeding 100°F. Winter temperatures are more moderate, with mean maximum temperatures in the 60s and lows in the 30s. Minimum temperatures below freezing (32°F) occur on an average of about one day per year. **Table 1,** Site Climate Data, shows the site weather data based on the gauging station at Inyokern (Station 044278). The Ridgecrest area receives less than five inches of rainfall per year. The majority of the rainfall occurs during November and March, but rainfall during the late summer is not

uncommon. There is, however, a summer thunderstorm season from July to September with violent heavy precipitation that occasionally produces flash flooding.

Based on the data from the National Oceanic and Atmospheric Administration Atlas Precipitation Frequency Data Server, 24-hour design storm precipitation depth is as follows:

- 1.10 inches for the 2-year, 24-hour storm event;
- 1.97 inches for the 10-year, 24-hour storm event;
- 3.25 inches for the 100-year, 24-hour storm event;

Table 2, Site Evaporation and Precipitation Data shows the evaporation and precipitation data assumed for the site. The average annual precipitation for the Project area is shown on **Figure 4**. The storm conveyance system is designed to contain the 100-year, 24-hour storm event.

The most significant large-scale phenomena affecting air quality in the Project area are the transport winds from the southwest. These winds are responsible for bringing ozone and other pollutants through the Cajon Pass from the Los Angeles Basin. A wind rose for the Ridgecrest monitoring station for 2003 to 2007 is presented in **Figure 5**.

3.4 Seismicity

The Project site is located in seismically active Southern California, a region that has experienced numerous earthquakes in the past. A review of the Alquist-Priolo (AP) Earthquake Fault Zone maps, **Figure 6a** and **Figure 6b**, and the Kern County Online Mapping System Faults and Fault Zones layer indicate that there are no AP fault zones present within the Project boundaries.

An unnamed buried fault trace has been mapped as trending northwest-southeast across the center of the site. Based on personal communication with Glen Harris (BLM Ridgecrest office), site features, and observations made during a July 2009 field reconnaissance, the more probable location of the unnamed fault is just north of, and parallel to Brown Road, and trends roughly east-west. This fault has not been mapped by the United States Geological Survey (USGS) as a Quaternary (sufficiently active) fault, and is not listed by the EQFAULT program as a fault potentially affecting the site.

Regardless of whether there are faults across the site, because the Project is located in a seismically-active area, all Project structures must be designed to comply with the California Building Code (CBC) and US Building Code (UBC) Zone 4 requirements. The CBC and UBC are considered to be standard safeguards against major structural failures and loss of life. The goals of the Codes are to provide structures that will:

1) resist minor earthquakes without damage;

2) resist moderate earthquakes without structural damage but with some non-structural damage; and

3) resist major earthquakes without collapse but with some structural and non-structural damage.

The CBC and UBC base seismic design on minimum lateral seismic forces ("ground shaking"). The CBC and UBC requirements operate on the principle that providing appropriate foundations, among other aspects, helps to protect buildings from failure during earthquakes.

3.5 Hydrogeology

The Indian Wells Valley is composed of two broad geologic units, consolidated rocks and unconsolidated deposits **(Figure 6a** and **Figure 6b)**. The consolidated rocks consist of Mesozoic igneous and metamorphic rocks, which form the basement complex (Sierra Nevada Batholith); Tertiary continental deposits; and Miocene volcanic rocks. The Mesozoic basement complex exists below 2,000 feet to as much as 6,000 feet of alluvial fill, underlie the groundwater basin, and crop out in the surrounding hills. The Tertiary continental deposits overlie the basement complex and fill the valley to approximately 1,000 feet below ground surface.

Miocene volcanic rocks crop out along the perimeter of the basin, more specifically, near the El Paso and Coso Mountains. The consolidated rocks are nearly impermeable except for areas where fracturing or weathering has occurred. These rocks are believed to yield little water to the overlying alluvial aquifer system.

3.5.1 Hydrostratigraphy

Previous investigations have divided the unconsolidated Quaternary deposits into two main aquifers: the shallow aquifer and the deep aquifer. However, a recent study by Brown and Caldwell identified four hydrostratigraphic features in the IWV Groundwater Basin. The features are: 1) Fine-Grained Sediment Plug, 2) Gravel Zone, 3) High Gradient, and 4) Playa. **Figure 7** shows the location of these features.

- The Fine-Grained Sediment Plug located approximately three to four miles east of the Sierra Nevada mountain front and trends north-south. The upper contact of this feature begins at depth of approximately 340 feet bgs and sediments may be as much as 1,340 feet thick. The areal extent of this deposit is not well defined due to limited borehole data.
- The Gravel Zone is a west-east trending area of coarse-grained high permeability sediments. This area is located from the mouth of Indian Wells Canyon to approximately the northwest portion of Ridgecrest, extends approximately two miles north-south, and fines to the east. This region is referred to the Inyokern and Intermediate Areas and contains high volume production wells. Wells within the Ridgecrest city limits are believed to be associated with this Gravel Zone; however, wells in this area have a higher percentage of fines and, therefore, their groundwater production is lower than the wells to the west.
- The High Gradient area extends from the El Paso sub-Basin into the main IWV Groundwater Basin near the southwestern portion of the valley. Groundwater gradients in this area have been measured at approximately 100 feet per mile. Brown and Caldwell propose that the high gradient may be caused by a combination of a narrowing of the area available for flow and the influx of recharge from Freeman Canyon. In addition, the high hydraulic gradient could be related to the contrast in aquifer transmissivity from the narrows to the high permeability zone to the north.

The Playa feature identified by Brown and Caldwell is located in the area of China Lake. The thickness of these sediments is not known, but are likely several tens of feet thick. Deposits are highly micaceous, silt sandy silt, and fine sand with occasional plastic clays. Shallow water beneath China Lake is highly saline and unfit for most uses.

3.5.2 Aquifer Characteristics

In the development of a groundwater flow model and hydorgologic study for the IWV Groundwater Basin, Brown and Caldwell used hydraulic conductivity values ranging from 0.1 ft/d to 100 ft/d. These values were based on geologic logs, pre-existing groundwater modeling studies, and interpretations based on local geology, depositional environments, and groundwater flow regime. The model showed that the areas with the highest hydraulic conductivities are generally located immediately east of the Sierra Nevada. Areas of the IWV Groundwater Basin with lower hydraulic conductivities are localized and distributed throughout the Basin.

Published aquifer testing data reports transmissivity values from less than 1,400 ft^2/d to 36,800 and 44,000 ft^2/d to 155,000 ft^2/d. Both sets of values were based on aquifer testing and geologic data. The Brown and Caldwell (2009) model used specific yield ranges of 0.05 to 0.15. Reported well yields in the lower aquifer are more than 1,000 gpm and some wells consistently yield more than 2,000 gpm. The IWV Groundwater Basin has an estimated storage capacity of about 2,200,000 acre-feet (af) and 5,120,000 af. The calculated storage of 2,200,000 af is based on 1921 water levels as a steady state limit and 200 feet below this level as the economically feasible limit to extract groundwater.

3.6 Water Supply

The Project will be dry cooled. The Project's various water uses include water for solar collector mirror washing, makeup for the SSG feed water, dust control, water for cooling plant auxiliary equipment, potable water and fire protection. Water needs for the Project will be met by the Indian Wells Valley Water District (IWVWD). The estimated water supply need for the Project is 150 af per year. Details of expected operational water use for the Project by month are provided below:

Estimated Water Usage

Month	Approximate Water Usage Acre-Feet (gpm)[1]	Month	Approximate Water Usage Acre-Feet (gpm)[1]
January	3.67 (28.25)	July	16.24 (118.55)
February	8.29 (60.48)	August	16.23 (118.48)
March	11.34 (82.80)	September	14.35 (104.73)
April	15.58 (113.71)	October	10.24 (74.75)
May	17.43 (127.20)	November	7.94 (57.95)
June	17.54 (128.07)	December	6.67 (48.68)

1. The estimated groundwater usage gpm is based on average daily consumption and assumes continuous pumping. Peak groundwater pumping rates during summer months will be up to 128 gpm.

Water provided from the IWVWD for process and cooling water needs will be stored in a 1,500,000 gallon permeate tank, which will provide enough storage capacity for a five-day total interruption of water supply to the facility as well as water for fire protection. Water for domestic uses by Project employees will also be provided by IWVWD and will be treated to potable water standards by an RO water treatment unit and chlorination. The typical quality of ground water that will be supplied by IWVWD is shown in **Table 3**. Water received from IWVWD will meet the requirements of the California Department of Health Services for potable water supplies and will not require further treatment for this purpose. Water used for power cycle makeup, mirror washing water, and cooling of ancillary equipment will require onsite treatment for reduction of dissolved solids.

4.0 Waste Classification and Management

The Project HTF (Therminol VP-1 or equivalent) is an oil that consists of a mixture of biphenyl and diphenyl oxide and that is solid at temperatures below 54°F, is relatively insoluble in water (solubility of approximately 25 miliigrams per liter [mg/L]), combustible, and has relatively low volatility (Solutia 2006). The components of HTF biodegrade relatively rapidly in the environment, have slight toxicity to tested terrestrial species, higher toxicity to tested aquatic species, and a potential to bio-accumulate (IPCS 1999; JECFA 2003; SOCMA Biphenyl Working Group 2003). Material Safety Data Sheets (MSDS) for HTF are provided in **Appendix B**.

4.1 Heat Transfer Fluid – Physical, Chemical and Toxicological Characteristics

HTF is composed of approximately 76.5 percent biphenyl and 23.5 percent diphenyl ether (**Appendix B**). Specific information requested on HTF or each of these compounds as available is as follows:

4.1.1 Degradation Rates

- Complete Product: An online MSDS reports aqueous biodegradation (elimination of dissolved organic carbon) of Solutia VP1 in OECD test 302A (inoculated with sewage) in 28 days.
- Biphenyl: Biphenyl has a soil half-life of 32 to 168 hours (Howard and Printup 1991). In a silt loam soil, 86% of originally applied biphenyl mineralized to carbon dioxide in 98 days (Fries and Morrow 1984). In another soil, 81% of biphenyl initially applied was mineralized after 24 days (Focht and Brunner 1985).
- Diphenyl ether: structurally similar 4,4' diaminodiphenyl ether has a soil biodegradation half life of 672 hours to 6 months (Howard and Printup 1991). Although biodegradation can occur, as discussed below, photodegradation is expected to drive the half-life of diphenyl ether in soil.
- At the Kramer Junction facility, HTF-contaminated soils with concentrations between 1,000 and 10,000 milligrams per kilogram (mg/kg) have treatment times that vary between one and four months. The variation in treatment times varies with ambient air and soil temperature.

4.1.2 Potential Breakdown Products

A study with a pure culture inoculum showed that the metabolites of biphenyl degradation are 2,3-dihydro-2,3-dihydroxybiphenyl, alpha-hydroxy-beta-phenylmuconic semi-aldehyde, phenyl pyruvate and benzoic acid (Tucker et al. 1975). Each of these compounds is more readily biodegraded than biphenyl, and biological transformations are expected to occur intracellularly. Similar information is not available for diphenyl ether.

4.1.3 Toxicity

- Complete Product: Acute animal toxicity data.
- Oral: LD50, rat, 2,050 mg/kg, No more than slightly toxic.
- Dermal: LD50, rabbit, > 5,010 mg/kg, Practically nontoxic after skin application in animal studies.
- Inhalation: LC50, rat, 2.66 mg/l, 4 h, Toxic based on animal inhalation exposure studies.
- Skin irritation: rabbit, Slightly irritating to skin, 24 h.
- Repeat dose toxicity: rat, inhalation, 13 weeks, produced effects on body weight, serum enzymes and/or organ weights in repeat dose studies.

- Repeat dose toxicity: rat, gavage, 26 weeks, produced effects on body weight, serum enzymes and/or organ weights in repeat dose studies. Effects only observed at very high dose levels. Target organs affected kidneys, liver, spleen.
- Repeat dose toxicity: rat, diet, subchronic, repeated oral exposure produced liver and kidney changes in animal models. Target organs affected liver and kidneys.
- Developmental toxicity: rat, gavage, no effects on offspring observed in laboratory animals in the presence of maternal toxicity (**Appendix B**).

4.1.4 Fate and Transport Information

- Biphenyl: Based on K_{oc} values as high as 3,300 (Briggs 1981), biphenyl is expected to have low to slight mobility in soil and adsorption to soil is expected to attenuate volatilization. Biphenyl is not expected to volatilize from dry soil surfaces based upon a vapor pressure of $8.93X10^{-3}$ millimeters of mercury (Southward and Keller 1986). As previously discussed, biodegradation is the expected fate for biphenyl in soil.
- Diphenyl ether: An experimental K_{oc} value of 1950 (Burkhard et al. 1984) suggests that diphenyl ether will have low mobility in soil (Swann et al. 1983). Transport from terrestrial surfaces to air via evaporation (Bauer et al. 1988) is expected to occur, attenuated by sorption to soil. The rate constant for the vapor phase reaction of diphenyl ether with photochemically produced hydroxyl radicals has been estimated to be $1.9X10^{-11}$ cu cm/molecule-sec at 25 degrees Celsius, which corresponds to an atmospheric half-life of about 20 hours (Meylan and Howard 1993).

4.2 Waste Classification

The HTF-affected soils will be characterized as hazardous or nonhazardous waste prior to determination of whether the material can be treated at the LTU or must be removed for off-site disposal. Therefore, HTF-affected soils will be relocated to a temporary staging area in the LTU and characterized consistent with California Department of Toxic Substances Control (DTSC) protocols. Soil sample of excavated HTF-affected soil will be collected in accordance with the EPA's current version of the manual "Test Methods for Evaluating Solid Waste" (SW-846) and the waste material will be characterized in accordance with State and Federal requirements. Soil samples will be analyzed for HTF constituents (biphenyl and diphenyl ether) using modified EPA Method Modified 8015.

Prior to operation of the LTU and initiation of any onsite remediation of HTF, the waste stream will be characterized and a waste classification determination rendered by the DTSC. Initially, in addition to sampling for HTF, soil samples will also be analyzed for ignitability and toxicity using appropriate State and Federal methods to characterize the waste as hazardous or non-hazardous. Once a sufficient data set has been accumulated to allow characterization of the material as hazardous or non-hazardous waste based on HTF content and generator knowledge, the DTSC will be petitioned for a determination of waste classification for HTF-affected soils generated at the facility. Following this determination, subsequent samples will only be analyzed for HTF to determine disposition of the waste either for remediation or for transportation and disposal off site. If the soil is characterized as a hazardous waste, the impacted soils will be transported from the site by a licensed hazardous waste hauler for disposal at a licensed hazardous waste landfill or treatment storage and disposal facility (TSDF).

Based on the classification practice and management of similar waste stream at the Kramer Junction Solar Electric Generating System (SEGS) facility in Kern County, it is anticipated that soil containing 10,000 mg/kg HTF or more will be managed as hazardous waste, and that soil containing less than 10,000 mg/kg HTF will be non-hazardous waste and thus can be managed at the site. At the Kramer Junction facility, the DTSC issued a letter dated April 4, 1995, stating that soil contaminated with HTF "poses an insignificant hazard" and classifies the waste as non-hazardous for soils with a concentration of less than 10,000 mg/kg HTF pursuant to CCR Title 22, Section 66260.200(f) (**Appendix C**). Given that the formulation of HTF has not changed significantly since this determination, it is anticipated that future waste characterization at RSPP will yield a similar result, although the DTSC has indicated that this decision must be made on a project

specific basis (i.e., the Kramer Junction classification does not necessarily ensure the same classification for the RSPP).

All HTF-affected soil classified as a hazardous waste will be removed for the site for proper off-site disposal. Therefore, the material in the LTU will be managed as a non-hazardous “designated waste” as defined in CCR Title 23, Chapter 15, Section 2522. Based on waste discharge requirements for similar sites, soil containing HTF in concentrations less than 100 mg/kg will not be regulated as a waste and could be reused as fill onsite.

4.3 Waste Management

The LTU will be used to treat HTF-affected soil at various concentrations. A process flow diagram showing the management and treatment of the HTF-affected soil is presented in **Figure 8**. Spills of HTF will be cleaned up within 48 hours and affected soil will be moved to a temporary staging area in the LTU where it will be placed on 60-mil plastic and covered with plastic sheeting pending receipt of analytical results and characterization of the waste material. As possible, free liquids will be removed using a vacuum truck. The liquids will be filtered and reused to the extent possible and reintroduced into the process. Filtrate will be characterized though will likely be managed as hazardous waste, as the concentration in the filtrate will likely be more than 10,000 mg/kg HTF.

No HTF-affected soils characterized as hazardous waste will be disposed or treated onsite. As stated previously, it is anticipated that soil containing 10,000 mg/kg HTF or more will be managed as hazardous waste, and that soil containing less than 10,000 mg/kg HTF will be managed at the site as non-hazardous waste. If the soil is characterized as a non-hazardous waste, it will be spread in the LTU for bioremediation treatment. If soil containing 10,000 mg/kg HTF or more is characterized and determined to be non-hazardous in accordance with California regulations, the soil will be sent off site either to a Class II landfill or a soil thermal treatment facility. In general, within the LTU, more highly contaminated soil will be covered with plastic sheeting to prevent contact with storm water and to control potential odors and emissions, as well as for moisture and temperature retention. Once the soil has been treated to a concentration of less than 100 mg/kg HTF, it will be moved from the LTU to another portion of the site until it is reused at the Project site as fill material.

Based on available operation data from other sites, it is anticipated that approximately 833 cubic yards (on average) of HTF-affected soil may be treated per year. Larger or smaller quantities could be generated during some years, depending on the frequency and size of leaks and spills.

A Spill Prevention, Control, and Countermeasure (SPCC) plan will be undertaken for the Project. Periodically, equipment failures in and around mirror fields are expected at the Project that may result in spills of HTF onto soil.

Excess wastewater or rain fall may occasionally accumulate in an LTU. The LTUs have been constructed with 2-foot high berms such that storm water will not drain into or from the LTU. Storm water that falls within the LTU berms will be collected in a sump located at the lowest point of the LTU. Any standing liquids in the LTU or sump will be removed within 48 hours. Based on the frequency of storms in the area, it is anticipated accumulation of rainwater within the containment would occur on a yearly basis. Water that accumulates within the LTUs will be removed using a vacuum truck and sampled for HTF and amendments as described in Section 12. If HTF is not detected above the practical quantitation limit (PQL) and amendment concentrations (i.e., nitrate, phosphate, TDS) are at or near background groundwater concentrations and below State of California primary or secondary maximum contaminant levels the water may be reused in the plant process. If HTF is detected and amendment concentrations exceed background or drinking water standards the waste will be properly disposed of at a licensed TSDF.

5.0 Monitoring and Reporting Requirements

The suggested monitoring and reporting requirements for the LTU is described below.

5.1 Heat Transfer Fluid-Affected Soil

Representative soil samples will be collected for every batch of HTF contaminated soil undergoing treatment in the LTU and composited according to methods specified in USEPA SW-846. The samples will be analyzed for HTF constituents using USEPA Method 8015. The results will be used to segregate the soils for treatment or direct disposal to an appropriate hazardous waste landfill or treatment storage and disposal facility.

5.2 Land Treatment Unit Detection Monitoring

Inspection of the LTU will be conducted monthly. The inspection will involve visual observation to identify the potential presence of cracks or subsidence in the base soil layer and perimeter berms that could allow penetration or migration of contaminants. Inspection of the effectiveness of general housekeeping, run-on controls, and the soil piles for odors and fugitive dust may be required for regular maintenance.

Annually, soil samples will be collected using a hand auger or GeoProbe™ at a depth of 1 foot below the compacted soil base at the LTU (approximately 6 feet bgs) and analyzed for HTF using modified USEPA Method 8015 to verify that HTF is not migrating below the 2 foot compacted clay liner and 3 foot compacted native material. If the laboratory results indicate that the HTF concentrations are greater than the laboratory detection limit, additional soil samples will be collected at successively deeper depths (using 1-foot intervals) until laboratory analytical results show that concentrations are less than the laboratory detection limit. If HTF concentrations above the laboratory detection limit are found below the 5-foot treatment zone, the facility will implement the Corrective Action Plan and submit a letter to the RWQCB highlighting the "evidence of a release."

Ground water beneath the LTU is approximately 480 feet or greater below the ground surface. The HTF material is oil that is solid at temperatures below 54°F and has relatively low solubility and a high sorption potential. The components of HTF are reported and have been demonstrated at Kramer Junction to biodegrade relatively rapidly within a four- to six-month period. Given the great distance to groundwater, the physicochemical properties of HTF showing a limited potential to migrate within the environment and the propensity to biodegrade, the proposed detection monitoring is sufficient to protect ground water resources beneath the site. Additional detection monitoring beyond these efforts does not appear to be warranted.

6.0 Record Keeping and Reporting Program

6.1 General Reporting

By January 31 and July 31 of each year, a report will be provided to the RWQCB including the following information for the period from January through June:

- HTF spill volumes of 20 gallons or greater,
- Locations of spilled HTF, and
- Dates of spills.

The report shall include:

- Total volume of contaminated soil resulting from spills regardless of the volume of HTF spilled,
- Analytical results of the HTF contaminated soil,
- Disposition of the contaminated soil,
- Total volume of contaminated soil, and
- Breakdown of the total volume by disposition location (e.g., hauled off site as hazardous waste, discharged to the LTU, or re-used onsite).

By January 31 of each year, an annual report will be provided to the RWQCB including the preceding semi-annual information and with the following information:

- Evidence that adequate financial assurance for closure, post-closure, and reasonably foreseeable releases is still in effect and may be verified by including a copy of the renewed financial instrument or a copy of the receipt for payment of the financial instrument;
- Evidence that the amount is still adequate or if not, that the amount of financial assurance has been increased by the appropriate amount, due to inflation, a change in the approved closure plan, or other unforeseen events;
- A review of the closure plan and a statement that the closure activities described are still accurate or an updated closure plan; and

6.2 Unscheduled Reports to be Filed with the Regional Board

Incidents that result in implementation of SPCC Plan response procedures will be reported to the appropriate agencies under the timelines provided below. If such incidents threaten to result in an off-site discharge, or may present a potential threat to human health or the environment, immediate verbal notification shall be made as specified in the SPCC Plan. A record of such verbal communications will be maintained in the operating record. As specified by State and Federal regulations, a written report describing the incident and the implementation of the SPCC Plan will be prepared and submitted to the Office of Emergency Services and, as required, to the USEPA and RWQCB. Additional reporting may be required under the WDRs and Monitoring and Reporting Program established by the RWQCB. Further discharge situations are outlined in the following subsections.

6.2.1 Release Reporting

The RWQCB will be immediately notified (verbally) whenever a determination is made that there is physical evidence of a release. This verbal notification will be followed by written notification via certified mail within seven days of such determination. Upon such notification, verification procedures may be initiated or RSI

may demonstrate that another source caused evidence of a release (see below). The notification will include the following information:

- LTU that may have released or be releasing;
- General information including the date, time, location, and cause of the release;
- An estimate of the flow rate and volume of waste involved;
- A procedure for collecting samples and description of laboratory tests to be conducted;
- Identification of any water-bearing media affected or threatened;
- A summary of proposed corrective actions; and
- For physical evidence of a release – physical factors that indicate physical evidence of a release; or

6.2.2 Heat Transfer Fluid Spill or Leak

HTF spill or leak reporting requirements will be incorporated into the SPCC Plan for the Project as follows:

- Project personnel will be required to submit an internal report detailing a HTF spill, regardless of size;
- Project personnel will be required to verbally report to the State of California, Office of Emergency Services and to the National Response Center a spill greater than reportable quantities (42 gallons) and outside of a containment; and
- Project personnel will be required to submit a report (Form 304) detailing a spill of 42 gallons or more to the State of California, Office of Emergency Services within 30 days.

7.0 Design and Construction Standards

7.1 Land Treatment Unit

In compliance with Table 2.1 in CCR Title 27, Chapter 3, Subchapter 2, Article 2, Section 20210, solid designated wastes will be managed in full containment in a Class II LTU with a single liner system. The LTU will be constructed to be above the level of a 100-year storm event and designed to meet seismic hazard criteria. In addition, the base of the LTU will have a greater than 5-foot separation between it and the underlying groundwater.

The location of the LTU is shown on **Figure 2**. Cross section details and layout of the LTU is shown on **Figure 9** and **Figure 10**.

The LTU will not incorporate a liner containment system or leak detection and removal system, but will be constructed with a prepared base consisting of two feet of compacted, low permeability, lime-treated material. This base will serve as a competent platform for land treatment activities, and will serve to slow the rate of surface water infiltration in the treatment area. The compacted lime-treated and native soil beneath the LTU is designated as a “treatment zone” to a depth of five feet. Although the LTU will be taking vehicle traffic, no hard surface will be required, as there is no liner system to protect. A staging area is allocated in the LTU for storage of HTF-impacted soils while they are being characterized. Soil characterized as hazardous will be removed from the site; therefore, no additional liner system is required in the LTU to cater for the hazardous waste.

The LTU will be surrounded on all sides by a 2-foot high compacted earthen berm with side slopes of approximately 3:1 (horizontal: vertical). These berms will control and prevent potential inflow (run on) of surface storm water into the LTU or runoff of storm water from the unit.

The Project LTU is sized based on data from an existing solar farm that uses a LTU to bioremediate HTF-impacted soil. The basis is summarized below.

1. HTF-impacted soil is generated at a rate consistent with existing solar farm experience. Kramer Junction is a 150 MW facility that generates an average of 500 cubic yards (cyd) of HTF-impacted soil per year (DTSC correspondence, 1995). This rate is ~ 3.3 cyd/year/MW.
2. Applying the Kramer Junction experience to the 250 MW Ridgecrest facility, the Ridgecrest facility is estimated to generate ~833 cyd/year of HTF-impacted soil.
3. HTF-impacted soil is treated in 6-inches thicknesses, so, on average, 45,000 square feet, or 1.1 acres, is needed for HTF-impacted generated per year.
4. The LTU will be used for either placement of HTF-impacted soil or treatment of HTF-impacted soil. That is at any one time the LTU is used to place material to be treated as it is generated or being used for soil treatment. HTF-impacted soil treatment is estimated to take 1 to 4 months to complete bioremediation; however, the design of the LTU will allow soil placed at the beginning of the year to have up to twelve months to complete bioremediation and removal.

To address above average spill events, Kramer Junction has additional capacity in the LTU or a factor of safety for HTF-impacted soil treatment. Kramer Junction has a capacity to treat 1,944 cyd/year and generates an average of 500 cyd/year of HTF-impacted soil, so the facility has an ~ 3.9 factor of safety. Applying this factor of safety to Ridgecrest, the total area estimated for LTU is ~175,000 square feet, or 4 acres.

7.1.1 Heat Transfer Fluid Treatment Process

Treatment of HTF-impacted soil in the LTU will involve moisture conditioning and may involve addition of nitrogen and phosphorous nutrients (i.e., fertilizers) as needed to stimulate consumption of HTF by the indigenous bacteria. The HTF-impacted soil will be moisture conditioned and turned periodically as needed to enhance aeration, promote breakdown of HTF by the indigenous bacteria and/or to control dust emissions. The amount of water required for moisture conditioning of the HTF-impacted soils will not cause pooling of water on the surface of the LTU. Permanent or portable irrigation sprinklers will supply water to the area for dust control and to assist in treatment.

Treatment piles may be covered by plastic sheeting as needed to enhance temperature and moisture retention characteristics, and as needed to control storm water contact, odors and dust emissions.

7.1.2 LTU Construction Process

The base layer construction process will follow these general steps:

a. Prior to construction, the LTU will be stripped, grubbed and cleared of topsoil;

b. General excavation and grading to sub grade will take place as needed;

c. Scarification and moisture conditioning of sub grade materials will take place; and

d. Placement, moisture conditioning, lime treatment, and compaction of native clayey silt material to form the base and perimeter berms will be completed before proof rolling after finish grading.

7.1.3 Site Preparation, Excavation and Grading

The LTU pad and berm construction will use standard cut and fill techniques. Native clayey silt material will be used to construct the pad and berms. The clayey silt material will be moisture conditioned and treated with at least 2 percent quicklime to achieve an R-Value of at least 40 to 50. Treatment and compaction of the material will be conducted using standard commercial lime treatment methods and equipment and compacted in lifts using a sheepsfoot roller. The lime treated layer will be compacted to a minimum of 95 percent of the maximum dry density as determined by ASTM D1557. Field testing of the density of the soil will be performed at regular intervals. Compaction results will be recorded. After finish grading, the surface of the LTU pad and berms will be proof rolled.

7.2 Grading Plans

One LTU is proposed for the RSPP and will be located in the east-central portion of the solar plant site. This location is adjacent to a constructed drainage channel and south of the northern solar field. The LTU is accessible from facility roads. Generally surface drainage in this area is anticipated to be within the drainage channel to the east of the LTU and will include sheet flow around the LTU.

The LTU will be constructed so that the entire interior working surface drains to a single sump in the lowest corner. Overall dimensions and finished grades for the Ridgecrest facility LTU with sumps are shown on **Figure 10**.

7.3 Relevant Specifications

The following specifications from the Construction Specification Institute will be developed, as a minimum:

- Soil Stripping and Stockpiling;
- Earthwork and Related Work; and
- Fencing.

8.0 Construction Quality Assurance

8.1 Introduction

The quality assurance program is based on the SWRCB – Construction Quality Assurance (CQA) Requirements under CCR, Title 27. The requirements themselves will be highlighted and an explanation of how the requirements will be met will follow immediately afterwards.

The LTU will be constructed as per the construction specifications that will be developed in accordance with the CQA plan provided herein. The CQA program will be implemented to ensure that construction is completed in accordance with design specifications.

For the LTU, CQA testing will be performed on the sub grade, compacted lime-treated base, and the berm fill.

Construction inspection requirements will include approval of each layer to ensure that there are no deficiencies in that layer prior to the placement of the next material, based on field observations and field tests. This will also include review of other CQA results to ensure that they are within the project's specifications.

Change authorization will flow through the onsite construction manager and will ensure that the Engineer of Record, as well as other required personnel, have input in the decision of any change. Daily reports will be kept to ensure that activities are documented and personnel involved in the project are updated daily.

8.2 Performance Standard

Quoting from the SWRCB CQA requirements section (a):

> *The construction quality assurance (CQA) program, including all relevant aspects of construction quality control (CQC), shall provide evidence that materials and procedures utilized in the placement of the any containment feature at a waste management unit (Unit) will be tested and monitored to assure the structure is constructed in accordance with the design specifications approved by the RWQCB.*

The project will implement QC procedures that incorporate inspection and test procedures to make sure that the containment facilities are constructed properly and that they are monitored appropriately throughout the life of the project. These tests and procedures will be documented in detail throughout the project.

8.2.1 Professional Qualifications

Quoting from the SWRCB CQA requirements section (b):

> *(1) The design professional who prepares the CQA plan shall be a registered civil engineer or certified engineering geologist; and*
>
> *(2) The construction quality assurance program shall be supervised by a registered civil engineer or certified engineering geologist who shall be designated the CQA officer.*

RSI will ensure that a qualified design professional prepare the CQA plan and act as a CQA officer whose responsibility is to supervise the CQA program.

Construction activities and operations will be directed and supervised by qualified individuals and the design will be conceived and presented in accordance with recognized civil, mechanical and electrical engineering procedures and practices.

8.2.2 CQA Reports

Quoting from the SWRCB CQA requirements section (c):

> *(1) The project's CQA report shall address the construction requirements, including any vegetation procedures, set forth in the design plan for the containment system. For each specified phase of construction, this report shall include, but not be limited to:*
>
> > *(A) A delineation of the CQA management organization, including the chain of command of the CQA inspectors and contractors;*
> >
> > *(B) A detailed description of the level of experience and training for the contractor, the work crew, and CQA inspectors for every major phase of construction in order to ensure that the installation methods and procedures required in the containment system design will be properly implemented;*
> >
> > *(C) A description of the CQA testing protocols for preconstruction, construction, and post-construction which shall include:*
> >
> > > *1. the frequency of inspections by the operator;*
> > >
> > > *2. the sampling and field testing procedures and equipment to be utilized, and the calibration of field testing equipment;*
> > >
> > > *3. the frequency of performance audits determined by the design professional and examined by the CQA officer;*
> > >
> > > *4. the size, method, location and frequency of sampling, sampling procedures for laboratory testing, the soils or geotechnical laboratory to be used, the laboratory procedures to be utilized, the calibration of laboratory equipment and quality assurance and quality control of laboratory procedures;*
> > >
> > > *5. the pass/fail criteria for sampling and testing methods used to achieve containment system design; and*
> > >
> > > *6. a description of the corrective procedures in the event of test failure.*

The Project will provide the following:

- An outline of the chain of command of the CQA inspectors and contractors in the CQA management organization.
- A description of the CQA testing procedures for the preconstruction, construction, and post construction phases of the project.
- A CQA report that includes construction QC requirements included in the design plan for each specified phase of construction.

8.2.3 Documentation

CQA documentation requirements shall include, at a minimum: reports bearing unique identifying sheet numbers for cross referencing and document control, the date, project name, location, descriptive remarks, data sheets, inspection activities, and signatures of designated authorities with concurrence of the CQA officer.

> *(1) The documentation shall include:*

(A) Daily Summary Reports — daily record keeping, which shall include preparation of a summary report with supporting inspection data sheets, problem identification and corrective measures reports. Daily summary reports shall provide a chronological framework for identifying and recording all other reports. Inspection data sheets shall contain all observations (i.e., notes, charts, sketches, or photographs), and a record of field and/or laboratory tests. Problem identification and corrective measures reports shall include detailed descriptions of materials and/or workmanship that do not meet a specified design and shall be cross referenced to specific inspection data sheets where the problem was identified and corrected;

(B) Acceptance Reports — all reports shall be assembled and summarized into Acceptance Reports in order to verify that the materials and construction processes comply with the specified design. This report shall include, at a minimum, inspection summary reports, inspection data sheets, problem identification, and corrective measures reports;

(C) Final Documentation — at the completion of the project, the operator shall prepare a Final Documentation which contains all reports submitted concerning the placement of the containment system. This document shall provide evidence that the CQA plan was implemented as proposed and that the construction proceeded in accordance with design criteria, plans, and specifications. The discharger shall submit copies of the Final Documentation report to the RWQCB as prepared by the CQA officer.

(2) Once construction is complete, the document originals shall be stored by the discharger in a manner that will allow for easy access while still protecting them from any damage. All documentation shall be maintained throughout the post closure maintenance period.

These documents will include daily summary reports with supporting inspection data sheets that contain all observations. A record of field and laboratory tests will also be kept. Acceptance report documents will ensure construction and materials comply with the original design and specifications. At the completion of the project, project closure documentation will be submitted to provide evidence that the CQA plan was implemented as proposed and that construction met design criteria, plans, and specifications.

8.2.4 Laboratory Testing Requirements

Quoting from the SWRCB CQA requirements section (e):

(1) Analysis of earthen materials shall be performed prior to their incorporation into any containment system component. Representative samples for each layer within the containment system shall be evaluated. The following minimum laboratory testing procedures shall be performed:

(A) ASTM Designation: D 1557 91 [1/91], "Laboratory Compaction Characteristics of Soil Using Modified Effort (2,700 kN-m/m3)" which is incorporated by reference;

(B) ASTM Designation: D 422 63 (Reapproved) [9/90], "Standard Method for Particle Size Analysis of Soils," which is incorporated by reference; and

(C) ASTM Designation: D 2487 93 [11/93], "Standard Classification of Soils for Engineering Purposes," which is incorporated by reference.

(2) In addition to the tests listed in (e and f), the following minimum laboratory tests shall be performed on low-hydraulic-conductivity layer components constructed from soil:

(A) ASTM Designation: D 4318 93 [11/93], "Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils," which is incorporated by reference; and

The Project will send materials proposed for construction to the lab to an accredited laboratory so that the quality and characteristics can be confirmed and compared to project specifications.

The laboratory tests will be performed as specified in section (e) of the SWRCB CQA requirements above and will include the following:

- ASTM Designation: D 1557 91 [1/91], "Laboratory Compaction Characteristics of Soil Using Modified Effort (2,700 kN-m/m3);"
- ASTM Designation: D 422 63 (Reapproved) [9/90], "Standard Method for Particle Size Analysis of Soils;" and
- ASTM Designation: D 2487 93 [11/93], "Standard Classification of Soils for Engineering Purposes."

Periodic laboratory and in-situ analysis may be completed to supplement the CQA.

8.2.5 Field Testing Requirements

Quoting from the SWRCB CQA requirements section (f):

> *The following minimum field test procedure shall be performed for each layer in the containment system: ASTM Designation: D 2488 93 [9/93], Standard Practice for Description and Identification of Soils (Visual Manual Procedure), which is incorporated by reference.*

The following tests will be performed on each layer of the containment system associated with the LTU pad:

- ASTM Designation: D 2488 93 [9/93], Standard Practice for Description and Identification of Soils (Visual Manual Procedure)
- ASTM D2922 and D3017 for using a nuclear density/moisture gauge (densitometer) to determine compaction percentage and moisture content.

8.2.6 Earthen Material Requirements

Quoting from the SWRCB CQA requirements section (h):

> *(1) The following minimum tests shall include, but not be limited to:*
>
> > *(A) Laboratory tests as specified in State Water Resources Control Board CQA requirements subsection (e); and*
> >
> > *(B) Field tests as specified in State Water Resources Control Board CQA requirements subsections (f and g).*
>
> *(2) The following minimum testing frequencies shall be performed:*
>
> > (*A) Four (4) field density tests shall be performed for each 1,000 cubic yards of material placed, or at a minimum of four (4) tests per day;*
> >
> > *(B) Compaction curve data (ASTM Designation: D 1557 91) graphically represented, and Atterberg limits (ASTM Designation: D 4318 93) shall be performed on the barrier layer material once a week and/or every 5,000 cubic yards of material placed;*

When testing any of the soils used during construction, as a minimum the tests referenced in SWRCB CQA requirements section (e) will be performed. There will be four field density tests performed per 1,000 cubic yards of material placed, or a minimum of four tests per day. Compaction curve data, including Atterberg Limits, will be performed at least once per week or every 5,000 cubic yards of material placed. For field

hydraulic conductivity tests (critical for the onsite material used in the base layer), the frequency of testing will be based on the pass/failure status of previous tests. They will be performed for the amount of time necessary to make sure steady conditions for the design hydraulic conductivity are met. The equation $I = Q /(tA)$ will be used to determine design hydraulic conductivity.

During construction, all compacted soils and granular material will be tested using a nuclear density/moisture gauge (densitometer) (ASTM D2922 and D3017) to determine compaction percentage and moisture content. Nuclear densitometer testing will be performed to ensure compaction and moisture condition requirements, as outlined in the project specifications, are being achieved. Each material will be tested following compaction in multiple locations to ensure compliance to Project specifications prior to proceeding with placement of the next material.

9.0 Storm Water Management

A conceptual drainage study was performed by AECOM to evaluate site hydrologic conditions and provide a preliminary design basis for onsite drainage structures and the rerouting of an unnamed wash located on the north eastern portion of the site. The evaluation was designed following guidance provided in the Riverside County Hydrology Manual and the Riverside County Division Four – Standards for Drainage. The objective of the drainage studies was to investigate the hydraulic and hydrologic conditions associated with the development of the Project site and provide mitigation requirements for the anticipated increase in storm water runoff due to development.

9.1.1 Offsite Drainage

Runoff from local topographic highs located south of the Project site discharges onto the Project site northward to relatively more gradual-sloped areas at the southern and northern solar fields **(Figure 3)**. The location of the watershed in the El Paso Mountains and the existing drainage flow paths on the Project site are shown in AFC Figure 5.17-11. There are three major watercourses that run through the Project site. The El Paso Wash drains 22 square miles upstream of the Project and runs approximately through the center of the site. This wash drains water from the south hills and crosses Brown Road inside the property boundary.

The second major watercourse consists of an unnamed watercourse that drains an area of four square miles southwest of the Project site. This watercourse crosses the southwest section of the Project area continuing in the northwest direction toward Brown Road.

The third major watercourse consists of the eastern drainage area, which extends east and west of the U.S. Highway 395 (Three Flags Highway) covering about 10 square miles. Drained water crosses U.S. Highway 395 at several points in both east-west and west-east directions, hydraulically connecting all the catchments in this drainage area. Water collected in this eastern drainage area flows westward toward the Project site from near the intersection of Brown Road and U.S. Highway 395. This watercourse crosses the Project site changing flow direction from the westward direction to a more northward direction midway through the Project site.

An elevated railroad grade is located south of the Project site. The railroad grade interrupts several natural drainage paths connecting flows to several watercourses that cross the railroad grade through pipes, concrete culverts, and timber bridges. Aerial photography and vegetation patterns indicate that the overall drainage pattern inside the Project area concentrates flows in several well-defined washes through the area. Storm flow generated by the existing site itself generally sheet to washes in the northeast and northwest directions. Existing flow patterns in the Project site drainage area and water crossings beneath the U.S. Highway 395 and the railroad are shown in AFC Figure 5.17-13.

9.1.2 Onsite Drainage

Proposed drainage modifications to the Project site seek to replicate the existing flow patterns as nearly as possible. Currently, the El Paso Wash flows through the center of the property and there are two unnamed tributaries of the El Paso Wash that flow near the eastern and western boundaries of the property. These tributaries connect to the El Paso Wash, off site and to north of the property. To replicate existing flow patterns, the solar fields are located so that the main flow lines of the El Paso Wash and the western tributary of the El Paso Wash remain the same. The eastern tributary of the El Paso Wash that enters the property from the east, near Brown Road will be intercepted by a new channel that will re-direct the flow from this tributary along the eastern boundary of the property and discharge into the existing eastern tributary flow line where the tributary exits the site **(Figure 3)**. The runoff from the solar fields is collected by perimeter drainage ditches that discharge into the El Paso Wash and the western tributary of the El Paso Wash.

Each of the proposed channels are being sized to contain the peak flow of the 100-year, 24-hour storm event. In general, each channel will also be allowed to naturally re-vegetate with native vegetation to a minor extent, but not so much as to affect the drainage function of these engineered channels. The calculations for each channel show that they may have an erosive effect at some locations in a 100-year event. Each channel will be designed with 3:1 side slopes to help mitigate the erosion of the banks. The channels will be constructed with native onsite soil material, and scour protection will be added in stress areas (i.e., locations where the erosion potential is greater than a straight, uniform channel reach, and includes junctions, transitions, and curves). No scour protection is proposed for the channel bottom in the straight sections of the channels. This is to allow the low flows to meander across the bottom replicating as nearly as possible the flow regimes under current conditions. The erosion control measures will be designed to maintain the infiltration characteristics of the channel reach similar to pre-construction conditions.

Each channel is designed as a trapezoidal channel with a transition (diffuser) at the discharge to return the storm water back to sheet flow at the edge of the Project site. The diffuser is designed with an expanding channel cross section to spread out the flow resulting in low-flow velocities. The purpose of the diffuser is to return the flood flows to the approximately location and depth that occur in the existing condition.

In summary, there are slight changes in peak flow rates in the channels between the existing condition and the proposed condition and slight shifting in contributing drainage areas from the existing to the proposed condition. These changes are attributed to the difference in the time of concentrations. The proposed flow rates leaving the site are generally lower than the existing flow rates, due to the fact that the time of concentrations for the proposed onsite drainage areas are longer than the existing times of concentrations for the existing overland flow.

9.1.3 Storm Water Design for Land Treatment Unit

The LTUs are surrounded by berms which will control and prevent potential inflow (run on) of surface storm water into the LTUs or runoff of storm water from the LTUs. The berms will protect storm water entering the LTUs in the 100-year, 24 hour storm event.

Precipitation that falls on the outer slopes of the berms will sheet flow following the drainage pattern for the area surrounding the LTU and enter the project drainage channels. The interior impermeable area of the LTU will accumulate with storm water and not contribute to peak runoff from the site as shown on **Figure 10**.

Precipitation that accumulates in the LTU will be observed to establish that the water is visibly free from HTF product, sheen or other evidence of contamination. Regardless of whether a sheen is observed, all storm water will be sampled and analyzed for HTF constituents to determine an appropriate disposal method. Liquids that accumulate in the LTU will be removed within 48 hours. Because significant precipitation events are relatively isolated, transfer of accumulated rainwater collected in the LTU is expected to be needed only every approximately three to five years.

9.1.4 Best Management Practices

Storm water BMPs will be provided onsite and will be included in the SWPPP in compliance with the National Pollutant Discharge Elimination System General Permit for Storm Water Discharges Associated with Construction Activity and Operation of the site. BMPs also will be contained in the CEC-mandated Drainage, Erosion, and Sediment Control Plan (DESCP). The Project will not submit a Notice of Intent for the SWPPPs, as they are not legally required by the SWRCB as a 401 and 404 Permit is not required.

During construction, BMPs will include:

- Temporary Erosion Control Measures: Construction of berms and ditches re-vegetation, slope stabilizers (interior slopes of the berms in the LTUs are to be stabilized before the liner systems are placed), dust suppression and sediment barriers;
- Sediment Control: Silt fences, gravel bags, fiber rolls, check dams and street sweeping;

- Tracking Controls: Stabilizing entrance and exit;
- Wind Erosion Controls: Applying potable groundwater to disturbed areas and covering exposed stockpiles;
- Non-Stormwater Control: Inspecting vehicles for leaks and dispose of cement appropriately; and
- Waste Management and Materials Pollution Control: Using watertight containers, prevent runoff (with berm, trench etc), into the storage areas and clean up spills immediately after discovery.

Permanent BMPs shall also be provided to protect the LTU during operation of the Project. These BMPs will include the following erosion and sediment control measures:

- Berms around the LTU;
- Exterior slopes of the berms stabilized to prevent wind and water erosion after completion of the liner system placement (e.g., placement of stripped organics removed from the pond area during grading, track walking transverse to slopes);
- Monitoring of berm integrity monthly and after any runoff-producing storm event for erosion;
- Repair of the berms as needed (regrading and track walking for minor erosion (less than 6 inches depth), regrading and placement of coarse aggregate for deeper erosion;
- Maintenance of the drainage channel as needed to restore flow lines and bank integrity.

10.0 Operating Requirements

10.1 Site Records

In accordance with CCR Title 27, Section 20510, key site records will be kept in the office at the Project. Records will be available for inspection by authorized representatives of the Local Environmental Agency (LEA) and RWQCB during the facilities regular working hours. Alternatively, an inspection can be arranged by notifying the Facility Manager. All required records will be properly completed, filed for retention, and maintained throughout the operating life of the LTU.

10.1.1 Operating Record

The operating record maintained at the Project will include the following information:

- HTF Spill Records – These records shall include the time and location and estimated quantity of HTF leaked, and the estimated volume of soil affected.
- Monitoring Results – Results of monitoring, analyses, and testing of the soil at the LTU required by the waste discharge requirements (WDRs) or regulatory requirements.
- Inspection Forms – Inspection results including a description of required inspection, sampling, maintenance or remedial action at the LTU, and the date of implementation, including the dates of soil turnings. Special occurrences encountered during operation of each unit and methods used to resolve problems arising from these events, including details of incidents that required implementing emergency procedures, will be included in these forms.
- Waste Transmittal Forms – Identify date, source of waste, estimated volumes, operators, laboratory reports, and location in the LTU into which the HTF-impacted soils were placed.
- Waste Manifests – Completed non-hazardous or hazardous waste manifests for each shipment of HTF-impacted soil waste removed from the Facility for off-site disposal.
- Spill Response Plan – Written reports prepared in response to any incident requiring implementation of spill response (Section 13.4).
- Correspondence with Local Agencies – Correspondence associated with emergency arrangements agreed to or refused by local authorities.
- Employee Information Records – Records documenting employee information such as job title for each position, job description, names of employees in each job, and introductory and continuing training received.
- Notifications of Violations – Notices of deficiency, abatement orders or any other notification of violation by any regulatory agency.
- Complaints – The Facility manager will record public complaints received regarding operation of the LTU, including:
  - The nature of the complaint;
  - The date the complaint was received;
  - If available, the name, address, and telephone number of the person or persons making the complaint; and
  - Actions taken to respond to the complaint.

10.1.2 Waste Discharge Volumes

In accordance with CCR Title 27, Section 21720(f), all discharges into the LTU will be recorded in the Operating Record. The following items will be recorded include:

- Volume in cubic yards of HTF-affected soil introduced into and removed from the LTU on a monthly basis;
- Cumulative total of HTF-affected soil introduced into and removed from the LTU.

10.1.3 Waste Manifests

Upon delivering a load of hazardous or non-hazardous HTF-impacted soil from the Project to a landfill, the accompanying waste manifest will be signed and dated by the truck-receiving operator to verify receipt and the driver/hauler will be given a signed copy of the manifest. As necessary, a copy of the Waste Transmittal Form or equivalent will be attached to the manifest. Within 30 days of receipt of hazardous waste, a signed copy of the hazardous waste manifest will be sent by the landfill to the generator and to the DTSC. This return manifest will be maintained at the Project Site with the original manifest. If a return manifest is not received within 30 days, the landfill will be contacted to determine the reason why the return manifest has not been received. If a return manifest is not received within 15 days after the due date, a discrepancy report shall be filed with the DTSC. Manifests, related documents, and corresponding daily delivery logs for wastes leaving the Project will be collected and reviewed.

10.1.4 Monitoring and Sampling Plan Results

Monitoring and sampling plan results will be retained at the Project as part of the operating record.

10.1.5 Inspection and Operating Records

Site personnel will complete the inspection logs and other required operation documentation and the facility management will review the applicable documents for completeness and accuracy. Completed inspection logs and notations of needed repairs will be maintained for a minimum of three years.

Further information regarding inspection and maintenance requirements are outlined in Section 12.

10.1.6 Record of Corrective Action Plan Implementation

Following any incident that requires implementation of the Project's Corrective Action Plan, a report will be prepared containing the information described in CCR Title 27, Section 21760(b)(2). At a minimum, the report will be submitted to the LEA and the RWQCB. In addition, a copy will be retained on filed at the Project Site as part of the operating record.

Further information regarding the Corrective Action Plan requirements is outlined in Appendix I.

10.1.7 Correspondence Regarding Arrangements with Local Authorities

Copies of all correspondence with local authorities regarding emergency response arrangements and revisions of the SPCC Plan will be maintained at the Project Site.

10.1.8 Training Records

In accordance with CCR Title 27, Section 20610, the following records will be retained for each position related to waste management as part of the operating record:

- A job title and written job description including assigned duties and required qualifications;
- Name of the employee filling each job;
- Description of initial and continuing training; and
- Documentation of initial and continuing training received.

Whenever a training course is conducted, the records for each employee who completed the course will be updated. When a new employee is hired, a training record file will be initiated for the new employee.

Personnel training records on current employees are retained until final closure of the Project. Records on former employees are retained for three years after the employee's leave date.

10.1.9 Design Documents

In accordance with the requirements of CCR Title 27, Section 21760, design, as-built, and operating documentation related to the LTU will be retained at the Project as part of the operating records.

10.1.10 Other Required Technical Documents

In accordance with CCR Title 27, Section 20510 and 20517, all other technical records associated with the LTU will be retained at the Project as part of the operating record.

10.1.11 Excavation Records

Records of excavations that may affect the safe and proper operation of the LTU, or cause damage to adjoining properties, as required by CCR Title 27, Section 20510(b), will be kept in the operating record.

10.1.12 Operator/Responsible Party Records

Records of written notification to the LEA, local health agency, and fire authority of names, addresses and telephone number of the operator or responsible party at the Site, as required by CCR Title 27, Section 20510(e), will be kept in the operating record.

10.2 Security

In accordance with CCR Title 27, Section 21600(b)(5)(B) and 20530, security measures will be provided to ensure the safest environment for employee working at the Project. Security measures include barriers and warning signs.

10.2.1 Barriers

The Project solar fields and support facilities' perimeter will be secured with a combination of chain link and wind fencing. Chain link metal fabric security fencing consists of eight-foot tall fencing with one-foot barbed wire or razor wire on top 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.

Controlled access gates will be located at the site entrance. Access through the main gate will require an electronic swipe card, preventing unaccompanied visitors from accessing the Project. All Project personnel, contractors, and visitors will be logged in and out of the Project at the main office during normal business hours. Visitors will be allowed entry only with approval from a staff member at the Project. Visitors will be issued visitor passes that are worn during their visit and returned at the main office when leaving.

10.2.2 Warning Signs

Each point of access from a public road shall be posted with an easily visible sign indicating the facility name, and other pertinent information as required by the WDR.

10.3 Sanitary Facilities

In accordance with CCR Title 27, Section 21600(b)(5)(C), sanitary facilities will be provided at the site for Project office employees. RSI will maintain all sanitary and hand-washing facilities that may be required, by applicable state or local requirements, in a reasonably clean and adequately supplied condition.

10.4 Communication Systems

Communication facilities will be provided at the site for Project employees that meet the requirements specified in the AFC and CCR Title 27, Section 21600(b)(5)(D).

10.4.1 Internal Communication

The internal communication system for the Project will include the following devices:

- Alarm system;
- Two-way radios;
- Telephones; and
- Intercoms.

Each Project building will also be equipped with telephones. Operations supervisors and other key personnel may carry hand-held two-way radios that can be used to contact the Project office or other site personnel in an emergency.

10.4.2 External Communication

Twenty-four hour access to outside emergency services, including police and fire departments and emergency response teams, is available through the commercial telephone system at the Project.

10.5 Lighting

Lighting will be provided at the Project Site to ensure the safety of employees during nighttime activities, and will meet the requirements of CCR Title 27, Section 21600(b)(5)(E). The lighting system will provide operations and maintenance personnel with illumination in both normal and emergency conditions. The system will consist primarily of Alternating Current (AC) lighting, but will include Direct Current (DC) lighting for activities or emergency egress required during an outage of the Project's AC electrical system. The lighting system will also provide AC convenience outlets for portable lamps and tools. Permanent lighting will be provided primarily along the paved access road to the Project Site and in the power block area. Lighting in the LTU area will be provided when needed using portable light stands shielded to minimize impacts to night skies.

10.6 Safety Equipment

In accordance with CCR Title 27, Section 21600(b)(5)(F), safety equipment will be provided for the health and safety of employees at the Project Site. As specified in the AFC, a Personnel Protective Equipment (PPE) Program will be developed for the facility, which will apply to all contractor and subcontractor employees, as well as direct RSI employees during operation.

Specific requirements of the PPE Program include:

- Determining and providing personal protective devices for specific jobs;
- Providing proper head protection requirements;
- Establishing eye and face protection requirements;
- Identifying body protection equipment requirements;
- Implementing hand protection requirements;
- Defining proper foot protection;
- Providing proper sanitation facilities;
- Determining safety belts and life lines job requirements;
- Establishing procedures to prevent and protect personnel from electric shock;
- Identifying onsite and off-site medical services and first aid requirements; and
- Specifying respiratory protection requirements for jobs.

Required PPE will be approved for use and distinctly marked to facilitate identification. The type of PPE required to operate, maintain, and monitor the LTU will be described in the job safety analysis undertaken prior to the commencement of operations.

10.6.1 Required Equipment

The following equipment shall be available at the Project Site to minimize hazards associated with operations:

- Alarm systems and internal communications;
- Radio and telephone systems;
- Emergency equipment for fires and spills; and
- Water supplies for fire fighting.

10.6.2 Emergency Equipment

In accordance with the Emergency Action Plan as specified in the AFC, RSI will obtain emergency response equipment. This equipment will be strategically located throughout the facility in order to respond to emergencies in a timely fashion.

10.6.3 Water Supplies for Fire Equipment

In accordance with the Fire Protection and Prevention Plan as specified in the AFC, the Facility will be equipped with water at adequate volume and pressure to supply water hose streams. The primary source of water for fire fighting is a 1,500,000 -gallon permeate storage tank. Only a portion of that tank (360,000 gallons) is dedicated to the Project's fire protection water system.

10.6.4 Equipment Testing and Maintenance

In accordance with the Emergency Action Plan as specified in the AFC, all emergency equipment at the Facility, including communications and alarm systems and fire and spill prevention equipment, will be tested and maintained.

10.7 Personnel Requirements

In accordance with CCR Title 27 ,Section 21600(b)(5)(G), written job descriptions will be maintained for each position at the facility related to management of waste in the permitted LTU at the Facility. These descriptions will be updated periodically by facility managers and supervisors to reflect the changing needs of the facility. Job descriptions will be kept on file at the facility and include the following information:

- Job title/position;
- Duties/responsibilities; and
- Job prerequisites and qualifications.

All Project employees will receive training in general procedures and operations, and in emergency response procedures. Personnel receive job-specific training during on-the-job training as required. This training ensures that personnel are sufficiently proficient in the particular skills required to perform their assigned duties and that they are aware of the inherent hazards. The management, planning, and operations personnel will have varying backgrounds with respect to the management and operation of the LTU at the Project Site. Technical staff will gain experience with these systems mainly through on-the-job training. A record of training and experience of each employee will be maintained at the Project office.

10.8 Personnel Training

An Operations Safety Training Program for employees and contractors will be developed for the Project as specified in the AFC that will meet the requirements of CCR Title 27, Section 21600(b)(5)(H). The Operations Safety Training Program will be revised as required to include any additional training necessary as equipment or operations change. Additional job-specific training may be completed by personnel as needed.

The staff person overseeing the portion of the training program pertinent to the LTU will be experienced in the operation of such units, waste management procedures and applicable regulations, emergency response, and SPCC Plan implementation.

All employees will be required to receive training in the following areas:

- Injury and Illness Prevention;
- Emergency Action Plan;
- PPE;
- Fall Protection;
- Fire Protection and Prevention;
- Confined Space Entry Program;
- Hazard Communication;
- Hand and Portable Power Tool Safety;
- Heat Stress and Cold Stress Safety;
- Hearing Conservation;
- UXO training: and
- Back Injury Prevention.

The topics applicable to operation of the LTU may include:

- Land Treatment Operation;
- Forklift Operation;
- Front-End Loader Operation;
- Mobile Equipment Safety;
- Inspection and Monitoring Program;
- HTF Material Safety Data Sheet Training;
- Soil Sampling;
- Equipment Inspections;
- Employee Exposure Monitoring Program; and
- Housekeeping and Material Handling.

10.9 Supervisory Structure

In accordance with CCR Title 27, Section 21600(b)(5)(I), the facility supervisor will be experienced in solar facilities operations and maintenance to ensure that the facility is properly operated in accordance with all applicable laws, regulations, permit conditions and other requirements. All shift managers and equipment operators will report to the facility supervisor.

11.0 Environmental Controls

11.1 Nuisance Controls

As defined by Rule 419 of the Kern County Air Pollution Control District, the definition of a nuisance is:

> *"A person shall not discharge from any source whatsoever such quantities of air contaminants or other material which cause injury, detriment, nuisance, or annoyance to any considerable number of persons or to the public or which endanger the comfort, repose, health or safety of any such persons or the public or which cause or have a natural tendency to cause injury or damage to business or property."*

In accordance with CCR Title 27, Section 21600(b)(8)(A), the LTU will be operated in compliance with all applicable permits and regulatory conditions to prevent creating environmental hazards and public nuisance. Given compliance with permits and conditions and the nature of the LTU, nuisance conditions are unlikely to arise. In addition, the LTU is located in a relatively isolated area away from potential receptors, so the public is unlikely to be impacted by these operations. If complaints are generated, they will be reported to the LEA within 24 hours.

11.2 Fire Control

A Fire Protection and Prevention Program will be prepared for the Project as specified in the AFC and will meet the requirements of CCR Title 27, Section 21600(b)(8)(B). The plan will include measures relating to safeguarding human life, preventing personnel injury, preservation of property and minimizing downtime due to fire or explosion. Fire protection measures will include fire prevention methods to prevent the inception of fires. Of concern are adequate exits, fire-safe construction, reduction of ignition sources, control of fuel sources, and proper maintenance of fire water supply and sprinkler systems.

The Fire Protection and Prevention Plan for the Project will include the following sections:

- Scope, purpose, and applicability;
- Potential fire hazards;
- Proper handling and storage of potential fire hazards;
- Potential ignition sources;
- Control of potential ignition sources;
- Persons responsible for equipment and systems maintenance;
- Portable fire extinguishers;
- Automatic sprinkler fire suppression system;
- Water-spray fire system;
- Local fire department;
- Training;
- Housekeeping procedures; and
- Record keeping requirements.

The Project's fire protection water system will be supplied from a dedicated 360,000-gallon portion of the 1,500,000-gallon permeate storage tank located onsite. One electric and one diesel fueled backup fire water pump, each with a capacity of 1,500 gpm, will deliver water to the fire protection water piping network. A smaller electric motor-driven jockey pump will maintain pressure in the piping network. If the jockey pump

is unable to maintain a set operating pressure in the piping network, the diesel fire pump starts automatically.

The piping network will be configured in a loop so that a piping failure can be quickly 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 will 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.

11.3 Dust Control

An Operations Dust Control Plan will be prepared for the Project as specified in the AFC to manage fugitive dust emissions and comply with the requirements of CCR Title 27, Section 21600(b)(8)(D). BMPs for dust control from the LTU will be implemented as necessary and will include the following:

- Adherence to speed limits during travel on dirt roads for monitoring and maintenance of the LTU; and
- Tarping of any truck loads of HTF contaminated soil to be removed from the Project Site for off-site disposal.

Wastewater from the water from the Reverse Osmosis (RO) system will be used for dust control onsite.

11.4 Vector Control

In accordance with CCR Title 27, Section 21600(b)(8)(E), a vector control program will be implemented at the Project as needed.

11.5 Drainage and Erosion Control

A Drainage, Erosion and Sediment Control Plan (DESCP) will be prepared for the Project as specified in the AFC and will address the requirements of CCR Title 27,Section 21600(b)(8)(F). The plan will describe the management and control of stormwater runoff at the site and will specify site-specific BMPs for erosion and sediment control that will include side slope protection of the berms surrounding the LTUs. An outline of the drainage design and BMPs is provided in Section 9.

11.6 Noise Control

Noise control requirements for the Project have been investigated in the AFC and will comply with the requirements of CCR Title 27, Section 21600(b)(8)(H). Due to the remoteness of the site and operating procedures of the treatment units, noise is not anticipated to be a problem. Off-site noise levels for the operation of the entire Project diminish to the point of being indistinguishable from ambient levels before reaching the off-site noise sensitive or residential receptors. The Project operator will comply with local, State, and Federal requirements and regulations regarding noise control.

Onsite mobile equipment used for pond maintenance will be equipped with approved mufflers and will conform to applicable Occupational Safety and Health Administration (OSHA) and CAL OSHA noise requirements. In addition, hearing protection will be available to facility personnel.

11.7 Traffic Control

Traffic control requirements for the Project have been investigated in the AFC and will meet the requirements of CCR Title 27, Section 21600(b)(8)(I) for the LTU. The proposed access to the LTU will be off the main paved entrance roadway for the Project. Traffic is expected to be limited to trucks and mobile equipment used in occasional inspection and maintenance activities. Control measures to mitigate onsite safety hazards and interference with site operations will include signs, paint markings, mirrors, and imposition of speed limits as needed.

The Project site is located southwest of U.S. Highway 395 on the north and south sides of Brown Road, approximately five miles southwest of Ridgecrest, California. Regional access is provided to the Project site and the surrounding Ridgecrest area by U.S. Highway 395. U.S. Highway 395 is a primary north/south regional arterial that extends northerly along the eastern side of the Sierra Nevada Mountain Range to Bishop. It extends southerly to I-15 approximately 10 miles south of Victorville. In the Project vicinity, U.S. Highway 395 is a two-lane facility with two, 12-foot travel lanes with approximately 6-foot paved shoulders and 6- to 8-foot graded shoulders on each side. The site is linked to U.S. Highway 395 via Brown Road, an existing two-lane paved road, approximately 24-feet wide, with variable graded shoulders from 4 to 10 feet on each side.

Additionally, the Project can be accessed from West Inyokern Road (SR-178), which extends westerly from the City of Ridgecrest as a four lane road to Inyokern and crosses Brown Road approximately nine miles north of the Project site. Between Ridgecrest and Brown Road, SR-178 is about 72 feet wide, including an approximately 24-foot wide unpaved median strip. It typically includes 4-foot paved shoulders with an additional 4-foot graded shoulder on each side. SR-178 is the northern-most boundary of the city of Ridgecrest.

Proposed traffic mitigation for the Project include the development and implementation of a construction phase Traffic Management Plan (TMP) in consultation with Caltrans and Kern County for the roadway network potentially affected by construction activities at the plant site and offsite linear facilities. In addition, RSI may split the arrival of the workforce in the morning into two parts arriving one hour or more apart when the total number of workers onsite will exceed 300.

12.0 Inspection, Sampling and Maintenance Programs

The following section outlines the inspection and maintenance requirements for the LTU. Records of inspections, sampling and monitoring shall be retained as part of the operating record as required under Section 10.0.

On the first day of operation, the pump, piping, and control switches will be checked to ensure they are in proper working condition per the manufacturers' specifications.

12.1 Inspection Program

Inspection of the LTU will be conducted monthly. The inspection will involve visual observation to identify the potential presence of cracks or subsidence in the base soil layer and perimeter berms that could allow penetration or migration of contaminants. Inspection of the effectiveness of general housekeeping, run-on controls, and the soil piles for odors and fugitive dust may be required for regular maintenance.

12.2 Sampling Program

Samples are to be properly documented and a written record of the chain-of-custody recorded. The chain-of-custody record will track the samples from the field to the laboratory. This form documents the time, date, location, person collecting the sample, and names and signatures of all persons handling the samples from the field to the laboratory.

12.2.1 Land Treatment Unit – Wastewater

Water that accumulates in the LTU that needs to be removed to maintain the operation of the LTU will be sampled to assess the HTF and amendment content. Samples will be analyzed by a state-certified laboratory to determine the concentration of the parameters in **Table 4** to determine an appropriate off-site disposal facility. If HTF is not detected above the PQL and amendment concentrations (i.e., nitrate, phosphate, TDS) are at or near background groundwater concentrations and below State of California primary or secondary maximum contaminant levels the water may be reused in the plant process. If HTF is detected and amendment concentrations exceed background or drinking water standards the waste will be properly disposed of at a licensed TSDF.

12.2.2 Land Treatment Unit – Soil

As described in Section 7, representative soil samples will be collected for every batch of HTF-contaminated soil undergoing treatment in the LTU and composited according to methods specified in USEPA SW-846. Results of the samples will be reported semi-annually. **Table 5** presents the analyte suite and their associated practical quantitation limits, and lists the chemical constituents for LTU soil sampling.

Annually, soil samples will be collected at a depth of one foot below the compacted soil base at the LTU (approximately six feet bgs) and analyzed for HTF using modified USEPA Method 8015 to verify that HTF is not migrating below the 5-foot treatment zone underlying the unit. Soil samples will be collected in handling and treatment areas at a spacing of one to two samples per acre. The samples will be randomly located within the one-acre area.

If results of sample analysis indicate HTF concentrations are greater than the laboratory detection limit, soil sample collection will be repeated at one-foot intervals until laboratory analytical results show that concentrations are less than the laboratory detection limit. If HTF concentrations above the laboratory detection limit are found below the five-foot treatment zone, the SPCC Plan will be implemented and a letter highlighting the "evidence of a release" will be submitted to the RWQCB. Results of integrity sampling program will be reported annually.

12.3 Maintenance Program

12.3.1 Land Treatment Unit

Maintenance involved with the LTU will include general housekeeping and drainage system maintenance. General housekeeping within the LTU includes the following:

- Keeping soil piles tidy and contained;
- Clearing the unit of debris that may have been accumulated during operation;
- Re-applying plastic sheeting on soil piles; and
- Moisture conditioning and fertilizing the soil piles as needed.

Drainage system maintenance will include the following:

- Re-grading of the base of the LTU; and
- Clearing the sump of accumulated debris or soil; and
- Repair/replacement of earth berms as needed.

13.0 Required Plans

13.1 Detection Monitoring Plan

A detection and evaluation monitoring program has been incorporated into **Appendix E**, Detection Monitoring Program, pursuant to Section 20425 of Title 27. The Corrective Action Plan will be triggered when detection or evaluation monitoring data indicates that there exists statistically significant evidence of a release to groundwater from the LTU. The requirements for establishing a statistically significant release are provided in the Detection Monitoring Program. **Appendix D**, Corrective Action Plan, has been incorporated pursuant to CCR Title 27, Section 20430 and establishes the specific corrective actions in the event of a documented release to groundwater.

13.2 Corrective Action

A Corrective Action Plan has been incorporated into **Appendix D** of this Application pursuant to CCR Title 27, Section 20430 and establishes the specific corrective actions in the event of a documented release to groundwater. The Corrective Action Plan will be triggered when detection or evaluation monitoring data indicates that there exists statistically significant evidence of a release to groundwater from the LTU. The requirements for establishing a statistically significant release are provided in the Detection Monitoring Program.

13.3 Closure and Post-Closure

Six months prior to the proposed date of closure, RSI will notify the RWQCB of the proposed closure and submit a ROWD application for closure. The requirements for facility closure at the Project site are provided in **Appendix F**, Preliminary Closure Plan.

The site will undergo clean closure; therefore, the requirement for post-closure monitoring and maintenance is not necessary. After clean closure is completed, all potential sources of contamination will be removed from the LTU site. A Preliminary Post-Closure Maintenance Plan is not included as part of the required plans for this ROWD.

13.4 Spill Prevention and Response Measures

This section presents the Spill Prevention and Response Plan for the LTU. Incorporated into this plan will be the requirements of the SPCC Plan that will be undertaken for the Project pursuant to CFR Title 40, Part 112, as required based on the volume of HTF storage. An SPCC Plan will be undertaken for the Project. The SPCC will include, but will not be limited to, the following:

- Secondary containment around the tanks storing HTF, capable of containing 110 percent of the storage tank capacity and/or sufficient freeboard to contain precipitation from a 25-year, 24-hour storm event.
- Daily inspections of all infrastructure containing HTF because it is not practicable to provide secondary containment around HTF-product piping as it runs throughout the solar field.
- Isolation and clean up within 48 hours if spills or leaks are detected.
- Assessment of potential spills, system fill procedures and overfill protection, and training will be included in other sections of the SPCC.

13.4.1 Spill Reporting

Incidents that result in implementation of the measures described in the subsequent sections of this Spill Prevention and Response Plan will be reported to the appropriate agencies. If such incidents threaten to result in an off-site discharge or may present a potential threat to human health or the environment, immediate verbal notification of the appropriate agencies shall be made as specified in the SPCC Plan. A record of such verbal communications will be maintained in the operating record. As specified by State and Federal regulations, a written report describing the incident and the implementation of the SPCC Plan will be prepared and submitted to the Office of Emergency Services and as required to the USEPA and RWQCB.

Additional reporting may be required under the WDRs and Monitoring and Reporting Program established by the RWQCB.

13.4.1.1 Release from the Evaporation Ponds or Land Treatment Unit

The RWQCB will be immediately notified (verbally) whenever a determination is made that there is physical or statistically significant evidence of a release. This verbal notification will be followed by written notification via certified mail within seven days of such determination. Upon such notification, verification procedures may be initiated or RSI may demonstrate that another source caused evidence of a release. The notification will include the following information:

- The unit that may have released or be releasing (individual LTU);
- General information including the date, time, location, and cause of the release;
- An estimate of the flow rate and volume of waste involved;
- A procedure for collecting samples and description of laboratory tests to be conducted;
- Identification of any water-bearing media affected or threatened;
- A summary of proposed corrective actions; and
- For physical evidence of a release - physical factors that indicate physical evidence of a release.

Upon notification, RSI may initiate verification procedures or demonstrate that a source other than the permitted waste management unit caused the evidence of a release. A supporting technical report must be provided to the RWQCB within 90 days, demonstrating the different source of the discharge.

13.4.1.2 Heat Transfer Fluid Spill or Leak

HTF spill or leak reporting requirements will be incorporated into the SPCC Plan for the Project as follows:

- Project personnel will be required to submit an internal report detailing a HTF spill, regardless of size;
- A release of 20 gallons is reportable to the CEC within 48 hours.;
- Project personnel will be required to verbally report a spill greater than reportable quantities (42 gallons), and is outside of a containment, to the State of California Office of Emergency Services and to the National Response Center; and
- Project personnel will be required to submit a report (Form 304) detailing a spill of 42 gallons or more to the State of California, Office of Emergency Services within 30 days.

These records shall include the time, location, and estimated quantity of HTF leaked, and the estimated volume of soil affected and other information as required by the regulatory agency.

13.4.2 Spill Response Record Keeping

In accordance with CCR Title 27, Section 20510, spill response records will be kept in the office at the Project. Spill response records will be available for inspection by authorized representatives of the LEA and

RWQCB during the facilities regular working hours. Alternatively, an inspection can be arranged by notifying the Facility Manager. All required records will be properly completed, filed for retention and maintained throughout the operating life of the LTU.

13.4.2.1 Required Records

The following records must be maintained onsite as part of the operating record:

- Written summaries of all verbal communications and/or notifications to agencies of spills or leaks;
- All written reports submitted to the LEA or RWQCB documenting the spill incident;
- All required notification, documentation or follow-up reports as required under the SPCC Plan;
- All subsequent follow-up or technical reports submitted to the RWQCB, LEA or other agency, and
- Any other additional reporting required under the Waste Discharge Requirements and Monitoring and Reporting Program established by the RWQCB.

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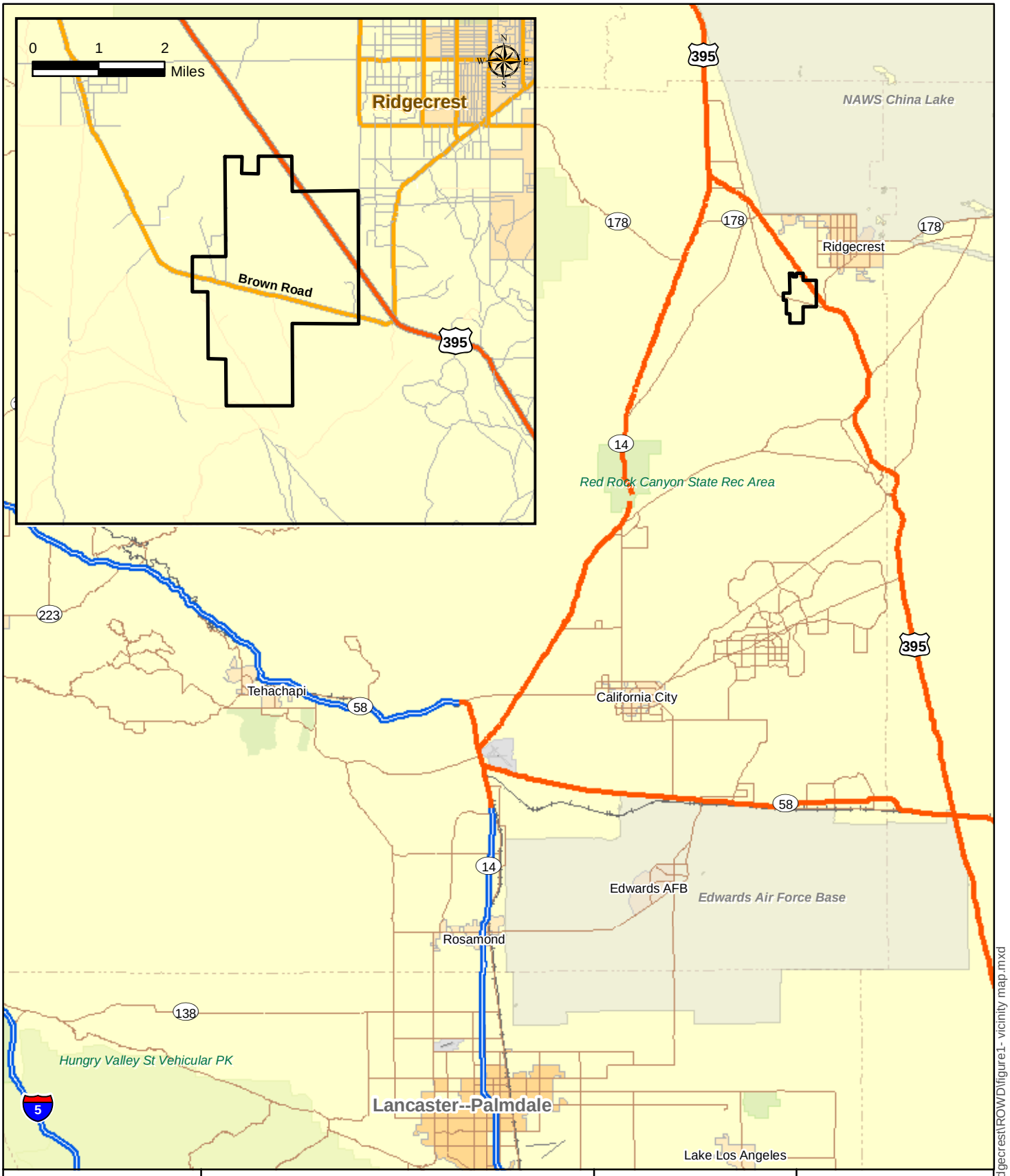

Map Location

0 5 10
Miles

Ridgecrest Solar Power Plant

Figure 1
Regional Location and Vicinity Map

Solar Millennium

AECOM

Project: 60139696
Date: January 2010

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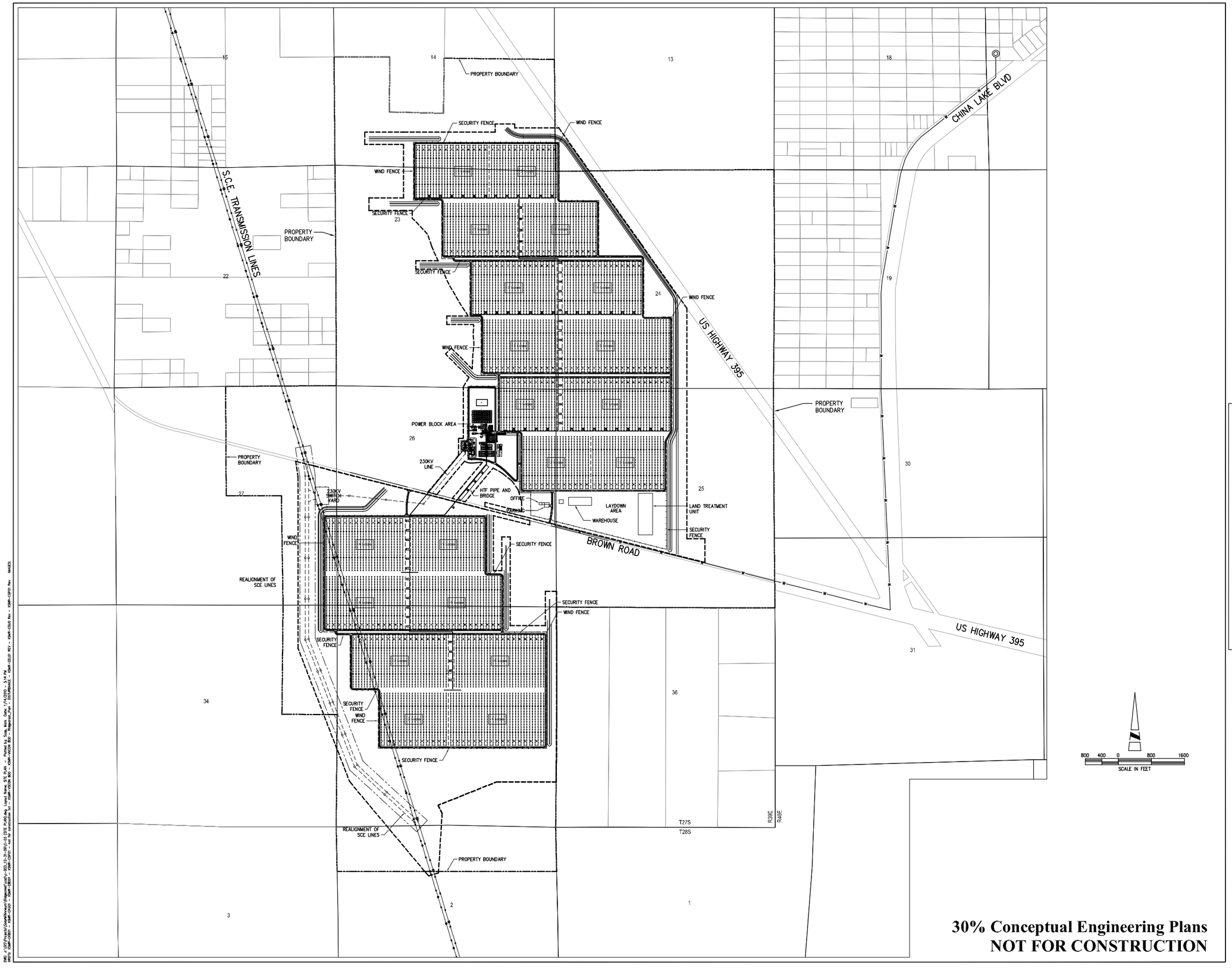

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WILLIAM CHARLES BLACK
No. C31465
EXP. 12-31-10
CIVIL
STATE OF CALIFORNIA

Designed:	W. BLACK
Checked:	W. BLACK
Drawn:	K. S. BEDFORD
Record Drawing by/date:	

Revisions:

#	DATE	DESCRIPTION

Prepared for:

Solar Millennium LLC

LEGEND:

- SOLAR FIELD PARABOLIC TROUGH
- BALANCE OF PLANT FACILITIES
- PROPOSED ACCESS ROAD (PAVED)
- PROPOSED ACCESS ROAD (GRAVEL)
- RAILROAD
- PROPOSED GAS
- PROPOSED WATER
- PROPOSED TELEPHONE
- PROPOSED ELECTRIC
- EXISTING ELECTRIC
- PROPOSED SECURITY FENCE
- PROPOSED WIND FENCE
- EXISTING CONTOURS (10 FOOT INTERVALS)
- PROPOSED DRAINAGE CHANNEL/FLOW DIRECTION
- EXISTING INTERMITTENT DRAINAGE CHANNEL
- SITE BOUNDARY
- HEADER PIPING
- ACCELERATION LANE

Ridgecrest Solar Power Project

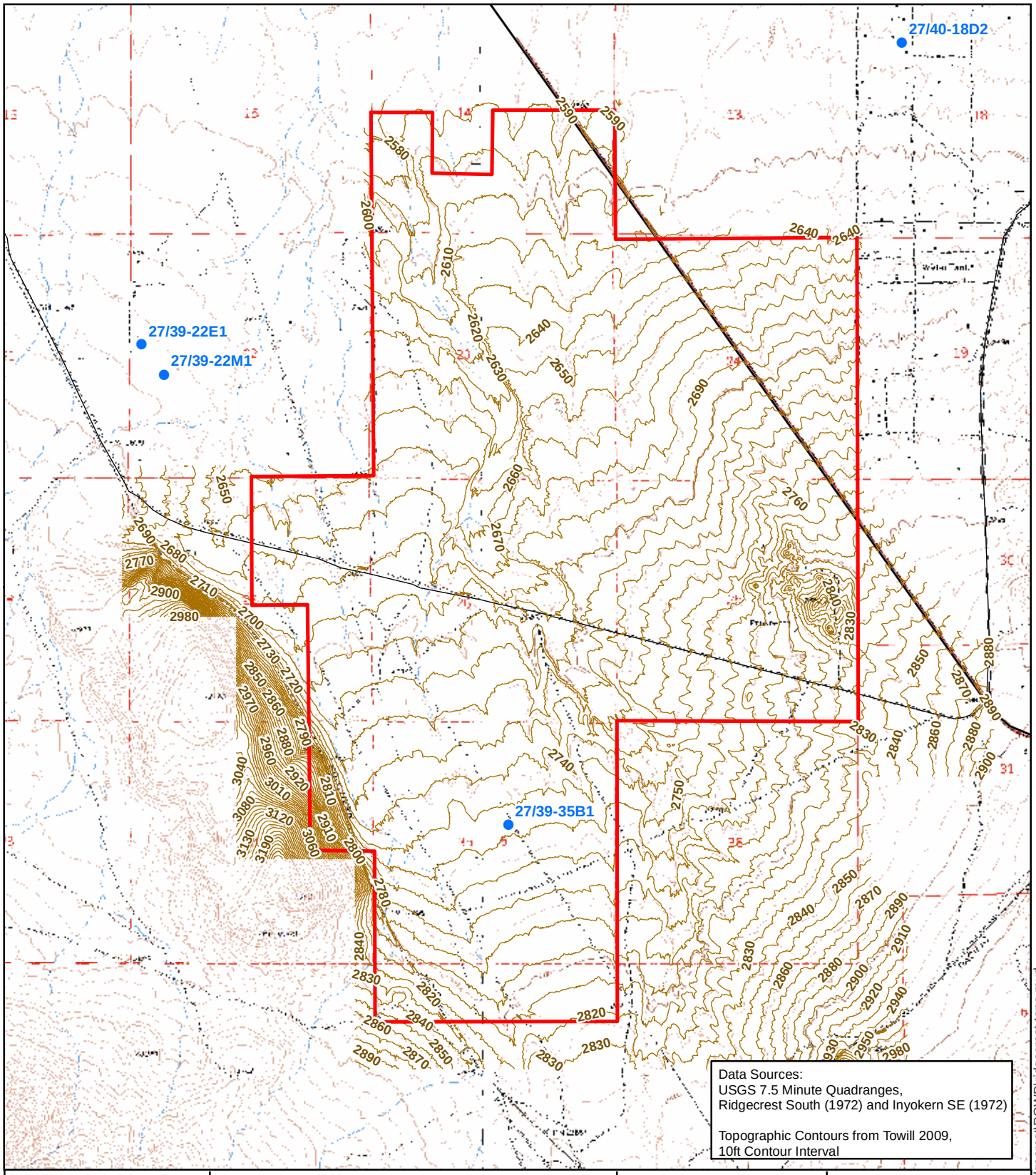
Kern County, California

Preliminary Site Plan

Figure 2

Date: 12/18/09

Sheet: .



Map Location

Legend

Project Right-of-Way

Groundwater Well Location based on Latitude and Longitude in USGS Database

0 3,000 6,000 Feet

N W E S

Ridgecrest Solar Power Plant

Figure 3
Site Topographic Map

Solar Millennium

AECOM

Project: 60139696
Date: January 2010

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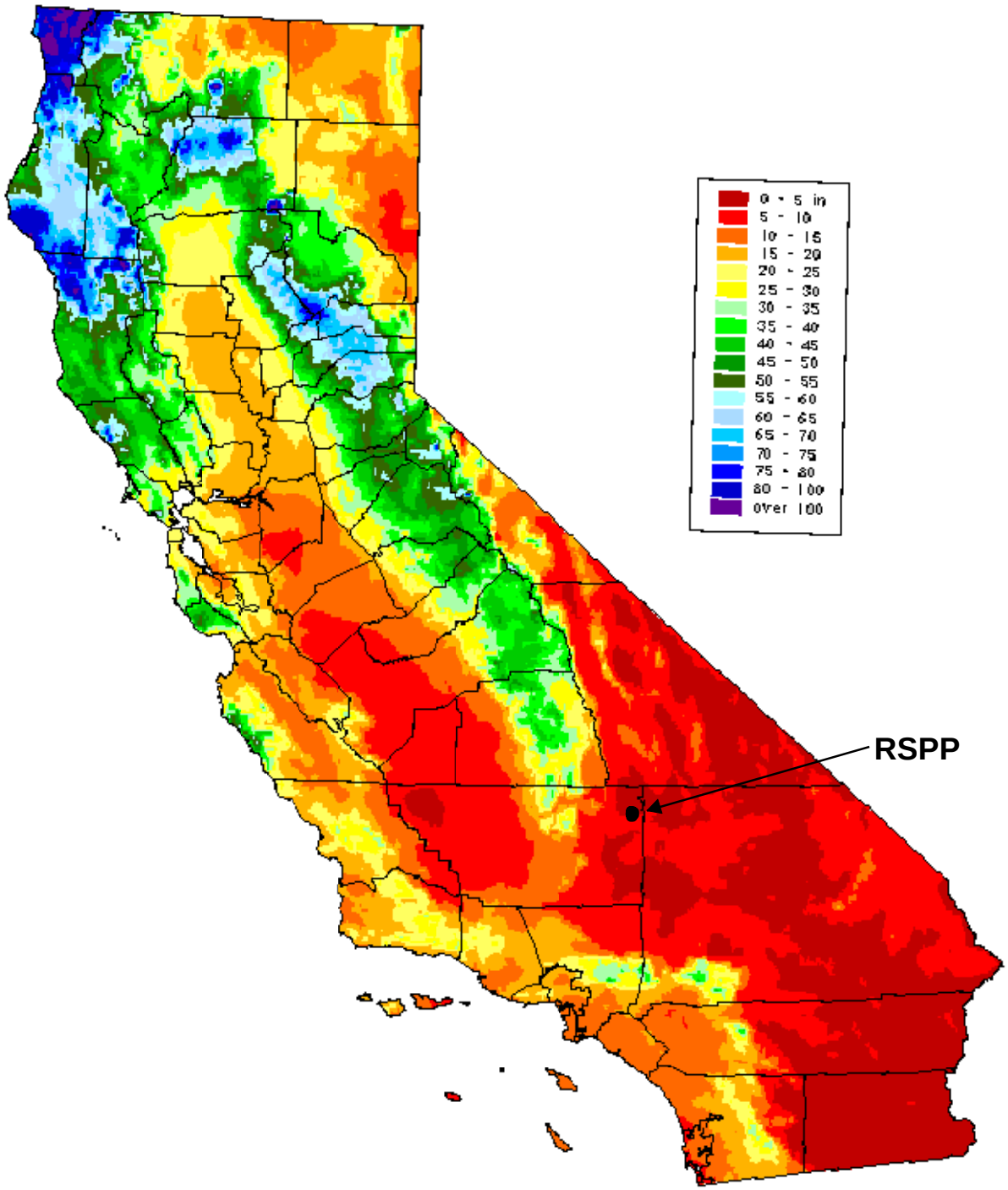

Source:
http://www.wrcc.dri.edu/pcpn/ca.gif
Oregon Climate Service, 1995

Map Location

N
W
E
S

Ridgecrest Solar Power Project

Figure 4
Average Annual Precipitation (inches), California
Period: 1961-1990

Solar Millennium

AECOM

Project: 60139696
Date: January 2010

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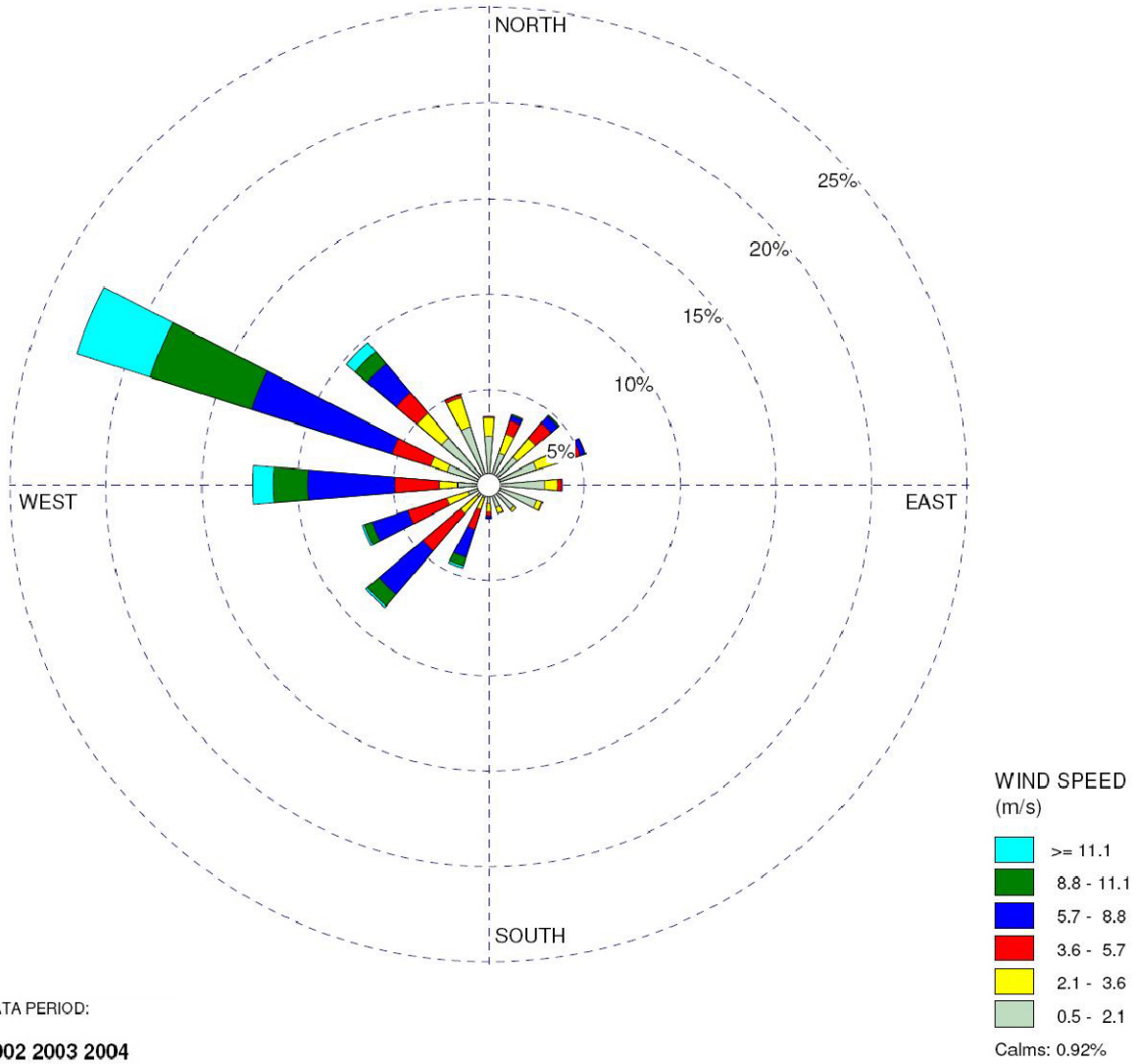
WIND ROSE PLOT:

Mojave ARB Monitoring Station, Mojave, CA
2002-2004 Wind Rose

DISPLAY:

Wind Speed
Direction (blowing from)



DATA PERIOD:

2002 2003 2004
Jan 1 - Dec 31
00:00 - 23:00

CALM WINDS:	TOTAL COUNT:
0.92%	**26304 hrs.**
AVG. WIND SPEED:	DATE:
5.03 m/s	**8/24/2009**

Map Location

Ridgecrest Solar Power Project

Figure 5
Wind Rose Plot
Mojave ARB Monitoring Station, Mojave, CA

Solar Millennium

AECOM

Project: 60139696
Date: January 2010

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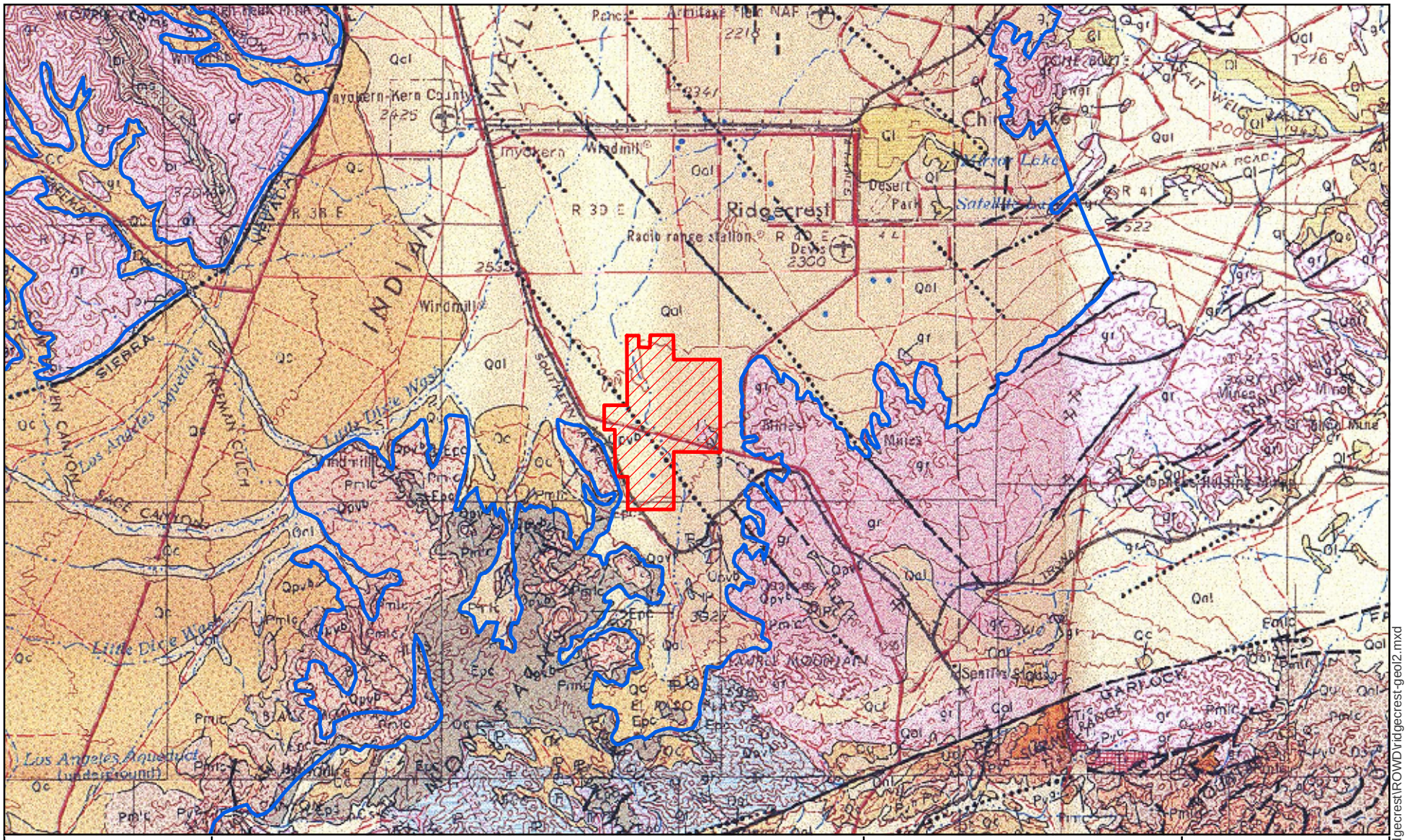

Map Location

Legend

Project Right-of-Way

Indian Wells Valley Groundwater Basin

See Figure 6b for Geologic Legend

Sources:
Division of Mines and Geology, Geologic Map of California, Trona Sheet, Scale 1:250,000, 1963

1 in = 3 miles

0 3 6 Miles

N W E S

Ridgecrest Solar Power Plant

Figure 6a
Regional Geologic Map

Solar Millennium

AECOM

Project: 60139696
Date: January 2010

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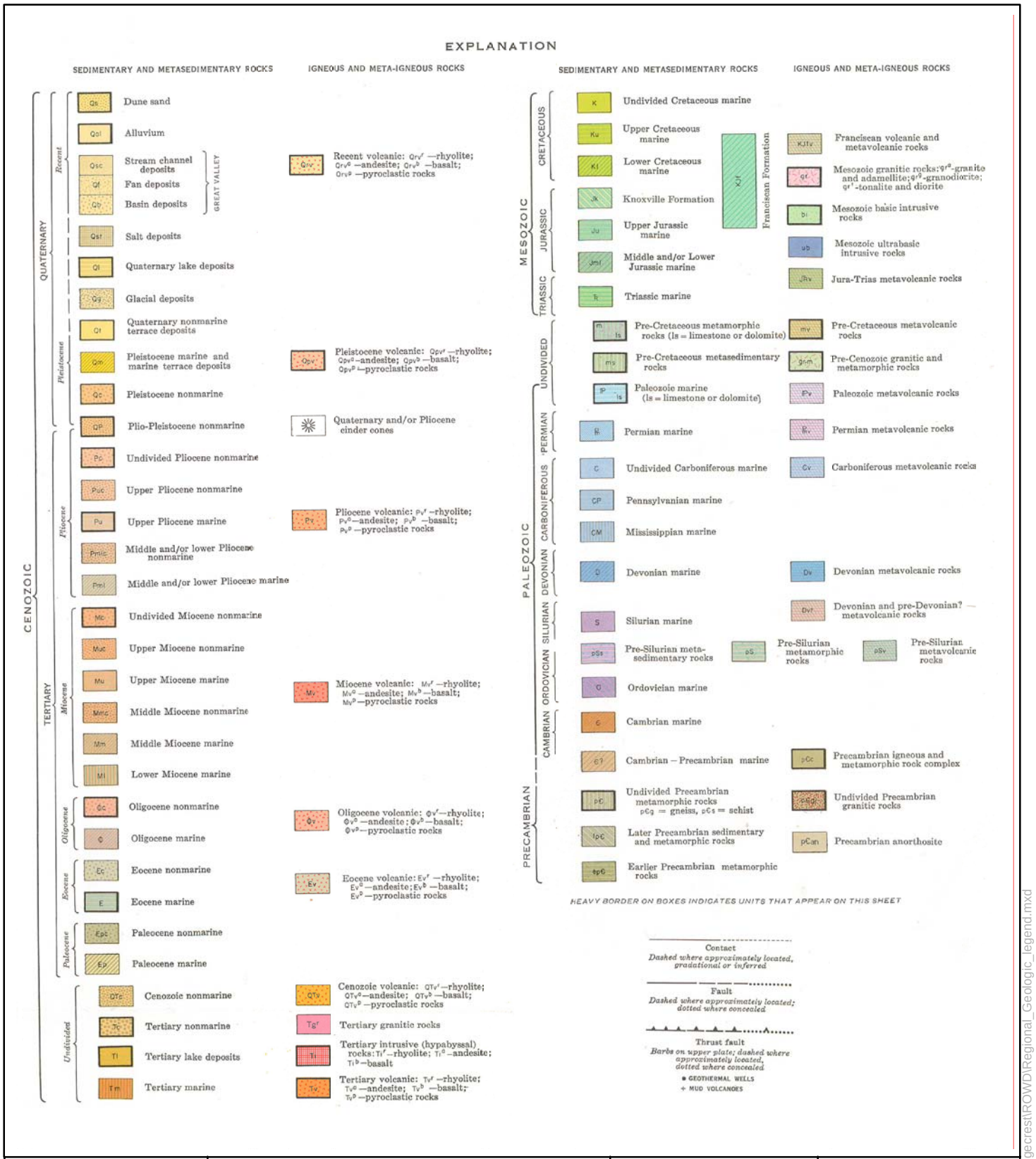

Map Location

Legend

Sources:
Division of Mines and Geology, Geologic Map of California, Trona, Scale 1:250,000, 1963

Ridgecrest Solar Power Project

Figure 6b
Regional Geologic Map Legend

Solar Millennium

AECOM

Project: 12944-003
Date: September 2009

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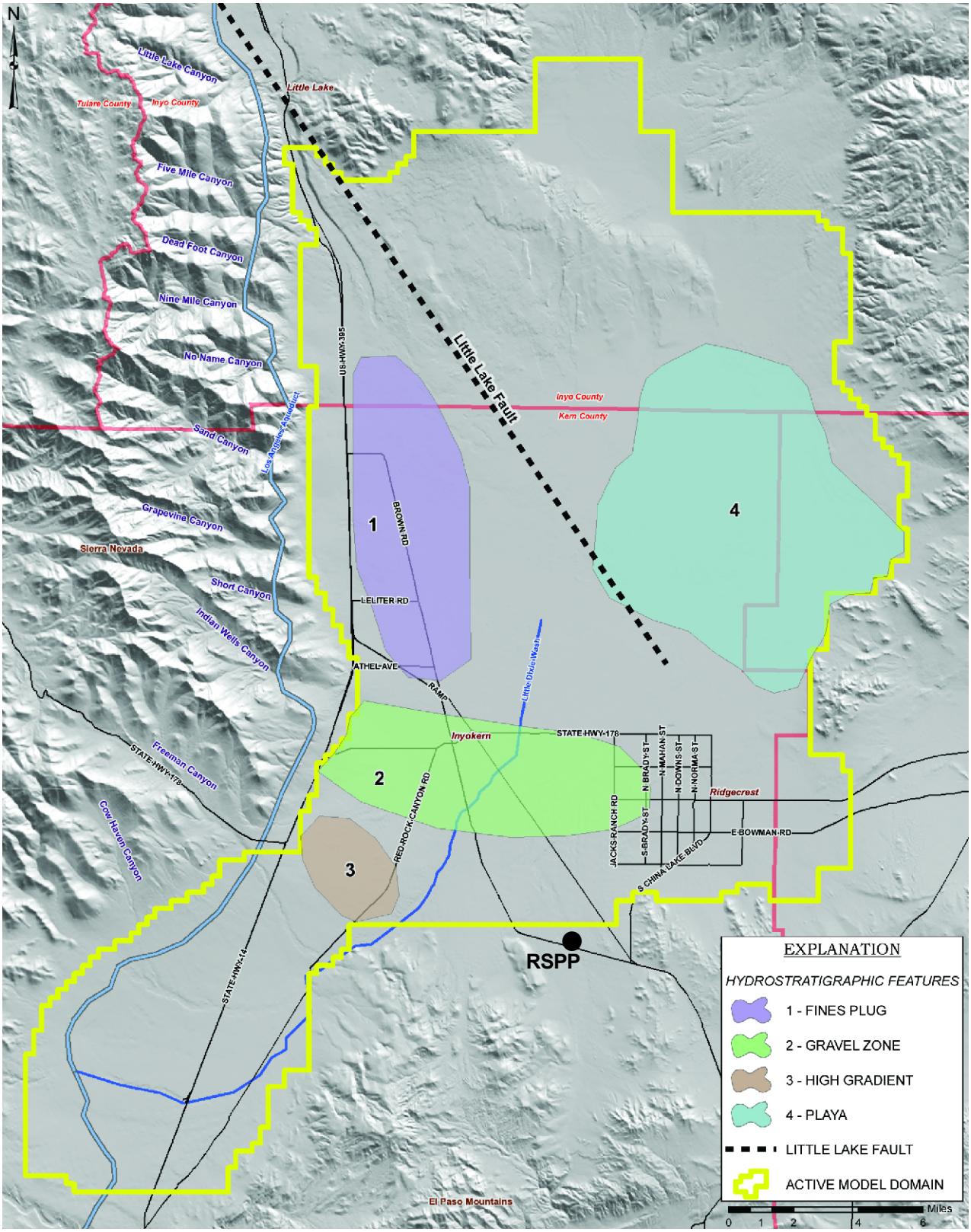

Map Location

Sources:
Modified from Brown and Caldwell Indian Wells Valley Basin Groundwater Flow Model and Hydrogeologic Study, March 27, 2009

Ridgecrest Solar Power Project

Figure 7 Hydrostratigraphic Features in the Indian Wells Valley Groundwater Basin

Solar Millennium

AECOM

Project: 60139696
Date: January 2010

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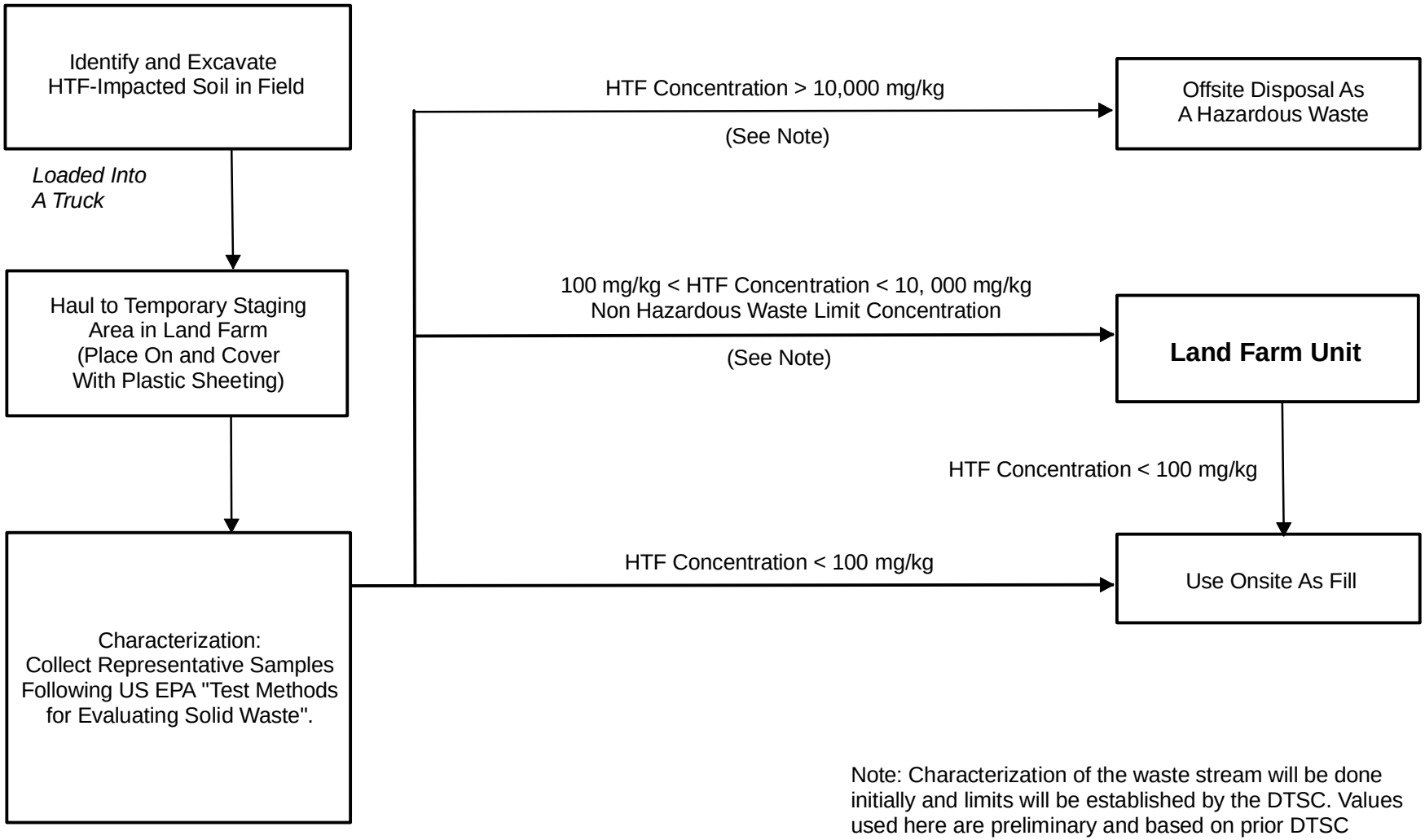

Note: Characterization of the waste stream will be done initially and limits will be established by the DTSC. Values used here are preliminary and based on prior DTSC determination.

Map Location

Ridgecrest Solar Power Project

Figure 8
Process Flow Diagram

Solar Millennium

AECOM

Project: 60139696
Date: January 2010

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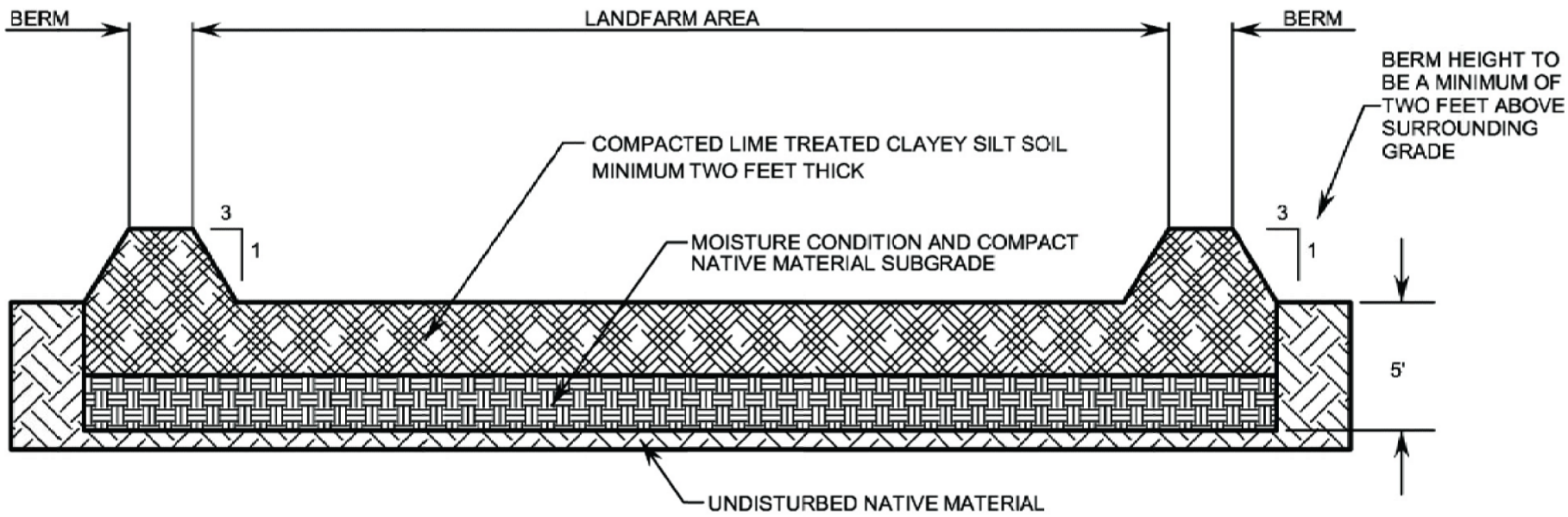

1 LANDFARM UNIT-SECTION
N.T.S.

NOTES:

1. THE COMPACTED AND NATIVE SOIL BENEATH THE LAND FARM UNIT IS DESIGNATED AS A "TREATMENT ZONE" TO A DEPTH OF 5 FEET.
2. THE LIME TREATED LAYER IS TO BE COMPACTED TO A MINIMUM OF 95% OF THE MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D1557 AND HAVE A LOW PERMEABILITY (CLAYEY SILT) MATERIAL.
3. THE CROSS SECTION IS A TYPICAL SECTION.
4. SEE TEXT FOR FURTHER DETAILS.

Map Location

Rdgecrest Solar Power Project

Figure 9
Cross-Section Details of Land Treatment Unit

Solar Millennium

AECOM

Project: 60139696
Date: Januaryr 2010

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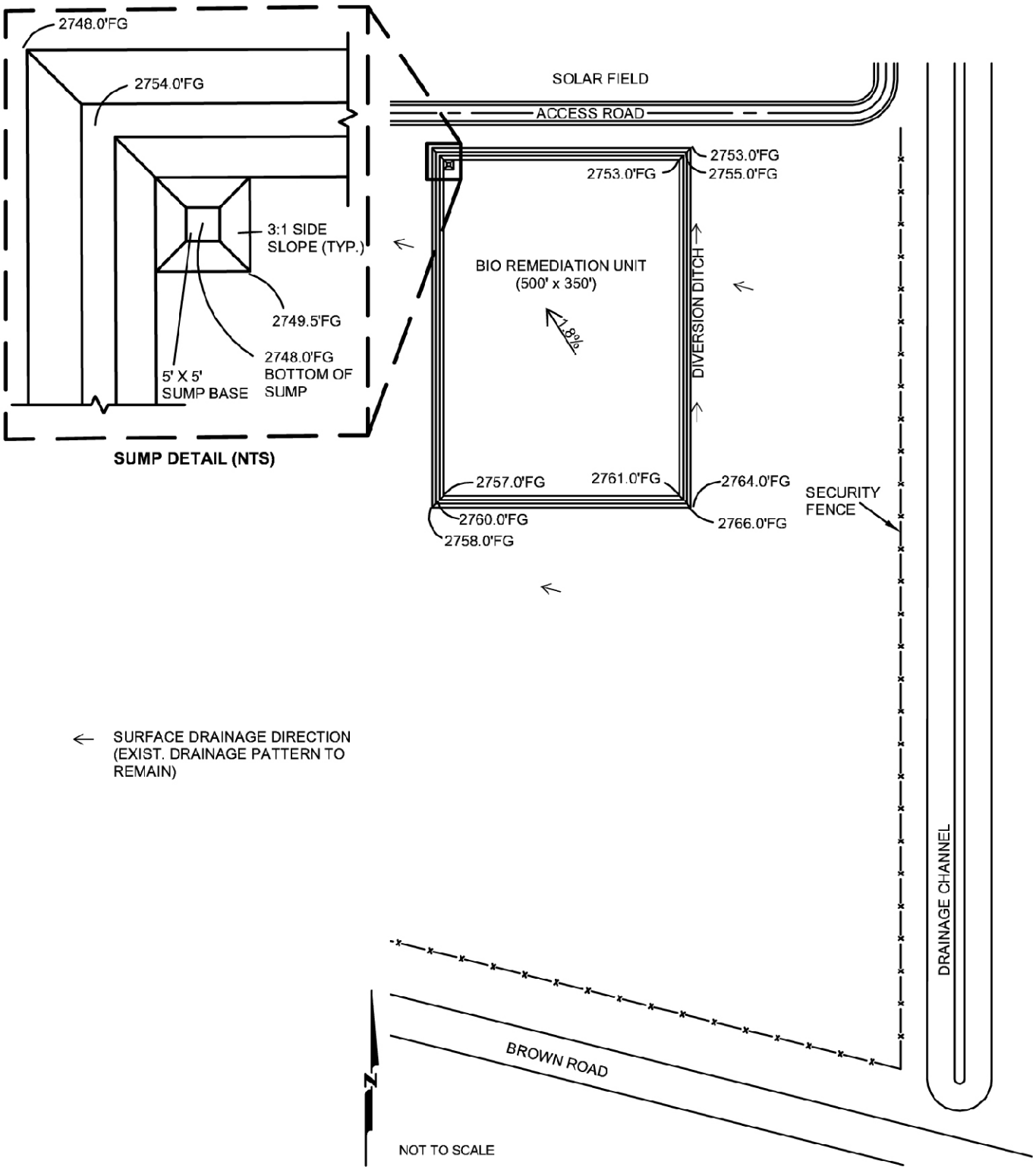

Map Location

Ridgecrest Solar Power Plant

Figure 10
Land Treatment Unit Details

Solar Millennium

AECOM

Project: 60139696
Date: January 2010

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Tables

Table 1: Site Climate Data

Month	Temperatures (1940 – 2008) (°F)					Number of Days			
	Monthly Averages			Record Extremes		Max. Temp.		Min. Temp.	
	Daily Max.	Daily Min.	Monthly	Record High	Record Low	90°F & Above	32°F & Below	32°F & Below	0°F & Below
Jan	59.6	30.7	45.2	80	1	0	0	18.5	0
Feb	64.9	34.6	49.7	86	9	0	0	11.4	0
Mar	70.4	38.8	54.6	93	15	0.1	0	5.5	0
Apr	77.8	44.5	61.2	100	24	2.9	0	1.6	0
May	87	52.9	69.9	108	26	13.3	0	0.1	0
Jun	96.8	60.5	78.6	117	38	25	0	0	0
Jul	102.7	66.2	84.5	119	46	30.8	0	0	0
Aug	101.3	64.6	82.9	114	45	30.2	0	0	0
Sep	94.2	58.1	76.2	110	35	22.9	0	0	0
Oct	83.3	48.2	65.8	105	20	7.8	0	0.4	0
Nov	69	37.3	53.1	88	14	0	0	7.8	0
Dec	59.7	30.3	45	84	5	0	0	20.3	0
Year[1]	80.6	47.2	63.9	119	1	1.77	0	0.87	0

1. Totals may not match the data in the columns due to rounding errors.
Source: WRCC 2009

Source Data Location: Inyokern, California

Table 2: Site Evaporation and Precipitation Data – Ridgecrest

Month	Rainfall (1940 – 2008) (Inches)			
	Mean	Highest Monthly	Lowest Monthly	Highest Daily
Jan	0.74	4.55	0	1.53
Feb	0.97	4.52	0	2.13
Mar	0.57	3.77	0	2.01
Apr	0.17	1.81	0	1.11
May	0.07	0.79	0	0.65
Jun	0.02	0.4	0	0.2
Jul	0.17	1.54	0	1.1
Aug	0.23	2.91	0	2.39
Sep	0.21	1.71	0	1.25
Oct	0.1	0.78	0	0.7
Nov	0.39	2.47	0	1.04
Dec	0.59	3.08	0	1.76
Year[1]	4.22	4.55	0.59	2.39

1. Totals may not match the data in the columns due to rounding errors.
Source: WRCC 2009.

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Published Evaporation (in)	0.00	4.65	6.45	9.97	13.59	15.33	17.21	16.00	11.83	8.28	4.76	3.52	111.59
Monthly Evaporation (in)	1.47	2.33	4.45	6.68	8.63	10.92	11.57	10.89	8.35	5.49	2.63	1.68	75.09

Notes:

Published evaporation is Class A Pan Evaporation
Source Data Location: Mojave, California (Evaporation) and Inyokern, California (Precipitation)

Table 3: Water Quality Data in the Indian Wells Valley Water District (all values reported in mg/L)

Analyte	IWVWD Wells[1]	Proposed Project Supply Wells[2]		
	General Water Quality	Well 18	Well 33	Well 34
Arsenic	0.0024 – 0.025	ND	ND	0.004
Bicarbonates (HCO_3)	87 – 150	150	140	140
Boron	0.180 – 1.20	0.26	0.29	0.29
Calcium	7.5 – 68	36	36	38
Chloride	21 – 210	25	30	31
Fluoride	0.43 – 1.20	0.94	0.73	0.62
Magnesium	ND	4.8	5.1	6.3
Nitrate (N)	6.5	1.7	1.8	2
Sodium	35 - 180	41	41	49
Sulfate	ND	43	43	46
Total Hardness ($CaCO_3$)	21 - 250	110	110	120
Total Dissolved Solids (TDS)	220 – 720	290	280	290
Uranium (in pCi/L)	2.1 – 6.1	NS	NS	NS
Gross Alpha Particle Activity (in pCi/L)	0.8 – 7.8	NS	NS	NS
Vanadium	ND - .04	0.014	0.012	0.016
pH	7.2 – 9.0	7.8	7.9	7.2

Key:
mg/L – milligrams per liter
ND – not detected at the practical quantitation limit shown
NS – not sampled
1. IWVWD, 2008.
2. Data provided by the IWVWD.

Table 4: Land Treatment Unit Runoff Sampling Parameters

Parameter	Unit
Biphenyl	mg/L
Diphenyl	mg/L

Table 5: Land Treatment Unit Soil Sample Analytical Parameters

Parameter	USEPA or Standard Method	Practical Quantitation Limit	Units
Biphenyl Oxide	8015M	1.0	mg/kg
Diphenyl Oxide	8015M	1.0	mg/kg

Table 6: Annual Groundwater Monitoring Parameters

Parameter	USEPA or Standard Method	PQL	Units
Arsenic	6020	0.5	mg/L
Boron	6020	0.5	mg/L
Calcium	200.7	0.5	mg/L
Chloride	300.0	0.5	mg/L
Fluoride	300.0	0.5	mg/L
Iron	200.7	0.5	mg/L
Magnesium	200.7	0.5	mg/L
Manganese	200.7	0.5	mg/L
Nitrate as Nitrogen	300.0	0.5	mg/L
Nitrite as Nitrogen	300.0	0.5	mg/L
Potassium	200.7	0.5	mg/L
Phosphate	365.3	0.03	mg/L
Selenium	200.7	0.5	mg/L
Sodium	200.7	0.5	mg/L
Sulfate	300.0	0.5	mg/L
TDS	SM 2450C	10	mg/L
Total Alkalinity (as CaCO3)	SM 2350B	1.0	mg/L
Biphenyl Oxide	8015M	1.0	mg/L
Diphenyl Oxide	8015M	1.0	mg/L

Key:
CaCO3 – calcium carbonate
mg/L – milligrams per liter
PQL – practical quantitation limit
SM – Standard Method
TDS – Total Dissolved Solids

Table 7: Quarterly Groundwater Monitoring Parameters

Parameter	USEPA or Standard Method	PQL	Units
Chloride	300.0	0.5	mg/L
Nitrate as Nitrogen	300.0	0.5	mg/L
Phosphate	365.3	0.03	mg/L
Sulfate	300.0	0.5	mg/L
Total Dissolved Solid	SM 2450C	10	mg/L
Biphenyl Oxide	8015M	1.0	mg/L
Diphenyl Oxide	8015M	1.0	mg/L
Static Water Depth	Field	+/- 0.1	feet bgs
pH reading	Field	+/- 0.1	pH units
Temperature	Field	+/- 0.1	°F or °C

Key:
mg/L – milligrams per liter
PQL – practical quantitation limit
SM – Standard Method

Appendix A

Basin Plan Compliance and Antidegradation Analysis

AECOM
Environment

Prepared for:
Solar Millennium, LLC

Basin Plan Compliance and Antidegradation Analysis

Ridgecrest Solar Power Project
Kern County, California

December 2009

60139694-5450-Antidegradation

AECOM
Environment

Prepared for:
Solar Millennium, LLC

Basin Plan Compliance and Antidegradation Analysis

Ridgecrest Solar Power Project
Kern County, California

Prepared By Carmen Caceres-Schnell

Reviewed By Michael Flack

Contents

1.0 Introduction 1-1

2.0 State and Federal Antidegredation Policy 2-1

3.0 Application of the State Antidegradation Policy 3-1

4.0 Compliance with Basin Plan Requirements for Surface Water 4-1

5.0 Lahontan Basin Plan Groundwater Requirements 5-1

6.0 Existing RSPP Groundwater Quality 6-1

7.0 Design and Operation of the RSPP Units 7-1

7.1 Land Treatment Unit 7-1

7.2 Management of Stormwater 7-1

7.3 Compliance with Basin Plan Groundwater Management Requirements 7-2

8.0 Compliance with the Antidegradation Objective for Groundwater 8-1

9.0 Conclusion 9-1

10.0 References 2

List of Tables

Table 1 Summary of Water Quality Data (all values reported in mg/L) 6-2

List of Acronyms

AFC	Application for Certification
Solar Millennium	Solar Millennium, LLC
BMP	Best Management Practice
RSPP	Ridgecrest Solar Power Project
CCR	California Code of Regulations
CDFG	California Department of Fish and Game
CFR	Code of Federal Regulations
CEC	California Energy Commission
cm/sec	centimeters per second
CQA	Construction Quality Assurance
CWC	California Water Code
DESCP	Drainage, Erosion and Sediment Control Plan
DTSC	Department of Toxic Substances Control
EPA	U.S. Environmental Protection Agency
HDPE	high-density polyethylene
HTF	heat transfer fluid
LTU	land treatment units
MCL	Maximum Contaminant Levels
MDL	Method Detection Limit
mg/kg	milligrams per kilograms
mg/L	milligrams per liter
PQL	Practical Quantitation Level
PRG	Preliminary Remediation Goal
ROWD	Report of Waste Discharge Requirements
RWQCB	Regional Water Quality Control Board
SWPPP	Stormwater Pollution Prevention Plans
TDS	total dissolved solid

1.0 Introduction

A Report of Waste Discharge Requirements (ROWD) application for the Ridgecrest Solar Power Project (RSPP or Project) is being submitted to the Lahontan Regional Water Quality Control Board (RWQCB) as part of the Project permitting requirements through the California Energy Commission (CEC). The ROWD application addresses the construction, operation, closure, and post closure of the land treatment unit (LTU) proposed for the RSPP in compliance with the regulations under California Code of Regulations (CCR) Title 27.

The requirement found in CCR Title 27, Section 21750, states the following;

> *The ROWD must incorporate an analysis of … how the Unit, including how any waste, if it escapes from the Unit, could affect the beneficial uses of groundwater bodies (including, but not limited to, any aquifers underlying the facility) and surface water bodies.*

Under the California Water Code (CWC) Section 13241, each RWQCB is required to establish water-quality control plans (Basin Plans) to ensure the reasonable protection of beneficial uses for Waters of the State including surface waters and groundwater. The Lahontan Region Basin Plan designates beneficial uses for surface and groundwaters within the Lohantan Region and establishes water quality objectives, waste discharge prohibitions, and other implementation measures to protect those beneficial uses. In compliance with the State of California's Nondegradation Policy, the Lahontan Basin Plan incorporates antidegradation requirements for surface and groundwater. In interpreting the requirements of CCR Title 27, Section 21750, the ROWD for the RSPP must be adequate to ensure the Project's compliance with the objectives and criteria of the Lahontan Basin Plan including antidegradation.

2.0 State and Federal Antidegredation Policy

The U.S. Environmental Protection Agency (EPA), Region IX, has issued detailed guidelines for implementation of Federal antidegradation regulations for surface waters in 40 Code of Federal Regulations (CFR) Section 131.12. The State antidegradation policy is titled the Statement of Policy with Respect to Maintaining High Quality Waters in California, codified in CCR Title 23, Section 2900, and is commonly known as “Resolution 68-16.” The State and Federal antidegradation policies are independently enforceable requirements, despite being referred to as policies.

Both the State and Federal antidegradation policies require that where surface waters are of higher quality than necessary to protect the designated beneficial uses, the high quality of those waters be maintained unless otherwise provided by the policies. Both policies require that certain findings be made before any adverse change to water quality can be permitted. The State Water Board has concluded that Resolution No. 68-16 incorporates the Federal antidegradation policy (see State Water Board Order No. WQ 2001-16, p. 19, fn 83).

Both the State and Federal antidegradation policies have been incorporated into the Lahontan Basin Plan as the nondegradation objective. The nondegradation objective applies to all waters of the Lahontan Region (including surface waters, wetlands, and groundwaters) and requires continued maintenance of existing high-quality waters. Whenever the existing quality of water is better that the quality of water established in the Basin Plan as objectives (both narrative and numerical), such existing quality shall be maintained unless appropriate findings are made under the policy.

3.0 Application of the State Antidegradation Policy

Under the State Nondegradation Objective, whenever the existing quality of water is better than that needed to protect all existing and probable future beneficial uses, the existing high quality shall be maintained until or unless it has been demonstrated to the State that any change in water quality will be consistent with the maximum benefit of the people of the State, and will not unreasonably affect present and probable future beneficial uses of such water.

Therefore, unless these conditions are met, background water quality concentrations (the concentrations of substances in natural waters which are unaffected by waste management practices or contamination incidents) are appropriate water quality goals to be maintained. If it is determined that some degradation is in the best interest of the people of California, some increase in pollutant level may be appropriate. However, in no case may such increases cause adverse impacts to existing or probable future beneficial uses of Waters of the State.

The State policy establishes a two-step process to determine if discharges that will degrade water quality are allowed. The first step requires that where a discharge will degrade high-quality water, the discharge may be allowed if any change in water quality:

1. Will be consistent with the maximum benefit to the people of the State,

2. Will not unreasonably affect present and anticipated beneficial uses of such water, and

3. Will not result in water quality less than that prescribed (e.g., by water quality objectives).

The second step is that any activities that result in discharge to high-quality waters are required to use the best practicable treatment or control necessary to avoid a pollution or nuisance and to maintain the highest water quality consistent with the maximum benefit to the people of the State.

The State antidegradation policy further establishes that if the discharge, even after treatment, unreasonably affects beneficial uses or does not comply with applicable provisions of Basin Plans, the discharge would be prohibited.

4.0 Compliance with Basin Plan Requirements for Surface Water

The construction, operation, and closure of the LTU will have no impact to surface water quality within the Project Site. The LTU will not discharge treated or untreated waste to surface waters or result in the discharge of pollutants to surface waters via stormwater runoff.

Surface waters at the site consist of El Paso Wash, an ephemeral wash currently bisecting the Project Site. El Paso Wash trends generally from the southeast to the northwest through the Southern Solar Field, across South Brown Road, then over the Northern Solar Field. El Paso Wash is a Waters of the State as defined under Section 13260 of the CWC and subject to the water quality requirements in the Colorado River Basin Plan. The U.S. Army Corps of Engineers issued a determination that El Paso Wash is not a navigable waters as defined under Section 404 of the Clean Water Act. A Streambed Alteration Agreement application for the re-routing of the wash around the Project Site was submitted to the California Department of Fish and Game (CDFG) on November 25, 2009. As a result of the wash diversion, the LTU will be isolated from storm water flows originating upgradient from the Project Site. In addition, a construction general and industrial stormwater permit will require the implementation of Stormwater Pollution Prevention Plans (SWPPPs) during construction and operation of the LTU. In addition, a construction general and industrial storm water permit will require the implementation of Storm water Pollution Prevention Plans (SWPPPs) and a CEC-mandated Drainage, Erosion, and Sediment Control Plan (DESCP) during construction and operation of the LTU. The SWPPP and DESCP will require implementation of Best Management Practices (BMP) to prevent the discharge of pollutants to storm water and will ensure that storm water runoff from the LTU will not cause degradation of the surface flows diverted around the facilities.

A Drainage, Erosion and Sediment Control Plan (DESCP) has been prepared and attached as Appendix L to the RSPP Application for Certification (AFC) which will address the requirements of CCR Title 27, Section 21600(b)(8)(F). The plan will describe the management and control of stormwater runoff at the Project Site and will specify the site-specific BMPs for erosion and sediment control that will include side slope protection of the berms surrounding the evaporation ponds.

The DESCP and wash diversion will ensure that stormwater run on and runoff will not damage the evaporation ponds and that accidentally releases due to erosion will not occur. Therefore, the LTU does not have the potential to impact or degrade surface water quality and no further analysis is required.

5.0 Lahontan Basin Plan Groundwater Requirements

The Lahontan Basin Plan incorporates narrative and numerical water quality objectives that apply to all ground and surface waters within the Lahontan Region. In general, where more than one objective is applicable, the stricter objective applies. The only exception to this requirement is where a region-wide objective has been superseded by the adoption of a site-specific objective by the regional board.

Beneficial uses designated by the Lahontan Basin Plan as applicable to the Indian Wells Valley Groundwater Basin include: municipal and domestic water supply, industrial process supply, agricultural supply, and freshwater replenishment to surface waters.

The Nondegradation Objective (State Board Resolution No. 68-16, “Statement of Policy with Respect to Maintaining High Quality of Waters in California”) is described in Chapter 3 of the Basin Plan and applies to groundwaters. Other water quality objectives for groundwater consist primarily of narrative objectives combined with a limited number of numerical objectives and are included in Chapter 3 of the Lahontan Basin Plan. The Basin Plan states that groundwaters shall not contain concentrations of bacteria, chemical constituents, radioactivity, or substances producing taste and odor in excess of the groundwater objectives described in Chapter 3. These objectives define the upper concentration or other limit that the regional board considers protective of beneficial uses. These objectives apply to all groundwaters, rather than to groundwaters only at a wellhead, at a point of consumption, or at point of application of discharge.

6.0 Existing RSPP Groundwater Quality

The Project site is located within Indian Wells Valley, which is in the southern end of the Basin and Range Province east of the Sierra Nevada, south of the Caso range, north of the El Paso Mountains, and west of the Argus Range. The Valley is characterized by a broad alluvial basin of Cenozoic-age sedimentary and volcanic material overlying older plutonic and metamorphic rocks. Quaternary lacustrine deposits are also found in the region as a result of playas in the northeastern portion of the valley. Surface water in the Indian Wells Valley drains from the surrounding mountains toward China Lake, a dry lake, which is located about 12 miles northeast of the Project site.

Groundwater beneath the Project and surrounding area is contained within the Indian Wells Valley Groundwater Basin. This basin encompasses an area of about 597 square miles (DWR 2004).

The groundwater quality in Indian Wells Valley varies throughout the Basin. According to the DWR report, TDS ranges from less than 600 mg/L to more than 1,000 mg/L. Analyses of water from ten public supply wells in the IWV Groundwater Basin show that TDS content ranges from 220 to 720 mg/L. In general, the highest quality water is in the deep aquifer (Groundwater Management Group 2008). TDS concentrations for wells in the IWV Groundwater Basin were mapped by the Indian Wells Valley Cooperative Groundwater Management Group. Groundwater considered to have the best quality (TDS of 500 mg/L or lower) is found in the southwestern part of the Valley and the western part of the Valley along the area of recharge.

A review of the water quality data for the IWV Groundwater Basin show that eight major types of groundwater quality occur in the Basin:

- Alpine waters, characteristically calcium-sodium-magnesium-bicarbonate. These are characteristic of the Sierra Nevada.
- Sodium-chloride waters, characteristic of China Lake, southeastern parts of the City of Ridgecrest, and the Coso Geothermal Area.
- Sodium-carbonate waters, principally occurring in the southwestern part of Indian Wells Valley.
- Sodium-bicarbonate waters, occurs in an extensive horseshoe-shaped area in the north and southwestern parts of the basin.
- Sodium-bicarbonate-chloride waters, east of the horseshoe area and may represent mixing of easterly moving groundwater with the groundwater of the China Lake Playa.
- Sulfate waters from geothermal areas, mineralized areas, and sewage pond seepage.
- Calcium-(sodium-magnesium)-bicarbonate-chloride-sulfate waters, these water probably represent a mixture of Alpine and Coso geothermal waters.
- “Waters of the well fields. Usually sodium-calcium, but sometimes calcium-sodium-bicarbonate-chloride waters. These water could represent Alpine waters concentrated by ET mixed with sodium chloride geothermal leakage”.

A review of the water quality data for the ten wells pumped for the IWVWD water supply shows the following:

- TDS concentrations (280 to 5,640 mg/L) generally exceeded the recommended standard of 500 mg/L, for a drinking water resource in California.
- Arsenic was reported in general water quality data for 2008 at concentrations between 0.0024 – 0.025 mg/L. Some concentrations exceeded the primary State and Federal Maximum Contaminant

Level (MCL) for Arsenic (0.010 mg/L). The IWVWD began compliance testing for arsenic in December 2007. At that time, three wells were placed on quarterly monitoring. Two wells violated the MCL based on samples collected in March, July, and October 2008. Arsenic is a naturally occurring element commonly found in drinking water sources in California.

- Boron concentrations range from 0.18 mg/L to 1.2 mg/L. Boron was reported in two District wells at concentrations of 1.2 mg/L and 1.1 mg/L. The Action Level for boron is 1.0 mg/L. The Action Level is the concentration of a contaminant which, if exceeded, triggers treatment or other requirements that a water system must follow.

The IWVWD serves the City of Ridgecrest and the surrounding areas. Ten wells are pumped by the IWVWD for their water supply and these wells are tested on regularly for the presence of radioactive, biological, inorganic volatile organic, and synthetic organic compounds. The results of the 2008 Annual Water Quality Report are presented on Table 5.17-6. Table 5.17-6 also presents the analytical results for three wells that are proposed to be pumped for the Project water supply and are located approximately four miles from the center of the Project site. Given the long screen interval for these wells, these data likely represent an average water quality of the more permeable sediments over the screen interval.

Table 1 Summary of Water Quality Data
(all values reported in mg/L)

Analyte	IWVWD Wells[1]	Proposed Project Supply Wells[2]		
	General Water Quality	Well 18	Well 33	Well 34
Arsenic	0.0024 – 0.025	ND	ND	0.004
Bicarbonates (HCO_3)	87 – 150	150	140	140
Boron	0.180 – 1.20	0.26	0.29	0.29
Calcium	7.5 – 68	36	36	38
Chloride	21 – 210	25	30	31
Fluoride	0.43 – 1.20	0.94	0.73	0.62
Magnesium	ND	4.8	5.1	6.3
Nitrate (N)	6.5	1.7	1.8	2
Sodium	35 - 180	41	41	49
Sulfate	ND	43	43	46
Total Hardness ($CaCO_3$)	21 - 250	110	110	120
Total Dissolved Solids (TDS)	220 – 720	290	280	290
Uranium (in pCi/L)	2.1 – 6.1	NS	NS	NS
Gross Alpha Particle Activity (in pCi/L)	0.8 – 7.8	NS	NS	NS
Vanadium	ND - .04	0.014	0.012	0.016
pH	7.2 – 9.0	7.8	7.9	7.2

Key:
mg/L – milligrams per liter
ND – not detected at the practical quantitation limit shown
NS – not sampled
1. IWVWD, 2008.
2. Data provided by the IWVWD

7.0 Design and Operation of the RSPP Units

7.1 Land Treatment Unit

The LTU will cover an area of approximately 400 feet by 800 feet and will consist of a bioremediation unit and a land treatment unit. Bioremediation will be used for soils with concentrations less than 10,000 milligrams per kilogram (mg/kg) of heat transfer fluid (HTF) and land treatment for soils with concentrations below 1,000 mg/kg of HTF. The California Department of Toxics Substances Control (DTSC) has determined that soil contaminated with HTF is classified as a non-hazardous waste. A copy of the DTSC determination letter is included in Appendix D to the RSPP ROWD.

The LTU will not incorporate a liner containment system or leak detection and removal system, but will be constructed with a prepared base consisting of a minimum of 2 feet of compacted, low permeability, lime-treated native material. This base will serve as a competent platform for land treatment activities, and will serve to slow the rate of surface water infiltration in the treatment area. The compacted and native soil beneath the LTU is designated as a “treatment zone” to a depth of 5 feet. Although the land treatment will be taking vehicle traffic, no hard surface will be required, as there is no liner system to protect.

The LTU will be surrounded on all sides by a 2-foot high compacted earthen berm with side slopes of approximately 3:1 (horizontal: vertical). These berms will control and prevent potential inflow (run on) of surface stormwater into the LTU or runoff of stormwater from the unit.

The design details, layout, and topography of the LTU are shown in Figures 8, 9, and 11 of the ROWD.

ROWD Figure 9, Land Treatment Area Section and Details, includes a cross section and construction details of the LTU. Additional details on the construction, operation, and maintenance of the LTU are provided in Section 7.4 of the ROWD. The LTU will be constructed in accordance with a CQA program in compliance with CCR Title 27 requirements.

The 2-foot thick compacted low permeability material and the 5 feet of “treatment zone” soil beneath the LTU will be adequate to prevent the migration of HTF to groundwater. In addition, implementation of the DESCP and storm water permit SWPPPs will prevent the discharge of contaminated soil to stormwater. Based on the proposed design, operation, and maintenance of the LTU, no degradation of surface or groundwater will occur.

7.2 Management of Stormwater

Releases or spills from damage caused by stormwater run on or runoff could result in degradation of surface and groundwater. However, measures to address the impacts of stormwater and erosion have been incorporated into the design of the Project. As part of the stormwater management for the site, Solar Millennium will re-route the current El Paso and two unnamed washes that run through the Project Site. The washes will be rerouted around the southern (Channel 1) and eastern (Channel 3) boundaries, and through the center of the Project (Channel 2), effectively diverting stormwater run on away from the LTU.

As described in the DESCP prepared for the Project, the diversions will be designed to handle a 100-year flood event and for flows of up to 6.7 feet per second (ft/s) for Channel 1, 10.1ft/s for Channel 2, and 11.7 ft/s for Channel 3. The constructed stormwater management facilities and BMPs are described in Section 9 of the ROWD.

7.3 Compliance with Basin Plan Groundwater Management Requirements

Releases from the LTUs in the form of leaks and spills would have the potential to impact groundwater quality in the underlying vadose zone or aquifers. The discharge of pollutants to the sub-surface would result in the degradation of potentially high-quality groundwaters and would be in violation of the antidegradation objective in the Lahontan Basin Plan. However, the compacted “treatment zone” of the LTU will be constructed and operated according to the CQA. Proper operation and maintenance of the facilities according to the CQA will prevent the discharge of pollutants to the vadose zone and underlying aquifer.

The ROWD application submitted by Solar Millennium complies with the groundwater management requirements for waste management units stated in Chapter 4 of the Basin Plan. Chapter 4 includes the specific requirements under CCR Title 27 and additional monitoring and reporting requirements to ensure compliance with Basin Plan groundwater quality objectives. As required under Chapter 4 of the Basin Plan, a Detection Monitoring Program that includes a groundwater monitoring plan has been submitted with the ROWD. The groundwater monitoring plan will provide sufficient lycimeters to provide the earliest possible detection of a release in the vadose zone from the LTUs. In addition, the ROWD incorporates preliminary closure plans and preliminary post-closure monitoring and maintenance plans in addition to a financial assurance that adequate funds will be irrevocably committed by Solar Millennium to ensure that the Project will be properly reclaimed and maintained.

8.0 Compliance with the Antidegradation Objective for Groundwater

Solar Millennium will meet the Step One demonstration requirements of the Basin Plan antidegradation objective in that operation of the Project:

1. Will be consistent with the maximum benefit to the people of the State in providing a clean, renewable source of energy;

2. Will not unreasonably affect the present and anticipated beneficial uses of groundwater within the Indian Wells Valley Groundwater Basin; and

3. Will not result in water quality less than that prescribed (e.g., by water quality objectives) based on the application of engineered liner systems, BMPs and the CQA program.

The Project has provided detailed information in the ROWD regarding the design of the compacted "treatment zone" underlying the LTU. The "treatment zone" will comply with Title 27 requirements to ensure that no releases occur to groundwater. Additionally, proper installation, operation, and maintenance of the Project will be assured by application of the CQA. Proper closure and post closure procedures will eliminate any long-term impacts to groundwater quality. This information is adequate to provide adequate documentation for Step 2 of the antidegradation demonstration.

9.0 Conclusion

Based on the above demonstrations, this analysis concludes that operation of the LTU will comply with the requirements of the Lahontan Basin Plan and will not result in degradation of existing high-quality groundwater.

10.0 References

Solar Millennium, LLC, 2009. Application for Certification, Ridgecrest Solar Power Project (RSPP). Submitted to the California Energy Commission. September.

California Department of Water Resources (DWR), 2009. Groundwater Level Data and Water Quality Data. Accessed at http://well.water.ca.gov.

DWR, 2004. Indian Wells Valley Groundwater Basin, California's Groundwater Bulletin 118, 1975 (updated in February 2004).

RWQCB, 1994. Water Quality Control Plan for the Lahontan Region, North and South Basin: California Regional Quality Control Board, Lahontan Region, Victorville, California.

Appendix B

Material Safety Data Sheets for HTF

Solutia Inc.

Material Safety Data Sheet

1. PRODUCT AND COMPANY IDENTIFICATION

Product name: THERMINOL® VP1 Heat transfer fluid

Reference Number: 000000000211 Date: 05/16/2006

Company Information:

United States:
Solutia Inc.
575 Maryville Center Drive, P.O. Box 66760
St. Louis, MO 63166-6760
Emergency telephone: Chemtrec: 1-800-424-9300
International Emergency telephone: Chemtrec: 703-527-3887
Non-Emergency telephone: 1-314-674-6661

Canada:
Solutia Canada Inc.
6800 St. Patrick Street
LaSalle, PQ H8N 2H3
Emergency telephone: CANUTEC: 1-613-996-6666
Non-Emergency telephone: 1-314-674-6661

Mexico:
Solutia MEXICO, S. DE R.L. DE C.V.
Prol. Paseo de la Reforma 2654
Local 501, Piso-5
Col. Lomas Altas
11950 Mexico, D.F.
Emergency telephone: SETIQ: (in Mexico) 01-800-002-1400
Non-Emergency telephone: (in Mexico) 01-55-5259-6800

Brazil:
Solutia Brazil Ltd.
Avenue Carlos Marcondes, 1200
CEP: 12241-420-São José dos Campos/SP-Brazil
Emergency telephone: 55 12 3932 7100 (PABX)
Non-Emergency telephone: 55 11 3365 1800 (PABX)

2. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

Form: liquid
Colour: clear to colourless
Odour: characteristic

WARNING STATEMENTS

WARNING!
Causes eye irritation
Causes skin irritation
Causes respiratory tract irritation
Contains material which can cause liver and nerve damage

POTENTIAL HEALTH EFFECTS

Likely routes of exposure:	eye and skin contact inhalation
Eye contact:	Highly irritating to eyes.
Skin contact:	Highly irritating to skin. Prolonged or repeated skin contact may result in irritant dermatitis.
Inhalation:	Severely irritating if inhaled. No more than slightly toxic if inhaled. Significant adverse health effects are not expected to develop under normal conditions of exposure.
Ingestion:	No more than slightly toxic if swallowed. Significant adverse health effects are not expected to develop if only small amounts (less than a mouthful) are swallowed.
Signs and symptoms of overexposure:	headache fatigue nausea/vomiting indigestion abdominal pain tremors
Target organs/systems:	May cause liver damage May cause nerve damage

Refer to Section 11 for toxicological information.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Components	CAS No.	Average concentration	Concentration range	Units
diphenyl ether	101-84-8	73.5		%
biphenyl	92-52-4	26.5		%

4. FIRST AID MEASURES

If in eyes:	Immediately flush with plenty of water for at least 15 minutes. If easy to do, remove any contact lenses. Get medical attention. Remove material from skin and clothing.
If on skin:	Immediately flush the area with plenty of water. Remove contaminated clothing. Wash skin gently with soap as soon as it is available. Get medical attention. Wash clothing before reuse.
If inhaled:	Remove patient to fresh air. If not breathing, give artificial respiration. If breathing is difficult give oxygen. Remove material from eyes, skin and clothing.

If swallowed: Immediate first aid is not likely to be required.
A physician or Poison Control Center can be contacted for advice.
Wash heavily contaminated clothing before reuse.

5. FIRE FIGHTING MEASURES

Fire point: 127 C

Hazardous products of combustion: carbon monoxide (CO); carbon dioxide; hydrocarbons

Extinguishing media: Water spray, foam, dry chemical, or carbon dioxide

Unusual fire and explosion hazards: None known

Fire fighting equipment: Firefighters, and others exposed, wear self-contained breathing apparatus. Equipment should be thoroughly decontaminated after use.

Miscellaneous advice: This product is not classified as a fire-resistant heat transfer fluid. Precautions to avoid sources of ignitions should be taken.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions: Use personal protection recommended in section 8.

Environmental precautions: Keep out of drains and water courses.

Methods for cleaning up: Contain large spills with dikes and transfer the material to appropriate containers for reclamation or disposal. Absorb remaining material or small spills with an inert material and then place in a chemical waste container. Flush spill area with water.

Refer to Section 13 for disposal information and Sections 14 and 15 for reportable quantity information.

7. HANDLING AND STORAGE

Handling
Avoid contact with eyes, skin and clothing.
Avoid breathing vapour or mist.
Keep container closed.
Use with adequate ventilation.
Wash thoroughly after handling.
Precautions against ignitions and fire should be taken with this product.
Heat transfer fluids are intended for INDIRECT heating purposes ONLY.
This product has not been approved for food grade use.

Emptied containers retain vapour and product residue. Observe all recommended safety precautions until container is cleaned, reconditioned or destroyed. Do not cut, drill, grind or weld on or near this container. The reuse of this material's container for non industrial purposes is prohibited and any reuse must be in consideration of the data provided in this material safety data sheet.

Storage
General: Stable under normal conditions of handling and storage.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Airborne exposure limits: (ml/m3 = ppm)

THERMINOL® VP1	No specific occupational exposure limit has been established.
biphenyl	ACGIH TLV: 0.2 ml/m3 ; mist ; 8-hr TWA OSHA PEL: 0.2 ml/m3 ; 1.0 mg/m3 ; ; 8-hr TWA Mexican OEL: 0.2 ml/m3 ; 1.5 mg/m3 ; ; 8-hr TWA Mexican OEL: 0.6 ml/m3 ; 4 mg/m3 ; ; 15-min STEL
diphenyl ether	ACGIH TLV: 1 ml/m3 ; ; 8-hr TWA ACGIH TLV: 2 ml/m3 ; ; 15-min STEL OSHA PEL: 1 ml/m3 ; 7 mg/m3 ; ; 8-hr TWA Mexican OEL: 1 ml/m3 ; 7 mg/m3 ; ; 8-hr TWA Mexican OEL: 2 ml/m3 ; 14 mg/m3 ; ; 15-min STEL

Eye protection:	Wear safety goggles. Have eye flushing equipment available.
Hand protection:	Wear chemical resistant gloves. Consult the glove/clothing manufacturer to determine the appropriate type glove/clothing for a given application. See Solutia Glove Facts for permeation data.
Body protection:	Wear suitable protective clothing. Consult the glove/clothing manufacturer to determine the appropriate type glove/clothing for a given application. Wear full protective clothing if exposed to splashes. Wash contaminated skin promptly. Launder contaminated clothing and clean protective equipment before reuse. Wash thoroughly after handling. Have safety shower available at locations where skin contact can occur.
Respiratory protection:	Avoid breathing vapour or mist. Use approved respiratory protection equipment (full facepiece recommended) when airborne exposure limits are exceeded. If used, full facepiece replaces the need for face shield and/or chemical goggles. Consult the respirator manufacturer to determine the appropriate type of equipment for a given application. Observe respirator use limitations specified by the manufacturer.
Ventilation:	Provide natural or mechanical ventilation to control exposure levels below airborne exposure limits. If practical, use local mechanical exhaust ventilation at sources of air contamination such as processing equipment.

Components referred to herein may be regulated by specific Canadian provincial legislation. Please refer to exposure limits legislated for the province in which the substance will be used.

9. PHYSICAL AND CHEMICAL PROPERTIES

Flash point:	110 C	Pensky-Martens closed tester
	124 C	Cleveland Open Cup

Autoignition temperature:	612 C	ASTM D-2155
Density:	1.06 g/cm3 @ 25 C	
Boiling point :	257 C	
Crystallising point :	12 C	
Water solubility:	~25 mg/l	

NOTE: These physical data are typical values based on material tested but may vary from sample to sample. Typical values should not be construed as a guaranteed analysis of any specific lot or as specifications for the product.

10. STABILITY AND REACTIVITY

Conditions to avoid:	All sources of ignition.
Materials to avoid:	Contact with strong oxidizing agents.
Hazardous reactions:	Hazardous polymerization does not occur.
Hazardous decomposition products:	None known;

11. TOXICOLOGICAL INFORMATION

This product has been tested for toxicity. Results from Solutia sponsored studies or from the available public literature are described below.

Acute animal toxicity data

Oral:	LD50 , rat, 2,050 mg/kg , No more than slightly toxic
Dermal:	LD50 , rabbit, > 5,010 mg/kg , Practically nontoxic after skin application in animal studies.
Inhalation:	LC50 , rat, 2.66 mg/l , 4 h, Toxic based on animal inhalation exposure studies.
Skin irritation:	rabbit , Slightly irritating to skin., 24 h
Repeat dose toxicity:	rat, , inhalation, 13 weeks, , Produced effects on body weight, serum enzymes and/or organ weights in repeat dose studies.
Repeat dose toxicity:	rat, , gavage, 26 weeks, , Produced effects on body weight, serum enzymes and/or organ weights in repeat dose studies. Effects only observed at very high dose levels.
Target organs affected	kidneys, liver, spleen
Repeat dose toxicity:	rat, , diet, subchronic, , Repeated oral exposure produced liver and kidney changes in animal models.
Target organs affected	liver, kidneys
Developmental toxicity:	rat, gavage, , No effects on offspring observed in laboratory animals in the presence of maternal toxicity.

Mutagenicity: No genetic effects were observed in standard tests using bacterial and animal cells.

Components

Data from Solutia studies and/or the available scientific literature on the components of this material which have been identified as hazardous chemicals under the criteria of the OSHA Hazard Communication Standard (29 CFR 1910.1200) or the Canadian Hazardous Products Act are discussed below.

biphenyl	Chronic exposure has been reported to cause headache, fatigue, nausea, indigestion, abdominal pain, tremor, central and peripheral nerve damage and liver injury. Slightly toxic following oral administration. Practically nontoxic after skin application in animal studies. Practically non irritating to skin (rabbit). Slightly irritating to eyes (rabbit). No mortality or signs of toxicity at the highest level achievable. Irritating to respiratory system in animal models. Produced effects on body weight, serum enzymes and/or organ weights in repeat dose studies. Produced no dermal sensitization (guinea pigs). No effects on offspring observed in laboratory animals in the presence of maternal toxicity. No genetic effects were observed in standard tests using bacterial and animal cells.
diphenyl ether	Predictive patch testing on human volunteers did not produce irritation or sensitization. Slightly toxic following oral administration. Practically nontoxic after skin application in animal studies. Slightly irritating to eyes (rabbit). Slightly irritating to skin (rabbit). Repeated exposure produced respiratory tract irritation in animal models. Repeated exposure produced eye irritation in animal models. No genetic effects were observed in standard tests using bacterial and animal cells.

12. ECOLOGICAL INFORMATION

Environmental Toxicity

Invertebrates	48 h, EC50	Water flea (Daphnia magna)	2.4 mg/l
Fish:	96 h, LC50	Rainbow trout (Oncorhynchus mykiss)	7.6 mg/l
	96 h, LC50	Fathead minnow (Pimephales promelas)	24 mg/l
Algae:	96 h, EC50	Algae (Selenastrum capricornutum)	1.3 mg/l

Biodegradation Modified SCAS (OECD 302A) Primary degradation 99 %

13. DISPOSAL CONSIDERATIONS

US EPA RCRA Status: This material when discarded may be a hazardous waste as that term is defined by the Resource Conservation and Recovery Act (RCRA), 40 CFR 261.24, due to its toxicity characteristic. This material should be analyzed in accordance with Method 1311 for the compound(s) below.

US EPA RCRA D018 Compound/Characteristic: BENZENE

hazardous waste number:

Disposal considerations: Incineration

Miscellaneous advice: This product meets the criteria for a synthetic used oil under the U.S. EPA Standards for the Management of Used Oil (40 CFR 279). Those standards govern recycling and disposal in lieu of 40 CFR 260 -272 of the Federal hazardous waste program in states that have adopted these used oil regulations. Consult your attorney or appropriate regulatory official to be sure these standards have been adopted in your state. Recycle or burn in accordance with the applicable standards.
Solutia operates a used fluid return program for certain fluids under these used oil standards. Contact your Sales Representative for details.
This product should not be dumped, spilled, rinsed or washed into sewers or public waterways.

14. TRANSPORT INFORMATION

The data provided in this section is for information only. Please apply the appropriate regulations to properly classify your shipment for transportation.

US DOT

Proper shipping name:	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. *biphenyl*
Hazard Class:	9
Hazard Identification number:	UN3082
Packing Group:	Packing Group III
Transport label:	Class 9
Special provisions:	This material meets the definition of a marine pollutant.
Other:	Applies ONLY to containers with an RQ or for shipments in bulk via water transportation.

Canadian TDG

Other:	Not regulated for transport.

Reportable Quantity/Limit

US DOT RQ 100 lb *biphenyl*
Package size containing reportable amount: 377 lb

ICAO/IATA Class

Other:	See DOT Information

15. REGULATORY INFORMATION

All components are in compliance with the following inventories:	U.S. TSCA, EU EINECS, Canadian DSL, Australian AICS, Korean, Japanese ENCS, Phillipine PICCS, Chinese
Canadian WHMIS classification:	D2(A) - Materials Causing Other Toxic Effects D2(B) - Materials Causing Other Toxic Effects

SARA Hazard Notification:

Hazard Categories Under Title III Rules (40 CFR 370):	Immediate Delayed

Section 302 Extremely Hazardous Substances:	Not applicable
Section 313 Toxic Chemical(s):	biphenyl

CERCLA Reportable Quantity:

100 lbs biphenyl
For this/these chemicals, release of more than the Reportable Quantity to the environment in a 24 hour period requires notification to the National Response Center (800-424-8802 or 202-426-2675).

This product has been classified in accordance with the hazard criteria of the Canadian Controlled Products Regulation and the MSDS contains all the information required by the Canadian Controlled Products Regulation.

Refer to Section 11 for OSHA/HPA Hazardous Chemical(s) and Section 13 for RCRA classification.

Safety data sheet also created in accordance with Brazilian law NBR 14725

16. OTHER INFORMATION

Product use: Heat transferring agents

Reason for revision: Significant changes to the following section(s):, Section 1

	Health	Fire	Reactivity	Additional Information
Suggested NFPA Rating	2	1	0	
Suggested HMIS Rating:	2	1	0	G

Prepared by the Solutia Hazard Communication Group. Please consult Solutia @ 314-674-6661 if further information is needed.

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Appendix C

DTSC Classification of HTF-Contaminated Soil

STATE OF CALIFORNIA - ENVIRONMENTAL PROTECTION AGENCY

PETE WILSON, Governor

PARTMENT OF TOXIC SUBSTANCES CONTROL
400 P Street, 4th Floor
P O Box 806
Sacramento, CA 95812-0806
(916) 327-2500

April 4, 1995

Mr. David M. Rib, Manager of Regulatory Affairs
KJC Operating Company
41100 Highway 395
Boron, CA 93516

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)

Dear Mr. Rib:

The Office of Scientific Affairs, Department of Toxic Substances Control (Department) has completed its review of the information submitted to the Department by you on behalf of the KJC Operating Company. The information was submitted in support of a petition to reclassify soil contaminated with a heat transfer fluid (HTF) known as Therminol as nonhazardous pursuant to 22 CCR section 66260.200(f). Based on our review of all the analytical data and information submitted, the Department finds that the Therminol-contaminated soil possesses mitigating physical and chemical characteristics which render it insignificant as a hazard to human health and safety, livestock, and wildlife. The Department, therefore, classifies the Therminol-contaminated soil as nonhazardous.

Background

The KJC Operating Company (KJC) facility, located in Boron, California, encompasses approximately 160 acres where a series of parabolic mirror troughs called Solar Collecting Assemblies (SCAs) are configured into multiple rows to form a solar field. The HTF, a synthetic material whose composition is a mixture of 26.5% biphenyl and 73.5% diphenyl oxide, is circulated through heat collection elements positioned at the focal point of each of the SCAs. The HTF is heated to between 650 and 735 degrees fahrenheit and, through a series of heat exchangers, generates steam for power production.

Occasional accidental or incidental spills or leaks of HTF result in contamination of the soils beneath the point of leakage. When these occur, the HTF-contaminated soils are excavated and transported to a central storage area. Historically, these HTF-contaminated soils were typically disposed of off-site into a Class I waste landfill. However, alternative treatment technologies have been explored for the management of this waste, the most recent being an on-site bioremediation facility. An estimated 500 cubic yards of HTF-contaminated sandy soil is generated per year. The average concentration of HTF in these contaminated soils ranges between 3,000 and 10,000 ppm.

Department's position that the test results demonstrate that the mitigating property is the much lower vapor pressure at the maximum ambient temperature, which will result in greatly reduced inhalation exposure than the theoretical value. Therefore, the Department grants your request for reclassification of the spilled Therminol as nonhazardous based on the information you previously submitted.

Conclusion

Based on the review of the analytical data and information provided, the Department finds that the HTF contaminated soils poses an insignificant hazard and classifies the waste as nonhazardous pursuant to 22 CCR section 66260.200(f). The Department's formal decision as outlined in this letter is contingent on the accuracy and representativeness of the analytical data and information provided to the Department for review. Furthermore, the nonhazardous classification granted in this letter is not to be construed as an approval by the Department to leave the HTF-contaminated soil on the site or for any other uses. Waste classification determines whether a waste must be managed and disposed of as a hazardous waste in accordance with Chapter 6.5, Division 20, of the California Health and Safety Code.

Irrespective of the Department's classification decision outlined in this letter, the management and disposal of the HTF-contaminated soils are subject to the requirements of the respective Regional Water Quality Control Board and other state, federal, or local agencies who have regulatory jurisdiction in this matter. It is the Department's understanding that the California Energy Commission, Energy Facilities Siting and Environmental Protection Division will also be providing direct oversight to insure that the HTF-contaminated soils will be managed and disposed of properly.

Should you have any questions regarding this classification letter, you may contact me at the letterhead address and telephone number. Classification of heat transfer fluid, ref: your letter of February 14, 1995.

Sincerely,

James C. Carlisle

James C. Carlisle, DVM, MSc
Waste Evaluation Unit
Office of Scientific Affairs

cc: Jeffrey J. Wong, PhD
Science Advisor to the Director

Sharon Fair
Surveillance and Enforcement, Region 4

Ronald Pilorin
Waste Evaluation Unit
Office of Scientific Affairs

Appendix D

Corrective Action Plan

AECOM
Environment

Prepared for:
Ridgecrest Solar 1, LLC

Corrective Action Plan
Ridgecrest Solar Power Project
Kern County, California
Appendix D of the Application/Report of Waste Discharge

January 2010

60139696-5450 - CAP

AECOM
Environment

Prepared for:
Ridgecrest Solar 1, LLC

Corrective Action Plan
Ridgecrest Solar Power Project
Kern County, California
Appendix D of the Application/Report of Waste Discharge

Prepared By Carmen Caceres-Schnell, PG

Reviewed By Roy Hauger, PE

Contents

1.0 Introduction 1-1

1.1 Purpose 1-1

1.2 Site Background 1-1

1.3 Waste Handling Facilities 1-2

1.3.1 On-site Land Treatment Unit 1-2

2.0 Corrective Action Plan Standards 2-1

3.0 Corrective Action Plan 3-1

3.1 Vadose Zone Corrective Actions 3-1

3.1.1 Land Treatment Unit 3-1

4.0 Reporting 4-1

5.0 References 5-1

List of Appendices

Appendix A Corrective Action Cost Estimates

List of Tables

Table 1 Land Treatment Unit Wastewater Sampling Parameters 3
Table 2 Land Treatment Unit Soil Sample Analytical Parameters 3

List of Figures

Figure 1 Regional Location and Vicinity Map
Figure 2 Site Plan
Figure 3 Land Treatment Unit Details
Figure 4 Cross Section Details of the Land Treatment Unit

List of Acronyms

BLM	Bureau of Land Management
CAP	Corrective Action Plan
CCR	California Code of Regulations
CMP	Corrective Measures Program
COC	constituents of concern
DMP	Detection Monitoring Program
DTSC	Department of Toxic Substances Control
EMP	Evaluation Monitoring Program
°F	degrees Fahrenheit
HTF	heat transfer fluid
LTU	land treatment unit
mg/kg	milligrams per kilograms
Project	Ridgecrest Solar Power Project
ROW	Right-of-Way
ROWD	Report of Waste Discharge
RWQCB	Regional Water Quality Control Board
SSG	solar steam generator
STG	steam turbine generator

1.0 Introduction

Ridgecrest Solar 1 LLC (formerly Solar Millennium LLC) is proposing to construct, own, and operate the Ridgecrest Solar Power Project (herein "Project"). The Project is a concentrated solar thermal electric generating facility located in the high northern Mojave Desert in northeastern Kern County, California, about five miles southwest of the City of Ridgecrest, California. The Project right-of-way (ROW), for which a ROW grant sought by Solar Millennium from the Bureau of Land Management (BLM), will extend across approximately 3,995 acres of public lands owned by the Federal government. The Project facilities will occupy 1,440 acres of the 3,995-acre site, and there will be a total disturbance area (including areas outside the facility fence line), of approximately 1,944 acres. The Project will use well-established parabolic trough solar thermal technology to produce electrical power using a steam turbine generator (STG) fed from a solar steam generator (SSG). The SSG receives heat transfer fluid (HTF) from solar thermal equipment comprised of arrays of parabolic mirrors that collect energy from the sun.

Ridgecrest Solar 1 proposes to use a land treatment unit (LTU) as part of the Project. The LTU is the facility that receives and temporarily stores soil contaminated with HTF released from the process to the environment. This Corrective Action Plan (CAP) was developed as part of the Report of Waste Discharge (ROWD) application for the proposed Project.

1.1 Purpose

The monitoring requirements for the Project's waste facilities are specified under California Code of Regulations (CCR) Title 27 Chapter 3, Subchapter 3, Article 1, Sections 20380 through 20435 (CCR Title 27, Sections 20380 through 20435). Article 1 includes provisions for a Corrective Measures Plan (CMP) (CCR Title 27, Section 20385). The objective of the CMP is to ensure the constituents of concern (COCs) achieve their respective concentration limits at all monitoring points and throughout the zone affected by the release, including any portions thereof that extend beyond the facility boundary, by removing the waste constituents or treating them in place.

This document describes the elements of the CAP and is considered to be a stand-alone document that supplements other elements of the ROWD application including the LTU Construction Engineering Design Package, the Construction Quality Assurance Plan, the Detection Monitoring Program (DMP), and the Closure Plan for the LTU.

1.2 Site Background

The Project is a concentrating solar electric generating facility proposed on an approximately 3,995-acre site in Kern County, California (see **Figure 1**). The Project will have a nominal electrical output of 250 megawatts (MW) and commercial operation is planned to commence by the third quarter of 2013, subject to timing of regulatory approvals and Applicant achievement of project equipment procurement and construction milestones. The solar thermal technology will provide 100 percent of the power generated by the Project; no supplementary energy source (e.g., natural gas to generate electricity at night) is proposed to be used for electric energy production. The Project will utilize two auxiliary boilers fueled by propane gas to reduce startup time and for HTF freeze protection. The auxiliary boilers will supply steam to the HTF freeze protection heat exchangers during nighttime hours to keep the HTF in a liquid state when ambient temperatures are not sufficient to keep the temperature of the HTF above its relatively high freezing point (54 degrees Fahrenheit [°F]). The propane gas will be delivered to the site via delivery truck. The Project will also have a diesel-fueled fire water pump for fire protection.

The Project proposes to use dry cooling for power plant cooling. Water for process water makeup and other industrial uses such as mirror washing will be supplied by the local municipal water district via a new

pipeline. This source will also be used to supply water for employee use (e.g., drinking, showers, sinks, and toilets). Water received from the Indian Wells Valley Water District (IWVWD) will meet the requirements of the California Department of Health Services for potable water supplies and will not require further treatment for this purpose. Power cycle makeup, mirror washing water, and cooling of ancillary equipment will require onsite treatment for reduction of dissolved solids, and this treatment varies according to the quality required for each of these uses. A sanitary septic system and on-site leach field will be used to dispose of sanitary wastewater.

The power generation cycle will not produce cooling tower blowdown because the plant will be dry cooled. The power plant unit includes two cooling systems: 1) an air-cooled steam cycle heat rejection system and, 2) the closed cooling water system for ancillary equipment cooling. A small auxiliary cooling tower will generate a small amount of blowdown which will be reused on site. No off-site backup cooling water supply is planned at this time.

The Project will include a LTU to treat soil contaminated with HTF. The unit will be designed in accordance with Lahontan Regional Water Quality Control Board (RWQCB) requirements. The LTU will cover an area of approximately 500 feet by 350 feet (4 acres).

The estimated project life for the Project is 30 years. Personnel will staff the Facility 24 hours per day/seven days per week. Even when the solar power plant is not operating, personnel will be present as necessary for maintenance, to prepare the Project for startup, and/or for site security. The layout of the proposed facility is shown in **Figure 2**.

1.3 Waste Handling Facilities

The waste storage and treatment unit includes a single LTU for HTF-contaminated soils as described below. The configuration of the planned LTU is shown in **Figure 3**.

1.3.1 On-site Land Treatment Unit

The LTU will be designed in accordance with Lahontan RWQCB requirements and is expected to comprise an area of about 4 acres. The bioremediation facility will 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 milligrams per kilogram (mg/kg) of HTF is classified as a non-hazardous waste[1]. 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 will 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.

The LTUs will be constructed with a 2 foot compacted, lime treated, clay/silt layer underlain by 3 foot of compacted native material in accordance with Title 27 requirements. Vadose zone leak detection at the LTU consists of the collection of soil samples from 1 foot below the compacted native material base at the LTU. Groundwater beneath the site is over 400 feet below ground surface. HTF is an oil that is solid at temperatures below 54°F, has relatively low solubility and a high sorption potential. The components of HTF have been demonstrated at Kramer Junction to biodegrade relatively rapidly within a four month period.

---

[1] 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 – Waste Evaluation Unit (WEU) File # F143, April 4.

Environment

Given the great distance to groundwater, the physicochemical properties of HTF showing a limited potential to migrate within the environment and the propensity to biodegrade, the proposed detection monitoring is sufficient to protect ground water resources beneath the site. Additional detection monitoring beyond these efforts does not appear to be warranted.

Nutrients including nitrogen and phosphorus will be added to the contaminated soil to encourage consumption of the HTF by the indigenous bacteria. The soil will 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. The remediated soil is expected to be used as fill material on the site. Soils with initial HTF concentrations less than 100 mg/kg will be used as fill material on the site.

The LTU will be surrounded on all sides by a minimum 2-foot high compacted earthen berm with side slopes of approximately 3:1 (horizontal: vertical). These berms will control and prevent potential inflow (run on) of surface stormwater into the LTU or runoff of stormwater from the unit. The design details of the LTU are shown in **Figure 4**.

2.0 Corrective Action Plan Standards

Standards for a CAP include requirements that a corrective action achieves the following goals: to remediate release from the Unit and to ensure compliance with the Water Standard adopted under section 20390 for the Unit. If evidence of a release has occurred, this standard specifies notification requirements to the RWQCB as well as specifies sampling and analytical protocols to further evaluate releases from the waste storage unit including reporting schedules and deadlines.

The monitoring requirements for the Project's waste facilities are specified under CCR Title 27 Chapter 3, Subchapter 3, Article 1, Sections 20380 through 20435 (CCR Title 27, Sections 20380 through 20435). These standards include provisions that include requirements for a DMP to: establish background values for monitoring parameters, conduct sampling and analyses for monitoring parameters, set forth monitoring schedules, and perform statistical analysis of data to determine if evidence of a significant release has occurred. If evidence of a release has occurred, these standards specify notification requirements to the RWQCB as well as specify sampling and analytical protocols to further evaluate releases from the waste storage unit including reporting schedules and deadlines.

Standards for a DMP are specified in CCR Title 27, Chapter 3, Subchapter 3: Water Monitoring. Under Subchapter 3, Article 1, the general applicability for water quality monitoring and response programs for solid waste management units are addressed in section 20380 (CCR Title 27, Section 20380). Required monitoring programs such as a DMP, Evaluation Monitoring, and CAP are defined in CCR Title 27, Section 20385.

Establishment of Water Quality Protection Standard (Water Standard) for each waste unit is required under CCR Title 27, Section 20390. CCR Title 27, Section 2395 addresses COC to which the Water Standard applies. The COC list includes all waste constituents, reaction products, and hazardous constituents that are reasonably expected to be in or derived from waste contained in the LTU.

CCR Title 27, Section 20400 requires the establishment of concentration limits for each COC including the determination of background values. Monitoring Points and Point of Compliance (CCR Title 27, Section 20405) specifies the downgradient (horizontal) extent to which groundwater will be monitored. The compliance period is defined in CCR Title 27, Section 20410, which is typically the number of years equal to the active life of the waste unit plus the closure period. The compliance period is the minimum time period during which Ridgecrest Solar 1 will conduct a groundwater quality monitoring program subsequent to a release from a waste unit.

Requirements in a DMP are specifically addressed in CCR Title 27, Section 20420. This includes requirements to establish the following: background values, monitoring parameters, routine monitoring, monitoring schedules, data recording format, and data analysis. This standard also provides provisions in the event that a release is indicated.

If evidence of a significant release from the LTU is determined, then an Evaluation Monitoring Program (EMP) pursuant to CCR Title 27, Section 20425 will be implemented to assess if groundwater has been impacted. If groundwater has been impacted above the RWQCB thresholds, then the measures described in the CAP (pursuant to CCR Title 27, Section 20430) will be implemented.

Finally, Unsaturated Zone Monitoring and Response Provisions for LTUs are addressed in CCR Title 27, Section 20435.

3.0 Corrective Action Plan

This CAP has been designed to address releases from the LTU that have been confirmed by either physical evidence of a release or a “measurably significant” evidence of a release from the LTU during a DMP. Estimated costs to perform the vadose zone corrective actions are presented in **Appendix A**.

3.1 Vadose Zone Corrective Actions

3.1.1 Land Treatment Unit

As described in Section 1.3.1, the LTU does not have a dedicated vadose zone leak detection system. The nature of the HTF is such that it will be in a solid form at temperatures below 53.6 °F, is relatively insoluble in water (solubility approximately 25 milligrams per liter), combustible and has relatively low volatility (Solutia, 2006). Therefore, the potential for HTF to migrate through the base of the LTU is considered very small. The annual sampling and analysis of the soil beneath the base of the LTU, for COCs associated with the LTU has been judged to be sufficient at similar sites.

Should HTF be detected in the soil beneath the LTU, the following steps will be implemented:

- Soil will be removed from the vicinity of the sample location where the HTF was detected;
- The compacted base layer will be excavated;
- Native material will be excavated to the depth of the soil sample. Additional soil excavation, not to exceed a depth of 5 feet beneath the compacted base, will be performed if excessive moisture is encountered;
- The excavation will be backfilled and compacted with native material;
- The compacted base layer will be reinstalled; and
- Within 24 hours of the release being detected, the RWQCB will be verbally notified of the release and a written notification via certified mail will be sent within seven days of determining there was a release.

Should a severe storm event occur that fills up the LTU and allows water to overtop the berm, the following steps will be implemented:

- Standing water in the LTU will be sampled and analyzed for Table 1 constituents. If the analytical results indicate the liquid is a hazardous waste, the water will be pumped to a temporary holding tank and transported to a properly permitted disposal facility; if the analytical results indicate the liquid is non-hazardous, then the liquid will be transferred into the onsite water treatment system and recycled.
- The area outside the berm will be assessed using visual means and soil samples will be collected and analyzed for COCs listed in Table 1, if the visual impacts are not readily evident;
- The impacted soil will be excavated and placed in the LTU;
- If the confirmation soil samples are non-detect for Table 1 COCs, the excavation will be backfilled with native material; and
- Within 24 hours of the release being detected, the RWQCB will be verbally notified of the release and a written notification via certified mail will be sent within seven days of determining there was a release.

4.0 Reporting

Once the CMP has been initiated, progress reports will be submitted, in writing, to the RWQCB on the effectiveness of the corrective action program. The reports will be submitted at a minimum of semi-annually. The RWQCB may determine more frequent reporting is required, to ensure the protection of human health or the environment.

In accordance with CCR Title 27, Section 20385, once a CAP has been instituted and RWQCB determines (pursuant to section 20425) that the assessment of the nature and extent of the release and the design of the CAP have been satisfactorily completed, the RWQCB will approve the application for an amended report of waste discharge for corrective action.

5.0 References

Solutia, 2006. Material Safety Data Sheet (MSDS).

Tables

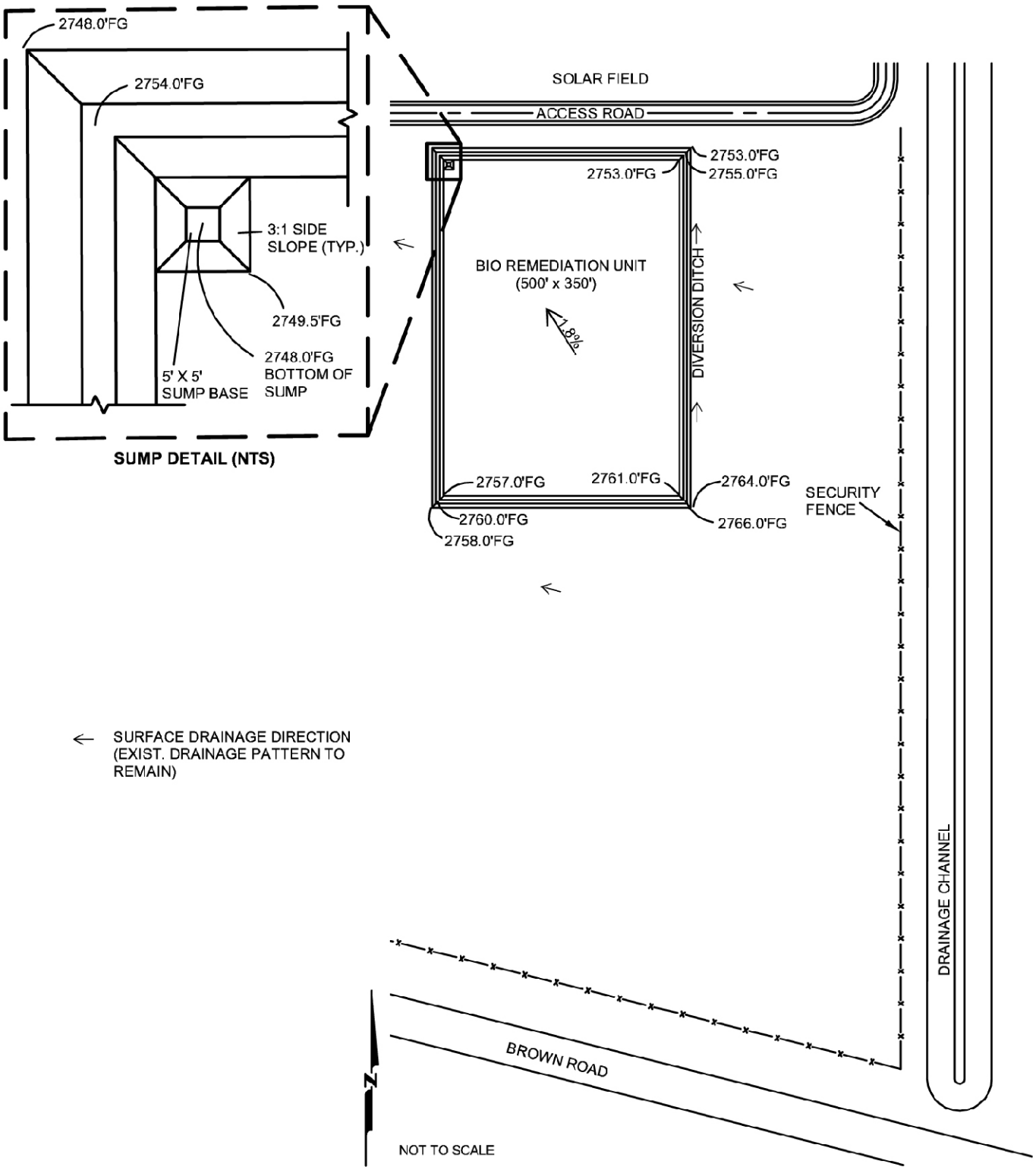
Table 1 Land Treatment Unit Wastewater Sampling Parameters

Parameter	U.S. EPA or Standard Method	RL Goal	Units
Biphenyl Oxide	8015M	500	ug/L
Diphenyl Oxide	8015M	500	ug/L
Key: mg/L – milligrams per liter RL – reporting limit			

Table 2 Land Treatment Unit Soil Sample Analytical Parameters

Parameter	U.S. EPA or Standard Method	RL Goal	Units
Biphenyl Oxide	8015M	1.0	mg/kg
Diphenyl Oxide	8015M	1.0	mg/kg
Key: mg/kg – milligrams per kilogram RL – reporting limit			

Figures



Map Location

Ridgecrest Solar Power Plant

Figure 3
Land Treatment Unit Details

Solar Millennium

AECOM

Project: 60139696
Date: January 2010

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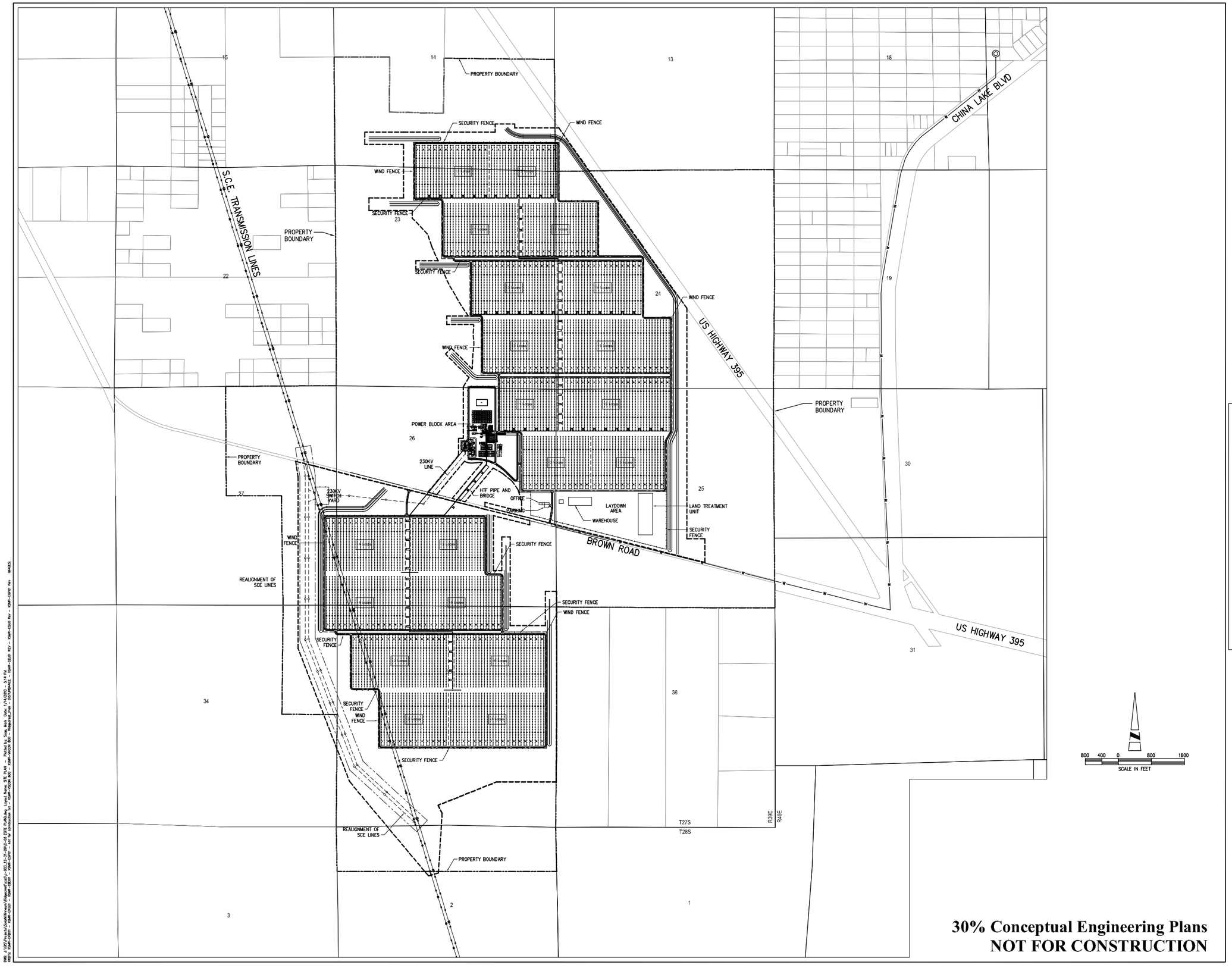

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Checked:	W. BLACK
Drawn:	K. S. BEDFORD
Record Drawing by/date:	

Revisions:

#	DATE	DESCRIPTION

Prepared for:

Solar Millennium LLC

LEGEND:

- SOLAR FIELD PARABOLIC TROUGH
- BALANCE OF PLANT FACILITIES
- PROPOSED ACCESS ROAD (PAVED)
- PROPOSED ACCESS ROAD (GRAVEL)
- RAILROAD
- PROPOSED GAS
- PROPOSED WATER
- PROPOSED TELEPHONE
- PROPOSED ELECTRIC
- EXISTING ELECTRIC
- PROPOSED SECURITY FENCE
- PROPOSED WIND FENCE
- EXISTING CONTOURS (10 FOOT INTERVALS)
- PROPOSED DRAINAGE CHANNEL/FLOW DIRECTION
- EXISTING INTERMITTENT DRAINAGE CHANNEL
- SITE BOUNDARY
- HEADER PIPING
- ACCELERATION LANE

Ridgecrest Solar Power Project

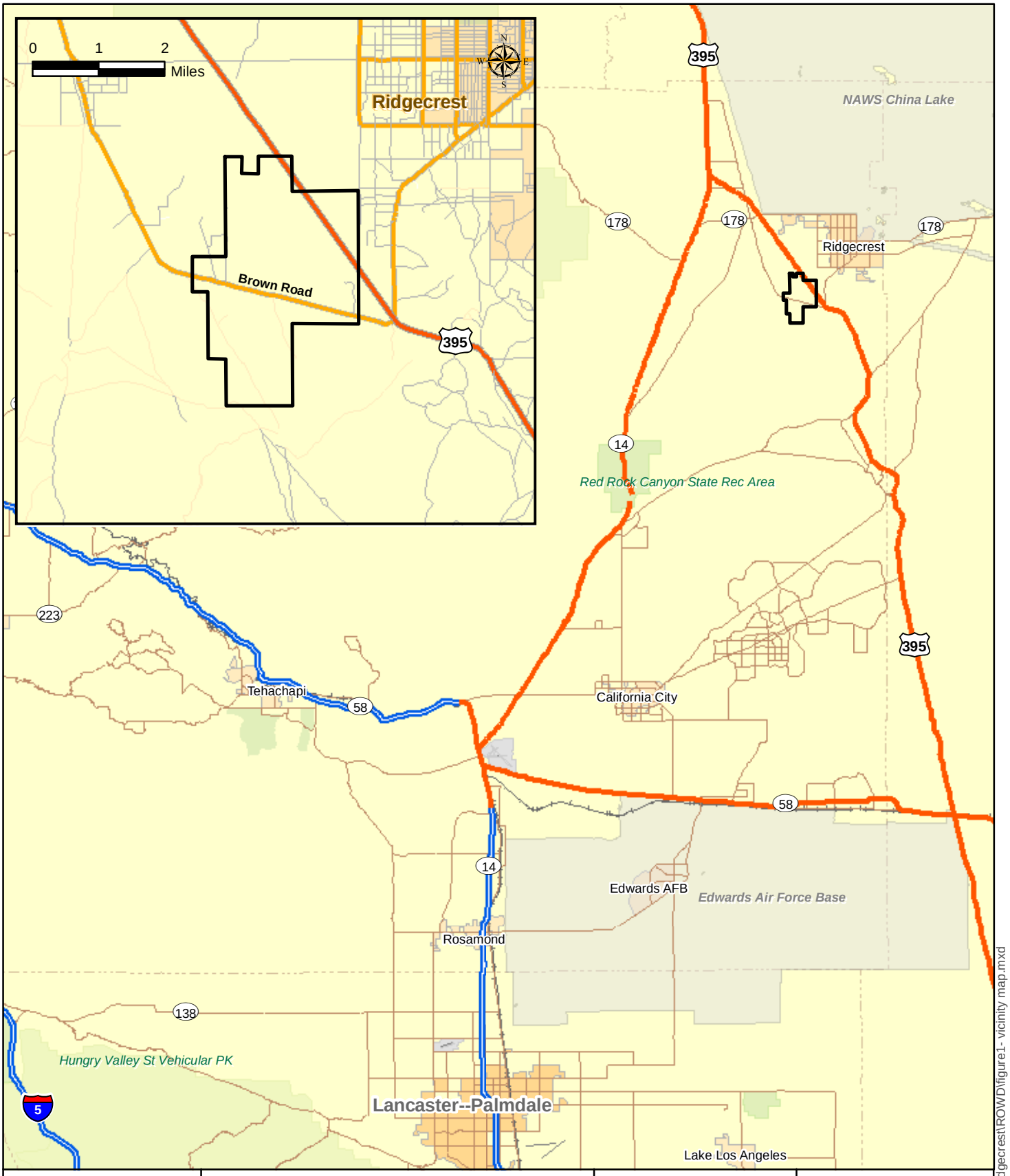
Kern County, California

Preliminary Site Plan

Figure 2

Date: 12/18/09

Sheet: .



Map Location

0 5 10
Miles

Ridgecrest Solar Power Plant

Figure 1
Regional Location and Vicinity Map

Solar Millennium

AECOM

Project: 60139696
Date: January 2010

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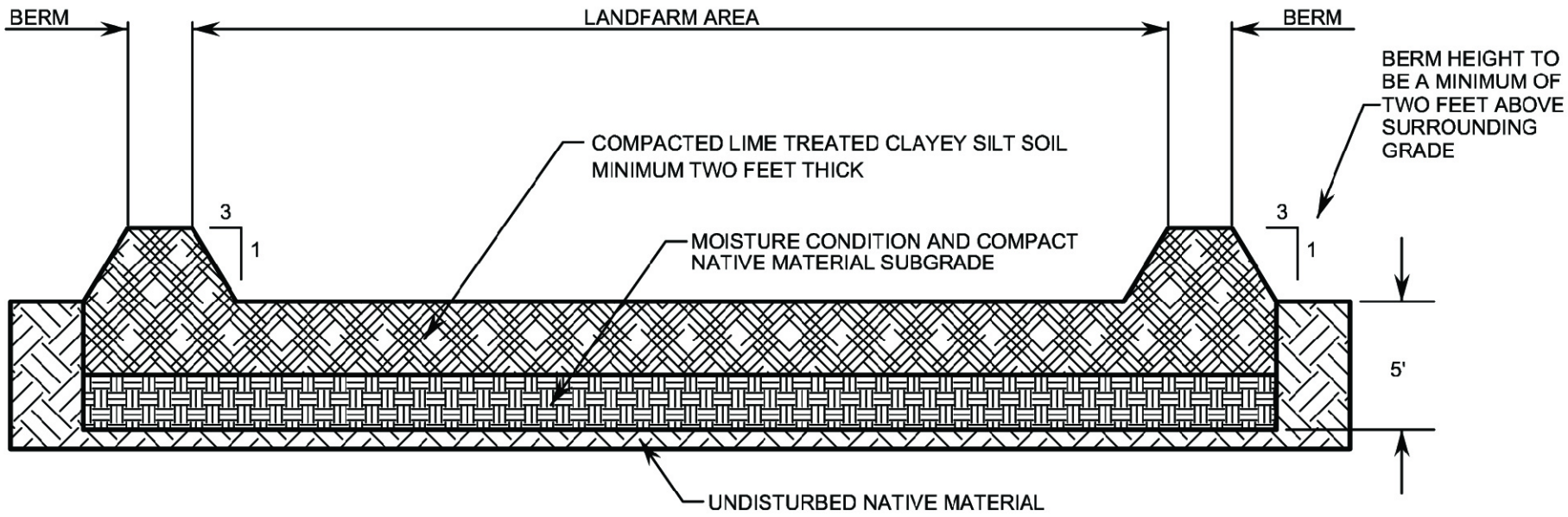

1 / - - LANDFARM UNIT-SECTION
N.T.S.

NOTES:

1. THE COMPACTED AND NATIVE SOIL BENEATH THE LAND FARM UNIT IS DESIGNATED AS A "TREATMENT ZONE" TO A DEPTH OF 5 FEET.
2. THE LIME TREATED LAYER IS TO BE COMPACTED TO A MINIMUM OF 95% OF THE MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D1557 AND HAVE A LOW PERMEABILITY (CLAYEY SILT) MATERIAL.
3. THE CROSS SECTION IS A TYPICAL SECTION.
4. SEE TEXT FOR FURTHER DETAILS.

Map Location

Rdgecrest Solar Power Project

Figure 4
Cross-Section Details of Land Treatment Unit

Solar Millennium

AECOM

Project: 60139696
Date: Januaryr 2010

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Appendix A

Corrective Action Cost Estimates

Ridgecrest Solar Power Project
Bioremediation Land Treatment Units

	Item	Contingency Cost Estimate (each)	Quantity	Subtotal Closure Cost Estimate
1	HTF detected below the floor of the LTU in native soil	$192,000	1	$192,000
2	Stormwater overtops LTU	$47,000	1	$47,000
		Total Contingency Cost Estimate		**$239,000**

Order-of-Magnitude Cost Estimate-Closure of Scenario 1

Activities sequence to excavate HTF impacted soil

1. Relocate soil undergoing treatment in area of failure to another part of the LTU
2. Remove in area of failure the compacted clay and relocate to another part of the LTU
3. Remove impacted soil in area of failure, and relocate to another part of the LTU
4. Test bottom of impacted area to confirm clean up
5 Replace compacted native material and clay layer

		Unit Cost	Unit Quantity	Unit	Number	Cost Reference
Costs						
1. Relocate Soil						
Mobilization/Demobilization	LS	$15,000	1	1	$15,000	ROM Estimate
Excavate (dozer, 300' haul, clay)	CYD	$15	833	1	$12,328	Means 02315-400-1500&-4100-3340
				Total	**$27,328**	
2. Remove and Relocate compacted clay layer						
Mobilization	LS	$5,000	1	1	$5,000	ROM Estimate
Excavate (dozer, 300' haul, clay)	CYD	$15	1,252	1	$18,520	Means 02315-400-1500&-4100-3340
				Total	**$23,520**	
3. Remove impacted soil and Relocate to another part of the LTU						
Mobilization	LS		1	1	$0	covered in Relocate Soil
Excavate (dozer, 300' haul, clay)	CYD	$15	1,481	1	$21,917	Means 02315-400-1500&-4100-3340
				Total	**$21,917**	
4. Sample area of impact to demonstrate that it is acceptable/clean						
Sample Collection	Day	$1,800	2	1	$3,600	ROM Estimate (20 ft grid)
Sample Analysis	Each	$250	25	1	$6,250	TPH by 8015 & CAM 17
Report of Analytical & Project Coordination	Each	$10,000	1	1	$10,000	ROM Estimate
				Total	**$19,850**	
5. Replace Soil and Clay Layer						
Mobilization	LS	$10,000	1	1	$10,000	ROM Estimate, added equipment
Excavate Soil use onsite source (0.75 cyd Loader)	CYD	$5	1,481	1	$7,340	Means 02315-400-1500 + confined are
Truck Haul from on site source and dump	CYD	$6.31	1,481	1	$9,346	Means 02320-200-0330
Place soil, moisture condition and compact	CYD	$5.64	1,481	1	$8,349	Means 02315-100-1900 + 2200
Purchase Clay and transport to site	CYD	$20	1,252	1	$25,037	ROM Estimate
Place Clay, moisture condition and compact	CYD	$8.45	1,252	1	$10,583	Means 03310-220-0020
				Total	**$70,656**	
Subtotal Field Activities Costs					**$163,270**	
Contingency	(0% of All of the Above Costs)				$0	
				Total	**$163,270**	
Total Field Activities Costs					**$164,000**	
Engineering and Oversite						
Engineering	(2% of Total Construction Cost)				$4,000	Means 01107-300-1200 (min.)
Permitting	(0.5% of Total Construction Cost)				$1,000	Means 01310-150-0010 (min.)
Construction Management	(5% of Total Construction Cost)				$9,000	Means 01107-200-0010 (min.)
Closure Report	(8% of Total Construction Cost)				$14,000	Means 01310-150-0010
Total Engineering and Oversite Cost					**$28,000**	
T O T A L C O S T					**$192,000**	

Order-of-Magnitude Cost Estimate-Closure of Scenario 1

Activities sequence to excavate HTF impacted soil

1. Relocate soil undergoing treatment in area of failure to another part of the LTU
2. Remove in area of failure the compacted clay and relocate to another part of the LTU
3. Remove impacted soil in area of failure, and relocate to another part of the LTU
4. Test bottom of impacted area to confirm clean up
5 Replace compacted native material and clay layer

	Unit Cost	Unit Quantity	Unit	Number	Cost Reference

Assumptions

No need for construction support facilities since site has infrastructure

Annual sampling for integrity is on 100 ft grids, if one sample indicates a leak, excavate ½ way toward each of the adjoining sampling points

Assume that failure is limited to a 100 ft by 100 ft area of the LTU 100 ft wide 100 ft long

and that the failure reaches 1 foot below treatment zone

Remove soil undergoing treatment in LTU from 25 ft each side of impacted area

Volume of soil is 1 ft thick 150 ft wide 150 ft long

Dry Weigh 1250 tons or 833 Cubic Yards

Soil is transferred to unaffected portion of the LTU

Remove compacted clay from 15 ft each side of impacted area of LTU and relocate in LTU for treatment

Clay Thickness 2 feet Vol 1252 Cubic Yards

Density 120 lbs/cft Wt. 2028 Tons

Remove impacted soil from impacted area and relocate in LTU for treatment

Impacted soil Thickness 4 feet Vol 1481 Cubic Yards

Notes

Unit Costs are from RS Means Building Construction Cost Data 2001 Western Version

Unit Costs are adjusted by the City Cost Index; 1.13 Means page 612 for Installation index for Riverside, CA

Unit Costs are adjusted by the ENR Historical Cost Index to estimate 2009 costs

Compare Construction Cost Index since closure is mostly labor and not materials purchase

ENR Construction Cost Index for Los Angeles in December 1997		6664
ENR Construction Cost Index for Los Angeles in December 2000		7068
ENR Construction Cost Index for Los Angeles in August 2009		9766
Historical Cost adjustment is 2009 #/ 1997 #	1.47	
Historical Cost adjustment is 2009 #/ 2000 #	1.38	
Combine historical (2009 to 2000) & City cost adjustment	1.57	

Order-of-Magnitude Cost Estimate-Closure of Scenario 2

Activities sequence to correct if stormwater overtopps LTU berm
1. Repair berm breach
2. Soil Sample to determine extent of impact
3.Remove and Dispose sediments downstream of failure
4 Soil Sample to confirm clean up

		Unit Cost	Unit Quantity	Unit	Number	Cost Reference
Costs						
1. Repair berms						
Mobilization/Demobilization	LS	$15,000	1	1	$15,000	ROM Estimate (rush)
Excavate (0.75 cyd Front End Loader)	CYD	$3	67	1	$220	Means 02315-40-1500
Loading to trucks	CYD	$0.50	67	1	$33	Means 02315-400-0020
Truck Haul to on site stockpile and dump	CYD	$4.59	67	1	$306	Means 02320-200-0400
Spread dumped fill, compaction	CYD	$3.63	67	1	$242	Means 02320-200-0600
				Total	**$15,801**	
2. Sample area to determine extent of impact to surrounding soils						
Sample Collection	Day	$1,800	1	1	$1,800	Estimate (50x50' grid)
Sample Analysis (1 ft)	Each	$250	8	1	$2,000	TPH by 8015 & CAM 17
Report of Sampling and Coordination	Each	$10,000	1	1	$10,000	ROM Estimate
				Total	**$13,800**	
3. Excavate impacted soil and dispose						
Mobilization	LS	$10,000	0	1	$0	covered in Repair Berms
Excavate (0.75 cyd Front End Loader)	day	$1,500	1	1	$1,500	Means 02315-40-1500&-4100
Hauling to LTU					$0	Include in Front End loader
				Total	**$1,500**	
4. Sample area of impact to demonstrate that it is clean						
Sample Collection	Day	$1,800	1	1	$1,800	ROM Estimate
Sample Analysis	Each	$250	8	1	$2,000	TPH by 8015 & CAM 17
Report of Analytical & Coordination	Each	$8,000	0	1	$0	Covered in Task 2
				Total	**$3,800**	
Subtotal Field Activities Costs					**$34,901**	
Contingency	(0% of All of the Above Costs)				$0	
				Total	**$34,901**	
Total Field Activities Costs					**$40,000**	
Engineering and Oversite						
Engineering	(4% of Total Construction Cost)				$2,000	Means 01107-300-1200 (max.)
Permitting	(2% of Total Construction Cost)				$1,000	Means 01310-150-0010
Construction Management	(10% of Total Construction Cost)				$4,000	Means 01107-200-0010 (rush.)
Total Engineering and Oversite Cost					**$7,000**	
T O T A L C O S T					**$47,000**	

Assumptions
No need for construction support facilities since site has infrastructure
Berms are constructed by removal of native material from on site source

Height (ft)	Top of Bern	Bottom of	Cross s Length	Volume (CYD)

Order-of-Magnitude Cost Estimate-Closure of Scenario 2

Activities sequence to correct if stormwater overtopps LTU berm

1. Repair berm breach
2. Soil Sample to determine extent of impact
3.Remove and Dispose sediments downstream of failure
4 Soil Sample to confirm clean up

	Unit Cost	Unit Quantity	Unit	Number	Cost	Reference
Volume of lost berm material is ~	4	18	54	144	25	67
Assume that impacted soil extents out over an area of 25 by 100 and is impacted to a depth of 6 inches						
Volume of impacted material is ~	0.5	25			100	46
Weight of impacted material is ~	60	tons				

Notes

Unit Costs are from RS Means Building Construction Cost Data 2001 Western Version

Unit Costs are adjusted by the City Cost Index; 1.13 Means page 612 for Installation index for Riverside, CA

Unit Costs are adjusted by the ENR Historical Cost Index to become 2009 costs

Compare Construction Cost Index since closure is mostly labor and not materials purchase

ENR Construction Cost Index for Los Angeles in December 2000		7068
ENR Construction Cost Index for Los Angeles in August 2009		9766
Historical Cost adjustment is 2009 #/ 2000 #	1.38	
Combined adjustment is	1.57	

Appendix E

Detection Monitoring Plan

AECOM
Environment

Prepared for:
Ridgecrest Solar 1, LLC

Detection Monitoring Program Ridgecrest Solar Power Project Kern County, California

Appendix E of the Application/Report of Waste Discharge

January 2010

60139696-DMP

AECOM
Environment

Prepared for:
Ridgecrest Solar 1, LLC

Detection Monitoring Program
Ridgecrest Solar Power Project
Kern County, California

Prepared By Brian Ho

Reviewed By Roy Hauger, PE

January 2010

60139696-DMP

Contents

1.0 Introduction 1-1

1.1 Site Background 1-1

1.2 Geologic and Hydrogeologic Setting 1-2

1.3 Waste Handling Facilities 1-2

1.4 LTU Design 1-3

2.0 Detection Monitoring Program Standards 2-1

3.0 Waste Unit Inspection, Sampling, and Maintenance Programs 3-1

3.1 Waste Unit Inspection Program 3-1

3.1.1 Land Treatment Units 3-1

3.2 Sampling Program 3-1

3.2.1 Land Treatment Unit – Wastewater 3-1

3.2.2 Land Treatment Unit – Soil 3-1

3.3 Maintenance Program 3-2

3.3.1 Land Treatment Units 3-2

4.0 Detection Monitoring 4-1

5.0 Reporting 5-1

5.1 Record Keeping and Reporting Requirements 5-1

5.1.1 Scheduled Reports Filed with the RWQCB 5-1

5.1.2 Unscheduled Reports Filed with the Regional Board 5-1

6.0 References 6-1

List of Appendices

A Material Data Safety Sheets

B Standard Operating Procedures

List of Tables

Table 1: Land Treatment Unit Wastewater Sampling Parameters

Table 2: Land Treatment Unit Soil Sampling Parameters

List of Figures

Figure 1: Regional Location and Vicinity Map

Figure 2: Site Plan

Figure 3A: Regional Geologic Map

Figure 3B: Regional Geologic Map Legend

Figure 4: Process Flow Diagram

Figure 5: Cross Section Details of the Land Treatment Unit

Figure 6: Land Treatment Unit Details

List of Acronyms

CAP	Corrective Action Plan
CCR	California Code of Regulations
DMP	Detection Monitoring Program
DTSC	Department of Toxic Substances
HTF	heat transfer fluid
IWVWD	Indian Wells Valley Water District
LTU	land treatment unit
msl	mean sea level
Project	Ridgecrest Solar Power Project
ROWD	Report of Waste Discharge
RWQCB	Regional Water Quality Control Board
SSG	solar steam generator
STG	steam turbine generator

1.0 Introduction

Ridgecrest Solar 1, LLC, a California limited liability company, is proposing to construct, own and operate the Ridgecrest Solar Power Project (herein or "Project"). The Project is a concentrating solar electric generating facility proposed on an approximately 3,995-acre site in Kern County, California. Ridgecrest Solar 1 proposes to use land treatment units (LTUs) as part of the Project. The LTUs will be used to receive, temporarily store, and treat soil contaminated with heat transfer fluid (HTF) released from the process to the environment.

This Detection Monitoring Program (DMP) was developed as part of the Report of Waste Discharge (ROWD) application for the proposed Project. The Draft ROWD will be submitted to the Regional Water Quality Control Board – Lahontan Region (RWQCB).

The monitoring requirements for the Project's waste facilities are specified under California Code of Regulations (CCR) Title 27 Chapter 3, Subchapter 3, Article 1, Sections 20380 through 20435 (CCR 27 20380 through 20435). Article 1 includes provisions for a Detection Monitoring Program (CCR 27 20385). The objective of the DMP is to determine if a release has occurred from the land treatment units, and if groundwater quality is being degraded.

This document describes the elements of the DMP and is considered to be a stand-alone document that supplements other elements of the ROWD application including the LTU Construction Engineering Design Package, the Construction Quality Assurance Plan, and the Closure- and Post-Closure Maintenance and Corrective Action Plans.

1.1 Site Background

The Project is a concentrating solar electric generating facility proposed on an approximately 3,995-acre site in Kern County, California (see **Figure 1**). The Project will use well-established parabolic trough solar thermal technology to produce electrical power using a steam turbine generator (STG) fed from a solar steam generator (SSG). The SSG receives heated HTF from solar thermal equipment comprised of arrays of parabolic mirrors that collect energy from the sun.

The Project proposes to use dry cooling for power plant cooling. Water for process water makeup, and other industrial uses such as mirror washing will be supplied by the local municipal water district via a new pipeline. This source will also be used to supply water for employee use (e.g., drinking, showers, sinks, and toilets). Water received from the Indian Wells Valley Water District (IWVWD) will meet the requirements of the California Department of Health Services for potable water supplies and will not require further treatment for this purpose. Power cycle makeup, mirror washing water, and cooling of ancillary equipment will require onsite treatment for reduction of dissolved solids, and this treatment varies according to the quality required for each of these uses. A sanitary septic system and on-site leach field will be used to dispose of sanitary wastewater. Water from the IWVWD will not be used for power plant cooling water.

The Project will include a LTU to treat soil contaminated with HTF. Based on the release history from the NextEra LLC Kramer Junction Facility, which is parabolic trough solar power plant that employs HTF in the same fashion as proposed for the RSPP, the LTU has been designed in accordance with CCR Title 27 requirements and designed to receive about 833 cubic yards of impacted soil on an annual basis. There is one LTU proposed for the Project. It will cover an area of approximately 500 feet by 350 feet (4 acres) in the eastern portion of the Project **(Figure 2)**. The LTU will use indigenous bacteria and amendments to the soil to bioremediate HTF-affected soils to levels acceptable for reuse on site. Characterization of the hazardous characteristics of HTF-affected soil will be established by the Department of Toxic Substances Control (DTSC) prior to operation and remediation. Soils in excess of the criterion established by the DTSC

will be removed from the site and transported to an appropriate treatment storage and disposal facility. Soil with HTF at concentrations below this criteria will be managed in the LTU and remediated to acceptable levels for reuse as fill on site.

1.2 Geologic and Hydrogeologic Setting

The Project site is located within Indian Wells Valley, which is in the southern end of the Basin and Range Province east of the Sierra Nevada, south of the Coso range, north of the El Paso Mountains, and west of the Argus Range. Indian Wells Valley is also situated between the Sierra Nevada Fault Zone to the west and the El Paso and Garlock faults to the south. The Valley is characterized by a broad alluvial basin of Cenozoic-age sedimentary and volcanic material overlying older plutonic and metamorphic rocks. Quaternary lacustrine deposits are also found in the region as a result of playas in the northeastern portion of the valley. Indian Wells Valley is underlain with alluvial deposits up to 2,000 feet thick. The geology of this area is shown on **Figure 3A and 3B**.

The Project site is underlain by three stratigraphic units: Jurassic age basement complex, Quaternary and Tertiary age Black Mountain Basalt and Quaternary alluvium of Holocene age. A basement complex of Jurassic, undifferentiated plutonic, hypabyssal, and metamorphic rocks outcrop in the eastern portion of the site. The basement complex forms a basin in which the Tertiary and Quaternary age deposits are found. The Black Mountain Basalt is thought to be of late Pliocene and Pleistocene age and consists of olivine basalt flows that are more than 100 feet thick in some places. An unconformity is formed at the boundary of the Black Mountain Basalt and the overhead Tertiary age continental deposits that comprise the Goler and Ricardo Formations. Surficial Quaternary alluvium sits atop the Tertiary continental deposits.

The Project site is located in the southeast portion of Indian Wells Valley. Topography at the site is relatively flat and slopes gently downward in a northwest direction at a gradient of approximately 2 percent. Ground surface elevations range from approximately 2,890 feet above mean sea level (msl) in the southeast to 2,580 feet above msl in the northwest. The Project site is bisected by a concealed, inactive fault. The fault shows evidence of displacement during the late Quaternary time, most likely during the Pleistocene. The inactive fault trends northwest and is located in the southern half of the site.

The majority of the Project site is underlain by Quaternary alluvium and alluvial fan deposits of Holocene age. These deposits consist of unconsolidated moderately to well-sorted gravel, sand silt, and clay. These deposits are derived as alluvial fans from the surrounding mountainous regions and may include fluvial deposits.

There are no perennial surface water bodies in Indian Wells Valley. During wet years, some surface flow enters the Valley through the Little Lake Gap. The water budget inflows for the Valley consist of mountain front recharge, subflow from the Rose Valley Basin and Coso Valley Basin, and infiltration of surface flows through Little Lake Gap. The only outflows are through groundwater pumping and evapotranspiration from the playa areas. Generally, groundwater flow directions throughout Indian Wells Valley are directed towards the playa just north of Ridgecrest. Groundwater flow direction on the Project site trends northeast towards the playa. In the region, groundwater elevations range from approximately 2,150 feet above msl to 2,350 feet above msl. Beneath the Project plant site groundwater flows to the northeast towards Ridgecrest and ranges from approximately 2,250 feet and 2,350 feet above msl.

1.3 Waste Handling Facilities

The LTU will be used to treat HTF-affected soil at various concentrations. A process flow diagram showing the management and treatment of the HTF-affected soil is presented in **Figure 4**. Spills of HTF will be cleaned up within 48 hours and affected soil will be moved to a temporary staging area in the LTU where it will be placed on and covered with plastic sheeting pending receipt of analytical results and characterization of the waste material. As possible, free liquids will be removed using a vacuum truck. The liquids will be filtered and reused to the extent possible and reintroduced into the process. Filtrate will be characterized

though will likely be managed as hazardous waste, as the concentration in the filtrate will likely be more than 10,000 mg/kg HTF.

No HTF-affected soils characterized as hazardous waste will be disposed or treated on site. Based on past experience, it is anticipated that soil containing 10,000 mg/kg HTF or more will be managed as hazardous waste, and that soil containing less than 10,000 mg/kg HTF will be non-hazardous waste and can be managed at the site. If the soil is characterized as a non-hazardous waste, it will be spread in the LTU for bioremediation treatment. In general, within the LTU, more highly contaminated soil will be covered with plastic sheeting to prevent contact with storm water and to control potential odors and emissions, as well as for moisture and temperature retention. Once the soil has been treated to a concentration of less than 100 mg/kg HTF, it will be moved from the LTU to another portion of the site until it is reused at the facility as fill material.

Based on available operation data from other sites, it is anticipated that approximately 833 cubic yards (on average) of HTF-affected soil may be treated per year. Larger or smaller quantities could be generated during some years, depending on the frequency and size of leaks and spills.

A Spill Prevention, Control, and Countermeasure (SPCC) plan will be undertaken for the Project. Periodically, equipment failures in and around mirror fields are expected at the Project resulting in spills of HTF onto soil.

Excess wastewater or storm water may occasionally accumulate in the LTU. The LTU has been constructed with 2-foot high (minimum) berms such that storm water will not drain into or from the LTU. Based on the frequency of storms in the area, it is anticipated accumulation of rainwater within the containment could occur on a yearly basis.

1.4 LTU Design

In compliance with Table 2.1 in CCR Title 27, Chapter 3, Subchapter 2, Article 2, Section 20210, solid designated wastes will be managed in full containment in a Class II LTU with a single liner system. The LTU will be constructed to be above the level of a 100-year storm event and designed to meet seismic hazard criteria. In addition, the base of the LTU will have a greater than 5-foot separation to the underlying groundwater.

The LTU will incorporate a 2-foot thick lime-treated clay/silt layer, underlain by 3 feet of compacted native, material. This 5-foot barrier will serve as a competent platform for land treatment activities, and will serve to slow the rate of surface water infiltration in the treatment area. A staging area is allocated in the LTU for storage of HTF-impacted soils while they are being characterized. Although the LTU will be taking vehicle traffic, no hard surface will be required, as there is no sensitive liner system to protect.

The LTU will be surrounded on all sides by a 2-foot high (minimum) compacted earthen berm with side slopes of approximately 3:1 (horizontal: vertical). These berms will control and prevent potential inflow (run-on) of surface storm water into the LTU or runoff of stormwater from the unit. A cross-section showing the design and details of the LTU are shown in **Figures 5 and 6.**

2.0 Detection Monitoring Program Standards

The monitoring requirements for the Project's waste facilities are specified under CCR Title 27 Chapter 3, Subchapter 3, Article 1, Sections 20380 through 20435 (CCR 27 20380 through 20435). These standards include provisions that include requirements to: establish background values for monitoring parameters, conduct sampling and analyses for monitoring parameters, set forth monitoring schedules, and perform statistical analysis of data to determine if evidence of a significant release has occurred. If evidence of a release has occurred, these standards specify notification requirements to the RWQCB as well as specify sampling and analytical protocols to further evaluate releases from the waste storage unit including reporting schedules and deadlines.

Standards for a DMP are specified in CCR 27, Chapter 3, Subchapter 3: Water Monitoring. Under Subchapter 3, Article 1, the general applicability for water quality monitoring and response programs for solid waste management units are addressed in section 20380 (CCR 27, 20380). Required monitoring programs such as a DMP, Evaluation Monitoring, and Corrective Action programs are defined in CCR 27, 20385.

Establishment of Water Quality Protection Standard (Water Standard) for each waste unit are required under CCR 27 20390. CCR 27 2395 addresses Constituents of Concern (COC) to which the Water Standard applies. The COC list includes all waste constituents, reaction products, and hazardous constituents that are reasonably expected to be in or derived from waste contained in the LTU.

CCR 27 20400 requires the establishment of concentration limits for each COC including the determination of background values. Monitoring Points and Point of Compliance (CCR 27, 20405) specifies the downgradient (horizontal) extent to which groundwater will be monitored. The compliance period is defined in CCR 27 20410, which is typically the number of years equal to the active life of the waste unit plus the closure period. The compliance period is the minimum time period during which the Project will conduct a groundwater quality monitoring program subsequent to a release from a waste unit.

General Water Quality Monitoring and System Requirements at addressed in CCR 27 20415 which define the elements of a groundwater monitoring system for a DMP, Evaluation Program, or a corrective action plan. Provisions for monitoring well standards, surface water monitoring systems, and unsaturated zone monitoring systems as well as descriptions of statistical data analysis methods are addressed in CCR 27 20415.

Requirements in a DMP are specifically addressed in CCR 27 20420. This includes requirements to establish the following: background values, monitoring parameters, routine monitoring, monitoring schedules, data recording format, and data analysis. This standard also provides provisions in the event that a release is indicated.

If evidence of a significant release from an LTU is determined, then an Evaluation Monitoring Program pursuant to CCR 27 20425 will be implemented to assess if groundwater has been impacted. If groundwater has been impacted above the RWQCB thresholds, then the measures described in the Corrective Action Plan (CAP) pursuant to CCR 27 20430) will be implemented.

Unsaturated Zone Monitoring and Response Provisions for Land Treatment Units are addressed in CCR 27 20435.

3.0 Waste Unit Inspection, Sampling, and Maintenance Programs

The DMP encompasses inspection of the LTUs as well as periodic sampling of waste unit contents and a maintenance program to ensure that the waste units operate as designed. The following section outlines the inspection and maintenance requirements for the LTUs.

3.1 Waste Unit Inspection Program

3.1.1 Land Treatment Units

Inspection of the LTU will be conducted monthly. The inspection will involve visual observation to identify the potential presence of cracks or subsidence in the base soil layer that would allow penetration of contaminants. The perimeter earthen berms will be inspected to ensure they in good repair and that these areas are free of debris and accumulated sediment. Inspection of the effectiveness of general housekeeping, run-on controls, and the soil piles for odors and fugitive dust may be required for regular maintenance.

3.2 Sampling Program

All samples collected for the DMP will be properly documented and a written record of the chain-of-custody recorded. The chain-of-custody record will track the samples from the field to the laboratory. This form documents the time, date, sample location, person collecting the sample, and names and signatures of all persons who are maintaining custody of the samples from the time the samples are collected in the field to their arrival at the laboratory.

3.2.1 Land Treatment Unit – Wastewater

Water that accumulates in the LTU that needs to be removed to maintain the operation of the LTU will be inspected and if needed, sampled to assess the HTF and amendment content. Samples will be analyzed by a state-certified laboratory to determine the concentration of the parameters in **Table 1** to determine an appropriate off-site disposal facility. If HTF is not detected above the practical quantitation limit and amendment concentrations (i.e., nitrate, phosphate, TDS) are at or near background groundwater concentrations and below State of California primary or secondary maximum contaminant levels, the water may be reused in the plant process. If HTF is detected and amendment concentrations exceed background or drinking water standards, the waste will be properly disposed of at a licensed TSDF.

3.2.2 Land Treatment Unit – Soil

Representative soil samples will be collected for every batch of HTF contaminated soil undergoing treatment in the LTU and composited according to methods specified in EPA SW-846. The samples will be analyzed for HTF constituents and to the associated reporting limits as listed in **Table 2** using EPA Method 8015 .

Soil sampling to confirm the integrity of the LTU will be performed on an annual basis. Within each LTU, samples will be collected at a depth of 1 foot below the compacted soil base (approximately 6 feet below ground level) and analyzed for HTF using modified EPA Method 8015 to verify that HTF is not migrating below the 5-foot treatment zone underlying the unit.

If the laboratory results indicate that the HTF concentrations are greater than the laboratory detection limit, additional soil samples will be collected at successively deeper depths (using 1-foot intervals) until

laboratory analytical results show that concentrations are less than the laboratory detection limit. If HTF concentrations above the laboratory detection limit are found below the 5-foot treatment zone, the Facility will implement the CAP and submit a letter to the RWQCB highlighting the "evidence of a release." Results of sample analysis will be reported annually.

3.3 Maintenance Program

3.3.1 Land Treatment Units

Maintenance involved with the LTUs will include general housekeeping and drainage system maintenance. General housekeeping within the LTU includes the following measures:

- Keeping soil piles tidy and contained;
- Clearing the unit of debris that may have been accumulated during operation;
- Re-applying plastic sheeting on soil piles as needed; and
- Moisture conditioning and fertilizing the soil piles as needed.

Drainage system maintenance will include the following measures:

- Re-grading of the base of the LTU as needed; and
- Repair/replacement of earth berms as needed.

4.0 Detection Monitoring

HTF (Therminol VP-1 or equivalent) is an oil that consists of a mixture of biphenyl and diphenyl oxide that is solid at temperatures below 54 degrees Fahrenheit, is relatively insoluble in water (solubility of approximately 25 mg/L), combustible, and has relatively low volatility (Solutia 2006). The components of HTF are reported to biodegrade relatively rapidly in the environment, have slight toxicity to tested terrestrial species, higher toxicity to tested aquatic species, and a potential to bio-accumulate (IPCS 1999; JECFA 2003; SOCMA Biphenyl Working Group 2003). Material Safety Data Sheets for HTF are provided in **Appendix A**. Standard Operating Procedures for the detection monitoring program are provided in **Appendix B**.

Installation of groundwater monitoring wells around the perimeter of the LTUs and initiation of a groundwater monitoring program was considered for this DMP but was rejected due to the immobility of HTF at ambient temperatures, the insolubility of HTF in water, and the water table is approximately 480 feet below the ground surface.

Similarly, unsaturated zone monitoring beneath the LTUs through the use of suction lysimeters, for example would not be a reliable method to evaluate for leaks from an LTU due to the high viscosity of the HTF at ambient temperatures.

As a result, groundwater monitoring and unsaturated monitoring are not planned as a routine monitoring component for the LTUs. If HTF is “released” from the LTU, it will be noticeable in the soil underlying the LTU during the annual soil sampling measures described above, at which time the CAP will be implemented.

Detection monitoring will consist of collecting soil samples annually at a depth of 1 foot below the compacted soil base at the LTU (approximately 6 feet below ground level) and analyzing the soil samples for the parameters listed in **Table 2** using EPA Method 8015M to verify that HTF is not migrating below the 5-foot treatment zone underlying the unit. Soil samples will be collected at a minimum frequency of one sample for each acre. If results of sample analysis indicate HTF concentrations greater than the laboratory detection limit, additional soil samples will be collected at successively deeper depths (at 1-foot intervals) until laboratory analytical results show that concentrations are less than the laboratory detection limit. If HTF concentrations above the laboratory detection limit are found below the 5-foot treatment zone, the Facility will implement the CAP and submit a letter to the RWQCB highlighting the “evidence of a release.” Results of sample analysis will be reported annually.

5.0 Reporting

5.1 Record Keeping and Reporting Requirements

5.1.1 Scheduled Reports Filed with the RWQCB

A detection monitoring report will be submitted on a annual basis to the RWQCB with reports submitted on January 31st of each year. Each report will include the following information:

- Total volume of contaminated soil resulting from spills regardless of the volume of HTF spilled,
- Analytical results of the HTF contaminated soil,
- Disposition of the contaminated soil,
- Total volume of contaminated soil, and
- Breakdown of the total volume by disposition location (e.g., hauled off site as hazardous waste, discharged to the LTU, or re-used on site).

- Evidence that adequate financial assurance for closure, post-closure, and reasonably foreseeable releases is still in effect and may be verified by including a copy of the renewed financial instrument or a copy of the receipt for payment of the financial instrument;
- Evidence that the amount is still adequate or if not, that the amount of financial assurance has been increased by the appropriate amount, due to inflation, a change in the approved closure plan, or other unforeseen events;
- A review of the closure plan and a statement that the closure activities described are still accurate or an updated closure plan; and

- A summary of the results of the annual soil sampling program to detect if a release had occurred and evaluate the integrity of the LTU.

The "General Provisions for Monitoring and Reporting," dated September 1, 1994, will be followed for all submittals to the RWQCB.

5.1.2 Unscheduled Reports Filed with the Regional Board

Incidents that result in implementation of the CAP or SPCC will be reported to the appropriate agencies. If such incidents threaten to result in an off-site discharge or may present a potential threat to human health or the environment, immediate verbal notification shall be made as specified in the CAP or SPCC. A record of such verbal communications will be maintained in the operating record. The potential discharge situations are outlined in the following sections.

5.1.2.1 Release from the LTU Reporting

The RWQCB will be immediately notified (verbally) whenever a determination is made that there is physical evidence of a release from the LTU. This verbal notification will be followed by written notification via certified mail within seven days of such determination. Upon such notification, verification procedures may be initiated or the Project may demonstrate that another source caused evidence of a release (see below). The notification will include the following information:

- LTU that may have released or may be releasing;
- General information including the date, time, location, and cause of the release;

- An estimate of the flow rate and volume of waste involved;
- A procedure for collecting samples and description of laboratory tests to be conducted;
- Identification of any water-bearing media affected or threatened;
- A summary of proposed corrective actions; and
- For physical evidence of a release – Physical factors that indicate physical evidence of a release.

5.1.2.2 Additional reporting

Additional reporting may be required under the Waste Discharge Requirements and Monitoring and Reporting Program established by the RWQCB.HTF Spill or Leak Reporting

HTF spill or leak reporting requirements will be incorporated into the SPCC plan for the Project as follows:

- Facility personnel will be required to submit an internal report detailing a HTF spill, regardless of size.
- A release of 20 gallons is reportable to the California Energy Commission.
- A release of 25 gallons is reportable to the RWQCB.
- Project personnel will be required to verbally report a spill greater than reportable quantities (42 gallons) and is outside of a containment to the State of California, Office of Emergency Services and to the National Response Center.
- Project personnel will be required to submit a written report (Form 304) detailing a spill of 42 gallons or more to the State of California, Office of Emergency Services within 30 days

6.0 References

International Programme on Chemical Safety (IPCS), 1999. International Chemical Safety Card 0791 - Diphenyl Ether.

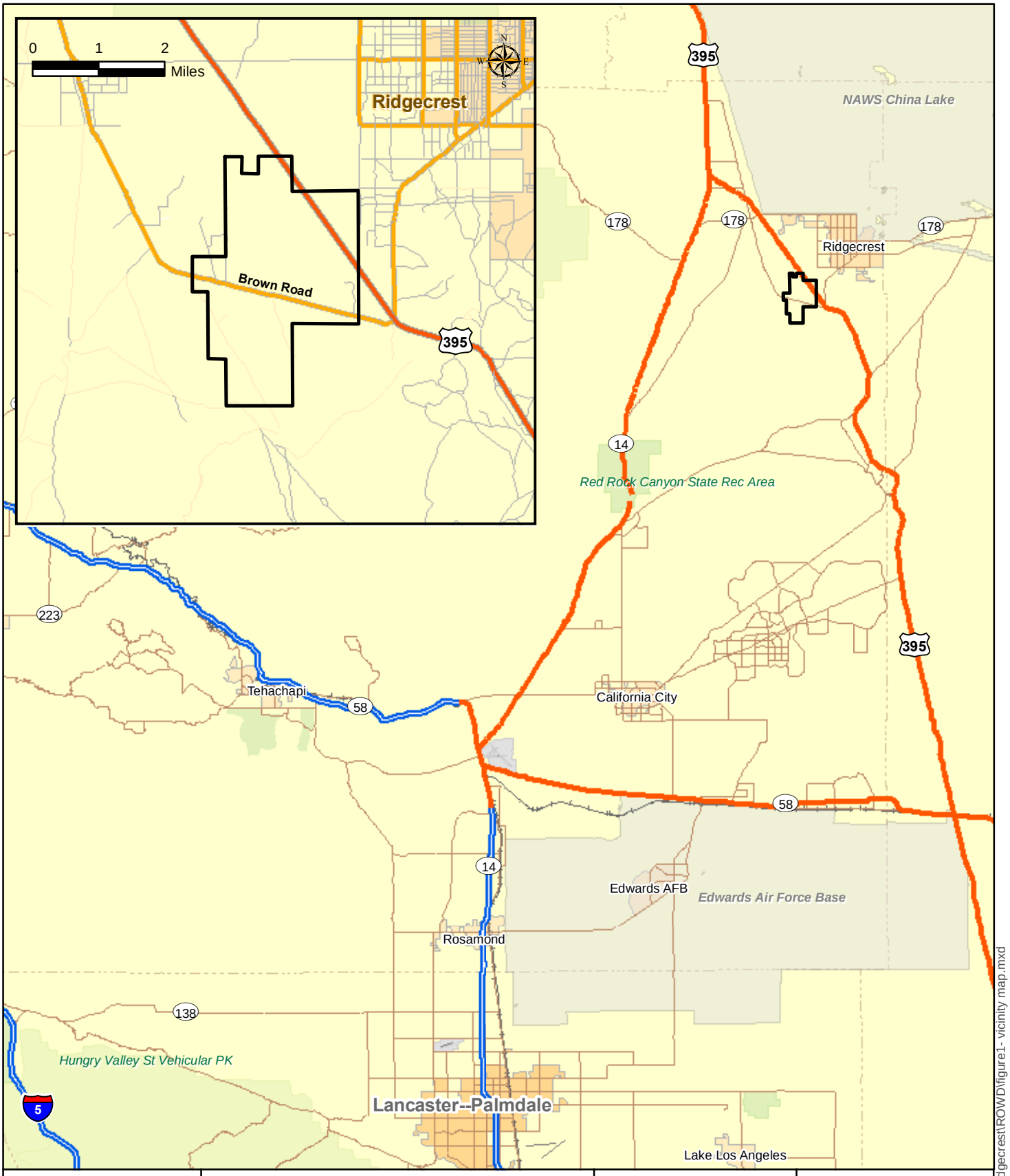
Joint FAO/WHO Expert Committee on Food Additives (JECFA), 2003. Toxicological Monograph FAS 52-JECFA 61/335 - Diphenyl Ether.

SOCMA Biphenyl Working Group, 2003. U.S. EPA High Production Volume (HPV) Challenge Program Submission - Biphenyl: CAS Number 92-52-4.

Solutia, 2006. Material Safety Data Sheet (MSDS).

Southern California Earthquake Center (SCEC), 2007. Faults of Southern California Map.

Figures



Map Location

0 5 10 Miles

Ridgecrest Solar Power Plant

Figure 1
Regional Location and Vicinity Map

Solar Millennium

AECOM

Project: 60139696
Date: January 2010

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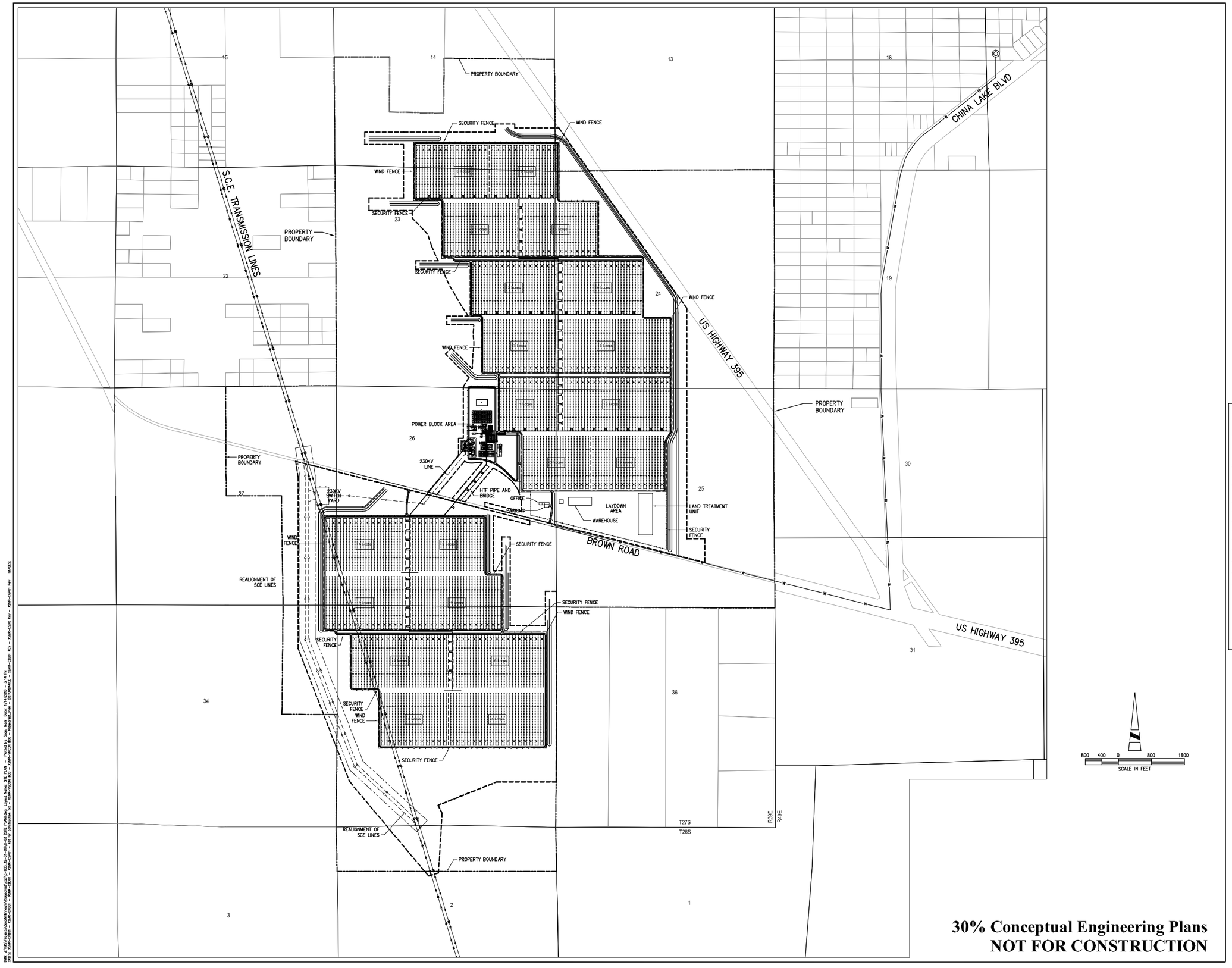

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WILLIAM CHARLES BLACK
No. C31465
EXP. 12-31-10
CIVIL
STATE OF CALIFORNIA

Designed:	W. BLACK
Checked:	W. BLACK
Drawn:	K. S. BEDFORD
Record Drawing by/date:	

Revisions:

#	DATE	DESCRIPTION

Prepared for:

Solar Millennium LLC

LEGEND:

- SOLAR FIELD PARABOLIC TROUGH
- BALANCE OF PLANT FACILITIES
- PROPOSED ACCESS ROAD (PAVED)
- PROPOSED ACCESS ROAD (GRAVEL)
- RAILROAD
- PROPOSED GAS
- PROPOSED WATER
- PROPOSED TELEPHONE
- PROPOSED ELECTRIC
- EXISTING ELECTRIC
- PROPOSED SECURITY FENCE
- PROPOSED WIND FENCE
- EXISTING CONTOURS (10 FOOT INTERVALS)
- PROPOSED DRAINAGE CHANNEL/FLOW DIRECTION
- EXISTING INTERMITTENT DRAINAGE CHANNEL
- SITE BOUNDARY
- HEADER PIPING
- ACCELERATION LANE

Ridgecrest Solar Power Project

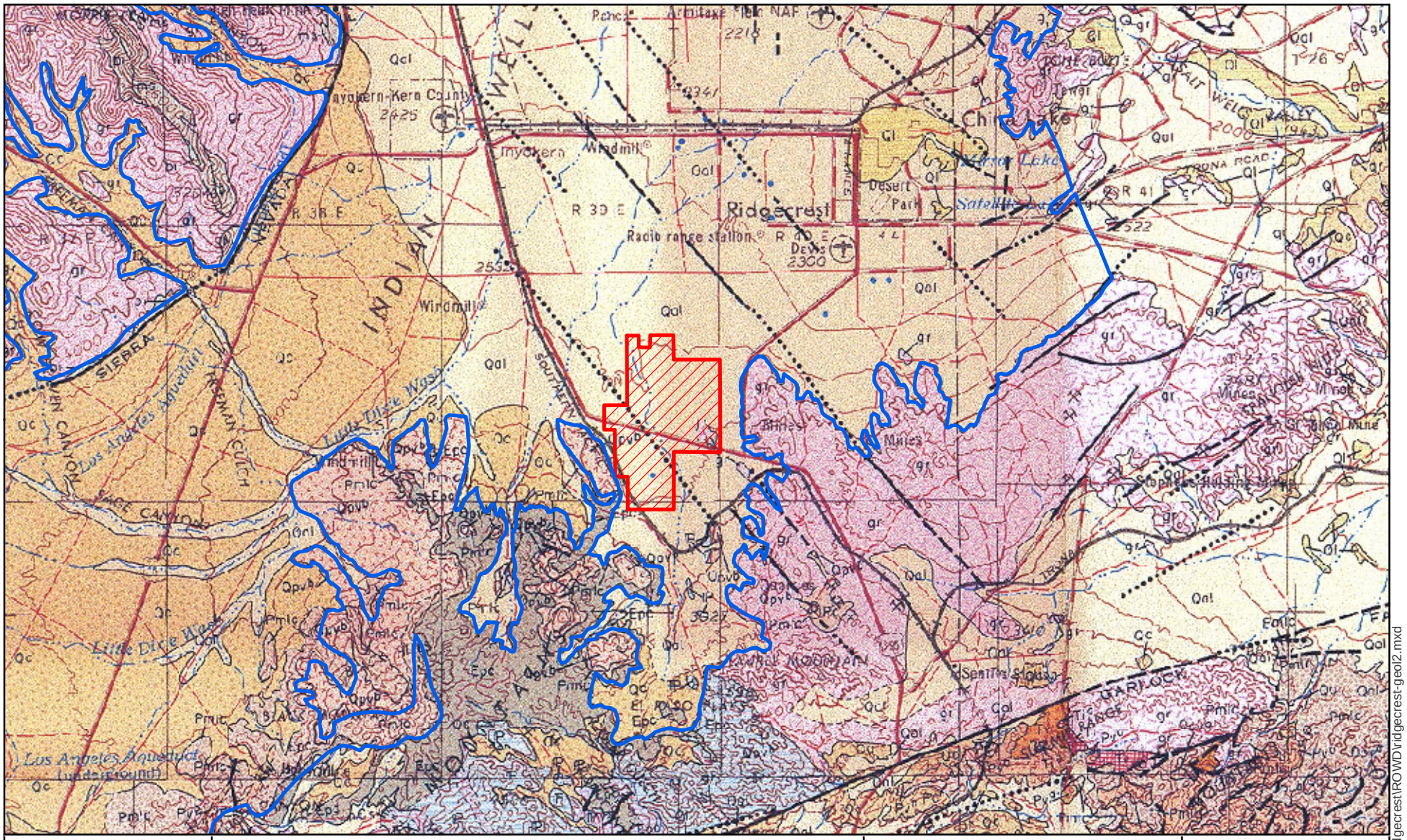
Kern County, California

Preliminary Site Plan

Figure 2

Date: 12/18/09

Sheet: .



Map Location

Legend

Project Right-of-Way

Indian Wells Valley Groundwater Basin

See Figure 3b for Geologic Legend

Sources:
Division of Mines and Geology, Geologic Map of California, Trona Sheet, Scale 1:250,000, 1963

1 in = 3 miles

0 3 6 Miles

N W E S

Ridgecrest Solar Power Plant

Figure 3a
Regional Geologic Map

Solar Millennium

AECOM

Project: 60139696
Date: January 2010

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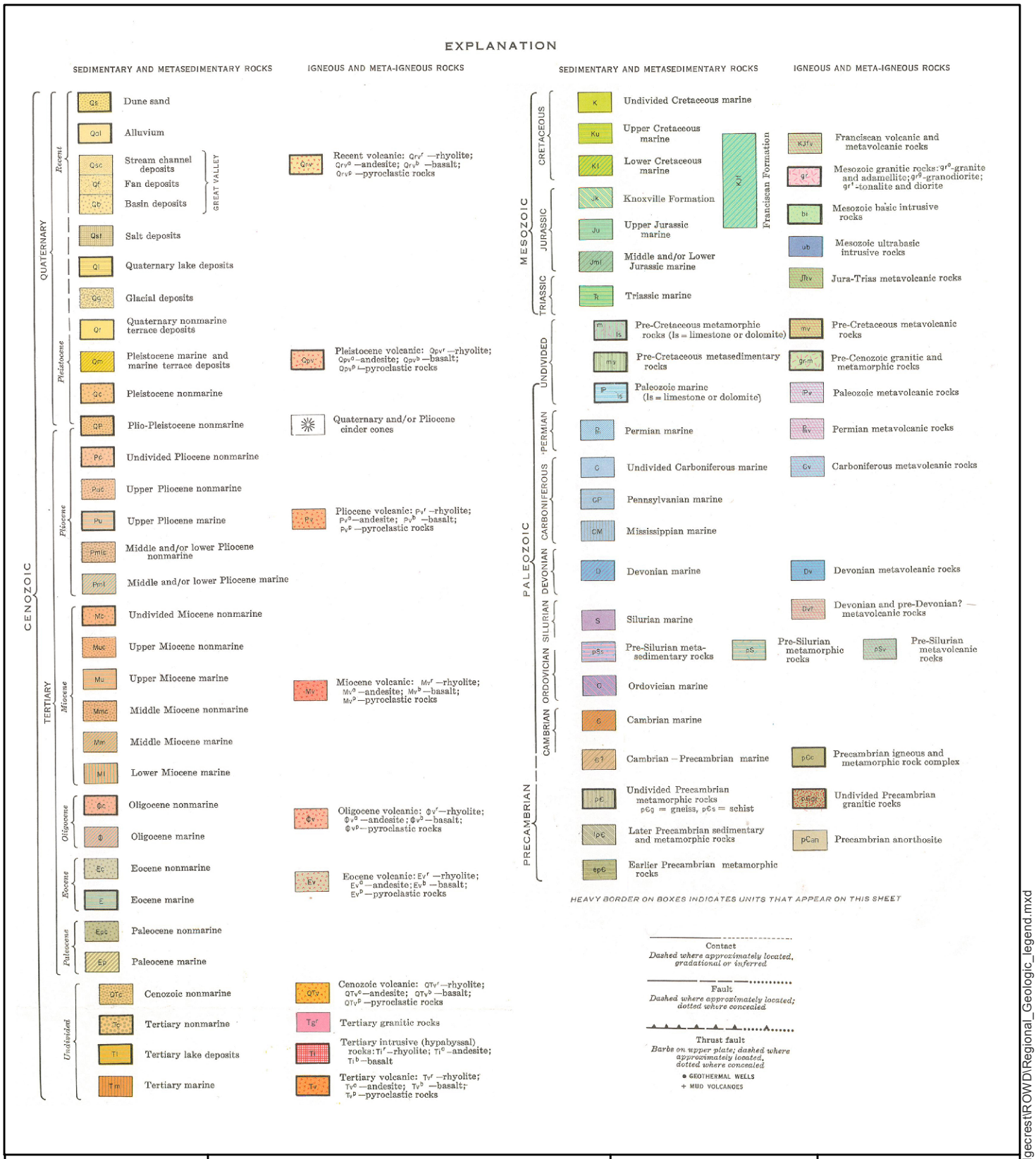

Map Location

Legend

Sources:
Division of Mines and Geology, Geologic Map of California, Trona, Scale 1:250,000, 1963

N
W
E
S

Ridgecrest Solar Power Project

Figure 3b
Regional Geologic Map Legend

Solar Millennium

AECOM

Project: 12944-003
Date: September 2009

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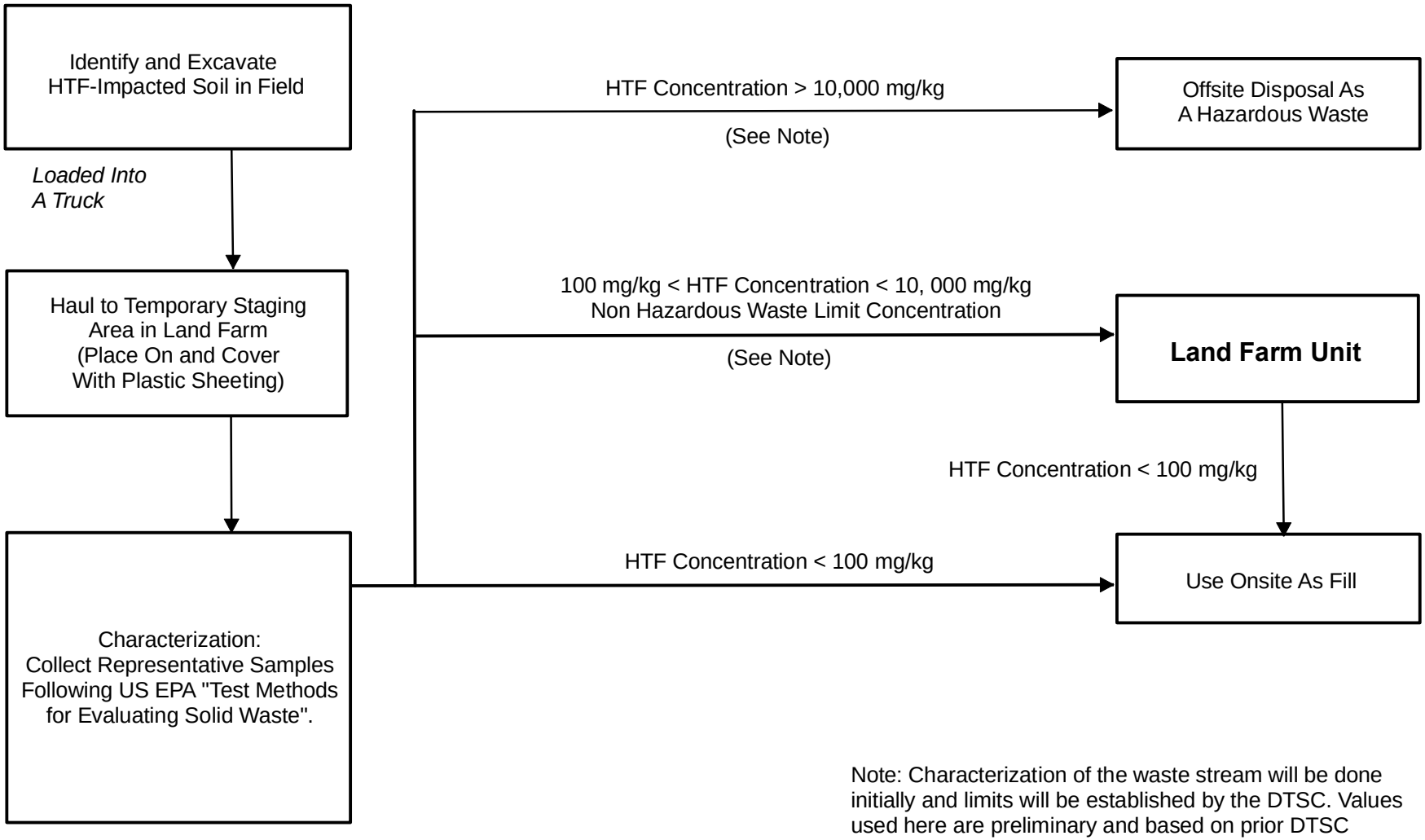

Note: Characterization of the waste stream will be done initially and limits will be established by the DTSC. Values used here are preliminary and based on prior DTSC determination.

Map Location

Ridgecrest Solar Power Project

Figure 4
Process Flow Diagram

Solar Millennium

AECOM

Project: 60139696
Date: January 2010

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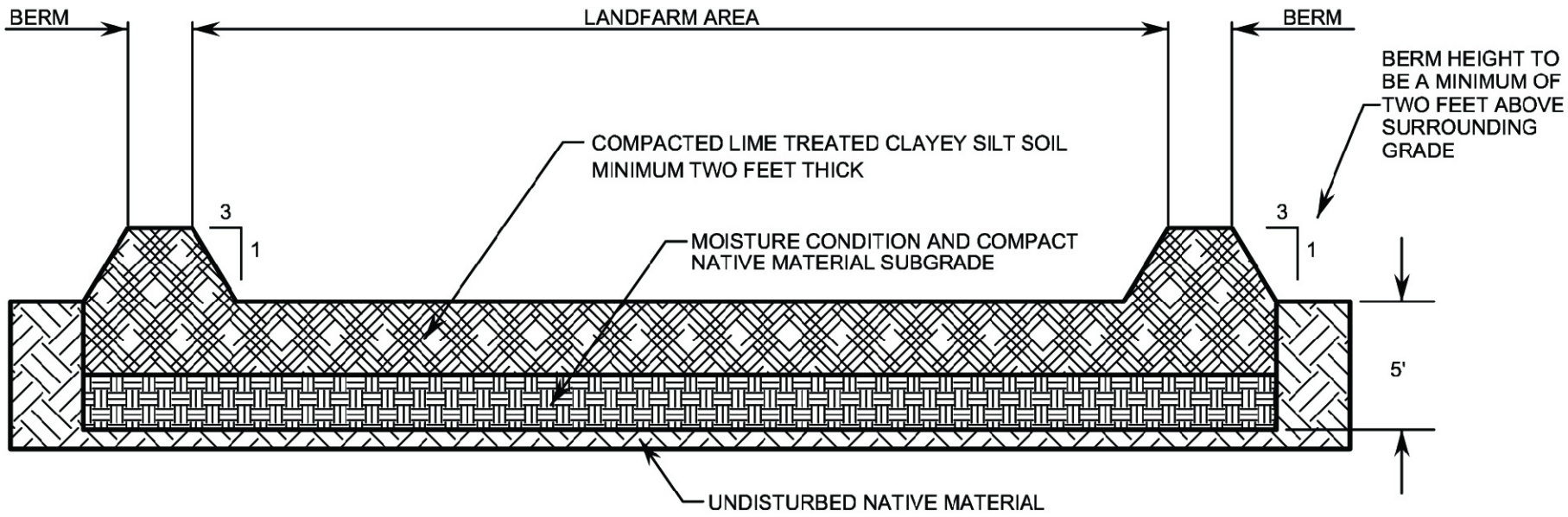

1 / - - LANDFARM UNIT-SECTION
N.T.S.

NOTES:

1. THE COMPACTED AND NATIVE SOIL BENEATH THE LAND FARM UNIT IS DESIGNATED AS A "TREATMENT ZONE" TO A DEPTH OF 5 FEET.
2. THE LIME TREATED LAYER IS TO BE COMPACTED TO A MINIMUM OF 95% OF THE MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D1557 AND HAVE A LOW PERMEABILITY (CLAYEY SILT) MATERIAL.
3. THE CROSS SECTION IS A TYPICAL SECTION.
4. SEE TEXT FOR FURTHER DETAILS.

Map Location

Rdgecrest Solar Power Project

Figure 5
Cross-Section Details of Land Treatment Unit

Solar Millennium

AECOM

Project: 60139696
Date: Januaryr 2010

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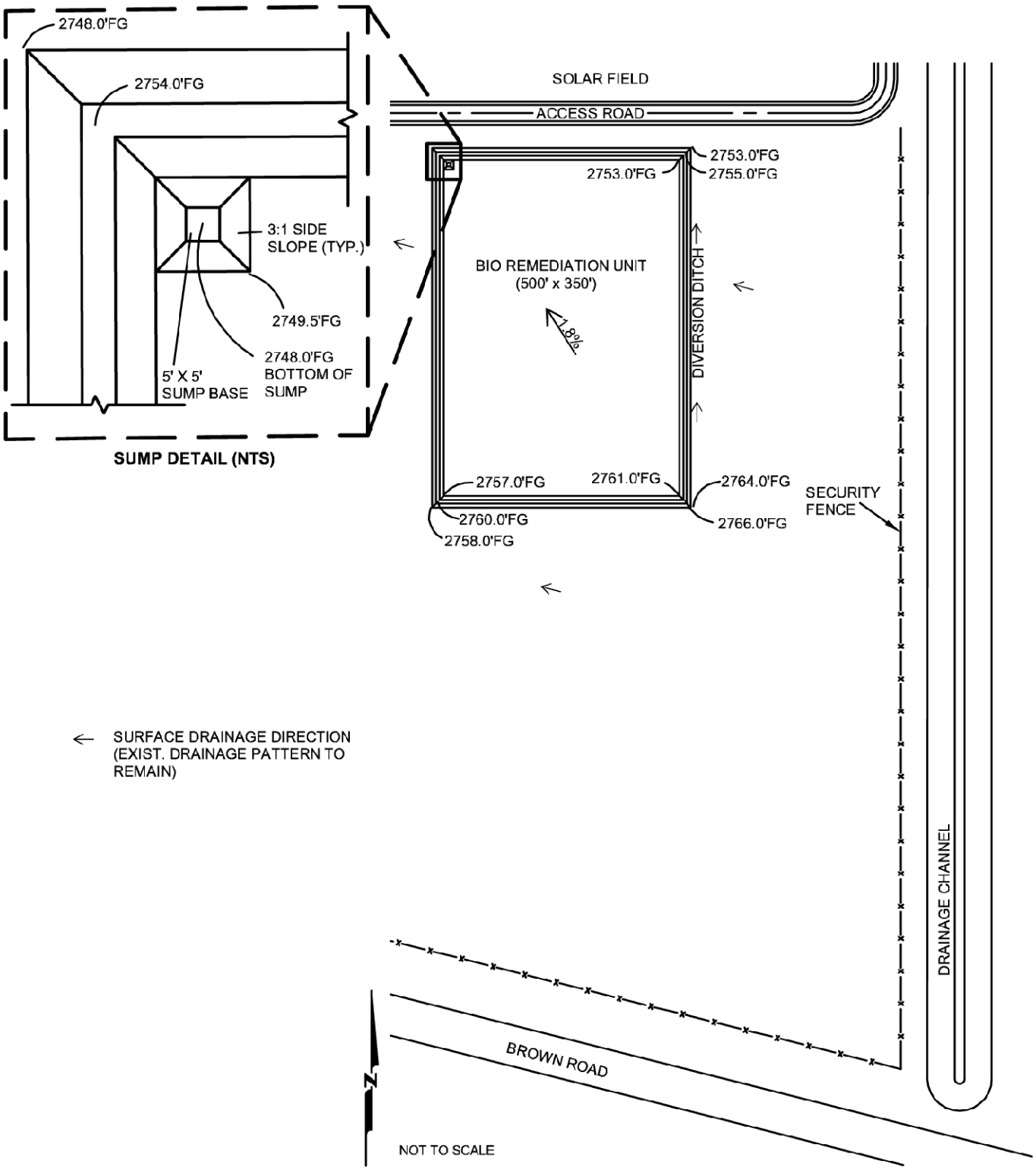

Map Location

Ridgecrest Solar Power Plant

Figure 6
Land Treatment Unit Details

Solar Millennium

AECOM

Project: 60139696
Date: January 2010

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Tables

Table 1 Land Treatment Unit Wastewater Sampling Parameters

Parameter	U.S. EPA or Standard Method	RL Goal	Units
Biphenyl Oxide	8015M	500	ug/L
Diphenyl Oxide	8015M	500	ug/L
Key: mg/L – milligrams per liter RL – reporting limit			

Table 2 Land Treatment Unit Soil Sample Analytical Parameters

Parameter	U.S. EPA or Standard Method	RL Goal	Units
Biphenyl Oxide	8015M	1.0	mg/kg
Diphenyl Oxide	8015M	1.0	mg/kg
Key: mg/kg – milligrams per kilogram RL – reporting limit			

Appendix A

Material Safety Data Sheets

Solutia Inc.

Material Safety Data Sheet

1. PRODUCT AND COMPANY IDENTIFICATION

Product name: THERMINOL® VP1 Heat transfer fluid

Reference Number: 000000000211 Date: 05/16/2006

Company Information:

United States:
Solutia Inc.
575 Maryville Center Drive, P.O. Box 66760
St. Louis, MO 63166-6760
Emergency telephone: Chemtrec: 1-800-424-9300
International Emergency telephone: Chemtrec: 703-527-3887
Non-Emergency telephone: 1-314-674-6661

Canada:
Solutia Canada Inc.
6800 St. Patrick Street
LaSalle, PQ H8N 2H3
Emergency telephone: CANUTEC: 1-613-996-6666
Non-Emergency telephone: 1-314-674-6661

Mexico:
Solutia MEXICO, S. DE R.L. DE C.V.
Prol. Paseo de la Reforma 2654
Local 501, Piso-5
Col. Lomas Altas
11950 Mexico, D.F.
Emergency telephone: SETIQ: (in Mexico) 01-800-002-1400
Non-Emergency telephone: (in Mexico) 01-55-5259-6800

Brazil:
Solutia Brazil Ltd.
Avenue Carlos Marcondes, 1200
CEP: 12241-420-São José dos Campos/SP-Brazil
Emergency telephone: 55 12 3932 7100 (PABX)
Non-Emergency telephone: 55 11 3365 1800 (PABX)

2. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

Form:	liquid
Colour:	clear to colourless
Odour:	characteristic

WARNING STATEMENTS

WARNING!
Causes eye irritation
Causes skin irritation
Causes respiratory tract irritation
Contains material which can cause liver and nerve damage

POTENTIAL HEALTH EFFECTS

Likely routes of exposure:	eye and skin contact inhalation
Eye contact:	Highly irritating to eyes.
Skin contact:	Highly irritating to skin. Prolonged or repeated skin contact may result in irritant dermatitis.
Inhalation:	Severely irritating if inhaled. No more than slightly toxic if inhaled. Significant adverse health effects are not expected to develop under normal conditions of exposure.
Ingestion:	No more than slightly toxic if swallowed. Significant adverse health effects are not expected to develop if only small amounts (less than a mouthful) are swallowed.
Signs and symptoms of overexposure:	headache fatigue nausea/vomiting indigestion abdominal pain tremors
Target organs/systems:	May cause liver damage May cause nerve damage

Refer to Section 11 for toxicological information.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Components	CAS No.	Average concentration	Concentration range	Units
diphenyl ether	101-84-8	73.5		%
biphenyl	92-52-4	26.5		%

4. FIRST AID MEASURES

If in eyes:	Immediately flush with plenty of water for at least 15 minutes. If easy to do, remove any contact lenses. Get medical attention. Remove material from skin and clothing.
If on skin:	Immediately flush the area with plenty of water. Remove contaminated clothing. Wash skin gently with soap as soon as it is available. Get medical attention. Wash clothing before reuse.
If inhaled:	Remove patient to fresh air. If not breathing, give artificial respiration. If breathing is difficult give oxygen. Remove material from eyes, skin and clothing.

If swallowed: Immediate first aid is not likely to be required.
A physician or Poison Control Center can be contacted for advice.
Wash heavily contaminated clothing before reuse.

5. FIRE FIGHTING MEASURES

Fire point: 127 C

Hazardous products of combustion: carbon monoxide (CO); carbon dioxide; hydrocarbons

Extinguishing media: Water spray, foam, dry chemical, or carbon dioxide

Unusual fire and explosion hazards: None known

Fire fighting equipment: Firefighters, and others exposed, wear self-contained breathing apparatus. Equipment should be thoroughly decontaminated after use.

Miscellaneous advice: This product is not classified as a fire-resistant heat transfer fluid. Precautions to avoid sources of ignitions should be taken.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions: Use personal protection recommended in section 8.

Environmental precautions: Keep out of drains and water courses.

Methods for cleaning up: Contain large spills with dikes and transfer the material to appropriate containers for reclamation or disposal. Absorb remaining material or small spills with an inert material and then place in a chemical waste container. Flush spill area with water.

Refer to Section 13 for disposal information and Sections 14 and 15 for reportable quantity information.

7. HANDLING AND STORAGE

Handling
Avoid contact with eyes, skin and clothing.
Avoid breathing vapour or mist.
Keep container closed.
Use with adequate ventilation.
Wash thoroughly after handling.
Precautions against ignitions and fire should be taken with this product.
Heat transfer fluids are intended for INDIRECT heating purposes ONLY.
This product has not been approved for food grade use.

Emptied containers retain vapour and product residue. Observe all recommended safety precautions until container is cleaned, reconditioned or destroyed. Do not cut, drill, grind or weld on or near this container. The reuse of this material's container for non industrial purposes is prohibited and any reuse must be in consideration of the data provided in this material safety data sheet.

Storage
General: Stable under normal conditions of handling and storage.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Airborne exposure limits: (ml/m3 = ppm)

THERMINOL® VP1	No specific occupational exposure limit has been established.
biphenyl	ACGIH TLV: 0.2 ml/m3 ; mist ; 8-hr TWA OSHA PEL: 0.2 ml/m3 ; 1.0 mg/m3 ; ; 8-hr TWA Mexican OEL: 0.2 ml/m3 ; 1.5 mg/m3 ; ; 8-hr TWA Mexican OEL: 0.6 ml/m3 ; 4 mg/m3 ; ; 15-min STEL
diphenyl ether	ACGIH TLV: 1 ml/m3 ; ; 8-hr TWA ACGIH TLV: 2 ml/m3 ; ; 15-min STEL OSHA PEL: 1 ml/m3 ; 7 mg/m3 ; ; 8-hr TWA Mexican OEL: 1 ml/m3 ; 7 mg/m3 ; ; 8-hr TWA Mexican OEL: 2 ml/m3 ; 14 mg/m3 ; ; 15-min STEL

Eye protection:	Wear safety goggles. Have eye flushing equipment available.
Hand protection:	Wear chemical resistant gloves. Consult the glove/clothing manufacturer to determine the appropriate type glove/clothing for a given application. See Solutia Glove Facts for permeation data.
Body protection:	Wear suitable protective clothing. Consult the glove/clothing manufacturer to determine the appropriate type glove/clothing for a given application. Wear full protective clothing if exposed to splashes. Wash contaminated skin promptly. Launder contaminated clothing and clean protective equipment before reuse. Wash thoroughly after handling. Have safety shower available at locations where skin contact can occur.
Respiratory protection:	Avoid breathing vapour or mist. Use approved respiratory protection equipment (full facepiece recommended) when airborne exposure limits are exceeded. If used, full facepiece replaces the need for face shield and/or chemical goggles. Consult the respirator manufacturer to determine the appropriate type of equipment for a given application. Observe respirator use limitations specified by the manufacturer.
Ventilation:	Provide natural or mechanical ventilation to control exposure levels below airborne exposure limits. If practical, use local mechanical exhaust ventilation at sources of air contamination such as processing equipment.

Components referred to herein may be regulated by specific Canadian provincial legislation. Please refer to exposure limits legislated for the province in which the substance will be used.

9. PHYSICAL AND CHEMICAL PROPERTIES

Flash point:	110 C	Pensky-Martens closed tester
	124 C	Cleveland Open Cup

Autoignition temperature:	612 C	ASTM D-2155
Density:	1.06 g/cm3 @ 25 C	
Boiling point :	257 C	
Crystallising point :	12 C	
Water solubility:	~25 mg/l	

NOTE: These physical data are typical values based on material tested but may vary from sample to sample. Typical values should not be construed as a guaranteed analysis of any specific lot or as specifications for the product.

10. STABILITY AND REACTIVITY

Conditions to avoid:	All sources of ignition.
Materials to avoid:	Contact with strong oxidizing agents.
Hazardous reactions:	Hazardous polymerization does not occur.
Hazardous decomposition products:	None known;

11. TOXICOLOGICAL INFORMATION

This product has been tested for toxicity. Results from Solutia sponsored studies or from the available public literature are described below.

Acute animal toxicity data

Oral:	LD50 , rat, 2,050 mg/kg , No more than slightly toxic
Dermal:	LD50 , rabbit, > 5,010 mg/kg , Practically nontoxic after skin application in animal studies.
Inhalation:	LC50 , rat, 2.66 mg/l , 4 h, Toxic based on animal inhalation exposure studies.
Skin irritation:	rabbit , Slightly irritating to skin., 24 h
Repeat dose toxicity:	rat, , inhalation, 13 weeks, , Produced effects on body weight, serum enzymes and/or organ weights in repeat dose studies.
Repeat dose toxicity:	rat, , gavage, 26 weeks, , Produced effects on body weight, serum enzymes and/or organ weights in repeat dose studies. Effects only observed at very high dose levels.
Target organs affected	kidneys, liver, spleen
Repeat dose toxicity:	rat, , diet, subchronic, , Repeated oral exposure produced liver and kidney changes in animal models.
Target organs affected	liver, kidneys
Developmental toxicity:	rat, gavage, , No effects on offspring observed in laboratory animals in the presence of maternal toxicity.

Mutagenicity: No genetic effects were observed in standard tests using bacterial and animal cells.

Components

Data from Solutia studies and/or the available scientific literature on the components of this material which have been identified as hazardous chemicals under the criteria of the OSHA Hazard Communication Standard (29 CFR 1910.1200) or the Canadian Hazardous Products Act are discussed below.

biphenyl	Chronic exposure has been reported to cause headache, fatigue, nausea, indigestion, abdominal pain, tremor, central and peripheral nerve damage and liver injury. Slightly toxic following oral administration. Practically nontoxic after skin application in animal studies. Practically non irritating to skin (rabbit). Slightly irritating to eyes (rabbit). No mortality or signs of toxicity at the highest level achievable. Irritating to respiratory system in animal models. Produced effects on body weight, serum enzymes and/or organ weights in repeat dose studies. Produced no dermal sensitization (guinea pigs). No effects on offspring observed in laboratory animals in the presence of maternal toxicity. No genetic effects were observed in standard tests using bacterial and animal cells.
diphenyl ether	Predictive patch testing on human volunteers did not produce irritation or sensitization. Slightly toxic following oral administration. Practically nontoxic after skin application in animal studies. Slightly irritating to eyes (rabbit). Slightly irritating to skin (rabbit). Repeated exposure produced respiratory tract irritation in animal models. Repeated exposure produced eye irritation in animal models. No genetic effects were observed in standard tests using bacterial and animal cells.

12. ECOLOGICAL INFORMATION

Environmental Toxicity

Invertebrates	48 h, EC50	Water flea (Daphnia magna)	2.4 mg/l
Fish:	96 h, LC50	Rainbow trout (Oncorhynchus mykiss)	7.6 mg/l
	96 h, LC50	Fathead minnow (Pimephales promelas)	24 mg/l
Algae:	96 h, EC50	Algae (Selenastrum capricornutum)	1.3 mg/l

Biodegradation Modified SCAS (OECD 302A) Primary degradation 99 %

13. DISPOSAL CONSIDERATIONS

US EPA RCRA Status: This material when discarded may be a hazardous waste as that term is defined by the Resource Conservation and Recovery Act (RCRA), 40 CFR 261.24, due to its toxicity characteristic. This material should be analyzed in accordance with Method 1311 for the compound(s) below.

US EPA RCRA	D018	Compound/Characteristic:	BENZENE

hazardous waste number:

Disposal considerations: Incineration

Miscellaneous advice: This product meets the criteria for a synthetic used oil under the U.S. EPA Standards for the Management of Used Oil (40 CFR 279). Those standards govern recycling and disposal in lieu of 40 CFR 260 -272 of the Federal hazardous waste program in states that have adopted these used oil regulations. Consult your attorney or appropriate regulatory official to be sure these standards have been adopted in your state. Recycle or burn in accordance with the applicable standards.
Solutia operates a used fluid return program for certain fluids under these used oil standards. Contact your Sales Representative for details.
This product should not be dumped, spilled, rinsed or washed into sewers or public waterways.

14. TRANSPORT INFORMATION

The data provided in this section is for information only. Please apply the appropriate regulations to properly classify your shipment for transportation.

US DOT

Proper shipping name:	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. *biphenyl*
Hazard Class:	9
Hazard Identification number:	UN3082
Packing Group:	Packing Group III
Transport label:	Class 9
Special provisions:	This material meets the definition of a marine pollutant.
Other:	Applies ONLY to containers with an RQ or for shipments in bulk via water transportation.

Canadian TDG

Other:	Not regulated for transport.

Reportable Quantity/Limit

US DOT RQ 100 lb *biphenyl*
Package size containing reportable amount: 377 lb

ICAO/IATA Class

Other:	See DOT Information

15. REGULATORY INFORMATION

All components are in compliance with the following inventories:	U.S. TSCA, EU EINECS, Canadian DSL, Australian AICS, Korean, Japanese ENCS, Phillipine PICCS, Chinese
Canadian WHMIS classification:	D2(A) - Materials Causing Other Toxic Effects D2(B) - Materials Causing Other Toxic Effects

SARA Hazard Notification:

Hazard Categories Under Title III Rules (40 CFR 370):	Immediate Delayed

Section 302 Extremely Hazardous Substances:	Not applicable
Section 313 Toxic Chemical(s):	biphenyl

CERCLA Reportable Quantity:

100 lbs biphenyl
For this/these chemicals, release of more than the Reportable Quantity to the environment in a 24 hour period requires notification to the National Response Center (800-424-8802 or 202-426-2675).

This product has been classified in accordance with the hazard criteria of the Canadian Controlled Products Regulation and the MSDS contains all the information required by the Canadian Controlled Products Regulation.

Refer to Section 11 for OSHA/HPA Hazardous Chemical(s) and Section 13 for RCRA classification.

Safety data sheet also created in accordance with Brazilian law NBR 14725

16. OTHER INFORMATION

Product use: Heat transferring agents

Reason for revision: Significant changes to the following section(s):, Section 1

	Health	Fire	Reactivity	Additional Information
Suggested NFPA Rating	2	1	0	
Suggested HMIS Rating:	2	1	0	G

Prepared by the Solutia Hazard Communication Group. Please consult Solutia @ 314-674-6661 if further information is needed.

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Appendix B

Standard Operating Procedures

RIDGECREST SOLAR 1, LLC
STANDARD OPERATING PROCEDURES
KERN COUNTY, CALIFORNIA

SOP-01

DRILLING METHODS

STANDARD OPERATING PROCEDURES

SOP-1
DRILLING METHODS

TABLE OF CONTENTS

Section **Page**

1.0 INTRODUCTION 1

2.0 DEFINITIONS 2

3.0 RESPONSIBILITIES 3

4.0 DRILLING METHODS 3
- 4.1 Methods Without Circulating Fluids 3
  - 4.1.1 Augering 3
  - 4.1.2 Percussion Drilling 6
- 4.2 Methods With Circulating Fluids 9
  - 4.2.1 Rotary Drilling Methods 9
  - 4.2.2 Dual-Tube Percussion Drilling 13
  - 4.2.3 Suction Drilling 14

5.0 CONSIDERATIONS FOR SELECTION OF DRILLING METHODS 15
- 5.1 Drilling Objectives 15
- 5.2 Site Conditions 15
  - 5.2.1 Subsurface Conditions 16
  - 5.2.2 Surface Conditions 16
- 5.3 Waste Generation 16

DISCLAIMER

THE FOLLOWING STANDARD OPERATING PROCEDURE PROVIDES GENERAL GUIDANCE FOR AECOM PERSONNEL FOR TECHNICAL ISSUES ADDRESSED DURING ENVIRONMENTAL SITE INVESTIGATION AND REMEDIATION ACTIVITIES. IT IS NOTED, HOWEVER, THAT EACH SITE IS UNIQUE AND THESE GUIDELINES ARE NOT A SUBSTITUTE FOR COMMON SENSE AND GOOD MANAGEMENT PRACTICES BASED ON PROFESSIONAL TRAINING AND EXPERIENCE. IN ADDITION, INDIVIDUAL CONTRACT TERMS MAY AFFECT THE IMPLEMENTATION OF THIS STANDARD OPERATING PROCEDURE. AECOM PERSONNEL RESERVE THE UNRESTRICTED RIGHT TO CHANGE, MODIFY OR NOT APPLY THESE GUIDELINES IN THEIR SOLE, COMPLETE, AND UNRESTRICTED DISCRETION TO MEET CERTAIN CIRCUMSTANCES, CONTRACTUAL REQUIREMENTS, SITE CONDITIONS, OR JOB REQUIREMENTS.

1.0 INTRODUCTION

Drilling is a common activity associated with many phases of environmental investigations. A variety of drilling methods can be used to collect site data during investigations and studies, and to install vapor extraction or water wells associated with remedial actions, treatability studies, or pilot studies.

Field investigations usually require invasive activities to gather information for site evaluation. The investigation may require a borehole to facilitate the collection and subsequent analysis of soil and/or groundwater samples. The borehole is often converted into a well for evaluating vapor or groundwater conditions over a longer period of time. In addition to the collection of samples for analyses, other data, such as sediment or rock classification; the presence of contamination; geophysical, geotechnical, or physical parameters of the sediment or rock; and the occurrence of groundwater, can be obtained from boreholes.

To determine the most appropriate drilling method for investigations or studies, primary consideration must be given to obtaining samples that are representative of existing conditions and are valid for chemical analysis. The samples must not be contaminated or adversely affected by the drilling method.

Drilling associated with remedial actions, pilot studies, or treatability studies may include the installation of vapor or water extraction and/or injection wells. In selecting the most appropriate drilling method for these projects, primary consideration must be given to completion of a well that will perform as designed.

This Standard Operating Procedure (SOP) describes the principles of operation and the applicability and implementability of standard drilling methods used during field investigations. The purpose of this document is to aid in the selection of appropriate drilling methods for site-specific conditions. This SOP is intended to be used by the Project Manager (PM), Project Engineer (PE), Field Team Leader (FTL), and site hydrogeologist or geologist (of which a minimum of one must be a qualified Nevada Certified Environmental Manager [C.E.M.]) to develop an understanding of each drilling method sufficient to plan, schedule, and perform the activities associated with drilling.

This SOP focuses on methods and equipment that are readily available and typically applied. It is not intended to provide a comprehensive discussion of drilling methods. Two general drilling methods are discussed: (1) methods that do not use circulating fluids; and (2) methods requiring the circulation of drilling fluids to transport cuttings to the surface. More specific drilling methods or techniques can be researched, as necessary, by contacting a drilling subcontractor and learning about the specific methodology that may be most beneficial to implement.

2.0 DEFINITIONS

Bailer	A cylindrical tool designed to remove material, both solid and liquid, from a well or borehole. A valve, which can be a ball or flap, at the bottom of the bailer retains the material in the bailer. There are four types of bailers: ball-valve, flat-valve, dart-valve, and the sand pump with rod plunger.
Cone Penetrometer	An instrument used to determine and evaluate subsurface conditions by measuring the ratio of cone tip resistance to sleeve friction, and then comparing that ratio to a standardized set of ratios. The cone penetrometer can be fitted with other instruments that are able to determine pore pressure (the presence of groundwater), to detect contamination and identify the contaminant, and to determine other physical parameters of the sediment. The cone penetrometer consists of a conical point attached to a drive rod of smaller diameter. Penetration of the cone into the formation forces the soil aside, creating a complex shear failure. The cone penetrometer is very sensitive to small differences in soil consistency.
Cuttings	As a borehole is drilled, the subsurface material displaced by drilling and brought to the surface.
Drilling Fluids or Muds	A water-based or air-based fluid used in the well drilling operation to remove cuttings from the borehole, to clean and cool the bit, to reduce friction between the drill string and the sides of the borehole, to stabilize borehole walls, and to seal the borehole.
Dual-Purpose Well	A well that can be used as both a monitoring and extraction or injection well.
Flight	An individual auger section, usually 5 feet in length.
Heaving Formation	Unconsolidated, saturated substrate encountered during drilling where the hydrostatic pressure of the formation is greater than the borehole pressure causing the sands to move up into the borehole, and frequently causing drilling or well installation complications. Clean water or drilling muds may need to be introduced into the borehole to minimize or eliminate the potential for heaving.
Kelly Bar	A hollow steel bar or pipe that is the main section of drill string to which the power is directly transmitted from the rotary table to rotate the drill pipe and bit. The cross section of the kelly is either square, hexagonal, or grooved. The kelly works up and down through drive bushings in the rotary table.
Pitch	The distance along the axis of an auger flight that it takes for the helix to make one complete 360-degree turn.
Rotary Table	A mechanical or hydraulic assembly that transmits rotational torque to the kelly, which is connected to the drill pipe and the bit. The rotary table has a hole in the center through which the kelly passes.
Split-Spoon Sampler	A thick-walled, typically 18-inch long steel tube split lengthwise and used to collect soil samples. The sampler is commonly lined with brass or

	stainless steel sample sleeves and is driven or pushed downhole by the drill rig to collect samples.
Thin-Walled Sampler	A sampling devise used to obtain undisturbed soil samples made from thin-wall tubing. The sampler is also known as a Shelby tube. The thin-wall sampler minimizes the most serious sources of disturbance: displacement and friction.

3.0 RESPONSIBILITIES

The **Project Manager** or **Task Leader** will select site-specific drilling methods, with input from the FTL and Site Hydrogeologist or Geologist, and will maintain close supervision of the activities and progress.

The **Site Hydrogeologist** (a California licensed Professional Geologist (P.G)) selects site-specific drilling options and assists in the preparation of technical provisions of drilling procedures and details.

The **Field Team Leader** implements the selected drilling program and assists in the selection of drilling methods.

4.0 DRILLING METHODS

Drilling methods can be separated into two general types: techniques that use circulating fluids and techniques that do not use circulating fluids. The following section discusses the drilling methods that fall into these two general categories.

4.1 Methods Without Circulating Fluids

There are two drilling methods that do not require circulating fluids: augering and percussion drilling. SOPs for each of these methods are described below.

4.1.1 Augering

Auger drilling is accomplished by rotating a pipe or rod that has a cutting bit. The common auger drilling methods discussed in this section are hand, continuous-flight, hollow-stem, and bucket.

4.1.1.1 Hand Auger

A hand auger typically cuts a hole 2 to 9 inches in diameter and, depending on the geologic materials, may be advanced to about 15 or 20 feet. Generally, the borehole cannot be advanced below the water table because the hole collapses. Soil samples for chemical or geotechnical analyses should not be collected directly from a hand auger because the samples are disturbed and cross contamination may

occur. Samples for chemical or geotechnical analyses should be taken with a sampling tool such as a drive sampler driven at the desired depth. Samples for lithologic logging purposes may be taken directly from the auger.

Applications	Limitations
• Shallow soil investigations	• Limited to shallow depths
• Requires minimal access	• Unable to penetrate dense or rocky soil
• Soil sample collection	• Borehole stability difficult to maintain
• Water-bearing zone identification	• Labor intensive

4.1.1.2 Continuous-Flight Auger

Continuous-flight augers consist of a plugged, tubular steel center shaft around which a continuous steel strip, in the form of a helix, is welded. An individual auger is known as a “flight” and is generally 5 feet long. Auger drill heads are generally designed to cut a hole 10 percent greater in diameter than the actual diameter of the auger they serve. In addition to diameter, augers are specified by the pitch of the auger and the shape and dimension of the connections.

Applications	Limitations
• Shallow soils investigations	• Soil sampling difficult and limited to areas of stable soils
• Soil sample collection	• Difficult to build monitoring wells in unstable soils
• Vadose zone monitoring wells	• Depth capability decreases as diameter of auger increases
• Groundwater monitoring wells in saturated, stable soils	• Monitoring well diameter limited by auger diameter
• Identification of depth to bedrock	
• Fast and mobile	

4.1.1.3 Hollow-Stem Auger

Hollow-stem augers are commonly used in unconsolidated materials to depths of approximately 150 feet. An advantage of this drilling method is that undisturbed soil samples can be collected and the augers act as a temporary outer casing when installing a monitoring well.

Hollow-stem augers are generally made of two pieces: an annular outer head attached to the bottom of the lead auger and an inner pilot or center bit mounted in a plug that is removable from the center of the auger to the surface. The removable inner plug is the primary advantage of this drilling method.

Withdrawing the plug while leaving the auger in place provides an open, cased hole into which samplers, down-hole drive hammers, instruments, casing, wire, pipe, or numerous other items can be inserted. Replacing the center bit and plug allows for continuation of the borehole.

Hollow-stem augers are specified by the inside diameter of the hollow stem, not by the hole size it drills. Hollow-stem augers are available with inside diameters of 2.5, 3.25, 3.375, 4.0, 4.25, 6.25, 6.625, 8.25, and 10.25 inches. The larger diameter augers, 8.25 and 10.25 inches, are not generally used for monitoring well installation, although they have been used for the installation of dual-purpose wells.

The rotation of the augers causes the cuttings to move upward and “smear” along the borehole walls. This smearing may effectively seal off the upper zones, thereby reducing the possibility of cross contamination of the upper zones to the deeper zones, but increases the possibility of deep to shallow contamination. However, this is not a method that is used for the purpose of sealing a borehole.

Drilling speed with hollow-stem augers is dependent upon the types of materials encountered. Heavy formations such as “fat” clays should be drilled at 30 to 50 revolutions per minute (rpm). Good clean sand that will stand open can be successfully augered at 75 rpm.

Applications

- Most frequently used method
- Most types of soil investigations
- Permits good soil sampling with split-spoon or thin-wall samplers
- Monitoring well installation in unconsolidated formations
- Can serve as temporary casing
- Can be used in stable formations to set surface casing

Limitations

- Difficulty in preserving sample integrity in heaving formations
- Formation invasion by water or drilling mud if used to control heaving
- Possible cross contamination of aquifers where annular space not positively controlled by water or drilling mud or surface casing
- Limited diameter of augers limits casing size
- Smearing of clays may seal off aquifer to be monitored

4.1.1.4 Bucket Auger

Bucket augers have a depth capacity of 30 to 75 feet and are used for large diameter holes (16 to 48 inches). Most bucket augers are “gravity fed” and are used for vertical holes. They are not normally used to drill monitoring wells or for soil sampling but may be used to drill production and recovery wells. Bucket augers may also be used to set conductor or surface casings for production wells.

Generally, the auger bucket advances into the formation by combination of dead weight and the tooth cutting angle. The auger cuts into the formation approximately 1 to 2 feet at a time, filling the auger bucket. The bucket is attached to the lower end of a kelly bar that passes through and is rotated by a

large ring gear that serves as a rotary table. The kelly is square in cross section and consists of two or more lengths of square tubing, one length telescoped inside the other. When the bucket is withdrawn from the hole by means of a wire-line hoist cable, it is swung to the side of the hole and the spoil is dumped out through the bottom by means of a hinge and latch device on the bucket bottom.

Applications	Limitations
• Drilling of large diameter boreholes to a maximum depth of 75 feet • Drilling in unconsolidated formations	• Difficult to advance the borehole below the water table • Consolidated formations and cobbles are difficult to drill • Loose sand formations may slough during drilling • Undisturbed soil sampling difficult to achieve

4.1.2 Percussion Drilling

The basic method of advance in percussion drilling is hammering, striking, or beating on the sediments or formation. Common percussion methods that do not use circulating fluids are cable-tool, driven boreholes, and sonic drilling.

4.1.2.1 Cable-Tool Drilling

Cable-tool operates by alternately raising and dropping a bit, hammer, or other heavy tool. In consolidated formations, the drill bit breaks or crushes the formation. In unconsolidated formations, the drill bit primarily loosens the formation when drilling. In both instances, the reciprocating action of the tools mixes the crushed or loosened particles with water to form a slurry or sludge at the bottom of the borehole. If little or no water exists in the penetrated formation, water is added to form the slurry. Slurry accumulation increases as drilling proceeds and eventually it reduces the impact of the tools. When the drop of the string of tools is hindered by the thickened slurry, the slurry is removed by a bailer. Water is then added, if needed, and drilling resumes.

Most boreholes drilled in unconsolidated formations are drilled “open hole;” that is, no casing is used during part or all of the drilling operation. Drilling in unconsolidated formations differs from hard-rock drilling as pipe or well casing must follow the drill bit closely as the well is deepened to prevent caving and to keep the borehole open.

Using the cable-tool drilling technique in monitoring work is limited because the method is slow. Drilling rates of 20 to 100 feet per day are typical with the average being approximately 50 feet per day. Holes much smaller than 6 inches are impractical because of the need for a relatively large, heavy bit. The

method does not use drilling muds but does allow sampling of groundwater with a drive and bail technique as the hole is advanced in high-yielding formations.

Applications

- Drilling in most types of geologic formations
- Almost any depth and diameter range
- Ease of monitoring well installation
- Ease and practicality of well development
- Excellent samples of geologic materials

Limitations

- Drilling relatively slow
- Heaving of unconsolidated materials must be controlled
- Equipment availability more common in central, north central and northeast sections of the United States

4.1.2.2 Driving

A borehole can be constructed by driving a solid probe or plugged pipe into the ground. The information obtained by this technique can be either minimal or extensive.

Driven wells, commonly referred to as wellpoints, are driven into the ground by hand or with heavy drive heads mounted on a tripod, drill rig derrick, or similar hoisting device. Wellpoints consist of a wellpoint (screen) that is attached to the bottom of a casing. Wellpoint and casing diameters generally range from 1.25 to 2 inches. Depths of 30 feet can be achieved by hand in sands or sands and gravels with thin clay seams. Depths of 50 feet or more can be achieved in loose soils with hammers weighing up to 1,000 pounds.

Driving through dense silts and clays and/or bouldery silts and clays is often extremely difficult or impossible. The well point may not be structurally strong enough and may be damaged or destroyed by driving through dense soils. Additionally, the screen may become plugged when driving through silts and clays and may be very difficult to reopen during development. Soil samples cannot be collected during this process; however, crude stratigraphic information may be obtained by recording the number of blows per foot of penetration. Driven wells or well points are usually installed for the collection of groundwater samples and the determination of static water levels to establish the regional groundwater gradient.

A large track-mounted backhoe (CAT 245) has been used to install extraction wells in a landfill to the 30-foot depth. The bucket of the backhoe is used to push a 6-inch diameter drive pipe with a plugged bottom. When the drive pipe reaches the final depth for the well, the plug at the bottom of the drive pipe is removed and the well screen and casing materials are placed inside the drive pipe. A large 50-ton crane then pulls the drive pipe, leaving the well materials in the borehole. This technique is highly dependent upon the geologic formation and required depth. The drive pipe pushes the formation aside. This can cause a compaction of the formation, which could impact the performance of the well.

Considerably more information can be obtained by driving a penetrometer or a Dutch Cone. Penetration of the soil with a cone forces the soil aside, creating a complex shear failure. The degree of resistance yields the geologic logs of the borehole. Penetrometers can also obtain groundwater samples and possibly soil samples. The borehole that the penetrometer makes is usually abandoned; however, occasionally a small-diameter piezometer can be constructed within the borehole. For more information on cone penetrometer testing, see the SOP on Cone Penetrometer Testing (SOP-11).

Applications	Limitations
• Drilling of a borehole when soil samples are not needed • Installation of a shallow well point when there are site access and work place limitations	• Geologic formations must be conducive for driven wells • Driven wells should be limited to shallow wells • Formation compaction usually occurs that can affect well production

4.1.2.3 Sonic Drilling

Sonic drilling, also known as resonance drilling, is a percussion drilling technique that uses a high-frequency drive hammer. The drilling rig uses a combination of mechanically generated vibrations and limited rotary power to penetrate the soil. The drill head, which is attached to the drill pipe, consists of two counter rotating, out-of-balance rollers that cause the drill pipe to vibrate. Resonance occurs when the frequency of the vibrations equals to the natural frequency of the drill pipe. The resonance and weight of the drill pipe along with the downward thrust of the drill head permit easier penetration of the formation, without adding drilling muds or lubricating fluids. The drive pipe is either closed bottom or fitted with a soil sampling tube. If the bottom of the drive pipe is closed, the borehole is made without the removal of any formation. Instead, the formation is literally pushed to the side and out of the way of the drive pipe, which acts as well casing as the boring proceeds.

A soil sampling device, such as a split-spoon sampler or a core barrel, can be placed inside the drive pipe in lieu of the end plug. The sampler is removed at 5- or 10-foot intervals and replaced with an empty sampler. This procedure yields a continuous soil sample and produces minimal waste as only the formation within the sampler is brought to the surface. A monitoring well can be installed in the borehole by removing the sampler and setting the well screen and casing inside the drive pipe. The drive pipe is then withdrawn. This drilling technique again pushes the formation aside to create the borehole. Certain formation compaction can occur which could impact the performance of a well. Sonic drilling can produce considerable heat at the bit on the drive pipe and within the sampler. The heat in the sampler may have a detrimental effect on soil samples such for chemical analysis that are impacted by heat, such as volatile organic compounds.

Applications

- Rapid drilling technique especially in difficult drilling formations
- Use when drilling in contaminated areas and disposal costs for wastes are high
- Can obtain continuous core

Limitations

- Very limited equipment availability
- Heat generated with drive pipe can compromise soil samples
- Formation compaction usually occurs that can affect well production

4.2 Methods With Circulating Fluids

Many drilling techniques use a circulating fluid, such as water or drilling mud, gas such as air, or a combination of air, water, and a surfactant to create foam. Circulation fluids flow from the surface either through the drill pipe, out through the bit, and up the annulus between the borehole wall and the drill pipe (direct rotary) or down the borehole annulus, into the bit, and up the drill pipe (reverse rotary). Generally the up-hole velocity needed to transport cuttings to the surface is between 100 to 150 feet per minute for plain water with no additives, 80 to 120 feet per minute for high-grade bentonite drill muds, 50 to 1,000 feet per minute for foam drilling, and up to 3,000 feet per minute for air with no additives. Additives decrease the required minimum velocity. Excessive velocities can cause erosion of the borehole wall.

The use of circulating fluids may involve the addition of chemicals to the borehole. Drilling mud utilizes bentonite clay and possibly polymers. Additives to air drilling may include surfactants (detergents) and water mist to generate foam. Compressed air may also contain various amounts of hydrocarbon lubricants. Therefore, attention should be given to the circulating fluids and any possible additives that are used when using drilling methods utilizing circulation fluids.

4.2.1 Rotary Drilling Methods

Rotary drilling methods require the rotation of the drill pipe and the drill bit to advance the borehole. The common drilling methods that use circulating fluids to remove the drill cuttings from the borehole are presented in the following sections.

4.2.1.1 Conventional Mud Rotary Drilling

In conventional mud rotary drilling, the circulating fluid is pumped from the surface through the rotating drill pipe and bit to flush cuttings to the surface. At the surface the fluid is directed into a circulation pit or tank where the cuttings settle out. The circulating fluid is then picked up with the mud pump and again directed downhole. Bentonite is usually added to water to make the drilling mud or fluid. The functions of the drilling fluid are to:

- Lift the cuttings from the bottom of the borehole and carry them to a settling pit
- Support and stabilize the borehole wall to prevent caving
- Seal the borehole wall to reduce fluid loss
- Cool and clean the drill bit
- Allow the cuttings to drop out in the settling pit
- Lubricate the bit, cone bearings, mud pump, and drill pipe

For effective rotary drilling, the down force on the bit should be great enough to cause continuous penetration of the boring. The pounds per inch of bit weight depends upon the configuration of the bit and the formation being penetrated. Rotary speeds are generally in the range of 60 to 200 rpm.

Applications

- Rapid drilling of clay, silt, and reasonably compacted sand
- Allows split-spoon and thin-walled samples in unconsolidated materials
- Allows core sampling in consolidated rock
- Drilling rigs widely available
- Abundant and flexible range of tool sizes and depth capabilities
- Very sophisticated drilling and mud programs available
- Geophysical borehole logs

Limitations

- Difficult to remove drilling mud and wall cake from borehole wall during development
- Bentonite and other drilling additives may influence quality of groundwater samples
- Circulated samples poor for monitoring well screen selection
- Split-spoon and thin-wall samplers are expensive and of questionable cost-effectiveness at depths greater than 150 feet
- Wireline coring techniques for sampling both unconsolidated and consolidated formations often not available locally
- Difficult to identify aquifers
- Drilling fluid invasion of permeable zones may compromise validity of subsequent monitoring well samples

4.2.1.2 Air Rotary Drilling

In air rotary drilling, the circulation fluid is compressed air or a mixture of compressed air, a surfactant, and water mist, which creates a foam. As in conventional mud rotary, the drilling fluid is forced through the rotating drill pipe and bit to flush cuttings to the surface. At the surface the fluid is directed into a pit or storage container. The up-hole velocity of the air and cuttings should be approximately 3,000 feet per minute. Air rotary drilling method is primarily used in consolidated formations due to the fact that the rapidly rising cuttings would cause considerable erosion of the borehole wall in unconsolidated formations. With the air rotary drilling method, the circulating fluid is not reused again. The following are functions of the drilling fluid:

- Lifting the cuttings from the bottom of the borehole and carrying them to the surface
- Cooling and cleaning the drill bit
- Lubricating the bit, cone bearings, mud pump, and drill pipe

Rotary speeds are generally in the range of 75 to 200 rpm. If the hardness of the formation increases to the point that roller-cone rock bits cannot successfully penetrate the formation, then a down-hole air hammer is used to penetrate the formation. The rotating speed using the down-hole air hammer is in the range of 15 to 30 rpm.

Applications

- Rapid drilling of semi-consolidated and consolidated rock
- Good quality/reliable formation samples
- Equipment generally available
- Allows easy and quick identification of lithologic changes
- Allows identification of most water bearing zones
- Allows estimation of yields in strong water-producing zones with short “down time”

Limitations

- Surface casing frequently required to protect top of hole
- Drilling restricted to semi-consolidated and consolidated formations
- Samples reliable but occur as small particles that are difficult to interpret
- Drying effect of air may mask lower yield water producing zones
- Air stream requires contaminant filtration
- Air may modify chemical or biological conditions. Recovery time uncertain

4.2.1.3 Air Rotary Casing Hammer (Drill and Drive)

Air rotary casing hammer method combines percussion and air rotary drilling methods to drill in unconsolidated formations. The borehole is drilled with the air rotary drilling method. Casing or drive pipe follows closely behind the rotary bit to prevent the erosion of the borehole wall. The casing is driven similar to a pile driver except for a hole through its axis through which a drill pipe is inserted and rotated. The drill bit is usually extended approximately 1-foot below the bottom of the drive pipe that acts as temporary casing.

Applications

- Rapid drilling of unconsolidated sands, silts, and clays
- Drilling in alluvial materials (including boulder formations)
- Casing supports borehole thereby maintaining borehole integrity and minimizing inter-aquifer cross contamination
- Eliminates circulation problems common with direct mud rotary method
- Good formation samples
- Minimal formation damage as casing pulled back

Limitations

- Thin, low pressure water bearing zones easily overlooked if drilling not stopped at appropriate places to observe whether or not water levels are recovering
- Samples pulverized as in rotary drilling
- Air may modify chemical or biological conditions
- Difficult to obtain soil samples for chemical analysis

4.2.1.4 Center Stem Recovery Rotary Drilling (Reverse Circulation)

In reverse circulation drilling, the circulating fluid (water) flows from the surface down the borehole annulus outside the drill pipe, into the drill bit, and up the inside of the drill pipe to ground surface. The fluid carries the cuttings to the surface and discharges them into a settling pit or tank. Reverse circulation is especially advantageous in very large boreholes and also in those cases where the erosive velocity of conventional rotary circulation would be detrimental to the borehole wall. Drilling is accomplished typically with water without additives. A large and dependable water supply is required to keep the borehole full of drilling fluid to maintain sufficient hydrostatic head on the borehole walls to prevent sloughing. Reverse circulation has few applications in monitoring work except when nested wells are desired. Production wells with 18- to 24-inch-diameter casing are typically drilled by the reverse circulation drilling method. Typical borehole diameters range from 15 to 36 inches; however, 60-inch-diameter boreholes are not uncommon.

Applications

- Large capacity production wells
- Nested wells
- Normally does not use drilling muds (little if any mud cake is formed on the wall of the borehole)
- Drills best in unconsolidated sands, silts, and clays

Limitations

- Requires large and dependable source of water during drilling and well installation
- Cobbles and bedrock are difficult to drill

4.2.1.5 Dual-Tube Rotary

Dual-tube rotary is an exploratory drilling technique utilizing two concentric drill pipes. Both drill pipes are rotated during drilling. The outside of the outer drill pipe is typically 4.5 inches in diameter. The diameter of the borehole is approximately 5 inches. Compressed air is forced between the two drill pipes and is

directed to the center pipe at the bit. The cuttings are carried to the surface by the returning air at a velocity of approximately 3,000 feet per minute. This is an excellent drilling method to identify lithology and the locations of aquifers in deep boreholes. It is very difficult to obtain undisturbed soil samples for chemical or geotechnical analyses; however, groundwater samples can be obtained as aquifers are encountered. Geophysical logs can be obtained if the borehole is filled with drilling mud as the drill pipe is removed. Monitoring wells are typically not installed in dual-tube rotary boreholes unless the borehole is reamed out by the mud rotary method. Depths of 1,000 feet are not uncommon for this drilling method and typically, the more consolidated the formation, the better the drilling, as unconsolidated formations cause more drag or friction on the outside of the rotating drill pipe.

Applications

- Used mostly for exploratory boreholes
- Rapid extraction of drill cuttings from the borehole
- Drill cuttings are representative of formation
- Very rapid penetration rate in most formations
- Can collect groundwater samples as aquifers are encountered

Limitations

- Equipment availability
- Cannot obtain undisturbed soil samples for chemical analysis
- Borehole size is limited (5 inches)

4.2.2 Dual-Tube Percussion Drilling

Dual-tube percussion drilling is very similar to dual-tube rotary drilling with the exception that the two drive pipes do not rotate during drilling. Two concentric drive pipes are driven into the ground with a hammer. The hammer is similar to units on pile drivers. The typical outside diameter of the outer drive pipe is 9 to 12 inches. The typical inside diameter of the inner pipe, where well materials would be inserted, is 6 to 8 inches. This drilling system is also a center stem recovery system. This drilling technique has been developed and is used primarily in hazardous waste investigations. This method is rapid and effective to depths of about 250 feet.

The outer pipe effectively seals off the formation while drilling, reducing the chance of cross contamination. Air is pumped between the annulus of the two pipes to the bit where it is deflected upward into the center pipe. Cuttings are transported to the surface through the center pipe.

In general, three systems are available: 7-inch outside diameter (OD)/4.25-inch inside diameter (ID), 9-inch OD/6-inch ID, and 12-inch OD/8-inch ID. A 2-inch-diameter monitoring well can be constructed in the 7-inch system, a 4-inch-diameter monitoring well can be constructed in the 9-inch system, and a 5- or 6-inch-diameter monitoring well can be constructed in the 12-inch system.

Applications **Limitations**

- Very rapid drilling through both unconsolidated and consolidated formations
- Allows continuous sampling for lithologic logging in most types of formations
- Very good representative samples can be obtained with minimal risk of contamination of sample and/or water bearing zone
- In stable formations, wells with diameters as large as 6 inches can be installed in open hole completions
- Soil samples can be easily obtained for chemical analysis

- Limited borehole size that limits diameter of monitoring wells
- In unstable formations wells are limited to approximately 4 inches
- Equipment availability more common in the southwest
- Air may modify chemical or biological conditions; recovery time is uncertain

4.2.3 Suction Drilling

Suction drilling has been used to drill into consolidated formations that yield little if any groundwater. This is an experimental drilling method that has been used by the U.S. Geological Survey (USGS) to drill in basalts in Idaho. The drilling technique is very similar to the reverse circulation drilling technique discussed in Section 4.2.1.4 with the exception that air is circulating, not water. To drill the borehole, a drill rig rotates a modified air rotary bit at the end of the drill pipe. The cuttings are removed by the suction from a high-pressure, high-volume air and steam ejector/eductor siphon system. The suction is directed to the interior of the drill pipe. The formation cuttings, including formation fluids, are brought to the surface via the interior of the drill pipe.

To drill a 10-inch-diameter borehole, two 600 cubic feet per minute (cfm)/250 pounds per square inch (psi) air compressors are connected parallel to the ejector/eductor siphon device. Suction from the siphon device is directed to the 2-3/8-inch-diameter drill pipe. A 1.5-horsepower blower fan is used to direct air down the borehole.

Applications

- Allows continuous sampling for lithologic logging
- Very good representative samples can be obtained
- Drilling is not impeded in fractured formations that typically cause lost circulation problems

Limitations

- Formations must be very consolidated to prevent the borehole wall from sloughing during drilling
- Cuttings are very abrasive to the drill pipe and discharge lines
- Difficult to maintain an adequate vacuum as air leaks form easily at threaded joints of the drill pipe
- Groundwater could prevent the advancement of the borehole

Drilling contractors have had numerous mechanical problems advancing boreholes beyond the 150-foot depth. Vacuum leaks have caused a loss in suction and the plugging of the drill pipe. The drill pipes have twisted off and the abrasive cuttings have worn holes in hoses and pipes. This drilling method has some unique advantages; however, until the mechanical problems are solved, this technique will not be available for use.

5.0 CONSIDERATIONS FOR SELECTION OF DRILLING METHODS

Each project or drilling site has its own considerations for the selection of a particular drilling method. Prior to selecting a drilling method, several factors must be considered. The major factors that this section will address include the objective of the drilling program, site conditions, wastes generated, and client preferences. Other factors include drilling costs, availability of trained crews and appropriate equipment, and project schedule requirements. Recognize that it may be very difficult to fulfill all of the sampling/drilling objectives with a single drilling method. The drilling method selected may compromise some of the objectives of the drilling program.

5.1 Drilling Objectives

The primary consideration in selecting any drilling method is to ensure the selected method is capable of meeting the objective(s) of the drilling/sampling program. It is common to have more than one objective for the drilling/sampling program and it may be difficult to satisfy all of the program objectives.

For example, if sample collection (soil or groundwater) is the objective, the selected method must be capable of collecting, in an appropriate and approved manner, the necessary samples. Additionally, the contaminants of concern may influence the drilling and sampling method.

Alternatively, if the objective of the drilling program is to install vapor or groundwater extraction wells, the selected method must be suitable for the installation of the designed well. It is important to not only consider the physical limitations of a particular drilling technique (i.e., depth and diameter), but examine the consequences of the drilling method with the drilling objective (i.e., smearing of the borehole walls rendering wells ineffective or inefficient).

5.2 Site Conditions

Site conditions can limit the drilling methods available for a particular program. Site conditions to be considered include both subsurface and surface conditions.

5.2.1 Subsurface Conditions

The subsurface stratigraphy of a site is a fundamental consideration when selecting a particular drilling method. The drilling equipment selected must be capable of effectively and economically penetrating the strata at the site to meet the project objectives. Particular stratigraphy that may pose problems for certain drilling methods include tight clayey soils, swelling clays, flowing sands, caliche, gravels, cobbles, lost circulation zones, and bedrock.

In addition to stratigraphy, the site hydrology must also be considered. If multiple water-bearing zones are expected, a conductor casing may be needed to seal off shallow water-bearing zones and prevent potential cross contamination. The need for conductor casings can affect the selection of a particular drilling method. Wells that deeply penetrate aquifers can also affect the selection of a particular drilling method.

5.2.2 Surface Conditions

Surface conditions can affect access to the site and the amount of available work space (both horizontal and vertical or overhead space). These in turn can affect the selection of a particular method or type of drill rig. Limited access and work space may require smaller or remotely powered drill rigs. The site terrain is a very important factor in choosing the drilling method as it is very expensive and difficult to mobilize large and/or heavy equipment over rugged terrain. For sites such as these, drill rigs (typically hollow-stem auger) are mounted on all-terrain equipment.

In addition to access and work space, the work environment must also be considered. This includes both weather and other site activities. Extremely hot or cold climates may require use of special drilling equipment or methods. Sites such as refineries where explosive atmospheres could exist may also require very special equipment.

5.3 Waste Generation

Drilling operations typically generate significant volumes of waste that must be handled, stored, and eventually disposed. This is of particular concern when drilling into contaminated or hazardous materials. The type and volume of wastes generated during drilling differs for different drilling methods. The different handling and disposal requirements of drilling wastes can greatly affect project costs. The different drilling methods can also require vastly different volumes of groundwater be removed to fully develop the well.

RIDGECREST SOLAR 1, LLC
STANDARD OPERATING PROCEDURES
KERN COUNTY, CALIFORNIA

SOP-14

FIELD DOCUMENTATION

STANDARD OPERATING PROCEDURES

SOP-14
FIELD DOCUMENTATION

TABLE OF CONTENTS

Section **Page**

1.0 INTRODUCTION 1

2.0 DEFINITIONS 1

3.0 RESPONSIBILITIES 1

4.0 FIELD DOCUMENTATION GUIDELINES 2
- 4.1 Field Logbooks 2
- 4.2 Tailgate Safety Meetings 5
- 4.3 Daily Quality Control Reports 6
- 4.4 Boring Logs 6
- 4.5 Well Construction Diagrams 8
- 4.6 Groundwater Sampling and Development Logs 9
- 4.7 Aquifer Testing Logs 9
- 4.8 Documentation of Sampling Activities 10
  - 4.8.1 Sample Labels 10
  - 4.8.2 Custody Seals 10
  - 4.8.3 Chain-of-Custody Records 10
  - 4.8.4 Sample Register 11

LIST OF ATTACHMENTS

Attachment 1 Tailgate Safety Meeting Form
Attachment 2 Daily Quality Control Report
Attachment 3 example lithologic log form
Attachment 4 example well construction log form
Attachment 5 Groundwater Sampling and Well Development Forms
Attachment 6 Aquifer Testing Form
Attachment 7 Sampling Documentation and Tracking Form

DISCLAIMER

THE FOLLOWING STANDARD OPERATING PROCEDURE PROVIDES GENERAL GUIDANCE FOR AECOM PERSONNEL FOR TECHNICAL ISSUES ADDRESSED DURING ENVIRONMENTAL SITE INVESTIGATION AND REMEDIATION ACTIVITIES. IT IS NOTED, HOWEVER, THAT EACH SITE IS UNIQUE AND THESE GUIDELINES ARE NOT A SUBSTITUTE FOR COMMON SENSE AND GOOD MANAGEMENT PRACTICES BASED ON PROFESSIONAL TRAINING AND EXPERIENCE. IN ADDITION, INDIVIDUAL CONTRACT TERMS MAY AFFECT THE IMPLEMENTATION OF THIS STANDARD OPERATING PROCEDURE. AECOM PERSONNEL RESERVE THE UNRESTRICTED RIGHT TO CHANGE, MODIFY OR NOT APPLY THESE GUIDELINES IN THEIR SOLE, COMPLETE, AND UNRESTRICTED DISCRETION TO MEET CERTAIN CIRCUMSTANCES, CONTRACTUAL REQUIREMENTS, SITE CONDITIONS, OR JOB REQUIREMENTS.

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) is a general reference for the required documentation to be completed by company personnel during field investigations. Subject to the requirements of the contract, records in the form of field logbooks, reports, and forms should normally be completed for the various field activities. Records should be maintained on a daily basis as the work progresses, and should contain enough information to allow the Field Event to be completely reconstructed. All field records must be accurate, objective, and legible, because it is part of the client's product and may potentially serve as a legal document. As the field logbook is often the only record of the work conducted during the Field Event, it should normally be photocopied at least every week.

Sample field documentation forms are attached.

2.0 DEFINITIONS

None

3.0 RESPONSIBILITIES

All field team members are responsible for recording daily activities. An in-depth description of the documentation mentioned below is given in later sections.

The **Field Team Leader** (FTL) is responsible for completing the FTL logbook, Daily Quality Control Reports (DQCRs), documentation concerning supervision of team members, and duplication and distribution of applicable records. The FTL will be supervised by a qualified Nevada Certified Environmental Manager [C.E.M.]).

The **Rig Geologist/Sampling Team** is responsible for completing the drilling logbook; lithologic logs; well construction diagrams; sampling documentation such as sample labels, sample register, and chain-of-custody (COC) forms.

The **Water Sampling/Development Team** is responsible for completing the water sampling/development logbook; groundwater sampling/development logs; and sampling documentation such as sample labels, sample register, and COC forms.

The **Aquifer Data Collection Team** is responsible for completing the aquifer logs (e.g., slug tests, step-drawdown tests, pump tests), water level records, and data organization/tracking (e.g., downloading of data from data loggers).

4.0 FIELD DOCUMENTATION GUIDELINES

Field documentation serves as the primary foundation for all field data collected that will be used to evaluate the project site. Field documentation must be accurate, legible, and written in indelible ink. Absolutely no pencils or erasures are to be used. Mistakes are to be crossed out with one line, dated, and initialed. Skipped pages or blank sections at the end of a page should be crossed out with an "X" covering the entire page or blank section, dated and initialed. The person making the correction should write "No Further Entries," and date and initial the page. The responsible field team member should sign and log the date and time after the last entry for the day. To further assist in the organization of the field books, logs, or forms, the date and the significant activity description (e.g., boring or well number) should be written at the top of each page. Each project job number should have its own field book. In addition, all original field documentation should be included with the project files.

The descriptions of field data and documentation given below serve as a guideline; individual projects will vary in documentation needs, depending on the circumstances surrounding the project and the needs of the client.

4.1 Field Logbooks

The field logbook should be a bound, weatherproof book with consecutively numbered pages that serves primarily as a daily log of the activities carried out during the investigation. All entries should be made in indelible ink. A field logbook should be completed for each operation undertaken during the investigation, such as field team leader notes, drilling, groundwater sampling/development, and site visitors. The logbook serves as a diary of the events of the day.

Field activities will vary from project to project; however, the concept and general information to be recorded will be generally consistent. The following sections describe the minimum information that should normally be recorded in the three logbooks in which field activities are documented.

FTL Logbook

The FTL's responsibilities include the general supervision, support, assistance, and coordination of the various field investigation activities. A large portion of the FTL's day is spent rotating between operations in a supervisory role. Records of the FTL's activities, as well as a summary of the field team's activities, are maintained in a logbook. The FTL's logbook will be used to fill out DQCRs, and as such should contain all information required in these reports (Section 3.3). Items to be documented include the following:

- Record of tailgate meetings
- Personnel and subcontractors on job site and time spent on the site

- Field operations and personnel assigned to these activities
- Site visitors
- Log of the FTL's activities—time spent supervising each operation and summary of daily operations as provided by field team members
- Problems encountered and related corrective actions
- Deviations from the sampling plan
- Records of communications—discussions of job-related activities with the client, subcontractor, field team members, and project manager
- Information on addresses and contacts
- Record of invoices signed and other billing information
- Field observations

Rig Geologist/Sampling Team Logbook

The rig geologist or sampling team leader is responsible for recording the following information:

- Health and safety activities
  - Calibration records for health and safety equipment (type of photoionization detector (PID), calibration gas used and associated readings, noise dosimeters, etc.)
  - Personnel contamination prevention and decontamination procedures
  - Record of daily tailgate safety meetings
- Weather
- Calibration of field equipment
- Equipment decontamination procedures
- Personnel and subcontractors on the job site and time spent on the site
- Site name and well or soil boring number
- Drilling activities
  - Sample location (sketch)
  - Drilling method and equipment used
  - Borehole diameter
  - Drill cuttings disposal/containerization (number of drums, roll off-bins, etc.)
  - Type and amount of drilling fluids used (mud, water, etc.)
  - Depth and time at which first groundwater was encountered, depth to water at completion of drilling, and the stabilized depth to water—absence of water in the boring should also be noted
  - Total drilling depth of well or soil boring

  - Type and amount of materials used for well installation
  - Well construction details—depth of grout (mixture, weight), bentonite seal, filter pack, etc. (include type and amount used, calculate estimated amount that should be used)
  - Type and amount of material used to backfill soil borings
  - Time and date of drilling, completion, and backfilling
  - Name of drilling company, driller, and helpers

- Sampling
  - Date and time of sample collection
  - Sample interval
  - Types of samples taken
  - Number of samples collected
  - Analyses to be performed on collected samples

- Disposal of contaminated wastes (personal protective equipment, paper towels, Visqueen®, etc.)
- Field observations
- Problems encountered and corrective action taken
- Deviations from the sampling plan
- Site visitors

Groundwater Sampling/Development Logbook

The groundwater sampling and development team members are responsible for recording the following information:

- Health and safety activities
  - Calibration records for health and safety equipment (i.e., type of PID, calibration gas used and readings, noise dosimeters etc.)
  - Personnel contamination prevention and decontamination procedures
  - Record of daily tailgate safety meetings

- Weather
- Calibration of field equipment
- Equipment decontamination procedures
- Personnel and subcontractors on job site and time spent on the site
- Equipment decontamination procedures
- Disposal of contaminated wastes (personal protective equipment, paper towels, Visqueen®, etc.)
- Site name and well number

- Water levels and product levels—time and datum that water levels are measured (i.e., top of casing); purging of the well (include calculations, well volumes) with the following information:
  - Measured field parameters (temperature, pH, conductivity, odor, color, cloudiness, etc.)
  - Amount of water purged
  - Purge method—indicate bailer/pump, diameter and length of bailer, material that the bailer is composed of, type of pump, new nylon rope, etc.
- Purge water disposal and containment (Baker tank/ drums, number used, identification, etc.)
- PID readings from inside of well, purged water, and breathing zone (Note: see SOP-39 for additional information on PID principles and procedures.)
- Background PID readings
- Well sampling
  - Number of samples collected and type of containers used
  - Date and time of sample collection
  - Type of analyses
  - Quality assurance/quality control (QA/QC) samples collected; names given to blind samples
- Field observations
- Problems encountered and corrective actions taken
- Deviations from the sampling plan
- Site visitors

4.2 Tailgate Safety Meetings

Tailgate safety meetings are held at the beginning of each day before the start of work. All personnel, subcontractors, and others who will be on the job site are required to attend. The meetings are usually conducted by the FTL, on-site safety officer, or other qualified team member. The topics discussed at the meeting include the following:

- Directions to the hospital
- Protective clothing and equipment
- Chemical hazards
- Physical hazards
- Special equipment
- Emergency procedures

- Emergency phone numbers

All site personnel are required to sign the tailgate safety meeting form (Attachment 1). The original form is kept on site, and a copy sent to the home office.

4.3 Daily Quality Control Reports

The preparation of DQCRs (Attachment 2) is the responsibility of the FTL. DQCRs are completed on a daily basis to summarize the events of the day and supplement the information that is already recorded in the field logbook. DQCRs should be completed regardless of the duration of the field effort. Copies of the report are distributed to the Tronox Project Manager, Project Geologist, field office file, and home office file. Information recorded in this report should include the following.

- Date and weather information—date, daily temperatures, wind speed and direction, humidity
- Personnel and time spent on site
- Subcontractors and time spent on site
- Special equipment on site—PID, Smeal water sampling rig, hollow-stem auger Rig, pH meter, conductivity meter, etc.
- Work and sampling performed—personnel performing specific site activities, a summary of samples collected, and a thorough explanation of the work completed
- Quality control activities—e.g., decontamination procedures, QA/QC samples taken, calibration of field equipment
- Health and safety levels and activities—field parameter measurements, including calibration of equipment; daily tailgate safety meetings, level of protection used, etc.
- Problems encountered/corrective actions taken—any technical difficulties (e.g., problems encountered during drilling or equipment breakdowns); any problems that could potentially affect the quality of the samples should be included
- Special notes—any information that does not fit under the categories listed above, but is important to record; information that would be useful for future sampling, (e.g., base contacts made, visitors on site, etc.)
- Next day activity expectations
- Date/Signature of individual completing the report

4.4 Boring Logs

The preparation of drill logs is the responsibility of the field team members assigned to the drill rig. A detailed description of well logging is provided in the SOP for Lithologic Logging, SOP-17. Several examples of drilling logs are given in the attachments for SOP-17. An example lithologic log form is

shown in Attachment 3. The exact format depends on the job and the client; however, the following basic information should normally be recorded on the log regardless of the format:

- Project and site name
- Name of driller and drilling company
- Type of drill rig used
- Drill rig contamination procedures
- Well/soil boring ID and location (sketch)
- Drilling and backfilling dates and times
- Reference elevation for all depth measurements
- Total depth of completed soil boring/well
- Depth of grouting, sealing, and grout mixes
- Signature of the logger.
- Description of unconsolidated materials
  - Geologic lithology description
  - Descriptive Unified Soil Classifications System (USCS) classification
  - USCS symbol
- Color (use appropriate soil color chart)
  - Penetration resistance (consistency or density)
  - Moisture content
  - Grain size information
  - Miscellaneous information (odor, fractures, visible contamination, etc.)
- Description of consolidated materials
  - Geologic rock description
  - Rock type
  - Relative hardness
  - Density
  - Texture
  - Color (use appropriate rock color charts)
  - Weathering
  - Bedding
  - Structures (fractures, joints, bedding, etc.)
  - Miscellaneous information (presence of odor, visible contamination, etc.)

- Stratigraphic/lithologic changes; depths at which changes occur
- Depth intervals at which sampling was attempted and amount of sample recovered
- Blow counts
- Depth intervals from which samples are retained
- Analyses to be performed on collected samples
- Depth at which first groundwater was encountered, depth to water at completion of drilling, and the stabilized depth to water. The absence of water in the boring should also be noted.
- Loss and depth of drilling fluids, rate of loss, and total volume of loss
- Use of drilling fluids
- Drilling and sampling problems
- PID readings

4.5 Well Construction Diagrams

The preparation of well construction diagrams is also the responsibility of field team members assigned to the drilling operations. This topic is further discussed in the SOP for Well Installation, SOP-02. An example well construction log form is shown in Attachment 4. The exact format of the diagram is dependent on the job and the client; however, the following basic information should be recorded and/or illustrated on the diagram regardless of the format.

- Project and site name
- Well identification number
- Name of driller and drilling company
- Depth and type of well casing
- Description of well screen and casing
- Borehole diameter
- Any sealing off of water-bearing strata
- Static water level upon completion of the well and after development
- Drilling and installation dates
- Type and amount of annulus materials used; depth measurements of annulus materials
- Other construction details (filter pack type and interval, location of centralizers, etc.)

- Surface elevation and reference elevation of all depth measurements

4.6 Groundwater Sampling and Development Logs

The groundwater sampling and development log should be used any time a well is developed or sampled (Attachment 5). The following information should be recorded on the log.

- Project name and site
- Well identification number
- Equipment decontamination procedures
- The date and time of sampling or development
- The water level and reference elevation
- Volume of water to be purged
- Pertinent well construction information (total depth, well diameter, etc.)
- Measurement of field parameters such as pH, turbidity, conductivity, and temperature, as well as the times at which the readings were taken.
- Type of purging and sampling equipment used
- Type of samples collected
- Sampler's initials

4.7 Aquifer Testing Logs

The aquifer testing team is responsible for setting up, collecting, tracking, and organizing data. The information listed below should normally be included. An example aquifer testing log form is shown in Attachment 6. The Aquifer Testing SOP-04 contains more details and the various book references related to the project site.

- Well number/identification (data logger identification)
- Data logger information/parameter setup
- Water level (include date, time, and measurement reference (such as top of casing)
- Type of aquifer test (slug, step-drawdown, pump test, etc.)
- Slug test (include length and diameter of slug for volume calculations)
- Start time of test
- Duration of test

- Pump tests (include disposal/containment of water information)
- Field observations and problems
- Tester's name

4.8 Documentation of Sampling Activities

Documentation to be made during sampling activities includes sample labels, sample seals, COC records, air waybill and identification of courier, and sample register. An example sampling documentation and tracking form is shown in Attachment 7.

4.8.1 Sample Labels

A sample label, written in indelible ink, should be affixed to all soil and water sample containers. Required information on sample labels may vary from job to job; however, the following should be included at a minimum:

- Sample number
- Type of sample (grab or composite)
- Type of preservative, if applicable
- Date and time of collection
- Project location
- Analyte(s)
- Initials of sampling personnel

4.8.2 Custody Seals

Custody seals consist of security tape with the initials of the sampler and the date placed over the lid of each cooler containing samples. The tape should be placed such that the seal must be broken to gain access to the contents. Custody seals should not be placed directly onto the volatile organic compound (VOC) sample bottles. Custody seals should be placed on coolers prior to the sampling team's release to a second or third party (e.g., shipment to the laboratory).

4.8.3 Chain-of-Custody Records

COC procedures allow for the tracing of possession and handling of individual samples from the time of field collection through laboratory analysis. The COC is documented through a record that lists each

sample and the individuals responsible for sample collection, shipment, and receipt. A sample is considered in custody if it is any of the following:

- In a person's possession.
- In view after being in physical possession.
- Locked or sealed so that no one can tamper with it after it has been in an individual's physical custody.
- In a secured area, restricted to authorized personnel.

A COC record is used to record the samples taken and the analyses requested. It is the legal record for maintaining accountability of control over the sample. Information recorded includes time and date of sample collection, sample number, and the type of sample, the sampler's signature, the required analysis, and the type of containers and preservatives used. A copy of the COC record should be retained by the sampler prior to release to a second or third party. Shipping receipts should be signed and filed as evidence of custody transfer between field sampler(s), courier, and laboratory.

The COC record will be properly signed and the date of collection and shipment recorded, along with the sample site identifications and requested analyses for each sample.

4.8.4 Sample Register

The sample register is a field record book with consecutive prenumbered pages. A full description of each sample is recorded in the book. The information included in the sample register should include the following:

- Sample number (identification)
- Duplicate and split sample numbers (identification)
- Location of sample
- Client
- Project number
- Collection method
- Number and size of bottles for each analysis
- Destination of the sample
- Type of analysis
- Date and time of collection

- Name of sampler

Other observations may be included as the situation dictates for a thorough record that could be used to reconstruct the events concerning that sample. All information must be recorded in indelible ink. Mistakes are to be crossed out with one line, dated, and initialed. Skipped pages or blank sections at the end of a page should be crossed out with an “X” covering the entire page or blank section, dated and initialed.

ATTACHMENT 1

TAILGATE SAFETY MEETING FORM

HEALTH AND SAFETY PRE-ENTRY BRIEFING ATTENDANCE FORM

Project Name _____
Project Location _____

Conducted by:		**Date Performed:**	
Topics Discussed:	1. Review of the content of the HASP (Required)		
	2.		
	3.		
	4.		

Printed Name	Signature	Representing

ATTACHMENT 2

DAILY QUALITY CONTROL REPORT

DAILY QUALITY CONTROL REPORT

Date:	Report No.:
AECOM PM:	Day:
Location:	Weather:
Project:	
Job No.:	Wind:
	Humidity:

Personnel Onsite:

Equipment Onsite:

Work Performed (including sampling):

QC Activities (including field calibrations):

DAILY QUALITY CONTROL REPORT (continued)

H&S Levels and Activities:

Problems Encountered and Corrective Action Taken:

Special Notes:

Tomorrow's Expectations:

Prepared by: _____ Title: _____

Distribution:

1. Project Manager (via email)
2. AECOM Project Manager
3. Field Office
4. Project File

Attachments:

ATTACHMENT 3

EXAMPLE LITHOLOGIC LOG FORM

AECOM

Client:		***BORING ID:***
Project Number:		
Site Location:		
Coordinates:	*Elevation:*	*Sheet: 1 of 1*
Drilling Method:		*Monitoring Well Installed:*
Sample Type(s):	*Boring Diameter:*	*Screened Interval:*

Weather:	*Logged By:*	*Date/Time Started:*	*Depth of Boring:*
Drilling Contractor:	*Ground Elevation:*	*Date/Time Finished:*	*Water Level:*

Depth (ft)	Geologic sample ID	Sample Depth (ft)	Blows per 6"	Recovery (inches)	Headspace (ppm)	U.S.C.S	**MATERIALS: Color, size, range, MAIN COMPONENT, minor component(s), moisture content, structure, angularity, maximum grain size, odor, and Geologic Unit (If Known)**	Lab Sample ID	Lab Sample Depth (Ft.)
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									

NOTES:

Date	Time	Depth to groundwater while drilling

Checked by _____ Date:_____

ATTACHMENT 4

EXAMPLE WELL CONSTRUCTION LOG FORM

AECOM

Well ID:

Low Flow Ground Water Sample Collection Record

Client: _____ Date: _____ Time: Start _____ am/pm
Project No: _____ Finish _____ am/pm
Site Location: _____
Weather Conds: _____ Collector(s): _____

1. WATER LEVEL DATA: (measured from Top of Casing)

a. Total Well Length _____ c. Length of Water Column _____ (a-b)

Casing Diameter/Material _____

b. Water Table Depth _____ d. Calculated System Volume (see back) _____

2. WELL PURGE DATA

a. Purge Method: _____

b. Acceptance Criteria defined (see workplan)

- Temperature	3%	-D.O.	10%
- pH	± 1.0 unit	- ORP	± 10mV
- Sp. Cond.	3%	- Drawdown	< 0.3'

c. Field Testing Equipment used: Make Model Serial Number

Time (24hr)	Volume Removed (Liters)	Temp. (°C)	pH	Spec. Cond. (µS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Flow Rate (ml/min)	Drawdown (feet)	Color/Odor

(continued on back)

d. Acceptance criteria pass/fail

	Yes	No	N/A
Has required volume been removed	☐	☐	☐
Has required turbidity been reached	☐	☐	☐
Have parameters stabilized	☐	☐	☐

If no or N/A - Explain below.

_____

3. SAMPLE COLLECTION: Method: _____

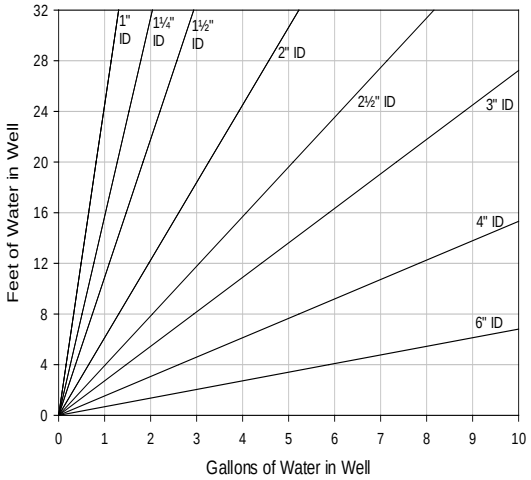
Sample ID	Container Type	No. of Containers	Preservation	Analysis Req.	Time

Comments _____

Signature _____ Date _____

Purge Volume Calculation:

Well ID:



Volume / Linear Ft. of Pipe		
ID (in)	Gallon	Liter
0.25	0.0025	0.0097
0.375	0.0057	0.0217
0.5	0.0102	0.0386
0.75	0.0229	0.0869
1	0.0408	0.1544
1.25	0.0637	0.2413
1.5	0.0918	0.3475
2	0.1632	0.6178
2.5	0.2550	0.9653
3	0.3672	1.3900
4	0.6528	2.4711
6	1.4688	5.5600

(continued from front)

Time (24 hr)	Volume Removed (Liters)	Temp (°C)	pH	Spec. Cond. (µS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Flow Rate (ml/min)	Drawdown (ft)	Color/Odor

ATTACHMENT 5

GROUNDWATER SAMPLING AND WELL DEVELOPMENT FORMS

AECOM

Well ID:

Low Flow Ground Water Sample Collection Record

Client: _____ Date: _____ Time: Start _____ am/pm
Project No: _____ Finish _____ am/pm
Site Location: _____
Weather Conds: _____ Collector(s): _____

1. WATER LEVEL DATA: (measured from Top of Casing)

a. Total Well Length _____ c. Length of Water Column _____ (a-b)

Casing Diameter/Material _____

b. Water Table Depth _____ d. Calculated System Volume (see back) _____

2. WELL PURGE DATA

a. Purge Method: _____

b. Acceptance Criteria defined (see workplan)

- Temperature	3%	-D.O.	10%
- pH	± 1.0 unit	- ORP	± 10mV
- Sp. Cond.	3%	- Drawdown	< 0.3'

c. Field Testing Equipment used: Make Model Serial Number

Time (24hr)	Volume Removed (Liters)	Temp. (°C)	pH	Spec. Cond. (µS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Flow Rate (ml/min)	Drawdown (feet)	Color/Odor

(continued on back)

d. Acceptance criteria pass/fail

	Yes	No	N/A
Has required volume been removed	☐	☐	☐
Has required turbidity been reached	☐	☐	☐
Have parameters stabilized	☐	☐	☐

If no or N/A - Explain below.

_____

3. SAMPLE COLLECTION: Method: _____

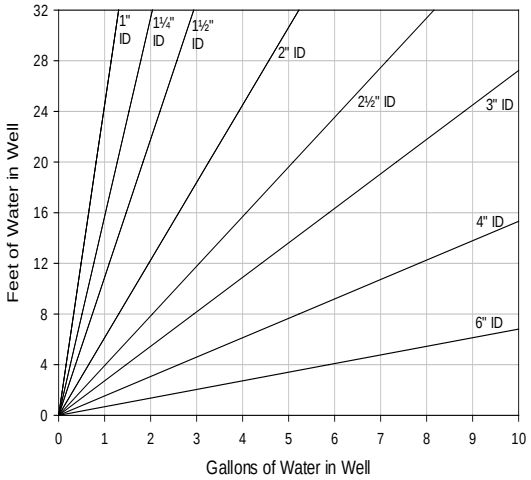
Sample ID	Container Type	No. of Containers	Preservation	Analysis Req.	Time

Comments _____

Signature _____ Date _____

Purge Volume Calculation:

Well ID:



Volume / Linear Ft. of Pipe		
ID (in)	Gallon	Liter
0.25	0.0025	0.0097
0.375	0.0057	0.0217
0.5	0.0102	0.0386
0.75	0.0229	0.0869
1	0.0408	0.1544
1.25	0.0637	0.2413
1.5	0.0918	0.3475
2	0.1632	0.6178
2.5	0.2550	0.9653
3	0.3672	1.3900
4	0.6528	2.4711
6	1.4688	5.5600

(continued from front)

Time (24 hr)	Volume Removed (Liters)	Temp (°C)	pH	Spec. Cond. (µS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Flow Rate (ml/min)	Drawdown (ft)	Color/Odor

ATTACHMENT 6
AQUIFER TESTING FORM

AQUIFER TEST DATA SHEET
(OBSERVATION WELLS)

Page ___ of ___

PROJECT NAME: _____ PROJECT NO: _____ PIEZO NO: _____
DATE: _____ PUMP DEPTH: _____ TEST NO: _____
TYPE OF TEST: _____ PUMPED WELL NO: _____ DISTANCE FROM PUMPING WELL: _____
MEASURING EQUIPMENT: _____ HYDROGEOLOGIST: _____

Time Data	Water Level Data	Time Data Continuation	Water Level Data Continuation
Pump On: Date/Time_____ Pump Off: Date/Time_____ Duration of Aquifer Test: Pumping:_____ Recovery:_____	Pretest Water Level_____ Static Water Level:_____ Measuring Point:_____ Elevation of Measuring Point:_____		

Date	Time	Depth to Water (ft)	Pressure Transducer (XD)	Flow Rate (gpm)	Date	Time	Depth to Water (ft)	Pressure Transducer (XD)	Flow Rate (gpm)

Conversion Factors: 1 PSI = 2.31 feet 1 cubic foot = 7.48 gallons

ATTACHMENT 7

SAMPLING DOCUMENTATION AND TRACKING FORM

Sample Tracking and Documentation Form

Project: _____ **Site:** _____

Location ID	Sample ID	Method	Matrix	Date Sampled	Time Sampled	Date Shipped	Cooler No.	Lab Dest.	Fedex Tracking No.	QA/QC Samples

Field Duplicates:

Splits (LIMS # _____):

Sample Tracking and Documentation Form

Project: _____ **Site:** _____

Location ID	Sample ID	Method	Matrix	Date Sampled	Time Sampled	Date Shipped	Cooler No.	Lab Dest.	Fedex Tracking No.	QA/QC Samples
Equipment Rinsate Blanks:										
Equipment Rinsate Blanks Splits (LIMS #_____):										
Trip Blanks										

QA/QC CODES:

1 = Primary Lab Duplicate
2 = Primary Lab Duplicate and QA Laboratory Split
3 = Primary Lab Rinsate Blank
4 = Primary Lab Rinsate Blank and QA Lab Rinsate Blank Split
5 = Matrix Spike and Duplicate (MS/MSD)

AECOM

Client:		***BORING ID:***
Project Number:		
Site Location:		
Coordinates:	*Elevation:*	*Sheet: 1 of 1*
Drilling Method:		*Monitoring Well Installed:*
Sample Type(s):	*Boring Diameter:*	*Screened Interval:*

Weather:	*Logged By:*	*Date/Time Started:*	*Depth of Boring:*
Drilling Contractor:	*Ground Elevation:*	*Date/Time Finished:*	*Water Level:*

Depth (ft)	Geologic sample ID	Sample Depth (ft)	Blows per 6"	Recovery (inches)	Headspace (ppm)	U.S.C.S	**MATERIALS: Color, size, range, MAIN COMPONENT, minor component(s), moisture content, structure, angularity, maximum grain size, odor, and Geologic Unit (If Known)**	Lab Sample ID	Lab Sample Depth (Ft.)
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									

NOTES:

Date	Time	Depth to groundwater while drilling

Checked by _____ Date:_____

RIDGECREST SOLAR 1, LLC
STANDARD OPERATING PROCEDURES
KERN COUNTY, CALIFORNIA

SOP-15

FIELD LOGBOOK

STANDARD OPERATING PROCEDURES

SOP-15
FIELD LOGBOOK

TABLE OF CONTENTS

Section **Page**

1.0 INTRODUCTION 1

2.0 DEFINITIONS 1

3.0 RESPONSIBILITIES 1

4.0 METHODS 1

DISCLAIMER

THE FOLLOWING STANDARD OPERATING PROCEDURE PROVIDES GENERAL GUIDANCE FOR AECOM PERSONNEL FOR TECHNICAL ISSUES ADDRESSED DURING ENVIRONMENTAL SITE INVESTIGATION AND REMEDIATION ACTIVITIES. IT IS NOTED, HOWEVER, THAT EACH SITE IS UNIQUE AND THESE GUIDELINES ARE NOT A SUBSTITUTE FOR COMMON SENSE AND GOOD MANAGEMENT PRACTICES BASED ON PROFESSIONAL TRAINING AND EXPERIENCE. IN ADDITION, INDIVIDUAL CONTRACT TERMS MAY AFFECT THE IMPLEMENTATION OF THIS STANDARD OPERATING PROCEDURE. AECOM PERSONNEL RESERVE THE UNRESTRICTED RIGHT TO CHANGE, MODIFY OR NOT APPLY THESE GUIDELINES IN THEIR SOLE, COMPLETE, AND UNRESTRICTED DISCRETION TO MEET CERTAIN CIRCUMSTANCES, CONTRACTUAL REQUIREMENTS, SITE CONDITIONS, OR JOB REQUIREMENTS.

1.0 INTRODUCTION

The field logbook is a controlled document that contains information about all major on-site activities associated with investigation and remediation projects. The field logbook serves as the primary documentation of all field activities and events. Information recorded in the field logbook is described in Section 4.0, Methods. Site-specific procedures described in project work plans supersede this Standard Operating Procedure (SOP). Some site conditions and/or client requirements may necessitate deviations from this SOP.

The site logbook is initiated at the start of the first on-site activity (e.g., initial reconnaissance survey or site walk). Entries are made each day field activities occur. The site logbook is part of the permanent project file maintained by AECOM, and is submitted to the project manager, who sends it to the project file at the completion of field activities. The site logbook may be admitted as evidence in cost recovery or other legal proceedings, so it is critical that this document be properly maintained.

2.0 DEFINITIONS

Field Logbook	The field logbook (also called field notebook) is a bound, waterproof notebook with consecutively numbered pages that cannot be removed.

3.0 RESPONSIBILITIES

Field logbooks are issued to field team members by the field team leader (FTL) or Project Manager. Each field team member in possession of a field logbook is responsible for keeping it current, accurate, straightforward, and relevant (see Section 4.0, Methods), and for submitting the field logbook to the FTL or Project Manager when the field work is completed. The Project Manager or designee reviews the field logbook for completeness, legibility, and relevance at the end of the field effort.

4.0 METHODS

During each field day, all site activities, personnel, visitors, and problems are recorded in the field logbook. The following paragraphs include lists of types of information included, when applicable, and methods for maintaining the field logbook.

The cover of each site logbook contains the following information:

- project name
- client name

- Contractors project number
- project manager's name
- applicable work plan (s)
- sequential book number
- start date
- end date

The beginning of each daily entry includes the following:

- date
- day of week
- location
- personal protective equipment (PPE) level
- start time
- weather
- personnel
- subcontractors
- visitors
- equipment
- Contractors job number and cost code for that day's activities

Daily site logbook entries include but are not limited to the following, as applicable:

- arrival and surveying, decontamination, inspection, or other field activity
- equipment calibration

- materials used
- sampling activities and methods
- sample numbers, dates, times, locations, and analyses
- sketches of work locations, sample locations, excavations, etc.
- sketches of well construction details
- sample shipment information (chain-of-custody form numbers, carrier, time)
- start and completion times of each work activity
- storage and disposal of wastes
- field measurements
- health and safety issues (PPE level, time of tailgate safety meeting, etc.)
- unusual events
- accidents and near misses
- work progress
- work problems
- corrective actions
- variations from project plans or standard procedures
- communication with the client or others
- communication with the project manager or other Contractors staff
- references to other project logs (purge, sample, equipment calibration, quality control, photograph, equipment, borehole, construction, development, etc.)

Because the site logbook and its contents are admissible as evidence in legal proceedings, the following guidelines are also important:

- Unnecessary or irrelevant information or opinions are not recorded.
- Language used in the site logbook is always professional.
- Pages are not removed from the site logbook.
- All entries are in waterproof blue or black ink.
- The person entering information signs each page on which information is recorded.
- Blank portions of pages, and pages that have been inadvertently left blank, are crossed out and signed.
- The words “End of Day” and the signature of the person making the entry appear at the end of each daily entry.
- The field logbook is reviewed and signed by the FTL or Project Manager when the field work is completed.

RIDGECREST SOLAR 1, LLC
STANDARD OPERATING PROCEDURES
KERN COUNTY, CALIFORNIA

SOP-17

SOIL LOGGING

STANDARD OPERATING PROCEDURES

SOP-17
SOIL LOGGING

TABLE OF CONTENTS

Section **Page**

1.0 INTRODUCTION 1

2.0 DEFINITIONS 1
2.1 GRAIN SIZES 1
2.2 PHYSICAL CHARACTERISTICS 2

3.0 RESPONSIBILITIES 4

4.0 SOIL LOGGING PROCEDURES 4
4.1 Field Classification of Soils 5
4.1.1 Procedure for Identifying Coarse-Grained Soils 5
4.1.2 Procedure for Identifying Fine-Grained Soils 7
4.1.3 Other Modifiers For Use With Fine-Grained Soils 7
4.1.4 Procedure for Identifying Borderline Soils 8
4.2 Descriptive Information for Soils 8
4.2.1 Color 8
4.2.2 Consistency/Density 9
4.2.3 Moisture 10
4.2.4 Grain Size 10
4.2.5 Odor 10
4.2.6 Cementation 10
4.2.7 Angularity 11
4.2.8 Structure 11
4.2.9 Lithology 11
4.2.10 Additional Comments 12
4.2.11 Bedrock Descriptions 12
4.3 Additional Boring Log Information 12

5.0 OTHER APPLICABLE SOPs 13

6.0 REFERENCES 14

LIST OF TABLES

Table 1. Criteria for Describing Dry Strength 3
Table 2. Criteria for Describing Dilatancy 3
Table 3. Criteria for Describing Toughness 3
Table 4. Criteria for Describing Plasticity 3
Table 5. Density/Consistency Based on Blow Counts 9
Table 6. Criteria for Describing Consistency 9
Table 7. Criteria for Describing Structure 11

LIST OF ATTACHMENTS

Attachment 1 Field Classification Guides
Attachment 2 Example Boring Log Form

DISCLAIMER

THE FOLLOWING STANDARD OPERATING PROCEDURE PROVIDES GENERAL GUIDANCE FOR AECOM PERSONNEL FOR TECHNICAL ISSUES ADDRESSED DURING ENVIRONMENTAL SITE INVESTIGATION AND REMEDIATION ACTIVITIES. IT IS NOTED, HOWEVER, THAT EACH SITE IS UNIQUE AND THESE GUIDELINES ARE NOT A SUBSTITUTE FOR COMMON SENSE AND GOOD MANAGEMENT PRACTICES BASED ON PROFESSIONAL TRAINING AND EXPERIENCE. IN ADDITION, INDIVIDUAL CONTRACT TERMS MAY AFFECT THE IMPLEMENTATION OF THIS STANDARD OPERATING PROCEDURE. AECOM PERSONNEL RESERVE THE UNRESTRICTED RIGHT TO CHANGE, MODIFY OR NOT APPLY THESE GUIDELINES IN THEIR SOLE, COMPLETE, AND UNRESTRICTED DISCRETION TO MEET CERTAIN CIRCUMSTANCES, CONTRACTUAL REQUIREMENTS, SITE CONDITIONS, OR JOB REQUIREMENTS.

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) is applicable to logging soils at all sites requiring soil investigation by AECOM personnel. The SOP is based on the Unified Soils Classification System (USCS) and the American Society for Testing and Materials (ASTM) Standard D2488-00 Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) (ASTM, 2000). Variance from the logging procedures described herein shall be warranted only if specifically required in writing by a particular client or regulatory agency. A solid working knowledge of this SOP is important for Tronox Contractors field personnel to standardize logging procedures and to enable subsequent correlations between borings at a site, allowing for accurate and thorough site characterization.

The information in this SOP is summarized in two soil logging field guides (attached). Laminated copies of these guides are available for field personnel; use of the field guides is strongly recommended. Other field guidance references may also be used according to personal preference; however, such references should be based on the USCS. Note that many references (for example, AGI Data Sheet grain-size scales) base soil classifications on the Wentworth Scale. Such scales may vary significantly from the USCS and may lead to inaccurate or inconsistent soil descriptions.

2.0 DEFINITIONS

Use of the USCS requires familiarity with the grain size ranges that define a particular type of soil, as well as several other physical characteristics. The grain size definitions and physical characteristics upon which soil descriptions are based are presented below. This information is also presented in tabular format on the field guides.

2.1 GRAIN SIZES

USCS grain sizes are based on U.S. standard sieve sizes, which are named as follows:

- Standard sieves with larger openings are named according to the size of the openings in the sieve mesh. For example, a "3-inch" sieve contains openings that are 3 inches square.

- Standard sieves with smaller openings are given numbered designations that indicate the number of openings per inch. For example, a "No. 4" sieve contains 4 openings per inch.

The following grain size definitions are paraphrased from the ASTM Standard D2488-00. Field personnel should familiarize themselves with the grain size definitions and refer to the appropriate field guide for a visual reference.

Boulders	Particles of rock that will not pass a 12-inch (300-mm) square opening
Cobbles	Particles of rock that will pass a 12-inch (300-mm) square opening and be retained on a 3-inch (75-mm) sieve
Gravel	Particles of rock that will pass a 3-inch (75-mm) sieve and be retained on a No. 4 (4.75-mm) sieve with the following subdivisions: – Coarse gravel passes a 3-inch (75-mm) sieve and is retained on a 3/4-inch (19-mm) sieve – Fine gravel passes a 3/4-inch (19-mm) sieve and is retained on a No. 4 (4.75-mm) sieve
Sand	Particles of rock that will pass a No. 4 (0.19-inch or 4.75-mm) sieve and be retained on a No. 200 (0.003-inch or 75-µm) sieve with the following subdivisions: – Coarse sand passes a No. 4 (0.19-inch or 4.75-mm) sieve and is retained on a No. 10 (0.08-inch or 2-mm) sieve – Medium sand passes a No. 10 (0.08-inch or 2-mm) sieve and is retained on a No. 40 (0.017-inch or 425-µm) sieve – Fine sand passes a No. 40 (0.017-inch or 425-µm) sieve and is retained on a No. 200 (0.003-inch or 75-µm) sieve
Silt	Soil passing a No. 200 (0.003-inch or 75-µm) sieve that is nonplastic or very slightly plastic and that exhibits little or no strength when air dried. Individual silt particles are not visible to the naked eye.
Clay	Soil passing a No. 200 (0.003 inch or 75-µm) sieve that can be made to exhibit plasticity within a range of water contents and that exhibits considerable strength when air-dried. Individual clay particles are not visible to the naked eye.

2.2 PHYSICAL CHARACTERISTICS

The following physical characteristics are used in the USCS classification for fine-grained soils. A brief definition of each physical characteristic is presented below. Tables 1 through 4 present descriptions of field tests that may be performed to estimate these properties in a field sample. However, with the exception of plasticity, the tests are generally too time consuming to perform regularly in the field. A determination of the type of fine-grained soil present in the sample can generally be made on the basis of plasticity, as described in Section 4.1.2.

Dry Strength	The ease with which a dry lump of soil crushes between the fingers (Table 1).
Dilatancy Reaction	The speed with which water appears in a moist pat of soil when shaking in the hand, and disappears while squeezing (Table 2).
Toughness	The strength of a soil, moistened near its plastic limit, when rolled into a 1/8-inch diameter thread (Table 3).

Plasticity — The extent to which a soil may be rolled into a 1/8-inch. thread, and re-rolled when drier than the plastic limit (Table 4).

Table 1. Criteria for Describing Dry Strength

Description	Criteria
None	The dry specimen crumbles into powder with mere pressure of handling.
Low	The dry specimen crumbles into powder with some finger pressure.
Medium	The dry specimen breaks into pieces or crumbles with considerable finger pressure.
High	The dry specimen cannot be broken with finger pressure. Specimen will break into pieces between thumb and a hard surface.
Very High	The dry specimen cannot be broken between the thumb and a hard surface.

Table 2. Criteria for Describing Dilatancy

Description	Criteria
None	No visible change in the specimen.
Slow	Water appears slowly on the surface of the specimen during shaking and does not disappear or disappears slowly upon squeezing.
Rapid	Water appears quickly on the surface of the specimen during shaking and disappears quickly upon squeezing.

Table 3. Criteria for Describing Toughness

Description	Criteria
Low	Only slight pressure is required to roll the thread near the plastic limit. The thread and the lump are weak and soft.
Medium	Medium pressure is required to roll the thread to near the plastic limit. The thread and the lump have medium stiffness.
High	Considerable pressure is required to roll the thread to near the plastic limit. The thread and the lump have very high stiffness.

Table 4. Criteria for Describing Plasticity

Description	Criteria
Nonplastic	A 1/8-inch (3-mm) thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be re-rolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The

Description	Criteria
	thread can be re-rolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.

3.0 RESPONSIBILITIES

This section presents a brief definition of field roles and the responsibilities generally associated with them. This list is not intended to be comprehensive; additional personnel may be involved in other aspects of the project. Project team member information is usually included in project-specific plans (e.g., work plan, field sampling plan, quality assurance plan), and field personnel should always consult the appropriate documents to determine project-specific roles and responsibilities. In addition, one person may serve in more than one role on any given project.

The **Project Manager** or **Task Leader** defines the objectives of field work; selects site-specific monitoring well design and installation methods with input from the Project Hydrogeologist and Field Team Leader; and maintains close supervision of activities and progress.

The **Project Hydrogeologist** selects site-specific drilling/sampling options, helps prepare technical provisions for drilling.

The **Field Team Leader** implements the selected drilling program and may also review boring logs.

The **Drilling Rig Geologist** records the boring logs and supervises the drilling subcontractor.

The **Quality Manager** performs field and logging process audits.

4.0 SOIL LOGGING PROCEDURES

The following aspects of a project must be considered before sampling and soil logging commences. This information is generally summarized in a project-specific work plan or field sampling plan, which should be thoroughly reviewed by field personnel prior to the initiation of work.

- Purpose of the soil logging (e.g., initial investigation, subsequent investigation, remediation)
- Known or anticipated hydrogeologic setting including lithology (consolidated/unconsolidated, depositional environment, presence of fill material), physical characteristics of the aquifer (porosity/permeability), type of aquifer (confined/unconfined), recharge/discharge conditions, aquifer thickness and ground water/surface water interrelationships
- Drilling conditions
- Previous soil boring or borehole geophysical logs

- Soil sampling and geotechnical testing program
- Characteristics of potential chemical release(s) (chemistry, density, viscosity, reactivity, and concentration)
- Health and Safety protection requirements
- Regulatory requirements

The procedures used to determine the correct soil sample classification are described below. These procedures are presented in tabular and flow chart form on the field guides.

4.1 Field Classification of Soils

The following soil classification procedures are based on the ASTM Standard D2488-00 for visual-manual identification of soils (ASTM, 2000). The flow chart is Attachment 1 to this SOP and presented in the field guide can be used to assign the appropriate soil group name and symbol. When naming soils, the proper USCS soil group name is given, followed by the group symbol. For clarity, it is recommended that the group symbol be placed in parentheses after the written soil group name.

Soil identification using the visual-manual procedures is based on naming the portion of the soil sample that will pass a 3-inch (75-mm) sieve. Therefore, before classifying a soil, any particles larger than 3 inches (cobbles and boulders) should be removed, if possible. Estimate and note the percentage of cobbles and boulders.

Using the remaining soil, the next step is to estimate the percentages, by dry weight, of the gravel, sand, and fine fractions (particles passing a No. 200 sieve). The percentages are to be estimated to the closest 5 percent. In general, the soil is *fine-grained* (e.g., a silt or a clay) if it contains 50 percent or more fines, and *coarse-grained* (e.g., a sand or a gravel) if it contains less than 50 percent fines. If one of the components is present but estimated to be less than 5 percent, its presence is indicated by the term *trace*. For example, “trace of fines” would be added as additional information following the formal USCS soil description.

4.1.1 Procedure for Identifying Coarse-Grained Soils

Coarse-grained soil contains less that 50 percent fines. If it has been determined that the soil contains less than 50 percent fines, the soil is a *gravel* if the percentage of gravel is estimated to be more than the percentage of sand. The soil is a *sand* if the percentage of gravel is estimated to be equal to or less than the percentage of sand.

If the soil is predominantly sand or gravel but contains an estimated 15 percent or more of the other coarse-grained constituent, the words "with gravel" or "with sand" is added to the group name. For example: "gravel with sand (GP)." If the sample contains any cobbles or boulders, the words “with cobbles” or “with cobbles and boulders” are added to the group name. For example: "silty gravel with cobbles (GM)."

5 Percent or Less Fines

The soil is a “clean gravel” or “clean sand” if the percentage of fines is estimated to be 5 percent or less. “Clean” is not a formal USCS name, but rather a general descriptor for implying little to no fines. Clean sands and gravels are given the USCS designation as either *well-graded* or *poorly-graded*, as described below.

Identify the soil as a *well-graded gravel* (GW) or as a *well-graded sand* (SW) if it has a wide range of particle sizes and substantial amounts of the intermediate particle sizes. Identify the soil as a *poorly-graded gravel* (GP) or as a *poorly-graded sand* (SP) if it consists predominantly of one grain size (uniformly graded), or has a wide range of sizes with some intermediate sizes obviously missing (gap- or skip-graded).

Note: When using the USCS designation, keep in mind the difference between grading and sorting. The term grading is used to indicate the range of particles contained in the sample. For example, a poorly-graded sand containing predominantly one grain size would be considered well-sorted, and vice-versa. One notable exception to this general rule is a skip-graded (bimodally distributed) sample; a sand containing two distinct grain sizes would be considered both poorly-sorted and poorly-graded. The USCS uses only the *grading* descriptor in soil naming, not the sorting descriptor.

≥ 15 Percent Fines

The soil is a *silty* or *clayey gravel* or a *silty* or *clayey sand* if the percentage of fines is estimated to be 15 percent or more. For example, identify the soil as *clayey gravel* (GC) or a *clayey sand* (SC) if the fines are clayey. Identify the soil as a *silty gravel* (GM) or a *silty sand* (SM) if the fines are silty. The coarse grained descriptor "poorly-graded" or "well-graded" is not included in the soil name, but rather, should be included as additional information following the formal USCS soil description.

>5 Percent but <15 Percent Fines

If the soil is estimated to contain greater than 5 percent but less than 15 percent fines, give the soil a dual identification using two group symbols. The first group symbol corresponds to a clean gravel or sand (GW, GP, SW, SP) and the second symbol corresponds to a clayey/silty gravel or sand (GC, GM, SC, SM). The group name corresponds to the first group symbol, and include the words "poorly-graded" or

"well-graded", plus the words "with clay" or "with silt" to indicate the character of the fines. For example, "poorly-graded gravel with silt (GP-GM)".

4.1.2 Procedure for Identifying Fine-Grained Soils

Fine-grained soil contains 50 percent or more fines. The USCS classifies inorganic fine-grained soils according to their degree of plasticity (no or low plasticity, indicated with an "L"; or high plasticity, indicated with an "H") and other physical characteristics (defined in Section 2.2 and Tables 1 through 4). As indicated in Section 2.2, the field tests used to determine dry strength, dilatancy, and toughness are generally too time consuming to be performed on a routine basis. Field personnel should be familiar with the definitions of the physical characteristics and the concepts of the field tests; however, field classifications will generally be based primarily on plasticity. If precise engineering properties are necessary for the project (i.e., construction, modeling, etc.), geotechnical samples should be collected for laboratory testing. The results of the laboratory tests should be compared to the field logging results. Soil classifications based on plasticity are as follows:

- Lean clay (CL) soil has medium to high dry strength, no or slow dilatancy, and medium toughness and plasticity.
- Fat clay (CH) soil has high to very high dry strength, no dilatancy, and high toughness and plasticity.
- Silt (ML) soil has no to low dry strength, slow to rapid dilatancy, and low toughness and plasticity, or is nonplastic.
- Elastic silt (MH) soil has low to medium dry strength, no to slow dilatancy, and low to medium toughness and plasticity. They will air dry more quickly than lean clay and have a smooth, silky feel when dry.
- Organic soil (OL or OH) soil contains enough organic particles to influence the soil properties. Organic soils usually have a dark brown to black color and may have an organic odor. Organic soils will often change color, from black to brown for example, when exposed to the air. Organic soils normally will not have a high toughness or plasticity.

4.1.3 Other Modifiers For Use With Fine-Grained Soils

15 percent to 25 percent coarse-grained material

If the soil is estimated to have 15 percent to 25 percent sand or gravel, or both, the words "with sand" or "with gravel" (whichever is predominant) is added to the group name. For example: "lean clay with sand (CL)" or "silt with gravel (ML)". If the percentage of sand is equal to the percentage of gravel, use "with sand."

≥30 percent coarse-grained material

If the soil is estimated to have 30 percent or more sand or gravel, or both, the words "sandy" or "gravelly" is added to the group name. Add the word "sandy" if there appears to be the same or more sand than gravel. Add the word "gravelly" if there appears to be more gravel than sand. For example: "sandy silt (ML)", or "gravelly fat clay (CH)".

4.1.4 Procedure for Identifying Borderline Soils

To indicate that the soil may fall into one of two possible basic groups, a borderline symbol may be used with the two symbols separated by a slash. For example, a soil containing an estimated 50 percent silt and 50 percent fine grained sand may be assigned a borderline symbol "SM/ML". Borderline symbols should not be used indiscriminately. Every effort should be made to first place the soil into a single group and then to estimate percentages following the USCS soil description.

4.2 Descriptive Information for Soils

After the soil name and symbol are assigned, the soil color, consistency/density, and moisture content is to be described in that order. Other information is presented later in the description, as applicable.

4.2.1 Color

Color is an important property in identifying organic soils, and may also be useful in identifying materials of similar geologic or depositional origin in a given location. The Munsell Soil Color Charts should be used, if possible.

When using the Munsell Soil Color Charts, a general color, such as brown, gray, red, is first assigned to the soils. Then go to the correct area in the charts and assign the applicable color name and Munsell symbol. The ability to detect minor color differences varies among people, and the chance of finding a perfect color match in the charts is rare. Keeping this in mind should help field personnel avoid spending unnecessary time and confusion going through the chart pages. In addition, attempting to describe detail beyond the reasonable accuracy of field observations could lead to making poorer soil descriptions than by simply expressing the dominant colors (Munsell Soil Color Chart, 1992).

If the color charts are not being used or are unavailable, again attempt to assign general colors to soils. Comparing a particular soil sample to samples from different locations in the borehole will help keep the eye "calibrated". For example, by holding two soils together, it may become evident that one is obviously greenish-brown, while another is reddish.

4.2.2 Consistency/Density

For intact fine-grained soil, describe consistency as very soft, soft, medium stiff, stiff, very stiff, or hard, based on the blows per foot using a 140 pound hammer dropped 30 inches (Table 5). If blow counts are not available, perform the field test described in Table 6 to determine consistency.

For coarse-grained soils, describe density based on blows per foot as very loose, loose, medium dense, dense, and very dense (Table 5). If blow counts are not available, attempt to estimate the soil density by observation, since a practical field test is not available. Be sure to clearly indicate on the field boring log if blow counts could not be obtained.

Table 5. Density/Consistency Based on Blow Counts

Density (Sand and Gravel) Blows/ft[a]				Consistency (Silt and Clay) Blows/ ft[a]			
Term	**1.4" ID**	**2.0" ID**	**2.5" ID**	**Term**	**1.4" ID**	**2.0" ID**	**2.5" ID**
Very Loose	0 – 4	0 – 5	0 – 7	Very Soft	0 – 2	0 – 2	0 – 2
Loose	4 – 10	5 – 12	7 – 18	Soft	2 – 4	2 – 4	2 – 4
Medium Dense	10 – 29	12 – 37	18 – 51	Medium Stiff	4 – 8	4 – 9	4 – 9
Dense	29 – 47	37 – 60	51 – 86	Stiff	8 – 15	9 – 17	9 – 18
Very Dense	>47	>60	>86	Very Stiff	15 – 30	17 – 39	18 – 42
				Hard	30 – 60	39 – 78	42 – 85
				Very Hard	>60	>78	>85

[a] 140 lb. Hammer dropped 30 inches

Table 6. Criteria for Describing Consistency

Description	Criteria
Very Soft	Thumb will penetrate soil more than 1 inch (25 mm)
Soft	Thumb will penetrate soil about 1 inch (25 mm)
Firm	Thumb will indent soil about ¼ inch (6 mm)
Hard	Thumb will not indent soil but readily indented with thumbnail
Very Hard	Thumbnail will not indent soil

4.2.3 Moisture

Describe the moisture condition of the soil as dry (absence of moisture, dusty, dry to the touch), moist (damp but no visible water), or wet (visible free water, saturated).

4.2.4 Grain Size

Describe the maximum particle size found in the sample in accordance with the following information:

- Sand-size—describe as fine, medium, or coarse. (See Section 2 for sand size definitions.)
- Gravel-size—describe the diameter of the maximum particle size in inches.
- Cobble or boulder-size—describe the maximum dimension of the largest particle.

For gravel and sand components, describe the range of particle sizes within each component. For example, "about 20 percent fine to coarse gravel, about 40 percent fine to coarse sand".

4.2.5 Odor

Due to health and safety concerns, **NEVER** intentionally smell the soil. This could result in exposure to volatile contaminants that may be present in the soil. If, however, an odor is noticed, it should be described if organic or unusual (e.g., petroleum product or chemical). Soils containing a significant amount of organic material usually have a distinctive odor of decaying vegetation (sometimes a hydrogen sulfide [rotten egg] smell). Organic vapor readings from a photoionization detector (PID) or similar instrument should be noted on the field boring log (Note: see SOP-39 for additional information on PID principles and procedures.). The project-specific health and safety plan should then be consulted to determine the appropriate level of protection necessary to continue field work.

4.2.6 Cementation

Describe the cementation of intact coarse-grained soils as weak, moderate, or strong, in accordance with the following criteria:

- Weak—crumbles or breaks with handling or little finger pressure
- Moderate—crumbles or breaks with considerable finger pressure
- Strong—will not crumble or break with finger pressure

The presence of calcium carbonate may be confirmed on the basis of effervescence with dilute hydrochloric acid (HCl) if calcium carbonate or caliche is believed to be present in the soil. Proper health

and safety precautions must be followed when mixing, handling, storing, or transporting HCl. For further information, see I/HW Health and Safety Procedure 630.24, "Procedure for Hydrochloric Acid Handling for Soil Logging."

4.2.7 Angularity

The angularity of the sand (coarse sizes only), gravel, cobbles, and boulders, as angular, subangular, subrounded, or rounded are described in accordance with the following criteria:

- Angular particles have sharp edges and relatively planar sides with unpolished surfaces.
- Subangular particles are similar to angular description but have rounded edges.
- Subrounded particles have nearly plane sides but have well-rounded corners and edges.
- Rounded particles have smoothly curved sides and no edges.

A range of angularity may be stated, such as "subrounded to rounded."

4.2.8 Structure

Describe the structure of intact soils in accordance with the criteria in Table 7.

Table 7. Criteria for Describing Structure

Description	Criteria
Stratified	Alternating layers of varying materials or color with layers at least 6 mm thick; note thickness
Laminated	Alternating layers of varying materials or color with the layers less than 6 mm thick; note thickness
Fissured	Breaks along definite planes of fracture with little resistance to fracturing
Slickensided	Fracture planes appear polished or glossy, sometimes striated
Blocky	Cohesive soil that can be broken down in small angular lumps that resist further breakdown
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay; note thickness
Homogenous	Same color and appearance throughout

4.2.9 Lithology

Describe the lithology (rock or mineral type) of the sand, gravel, cobbles, and boulders, if possible. It may be difficult to determine the lithology of fine and medium-grained sand or particles that have undergone alteration.

4.2.10 Additional Comments

Additional comments may include the presence of roots or other vegetation, fossils or organic debris, staining, mottling, or oxidation; difficulty in drilling, and caving or sloughing of the borehole walls. Also, when drilling in an area known or suspected to contain imported fill material, every effort should be made to identify the contact between fill and native soils. If a soil is suspected to be fill, this should be clearly indicated on the log following the soil description. Stratigraphic units and their contacts should be noted wherever possible.

4.2.11 Bedrock Descriptions

If the soil boring penetrates bedrock, the boring log should indicate the rock type, color, weathering, fracturing, competency, mineralogy, age (if known), and any other miscellaneous information available. Definitions of these terms are not included in this SOP, because only a small percentage of drilling activities conducted by Tronox Contractors for Tronox penetrate bedrock. If bedrock drilling is planned, the field team leader, with the concurrence of the project manager, makes arrangements to provide the field team with appropriate definitions and indicate the types with information that should be collected.

4.3 Additional Boring Log Information

The boring log form (example shown in Attachment 2) should be used unless a different form is required by the client. Information in the log heading should be complete and accurate. In addition to soil descriptions, the following information should be included, at a minimum:

- Boring or monitoring well number
- Project name and job number
- Site name
- Name of individual who logged the boring
- Name of boring log reviewer
- Drilling contractor
- Drill rig type and method of drilling (for example, "CME 75, hollow stem auger")
- Name of drilling company
- Name of driller and helper
- Borehole diameter and drill bit type

- Type of soil sampler (for example, Modified California, continuous core, etc.)
- Time and date that drilling started and finished
- Time and date that the well was completed or the soil boring backfilled, as appropriate
- Method of borehole abandonment
- Sketch map of boring or well location with estimated distances to major site features such as property lines or buildings, and north arrow

Soil sample information should include the depth interval that was sampled, the blow counts per 6 inches, the amount of soil recovered, and the portion submitted for analysis or testing, if any. The sample identification number may also be noted on the log.

The degree to which soil samples are collected during a field effort depends on the overall scope and purpose of the investigation, which should be clearly defined before the field effort commences. Additional soil samples may need to be collected if, for example, soils are very heterogeneous or unexpected conditions such as perched water zones or zones of contamination are encountered.

If groundwater is encountered during drilling, the depth to water and the time and date of the observation should be recorded. If the first water encountered is a perched zone, the depth, time, and date that any additional groundwater zones are encountered should also be recorded. Depth to water after drilling, the measuring point, and the date and time of the measurement(s) must be noted. Additional measurements of depth to groundwater, including depth and time, may be beneficial.

If a monitoring well is installed, the construction details such as casing material type, screen length and slot size should be noted on the boring log. The annulus fill material (sand pack, bentonite, grout, etc.) should also be recorded.

If the soil boring is abandoned, the backfill material used (e.g., grout, bentonite, etc.) and volume used, should be recorded on the boring log.

5.0 OTHER APPLICABLE SOPs

Several other AECOM SOPs contain information related to soil boring and logging activities. The following is a list of these SOPs:

Drilling Methods
Monitoring Well Design and Installation
Sample Management/Preservation
Soil Sampling
Trenching and Test Pitting
Field Documentation

Site Logbook

6.0 REFERENCES

ASTM, 2000, Standard D2488-00 Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).

ATTACHMENT 1
FIELD CLASSIFICATION GUIDES

UNIFIED SOIL CLASSIFICATION SYSTEM

Major Divisions			Group Symbols	Typical Names	Field Identification Procedures (excluding particles larger than 3 inches and basing fractions on estimated weights)			Information Required for Describing Soils
1	2		3	4	5			6
Coarse-grained Soils More than half of meterila is larger than No. 200 sieve size. The No. 200 sieve size is about the smallest particle visible to the naked eye.	Gravels More than half of coarse fraction is larger than No. 4 sieve size. (For visual classification, the 1/4-in. size may be used as equivalent to the No. 4 sieve size.)	Clean Gravels (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.	Wide range in grain sizes and substantial amounts of all intermediate particle sizes.			For undisturbed soils add information on stratification, degree of compactness, cementation, moisture conditions, and drainage characteristics.
			GP	Poorly graded gravels or gravel-sand mixtures, little or no fines.	Predominantly one size or a range of sizes with some intermediate sizes missing.			
		Gravels with Fines (Appreciable amount of fines)	GM	Silty gravels, gravel-sand-silt mixture.	Nonplastic fines or fines with low plasticity (for identification procedures see ML below)			Give typical name: Indicate approximate percentage of sand and gravel, maximum size; angularity, surface condition, and hardness of the coarse grains; local or geologic name and other pertinent descriptive information; and symbol in parentheses.
			GC	Clayey gravels, gravel-sand-clay mixtures.	Plastic fines (for identification see CL below)			
	Sands More than half of coarse fraction is smaller than No. 4 sieve size	Clean Sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines.	Wide range in grain size and substantial amounts of all intermediate particle sizes.			
			SP	Poorly graded sands or gravelly sands, little or no fines.	Predominantly one size or a range of sizes with some intermediate sizes missing.			Example: Silty sand, gravelly; about 20% hard, angular gravel particles 1/2 in. maximum size; rounded and subangular sand grains, course to fine; about 15% nonplastic fines with low dry strength; well compacted and moist in place; alluvial sand; (SM).
		Sands with Fines (Appreciable amount of fines)	SM	Silty sands, sand-silt mistures.	Nonplastic fines or fines with low plasticity (for identification procedures see ML below)			
			SC	Clayey sands, sand-clay mixtures.	Plastic fines (for identification procedures see CL below)			
Fine-grained Soils More than half of material is smaller than No. 200 sieve size.					Identification Procedures on Fraction Smaller than No. 40 Sieve Size			
					Dry Strength (Crushing characteristics)	Dilatancy (Reaction to shaking)	Toughness (Consistency near PL)	
	Silts and Clays Liquid limit is less than 50		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.	None to slight	Quick to slow	None	For undisturbed soils add information on structure, stratification, consistency in undisturbed and remolded states, moisture and drainage conditions.
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.	Medium to high	None to very slow	Medium	
	Silts and Clays Liquid limit is greater than 50		OL	Organic silts and organic silty clays of low plasticity.	Slight to medium	Slow	Slight	Give typical name; indicate degree and character of plasticity; amount and maximum size of coarse grains; color in wet condition; odor, if any; local or geologic name and other pertinent descriptive information; and symbol in parentheses.
			MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.	Slight to medium	Slow to none	Slight to medium	
			CH	Inorganic clays of high plasticity, fat clays.	High to very high	None	High	
			OH	Organic clays and silts of medium to high plasticity.	Medium to high	None to very slow	Slight to medium	Example: Clayey silt, brown; slighty plastic; small percentage of fine sand; numerous vertical root holes; firm and dry in place; loess; (ML).
Highly Organic Soils			Pt	Peat and other highly organic soils.	Readily identified by color, odor, spongy feel and frequently by fibrous texture.			

ATTACHMENT 2

EXAMPLE BORING LOG FORM

AECOM

Client:		***BORING ID:***
Project Number:		
Site Location:		
Coordinates:	*Elevation:*	*Sheet: 1 of 1*
Drilling Method:		*Monitoring Well Installed:*
Sample Type(s):	*Boring Diameter:*	*Screened Interval:*

Weather:	*Logged By:*	*Date/Time Started:*	*Depth of Boring:*
Drilling Contractor:	*Ground Elevation:*	*Date/Time Finished:*	*Water Level:*

Depth (ft)	Geologic sample ID	Sample Depth (ft)	Blows per 6"	Recovery (inches)	Headspace (ppm)	U.S.C.S	**MATERIALS: Color, size, range, MAIN COMPONENT, minor component(s), moisture content, structure, angularity, maximum grain size, odor, and Geologic Unit (If Known)**	Lab Sample ID	Lab Sample Depth (Ft.)
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									

NOTES:

Date	Time	Depth to groundwater while drilling

Checked by _____ Date:_____

Appendix F

Preliminary Closure Plan for Land Treatment Unit

AECOM
Environment

Prepared for:
Ridgecrest Solar 1, LLC

Preliminary Closure Plan for Land Treatment Unit
Ridgecrest Solar Power Project
Kern County, California
Appendix F of the Application/ Report of Waste Discharge

January 2010

60139696-5450-Closure

AECOM
Environment

Prepared for:
Ridgecrest Solar 1, LLC

Preliminary Closure Plan for Land Treatment Unit
Ridgecrest Solar Power Project
Kern County, California
Appendix F of the Application/ Report of Waste Discharge

Prepared By Brian Ho

Reviewed By Roy Hauger, PE

Contents

1.0 Introduction 1-1

1.1 Purpose 1-1

1.2 Objectives 1-1

2.0 Site Background 2-1

2.1 Land Treatment Unit 2-1

3.0 Closure Strategy 3-1

3.1 Health and Safety Procedures 3-1

3.2 Land Treatment Closure Schedule of Actions 3-1

4.0 Additional Information 4-1

4.1 Contingency in the Event of a Release 4-1

4.2 Financial Responsibility 4-1

4.3 Cost Analysis 4-1

4.4 Closure Schedule 4-1

4.5 Final Treatment Procedures 4-1

4.6 Land Use of Closed Unit 4-2

List of Appendices

Appendix A Cost Estimate

List of Figures

Figure 1 Regional Location and Vicinity Map 4-2

Figure 2 Site Plan 4-3

Figure 3 Land Treatment Unit Details 4-4

Figure 4 Cross Section Details of the Land Treatment Unit 4-5

List of Acronyms

BLM	Bureau of Land Management
CIWMB	California Integrated Waste Management Board
HTF	heat transfer fluid
IWVWD	Indian Wells Valley Water District
LTU	land treatment unit
mg/kg	milligrams per kilogram
ROW	Right-of-Way
ROWD	Report of Waste Discharge
RSPP	Ridgecrest Solar Power Project
RWQCB	Regional Water Quality Control Board
SSG	solar steam generator

1.0 Introduction

This document presents a Preliminary Closure Plan for a land treatment unit (LTU) for the proposed Ridgecrest Solar Power Project (RSPP or Project), located in the high northern Mojave Desert in northeastern Kern County, California, about five miles southwest of the City of Ridgecrest, California (**Figure 1**). Ridgecrest Solar 1, LLC (formerly Solar Millenium LLC) is proposing to construct, own and operate the RSPP. The Project right-of-way (ROW), for which a ROW grant sought by the Applicant from the Bureau of Land Management (BLM), will extend across approximately 3,995 acres of public lands owned by the Federal government. The Project facilities will occupy 1,944 acres of the 3,995-acre site, and there will be a total disturbance area (including areas outside the facility fence line), of approximately 1,944 acres. The LTU will be used to receive, temporarily store, and treat soil contaminated with heat transfer fluid (HTF) released from the process to the environment. This Closure Plan is specific to the LTU associated with the Project.

A notice to terminate will be sent to the Regional Water Quality Control Board (RWQCB) 60 days prior to closing the LTU. The notice will include the final closure activities. The LTU will be closed using the schedule of actions explained below.

1.1 Purpose

This plan is intended to be a standalone separable document to the Report of Waste Discharge (ROWD) application for the Project, in accordance with the California Integrated Waste Management Board (CIWMB) Title 27 Regulations, Division 2, Subdivision 1, Chapter 4, Subchapter 4, Section 21769; State Water Resources Control Board Closure; and Post-Closure Maintenance Plan Requirements.

The procedures described for closure are designed to ensure public health and safety, environmental protection, and compliance with applicable regulations. It is assumed that closure would begin 30 years after the commercial operation date of the solar plant. A Certification of Closure will be submitted for approval to the RWQCB to ensure the LTU has been closed in accordance with the approved final Closure Plan.

1.2 Objectives

The Project goals for LTU facility closure are as follows:

- Remove all improvements within 3 feet of final grade; and
- Restore the lines and grades in the disturbed area of the Project Site to match the natural gradients.

The proposed implementation strategy to achieve the goals for site facility closure is as follows:

- Use industry standard demolition means and methods to decrease personnel and environmental safety exposures by minimizing time and keeping personnel from close proximity to actual demolition activities to the extent practical;
- Plan each component of the closure such that personnel and environmental safety are maintained while efficiently executing the work;
- Specify in detail how each major effort will be performed and integrated to achieve the Project goals;
- Train field personnel for decommissioning actions to be taken in proportion to the personnel, Project or environmental risk for those actions;
- Evaluate the execution of the decommissioning and restoration plan through Project oversight and quality assurance; and
- Document implementation of the plan and compliance with environmental requirements.

2.0 Site Background

The Project is a concentrating solar electric generating facility proposed on an approximately 3,995-acre site in Kern County, California. The Project will use well-established parabolic trough solar thermal technology to produce electrical power using a steam turbine generator fed from a solar steam generator (SSG). The SSG receives HTF from solar thermal equipment comprised of arrays of parabolic mirrors that collect energy from the sun.

The Project proposes to use dry cooling for power plant cooling. Water for process water make up, and other industrial uses such as mirror washing will be supplied by the local municipal water district via a new pipeline. This source will also be used to supply water for employee use (e.g., drinking, showers, sinks, and toilets). Water received from the Indian Wells Valley Water District (IWVWD) will meet the requirements of the California Department of Health Services for potable water supplies and will not require further treatment for this purpose. Power cycle makeup, mirror washing water, and cooling of ancillary equipment will require onsite treatment for reduction of dissolved solids, and this treatment varies according to the quality required for each of these uses. A sanitary septic system and on-site leach field will be used to dispose of sanitary wastewater.

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. No off-site backup cooling water supply is planned at this time.

The Project will include a LTU to treat soil contaminated with HTF. The unit will be designed in accordance with Lahontan RWQCB requirements. The LTU will cover an area of approximately 500-feet by 350-feet (4 acres).

2.1 Land Treatment Unit

The LTU will not incorporate a liner containment system or leak detection and removal system, but will be constructed with a prepared base consisting of a minimum of 2 feet of compacted, low permeability, lime-treated native material. This base will serve as a competent platform for land treatment activities, and will serve to slow the rate of surface water infiltration in the treatment area. The compacted and native soil beneath the LTU is designated as a “treatment zone” to a depth of 5 feet. Although the LTU will be taking vehicle traffic, no hard surface will be required, as there is no liner system to protect.

The LTU will be surrounded on all sides by a 2-foot high (minimum) compacted earthen berm with side slopes of approximately 3:1 (horizontal: vertical). These berms will control and prevent potential inflow (run on) of surface stormwater into the LTU or runoff of stormwater from the unit.

The site plan design details, and cross section details of the LTU are shown in **Figures 2, 3, and 4**.

3.0 Closure Strategy

The closure for the LTU consists of the following major elements:

- Documentation and establishment of health and safety procedures;
- Prior to initial facility operation, collecting samples from the compacted native soil for laboratory analysis;
- Conducting pre-closure activities such as final closure and restoration planning that addresses the "as-found" site conditions at the start of the Project;
- Demolishing the aboveground structures (dismantling and removing of improvements and materials) in a phased approach while still using some items until the end of the Project;
- Demolishing and removing of belowground facilities as needed to meet the closure goals;
- Cleaning up of soils, if needed, with special attention applied to the LTU to ensure that clean closure is achieved;
- Disposing of materials in appropriate facilities for treatment/disposal or recycling (if needed); and
- Re-contouring lines and grades to match the natural gradient and function.

The plan is to close the LTU, by contouring the area to return it to near original conditions while disturbing as little of the other areas as is practical.

3.1 Health and Safety Procedures

The health and safety procedures to be established prior to decommissioning are listed below:

- General safety and hazard responsibilities;
- An effective hazard communications program;
- Task hazard analysis and control;
- Personal protection equipment requirements;
- Occupational and environmental monitoring requirements;
- Medical and other emergency procedures;
- Operational issues;
- Personnel training;
- Incident reporting; and
- Self audit and compliance procedures.

3.2 Land Treatment Closure Schedule of Actions

Baseline Sampling

Baseline sampling will be conducted in the compacted native materials prior to the initiation of LTU activities. Samples will be collected on 50-foot by 50-foot grid spacing. Laboratory analysis will include total petroleum hydrocarbons, Title 22 metals, biphenyl, diphenyl oxide, and general chemistry.

Soil Segregation

If contaminated soil remains in the LTU when it is time to close the LTU, the contaminated soil may be at various stages of treatment, depending on length of time in each unit. In order to properly handle and dispose of the contaminated soil, representative soil samples will be collected from the LTU to determine HTF concentrations. Soil will be segregated based on the following criteria:

- For concentrations below 100 milligrams per kilograms (mg/kg) of HTF, the soil will be used as back fill material on site.
- For concentrations below 10,000 mg/kg of HTF but above 100 mg/kg, the soil will be stored and treated in the LTU until concentrations are below 100 mg/kg of HTF.
- Although not expected, any soil with concentrations above 10,000 mg/kg of HTF will be collected and containerized pending disposal at a Class I waste disposal facility.

The LTU soils will continue to be managed, maintained, monitored, and reported as outlined in the Waste Discharge Report for the LTU. Once soil concentrations are below 100 mg/kg, the soil will be used as fill material on the property.

For closure, the soil will be characterized by collecting samples on a 100 by 100 foot grid and analyzing them for Title 22 metals and HTF constituents using EPA Method 8015M. For the cost estimate it was assumed that soil within the treatment unit would be sampled on a 100 by 100 foot grid and that samples would be collected from two depths, one of the soil within the compacted lime treated soil layer (typically less than 3 feet bgs) and another sample from the compacted native soil layer at the base of the LTU (typically from 3 to 5 feet bgs). The purpose of this sampling is to identify any remaining impacted soil and to verify and document that the soil that is not removed is acceptable to leave in place.

Site Restoration

The LTU will be backfilled with soil to grade. The LTU design uses native soil only; therefore, no demolition is required. Bermed areas will be leveled and used as the primary backfill material.

4.0 Additional Information

Additional Plan information, as required per the CIWMB Title 27 is detailed in the following sections.

4.1 Contingency in the Event of a Release

For unauthorized discharges of hazardous material, or for public health or environmental emergencies caused by a discharge or threatened waste discharge, local emergency responders and the Office of Emergency Services will be notified. For all other unauthorized discharges or threatened discharges that are not an immediate threat to public health or the environment, notification will be made to the RWQCB by telephone within 24 hours of an adverse condition. An adverse condition includes a discharge or threatened discharge, such as:

- Release of wastewater outside a lined area;
- Suspected or actual evaporation pond liner leak; and
- Violation of discharge specifications.

Written notification to the RWQCB will occur within seven business days of an unauthorized discharge. The RWQCB Lahontan Region's guidance document titled Reporting Unauthorized Waste Discharges (Spills and Leaks) dated October 23, 2002 will be followed.

An evaluation monitoring program may be required, pursuant to Section 20425 of Title 27 to evaluate evidence of a release if detection monitoring and/or verification procedures indicate evidence of a release.

4.2 Financial Responsibility

The waste management unit (i.e., LTU) is considered Class II. At Class II units for which the CIWMB does not require a closure fund, the RWQCB requires the establishment of an irrevocable closure fund (or provide other means) pursuant to the CIWMB-promulgated sections of Title 27, Chapter 6 but with the RWQCB named as beneficiary, to ensure closure of each classified unit in accordance with an approved plan meeting all applicable State Water Resources Control Board-promulgated requirements of Title 27, Chapter 6, Subchapter 2.

4.3 Cost Analysis

A detailed cost estimate to close the LTU is provided in Appendix A. Unit costs are based on RS Means Building Construction Cost Data 2001 Western Version and adjusted by ENR Historical Cost Index to obtain present value (2009) unit costs. The total cost estimate is **$70,000**. A letter of credit will be used to demonstrate financial assurance for the closure costs.

4.4 Closure Schedule

A closure schedule will be determined at a future date under separate cover of the Final Closure Maintenance Plan.

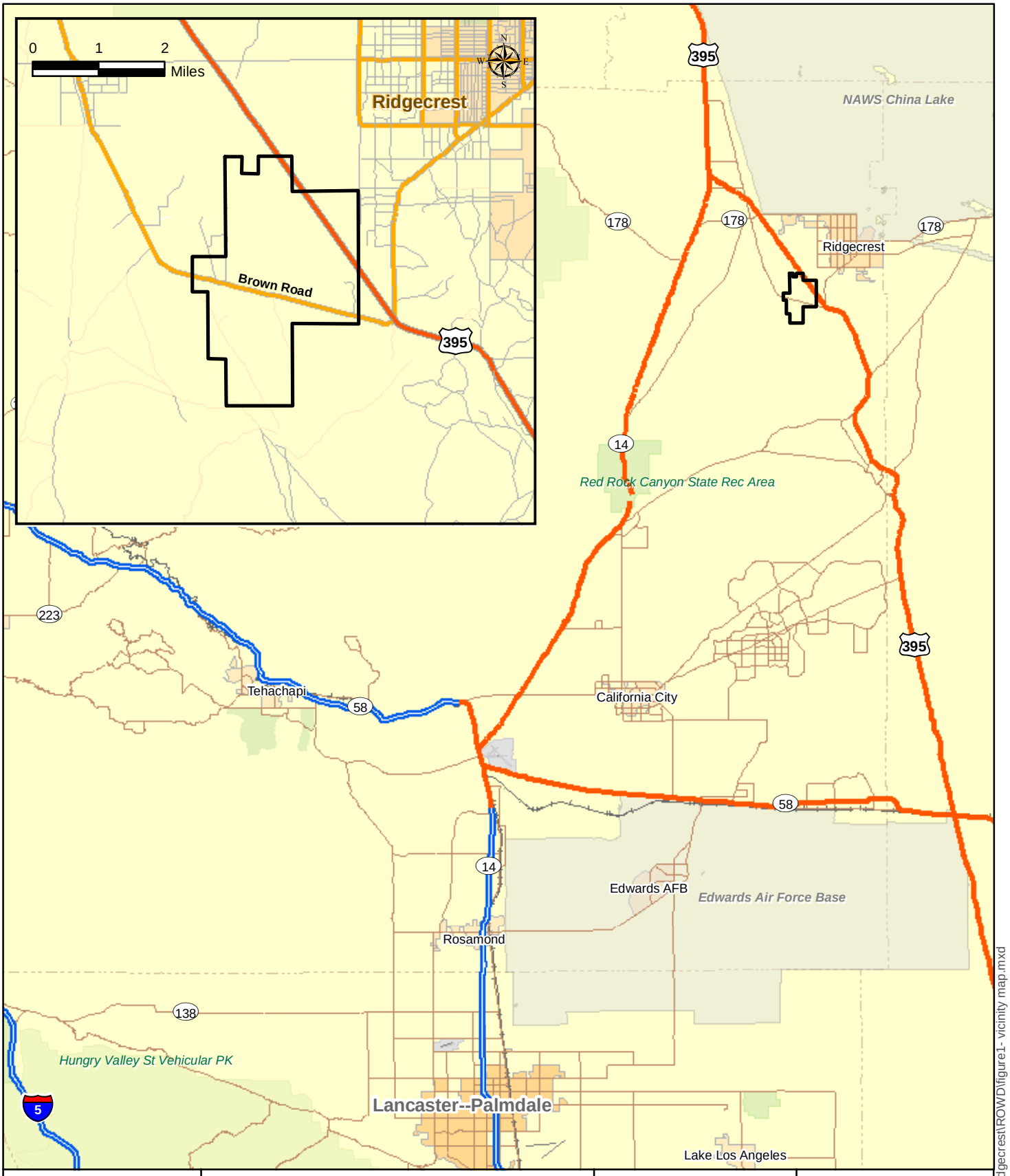
4.5 Final Treatment Procedures

All waste and contaminated materials will be removed off site and all facilities will be remediated in accordance with Section 3.2 detailed previously. At this time it is anticipated that the LTU will be clean closed and no post closure monitoring will be required, however, if impacts remain or the regulatory agencies require it, post closure monitoring will be satisfied with the requirements identified in the Post Closure Maintenance Plan. Final finishing of the surface of the LTU will be sculptured to blend with the surrounding terrain and establish native vegetation consistent with surrounding parcels.

4.6 Land Use of Closed Unit

The land use of the closed unit after closure has not been determined. At present it is anticipated that the facilities will be left as vacant, non-irrigated open land that has been remediated. Based on the plan to clean close the LTU, future use should not be restricted any more than surrounding parcels. Any future development will need to undergo the standard review and approval process in effect at that time.

Figures



Map Location

0 5 10
Miles

Ridgecrest Solar Power Plant

Figure 1
Regional Location and Vicinity Map

Solar Millennium

AECOM

Project: 60139696
Date: January 2010

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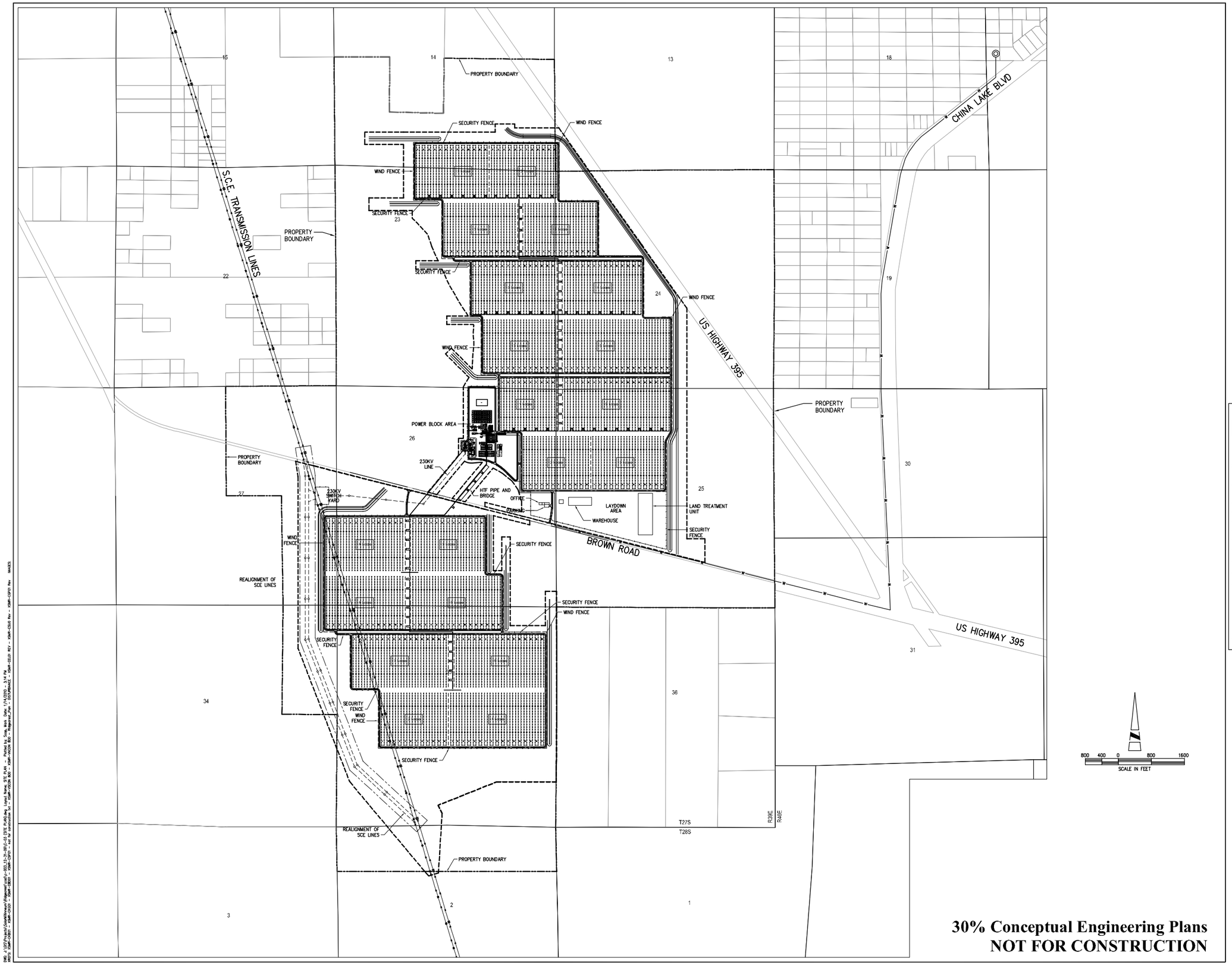

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REGISTERED PROFESSIONAL ENGINEER
WILLIAM CHARLES BLACK
No. C31465
EXP. 12-31-10
CIVIL
STATE OF CALIFORNIA

Designed:	W. BLACK
Checked:	W. BLACK
Drawn:	K. S. BEDFORD
Record Drawing by/date:	

Revisions:

#	DATE	DESCRIPTION

Prepared for:

Solar Millennium LLC

LEGEND:

- SOLAR FIELD PARABOLIC TROUGH
- BALANCE OF PLANT FACILITIES
- PROPOSED ACCESS ROAD (PAVED)
- PROPOSED ACCESS ROAD (GRAVEL)
- RAILROAD
- PROPOSED GAS
- PROPOSED WATER
- PROPOSED TELEPHONE
- PROPOSED ELECTRIC
- EXISTING ELECTRIC
- PROPOSED SECURITY FENCE
- PROPOSED WIND FENCE
- EXISTING CONTOURS (10 FOOT INTERVALS)
- PROPOSED DRAINAGE CHANNEL/FLOW DIRECTION
- EXISTING INTERMITTENT DRAINAGE CHANNEL
- SITE BOUNDARY
- HEADER PIPING
- ACCELERATION LANE

Ridgecrest Solar Power Project

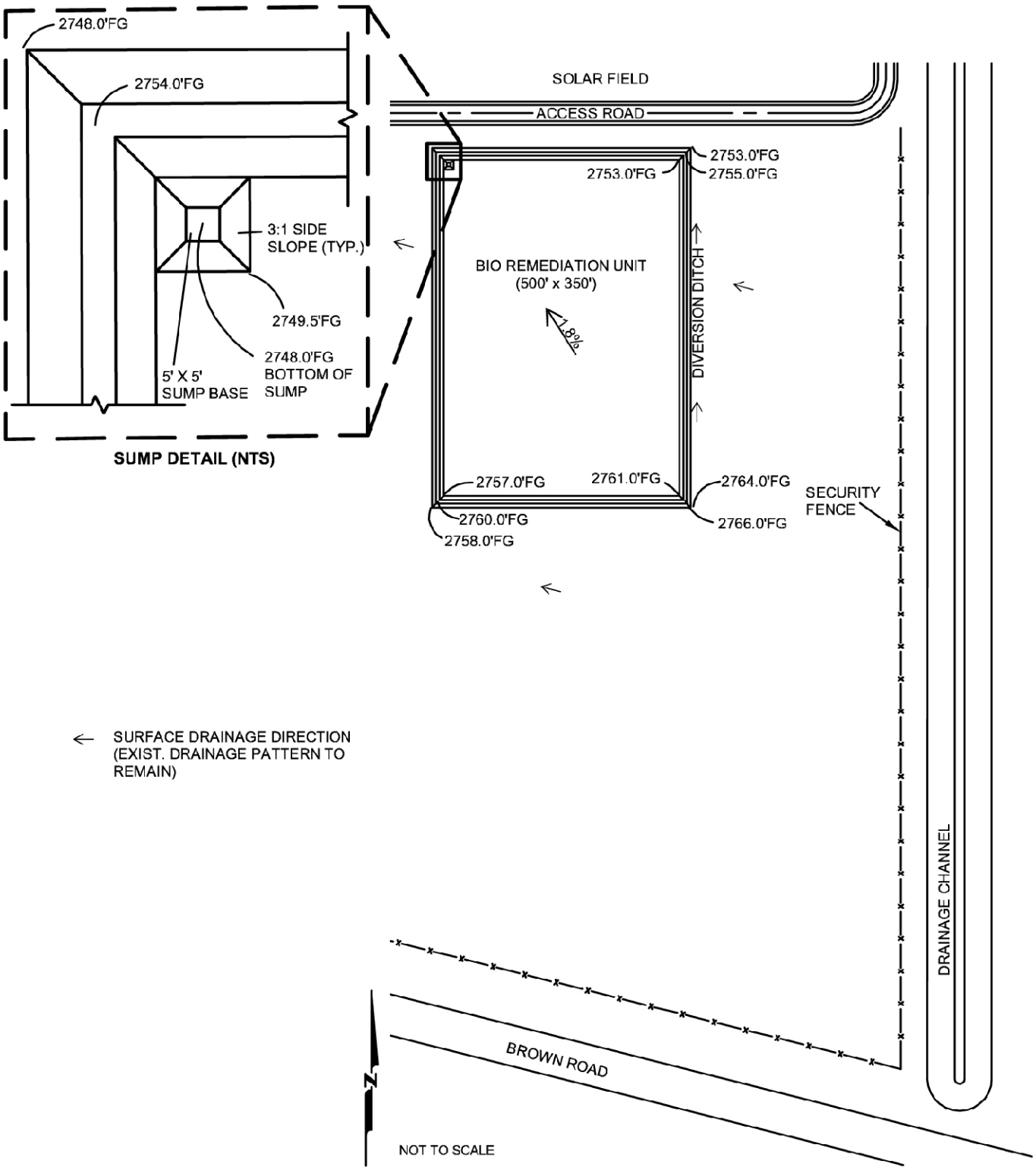
Kern County, California

Preliminary Site Plan

Figure 2

Date: 12/18/09

Sheet: .



Map Location

Ridgecrest Solar Power Plant

Figure 3
Land Treatment Unit Details

Solar Millennium

AECOM

Project: 60139696
Date: January 2010

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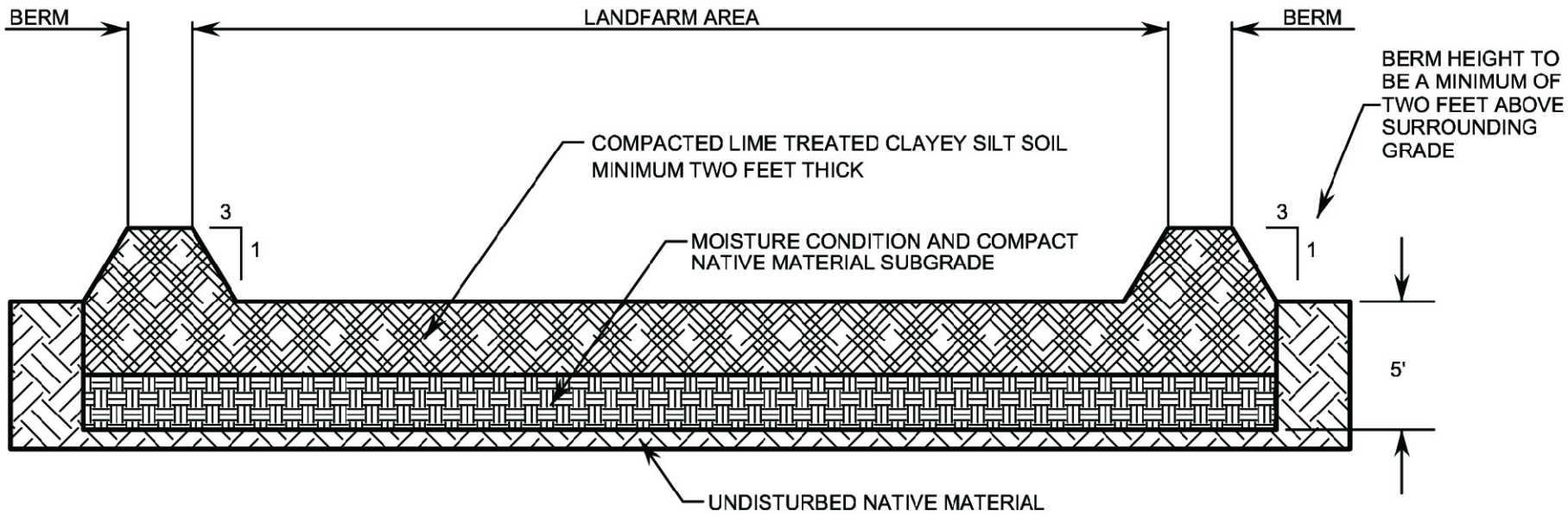

1 / - - LANDFARM UNIT-SECTION
N.T.S.

NOTES:

1. THE COMPACTED AND NATIVE SOIL BENEATH THE LAND FARM UNIT IS DESIGNATED AS A "TREATMENT ZONE" TO A DEPTH OF 5 FEET.
2. THE LIME TREATED LAYER IS TO BE COMPACTED TO A MINIMUM OF 95% OF THE MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D1557 AND HAVE A LOW PERMEABILITY (CLAYEY SILT) MATERIAL.
3. THE CROSS SECTION IS A TYPICAL SECTION.
4. SEE TEXT FOR FURTHER DETAILS.

Map Location

Rdgecrest Solar Power Project

Figure 4
Cross-Section Details of Land Treatment Unit

Solar Millennium

AECOM

Project: 60139696
Date: Januaryr 2010

J:\GIS\Projects\SolarMillinneum\Ridgecrest\ROWD\Land_Treatment_Unit-x-sec.mxd

Appendix A

Cost Estimate

Ridgecrest Solar 1, LLC
Land Treatment Unit Closure Costs

Item	Closure Cost Estimate (each)	Quantity	Subtotal Closure Cost Estimate
Bioremediation Unit and Land Farm Unit	$70,000	1	$70,000
	Total Closure Cost Estimate		**$70,000**

Ridgecrest, CA
Order-of-Magnitude Cost Estimate-Closure of Land Farm

Activities sequence to close land farm unit

1. Sample Land Farm Units to demonstrate it is acceptable to use soil as fill material
2. Sample Clay/Silt layer to demonstrate that it is acceptable to leave in place
3. Demo berms and return to interior of land farm

		Unit Cost	Unit Quantity	Unit	Number	Cost Reference
Costs						
1. Sample Land Farm Units treated soils to demonstrate that they are acceptable to leave in place						
Sample Collection	Day	$1,800	1	1	$1,575	20 per day
Sample Analysis	Each	$250	18	1	$4,375	TPH by 8015 & Title 22; Estimate (100x100' grid)
Report of Analytical	Each	$5,000	1	1	$5,000	ROM Estimate
				Total	**$10,950**	
2. Sample Clay/Silt layer of pad to demonstrate that it is acceptable to leave in place						
Sample Collection	Day	$1,800	2	1	$3,150	ROM Estimate; 20 per day
Sample Analysis (1 ft & 5 ft)	Each	$250	35	1	$8,750	TPH by 8015 & Title 22; Estimate (100x100' grid)
Report of Analytical	Each	$5,000	1	1	$5,000	ROM Estimate
				Total	**$16,900**	
3. Demo berms and return to interior of land farm						
Mobilization	LS	$5,000	1	1	$5,000	ROM Estimate
Excavate (Dozer, 300' haul, common earth)	CYD	$8	2,323	1	$17,708	Means 02315-410-4420
				Total	**$22,708**	
Subtotal Field Activities Costs					**$50,558**	
Contingency	(0% of All of the Above Costs)				$0	
				Total	**$50,558**	
Total Field Activities Costs					**$60,000**	
Engineering and Oversite						
Engineering	(1% of Total Construction Cost)				$1,000	Means 01107-300-1200 (min.)
Permitting	(1% of Total Construction Cost)				$1,000	Means 01310-150-0010 (min.)
Construction Management	(5% of Total Construction Cost)				$3,000	Means 01107-200-0010 (min.)
Closure Report	(8% of Total Construction Cost)				$5,000	Means 01310-150-0010
Total Engineering and Oversite Cost					**$10,000**	
T O T A L C O S T					**$70,000**	

Assumptions

No need for construction support facilities since site has infrastructure

Berms are constructed by removal of native material from leachate sump & interior of land farm

	Height (ft)	Top of Berm	Bottom of	Cross s	Length	Volume (CYD)
Volume of berm material is ~	3	3	21	36	1742	2323

Assume that berms are 3 feet high average

Accumulated HTF material has all degraded to below 100 mg/kg and is acceptable as fill

	# of LTUs Required		1			
Land Farm Area	Width	350	feet	Length	500	feet
	Area	175000	Square Fe	Area	4.02	acres
Compacted Clay/Silt	Thickness	2	feet	Vol	12963	Cubic Yards

Assume that Compact Clay/Silt can remain as it is not impacted

Notes

Unit Costs are from RS Means Building Construction Cost Data 2001 Western Version

Unit Costs are adjusted by the City Cost Index; 1.13 Means page 612 for Installation index for Riverside, CA

Unit Costs are adjusted by the ENR Historical Cost Index to become 2008 costs

Compare Construction Cost Index since closure is mostly labor and not materials purchase

ENR Construction Cost Index for Los Angeles in December 2000	7068
ENR Construction Cost Index for Los Angeles in Aug 2009 (est)	9766
Historical Cost adjustment is 2009 #/ 2000 #	1.38
Combined adjustment is	1.57

Ridgecrest
Kern County
Ridgecrest, CA 93555

Inquiry Number: 2657316.2
December 11, 2009

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Attachment DR-WASTE-243

Aerials and Topographic Maps

Date EDR Searched Historical Sources:

Aerial Photography December 11, 2009

Target Property:

Kern County

Ridgecrest, CA 93555

Year	***Scale***	***Details***	***Source***
1952	Aerial Photograph. Scale: 1"=555'	Flight Year: 1952	Robinson
1984	Aerial Photograph. Scale: 1"=690'	Flight Year: 1984	USGS
1994	Aerial Photograph. Scale: 1"=666'	Flight Year: 1994	USGS
2005	Aerial Photograph. 1" = 604'	Flight Year: 2005	EDR

INQUIRY #: 2657316.2
YEAR: 1952
= 555'
N
EDR Environmental Data Resources Inc

INQUIRY #: 2657316.2
YEAR: 1984
= 690'
N

INQUIRY #: 2657316.2
YEAR: 1994
= 666'
N
EDR Environmental Data Resources Inc

INQUIRY #: 2657316.2
YEAR: 2005
= 604'
N
EDR Environmental Data Resources Inc

Ridgecrest
Kern County
Ridgecrest, CA 93555

Inquiry Number: 2657316.1
December 11, 2009

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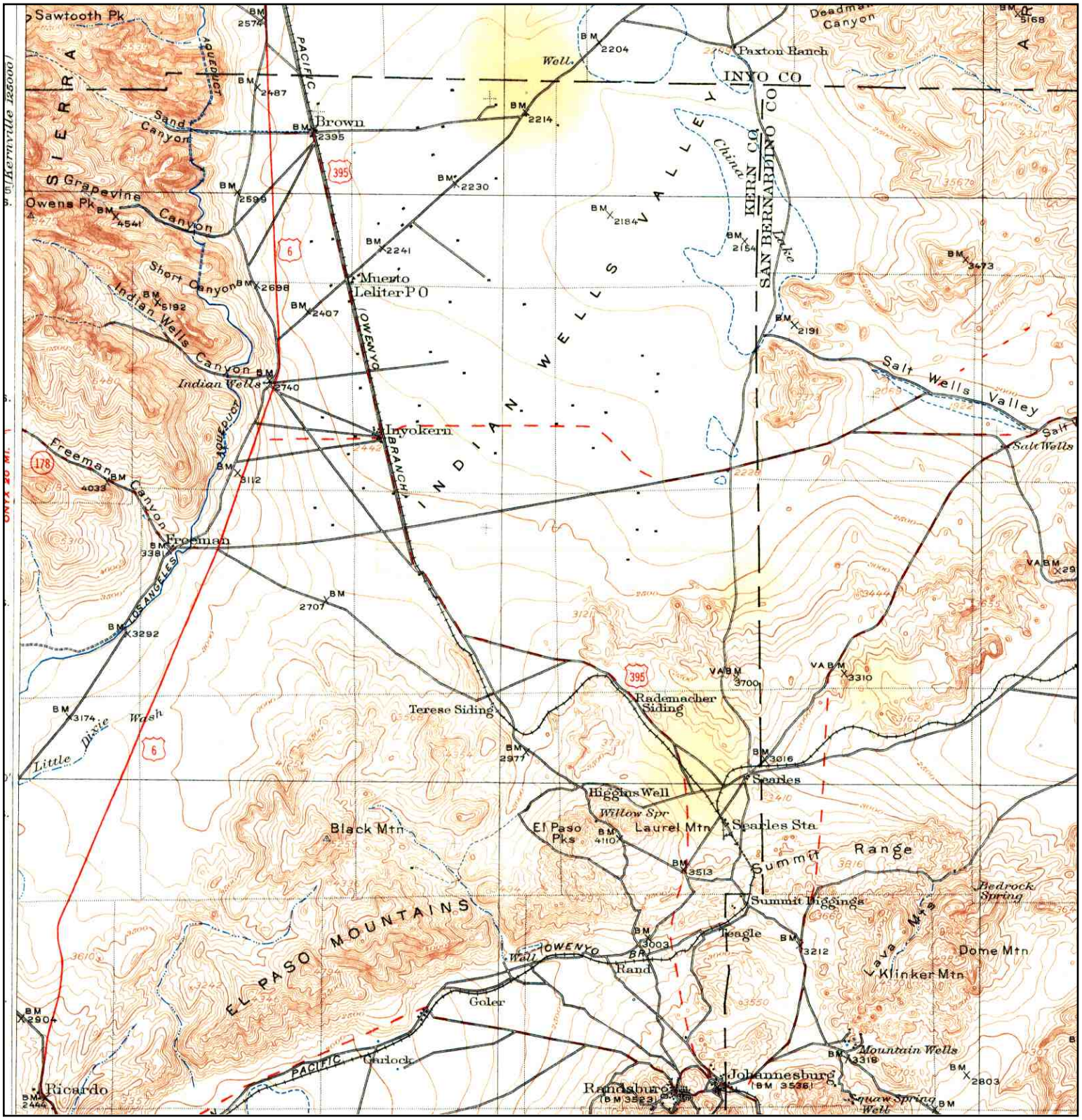

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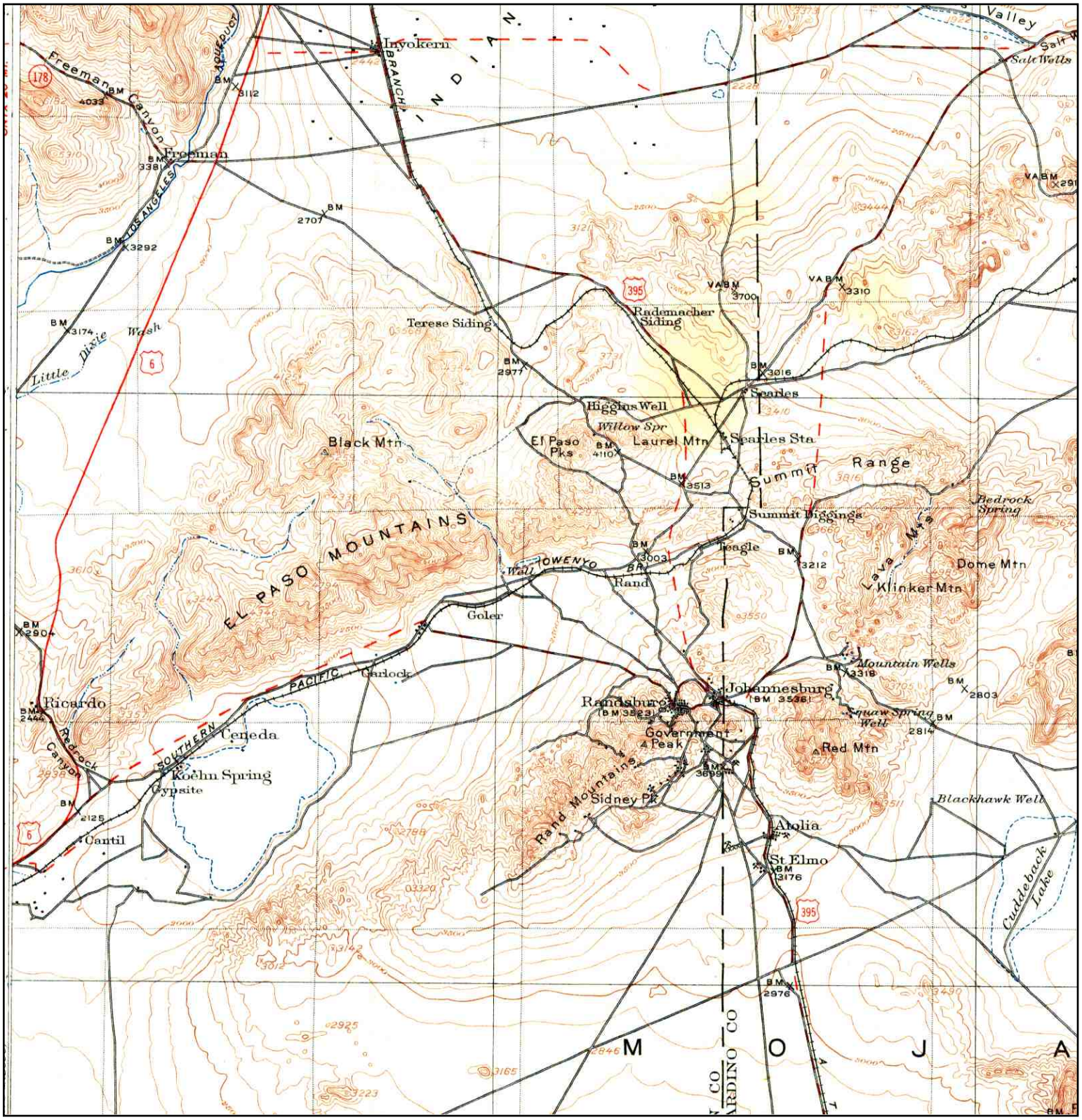

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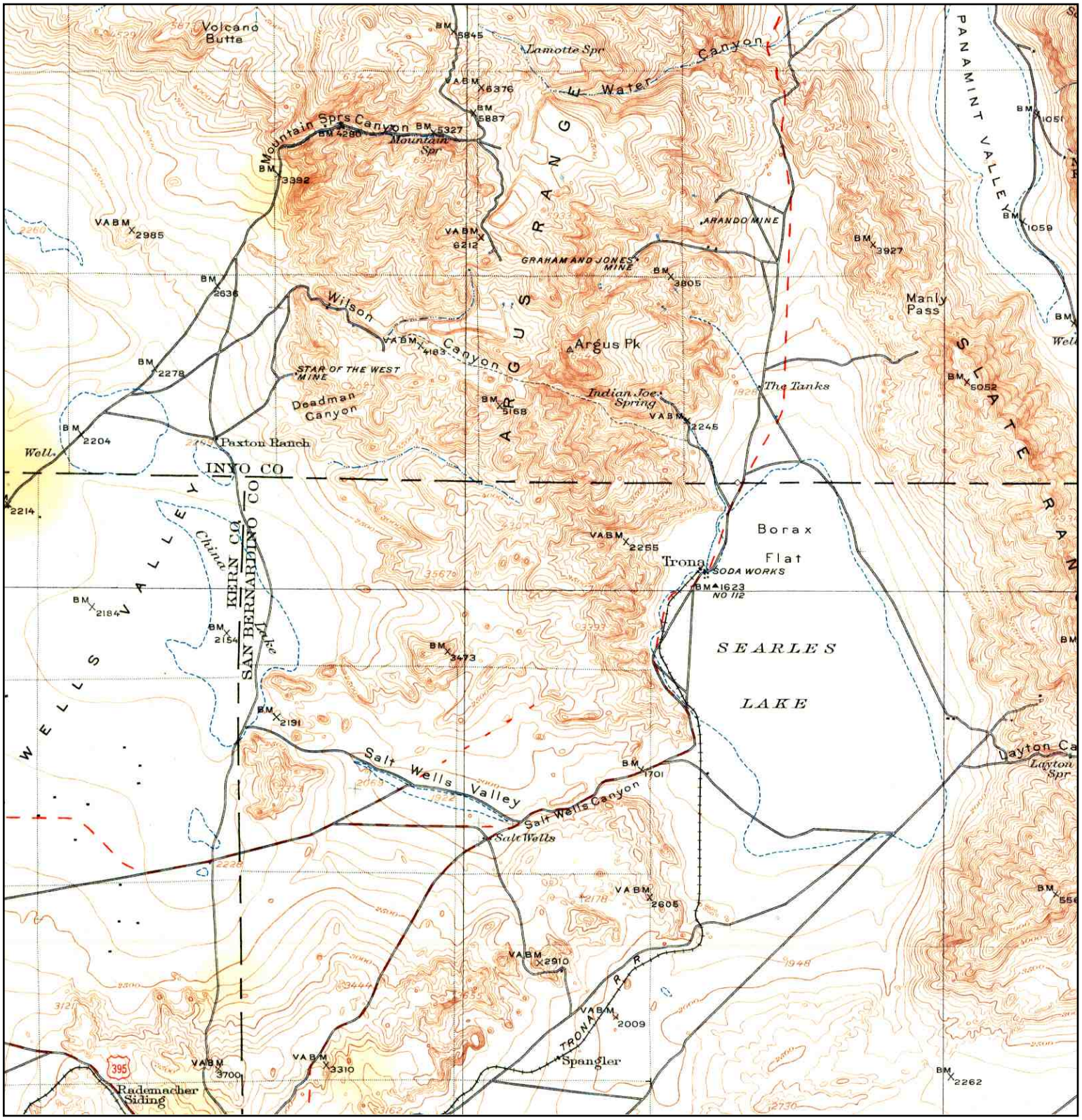

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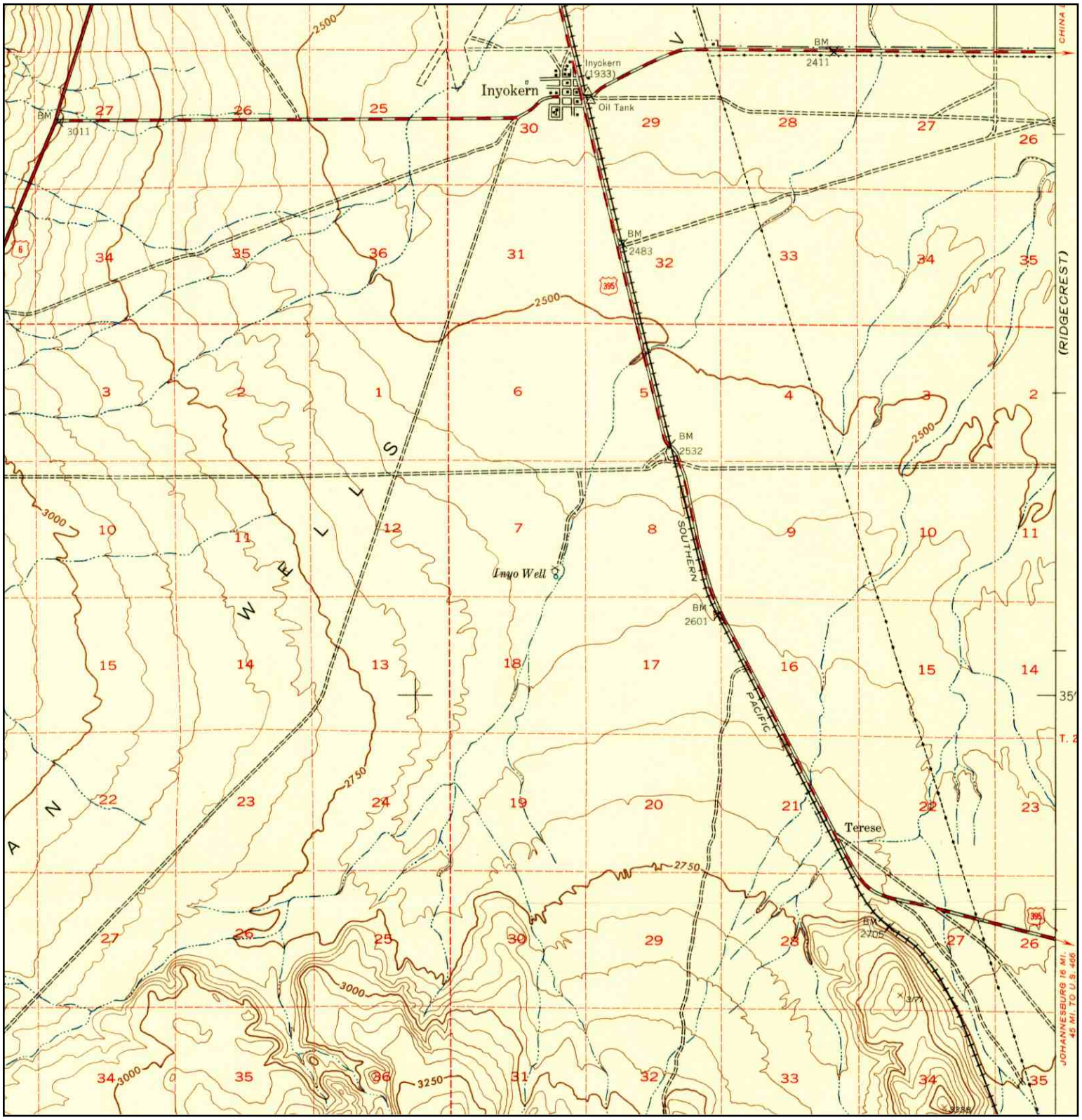

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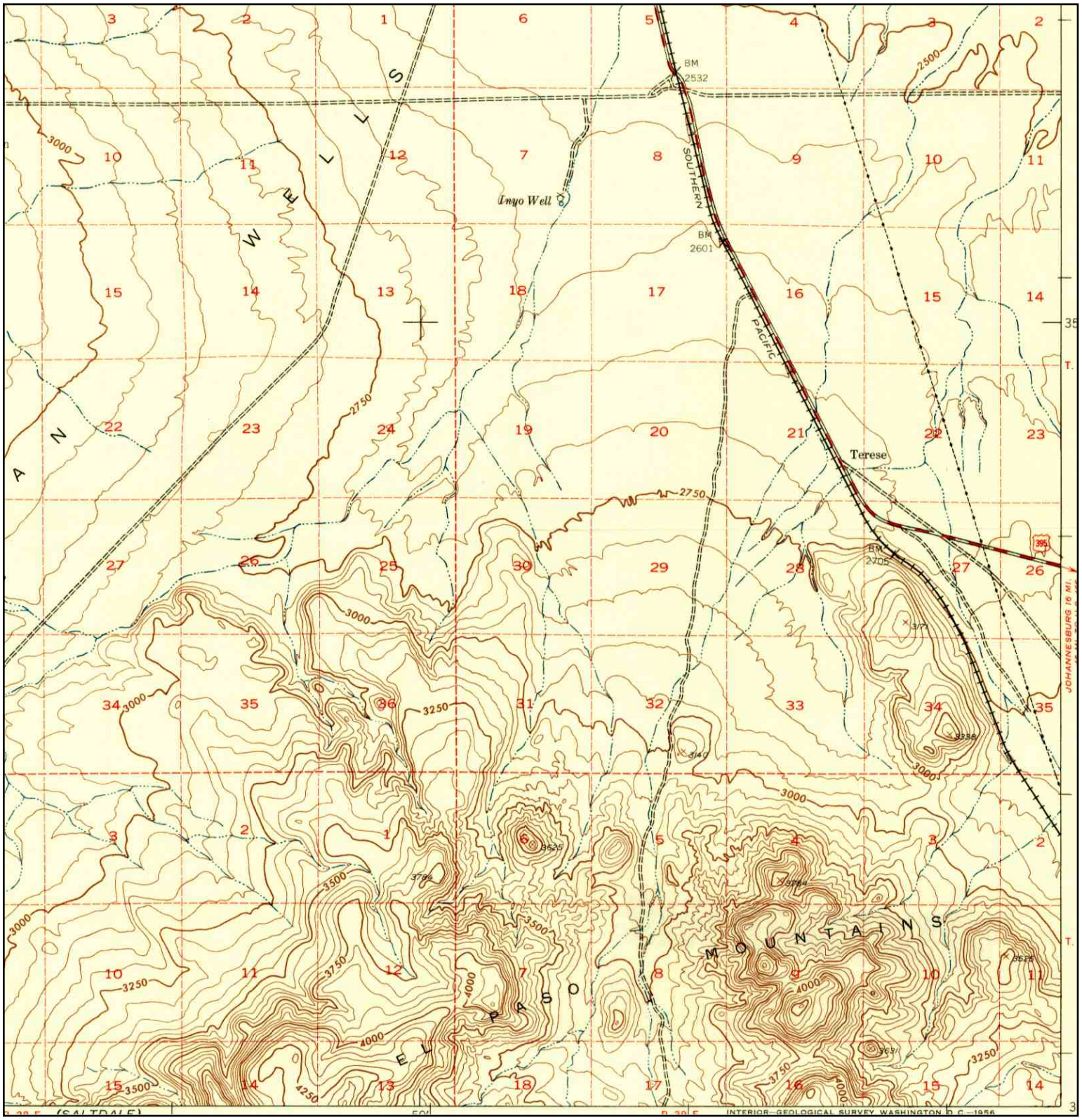

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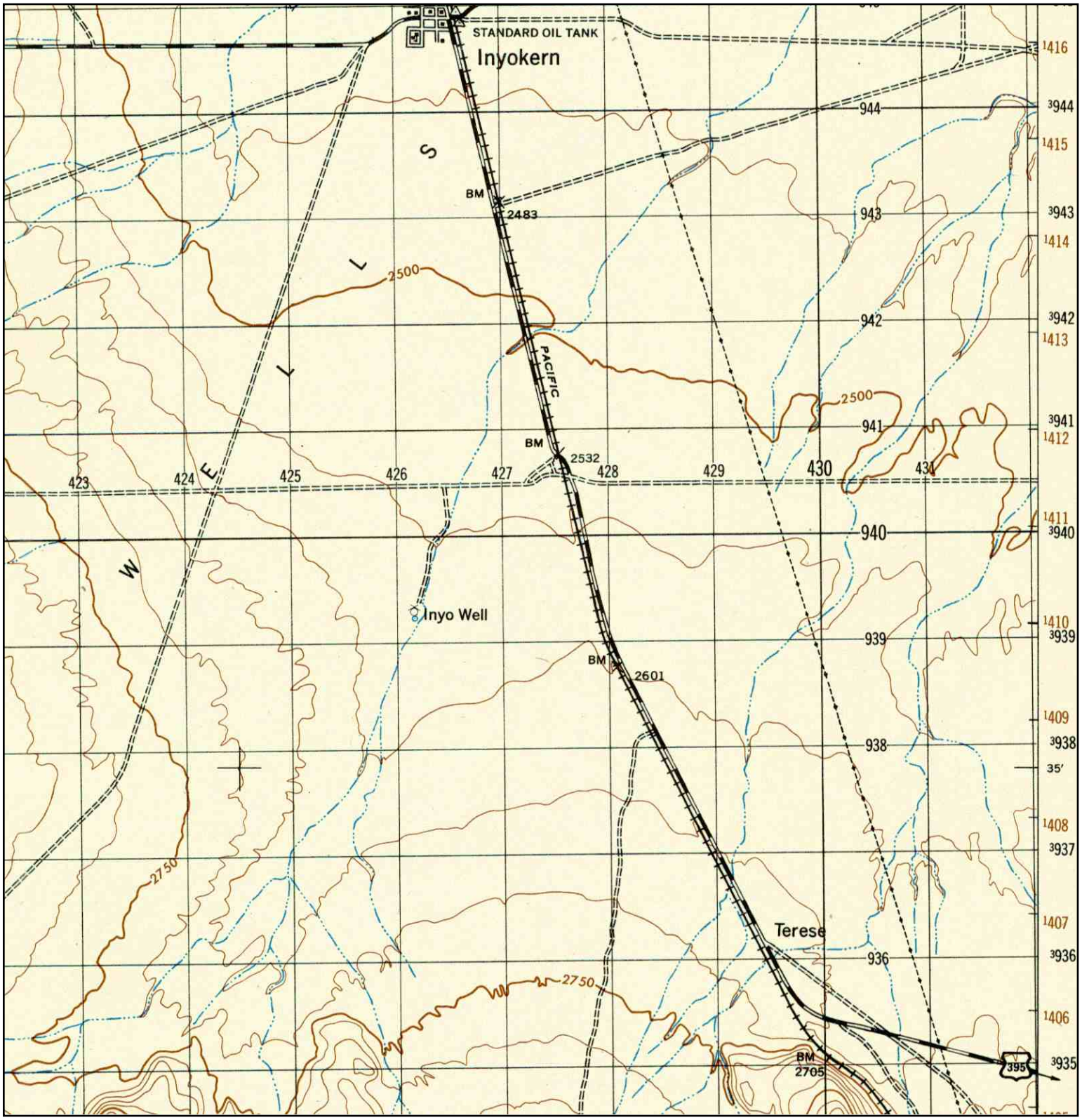

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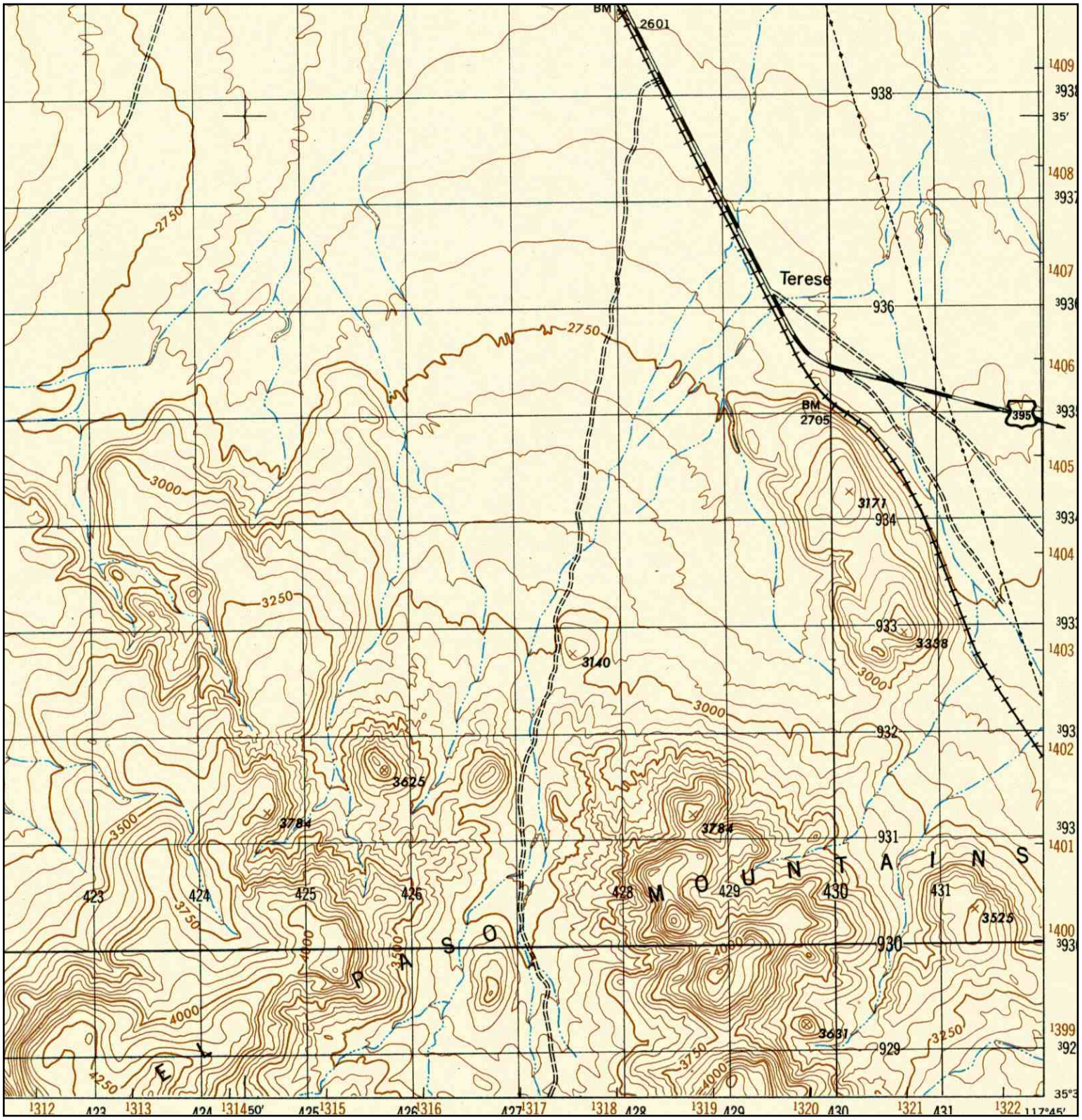

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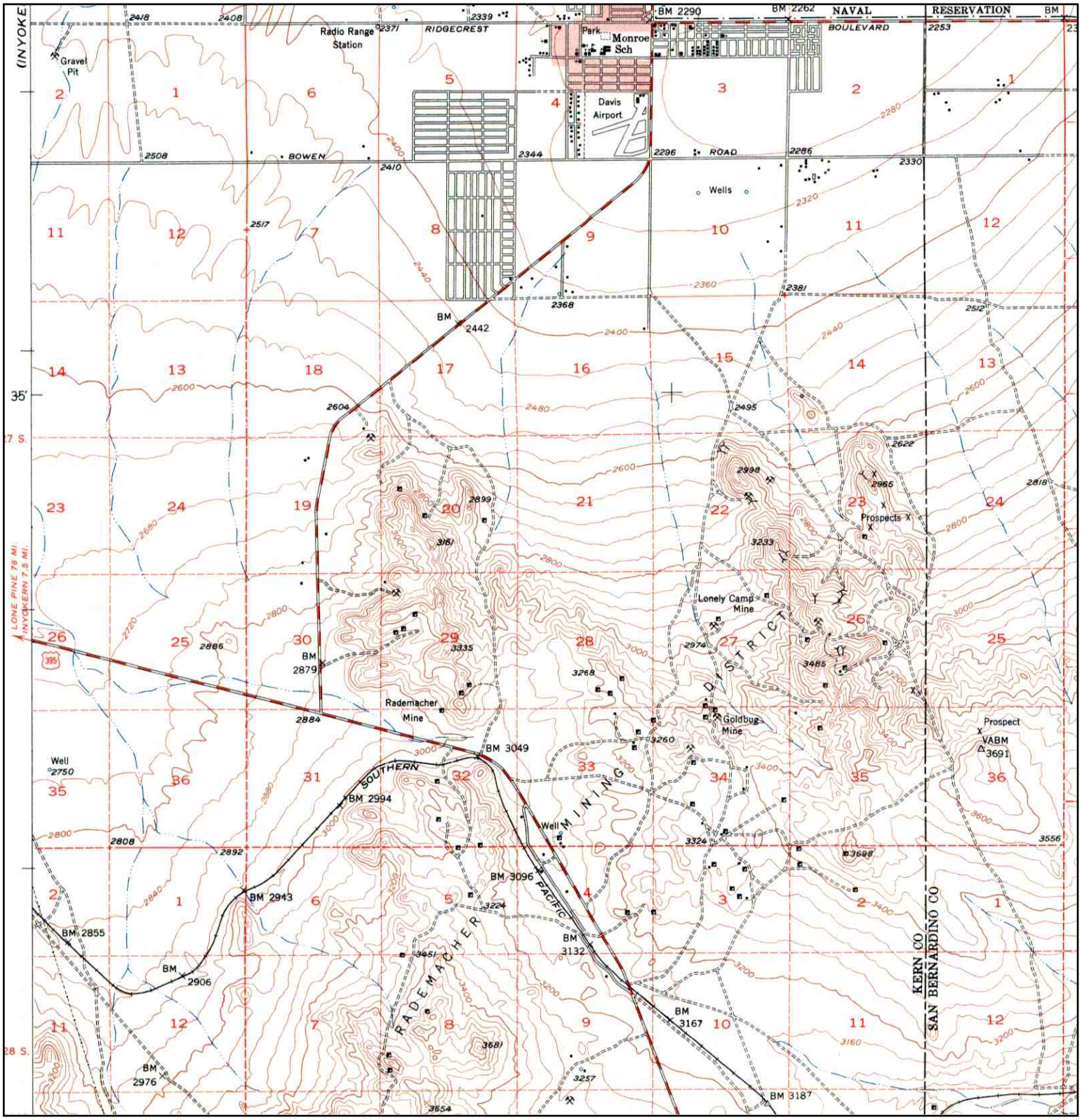

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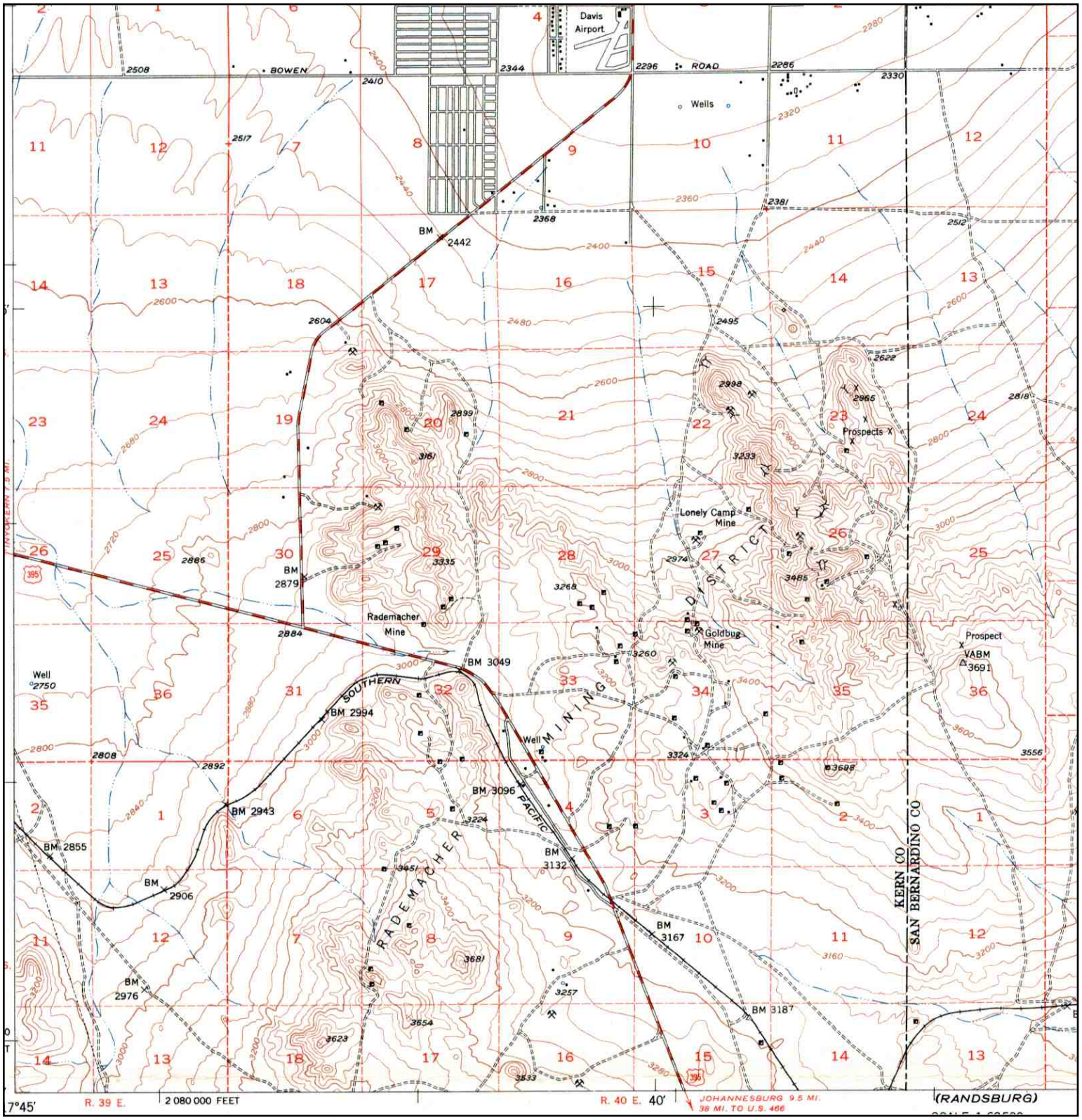

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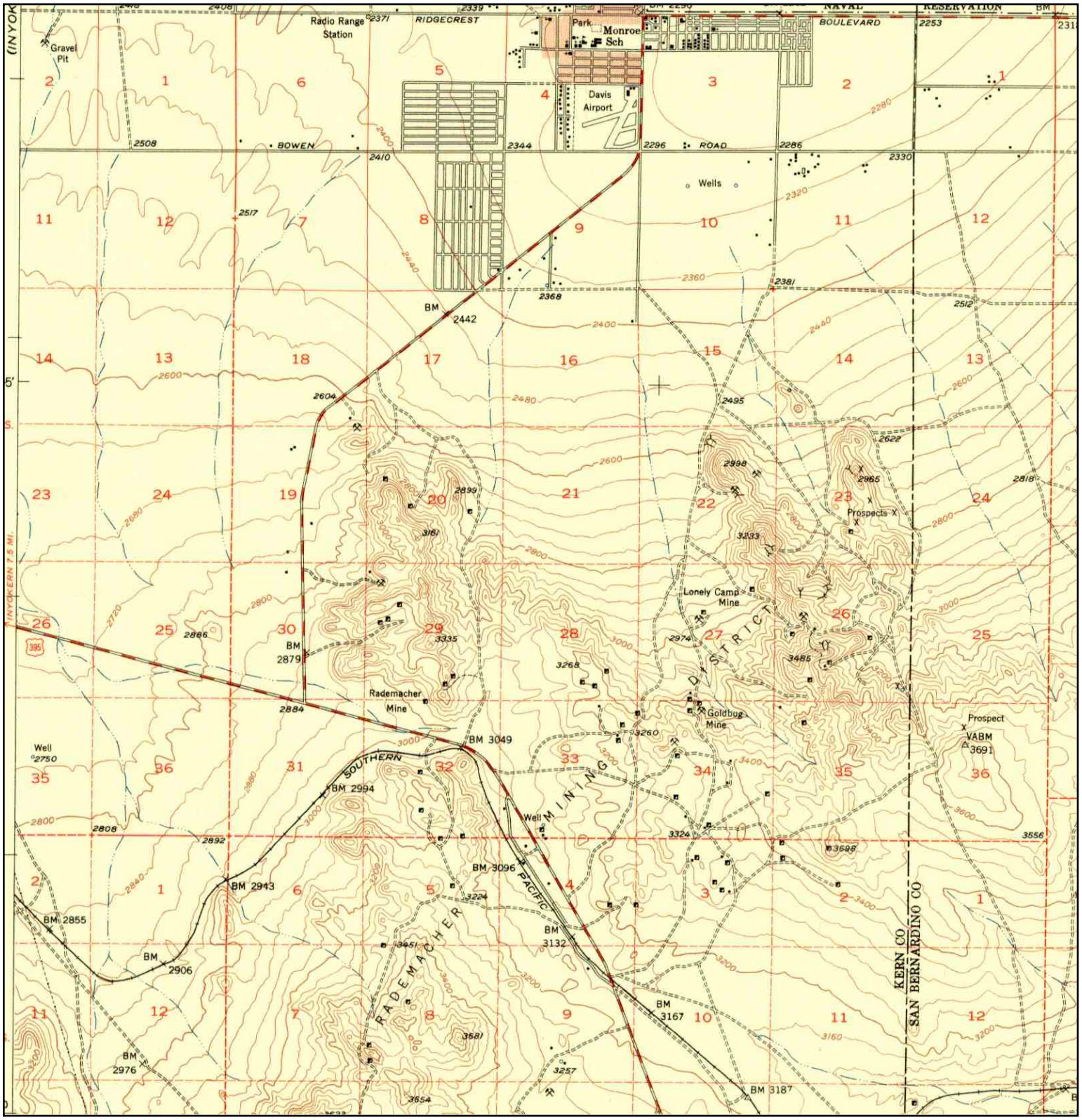

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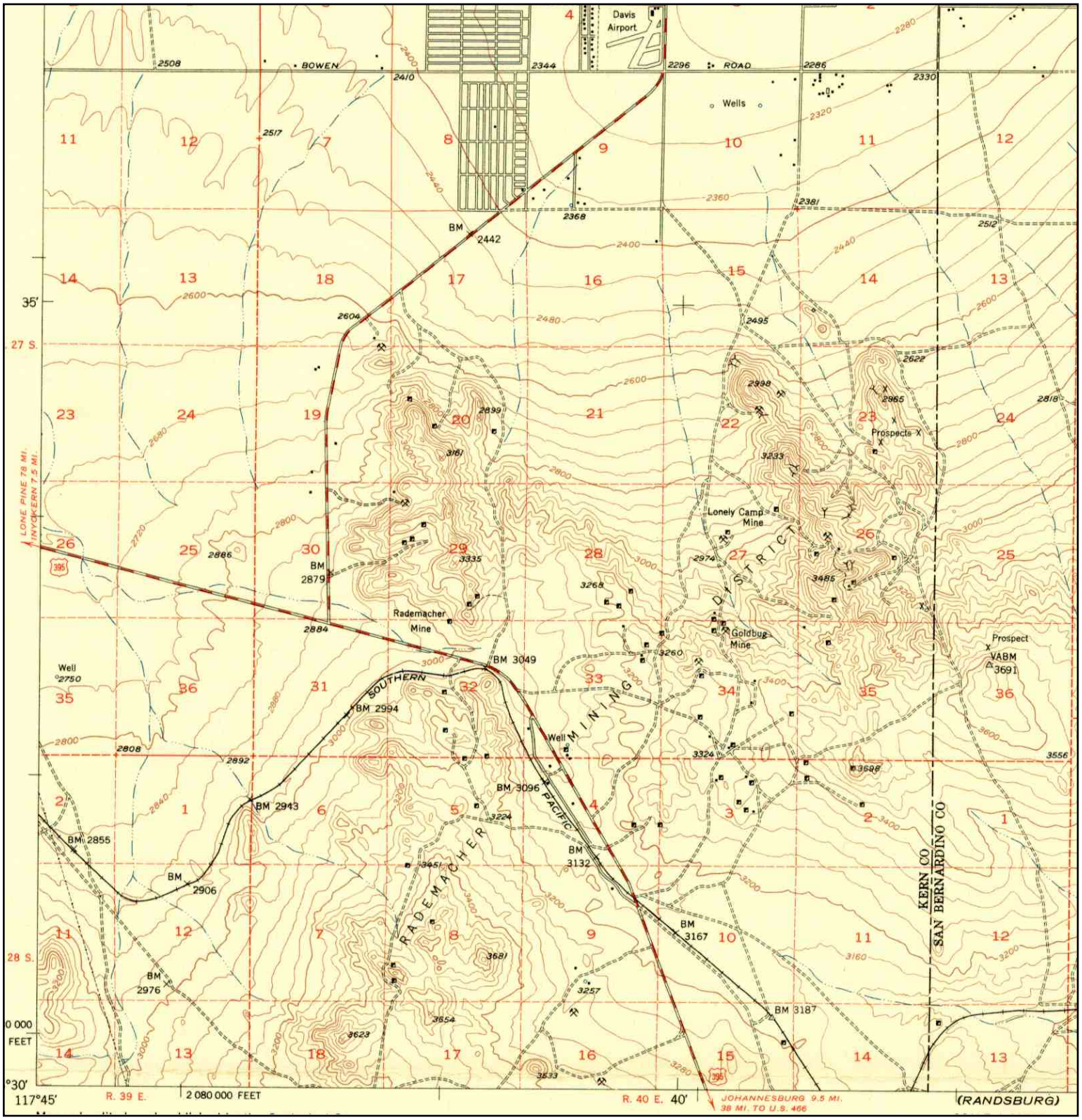

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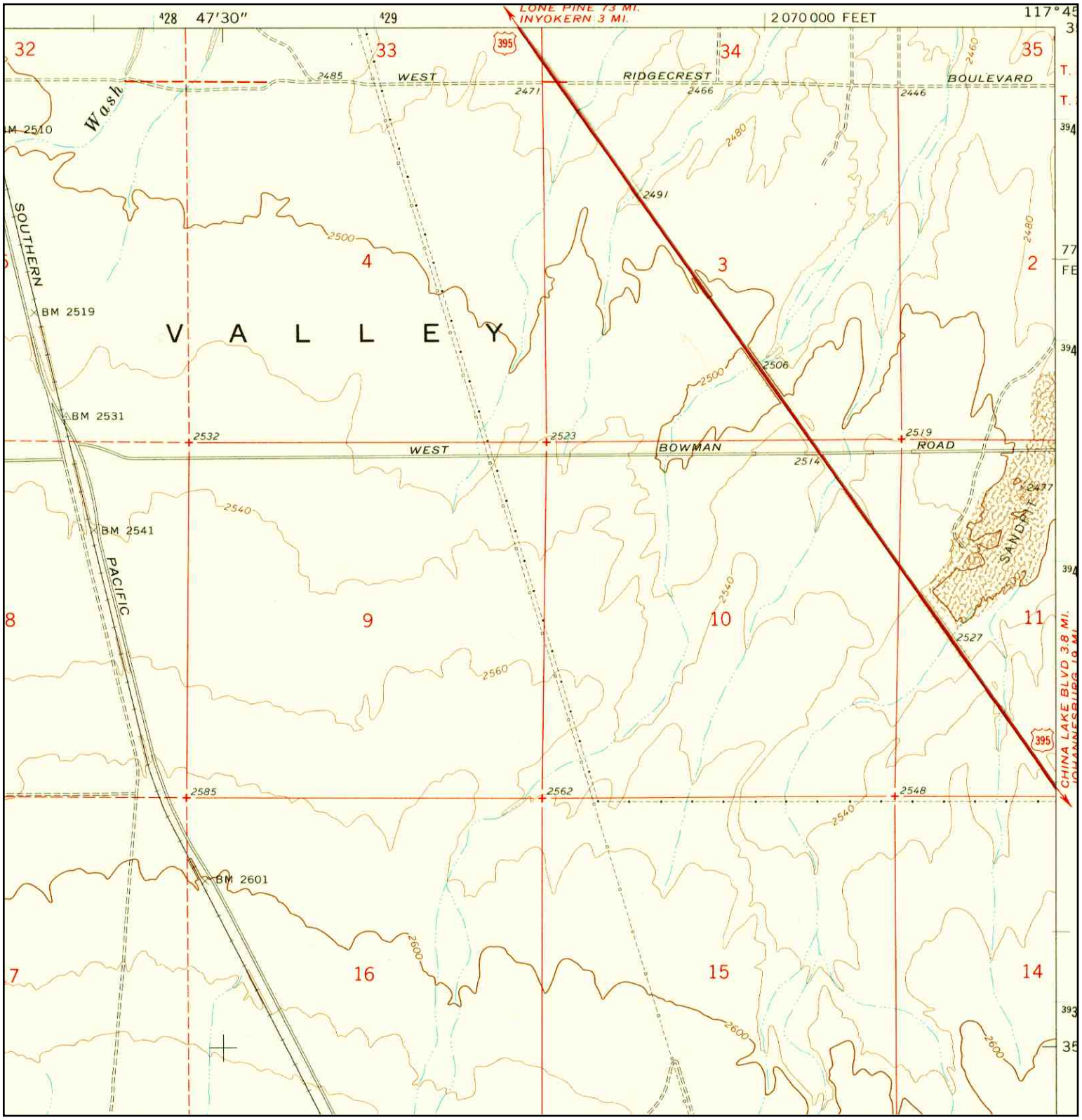

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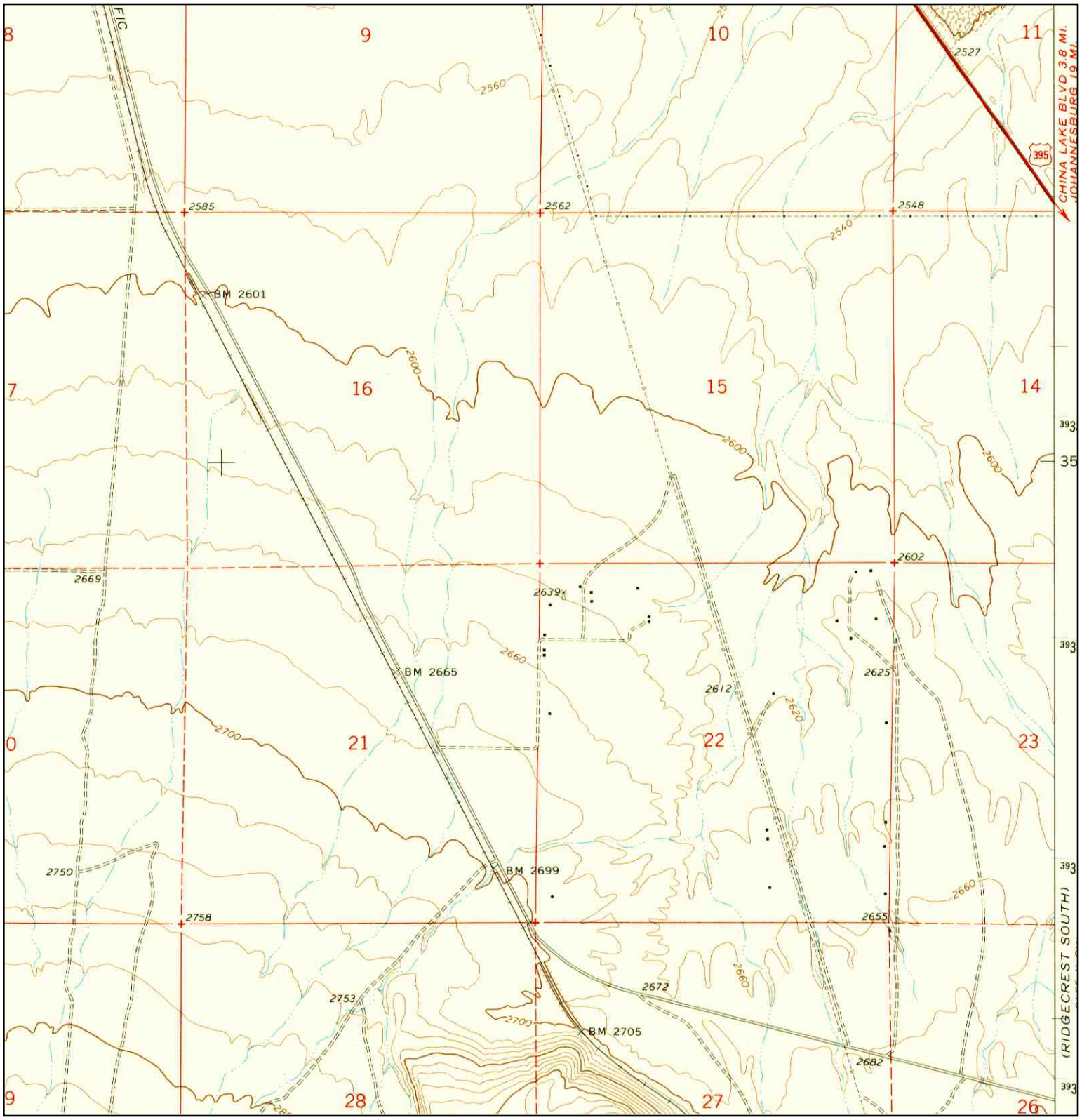
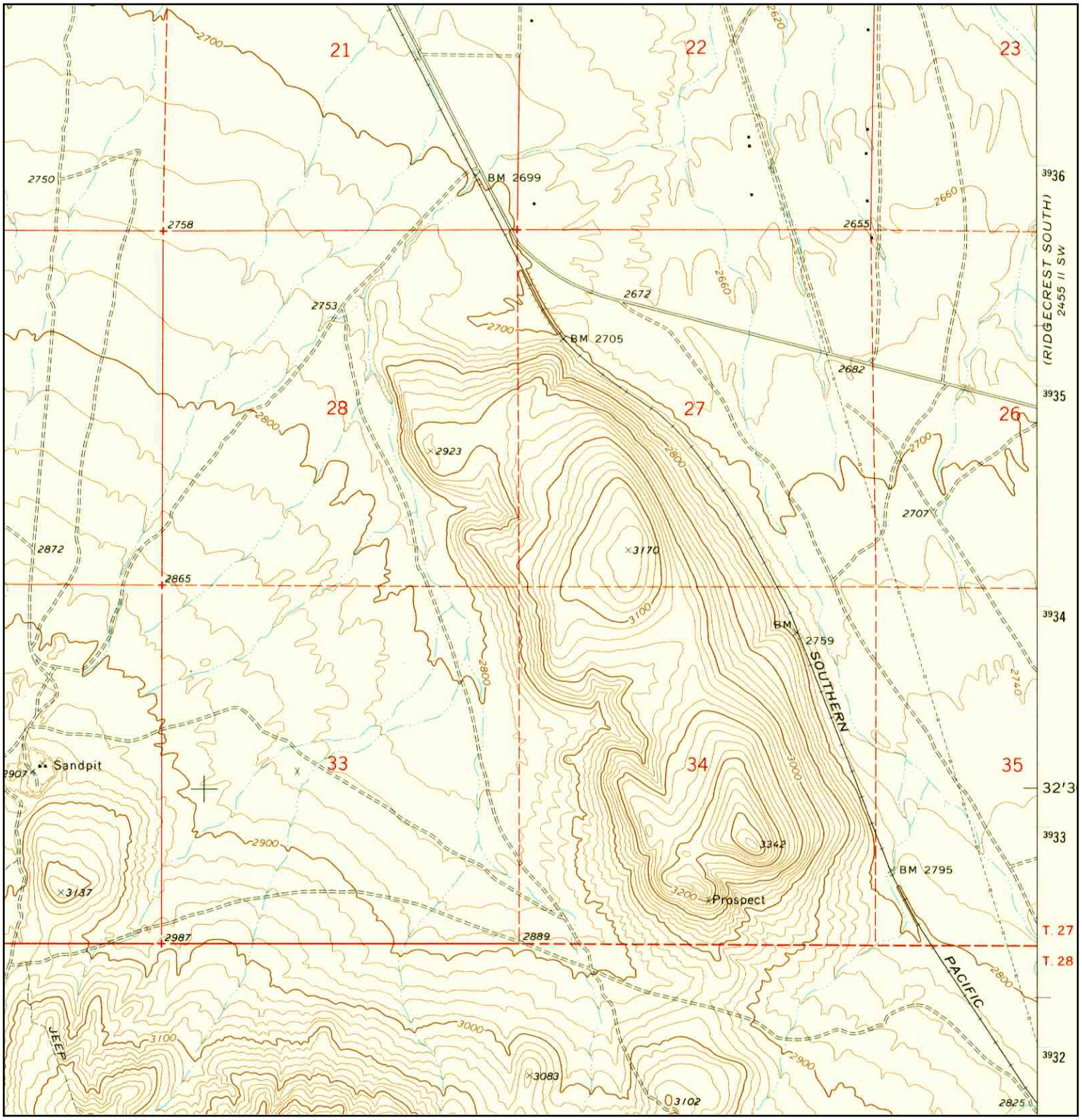
Historical Topographic Map



N	TARGET QUAD NAME: INYOKERN SE MAP YEAR: 1972 SERIES: 7.5 SCALE: 1:24000	SITE NAME: Ridgecrest ADDRESS: Kern County Ridgecrest, CA 93555 LAT/LONG: 35.5643 / 117.7497	CLIENT: AECOM CONTACT: Cassandra Weir INQUIRY#: 2657316.1 RESEARCH DATE: 12/11/2009

Historical Topographic Map



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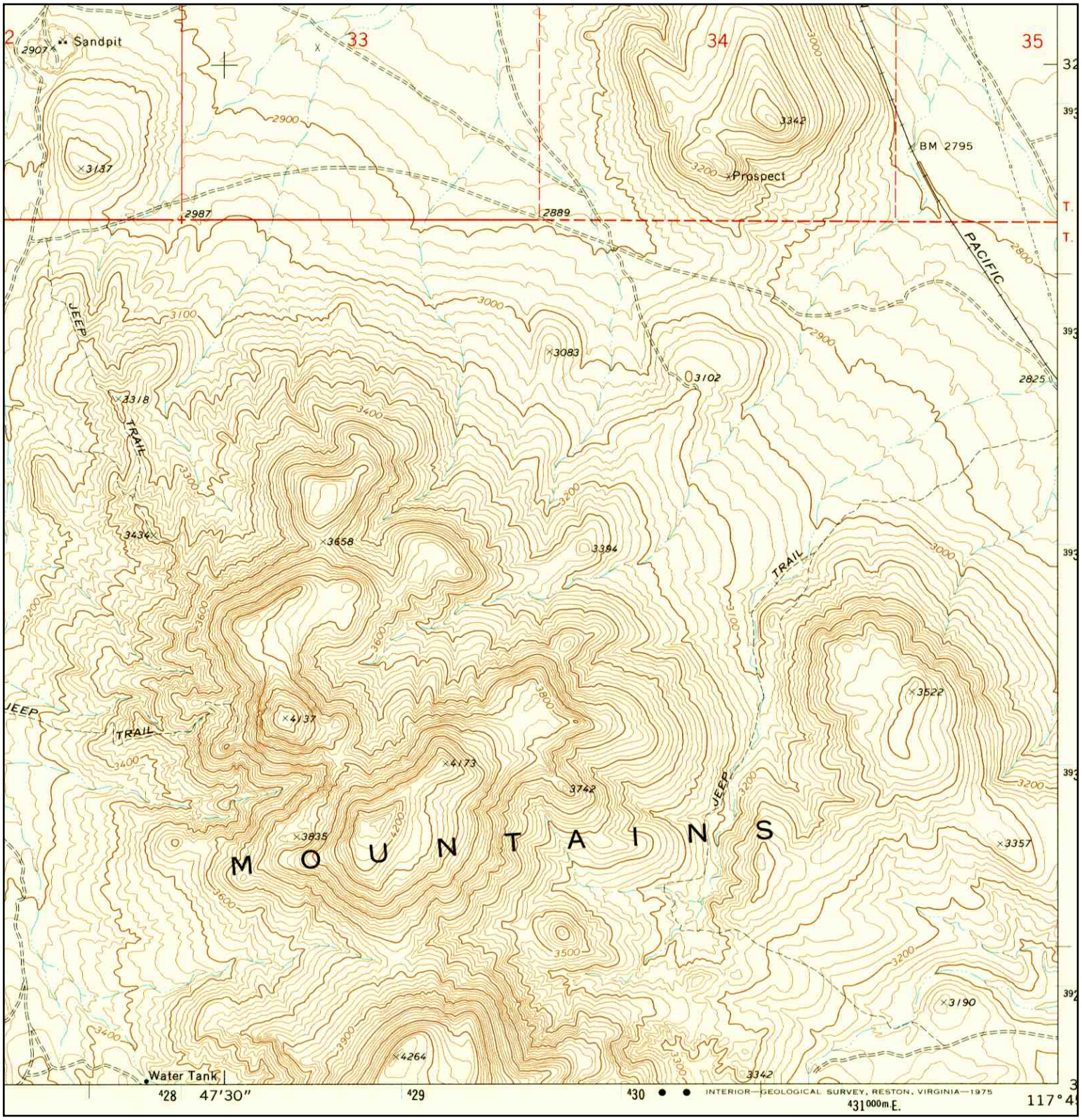

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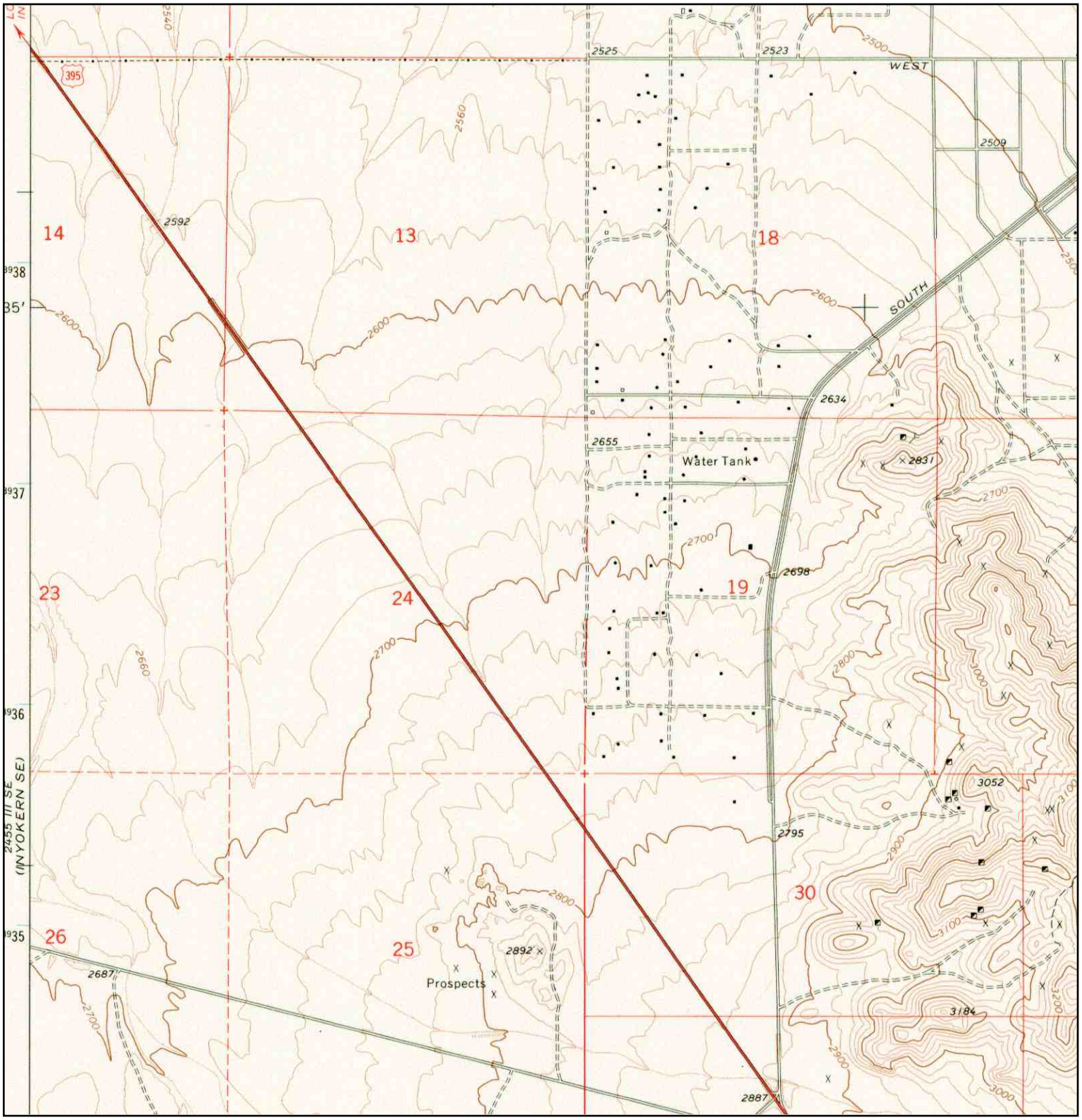
Historical Topographic Map



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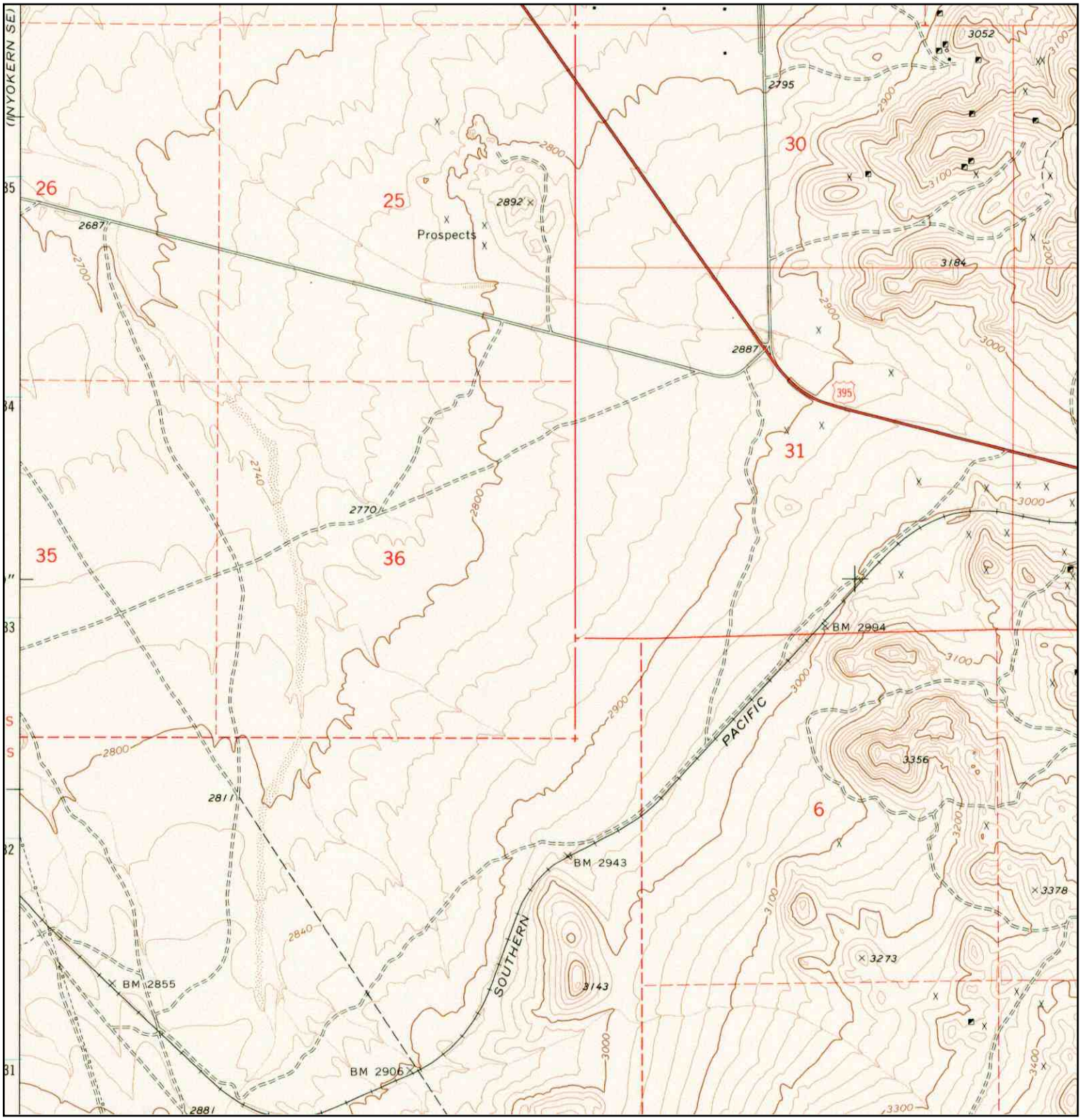
Historical Topographic Map



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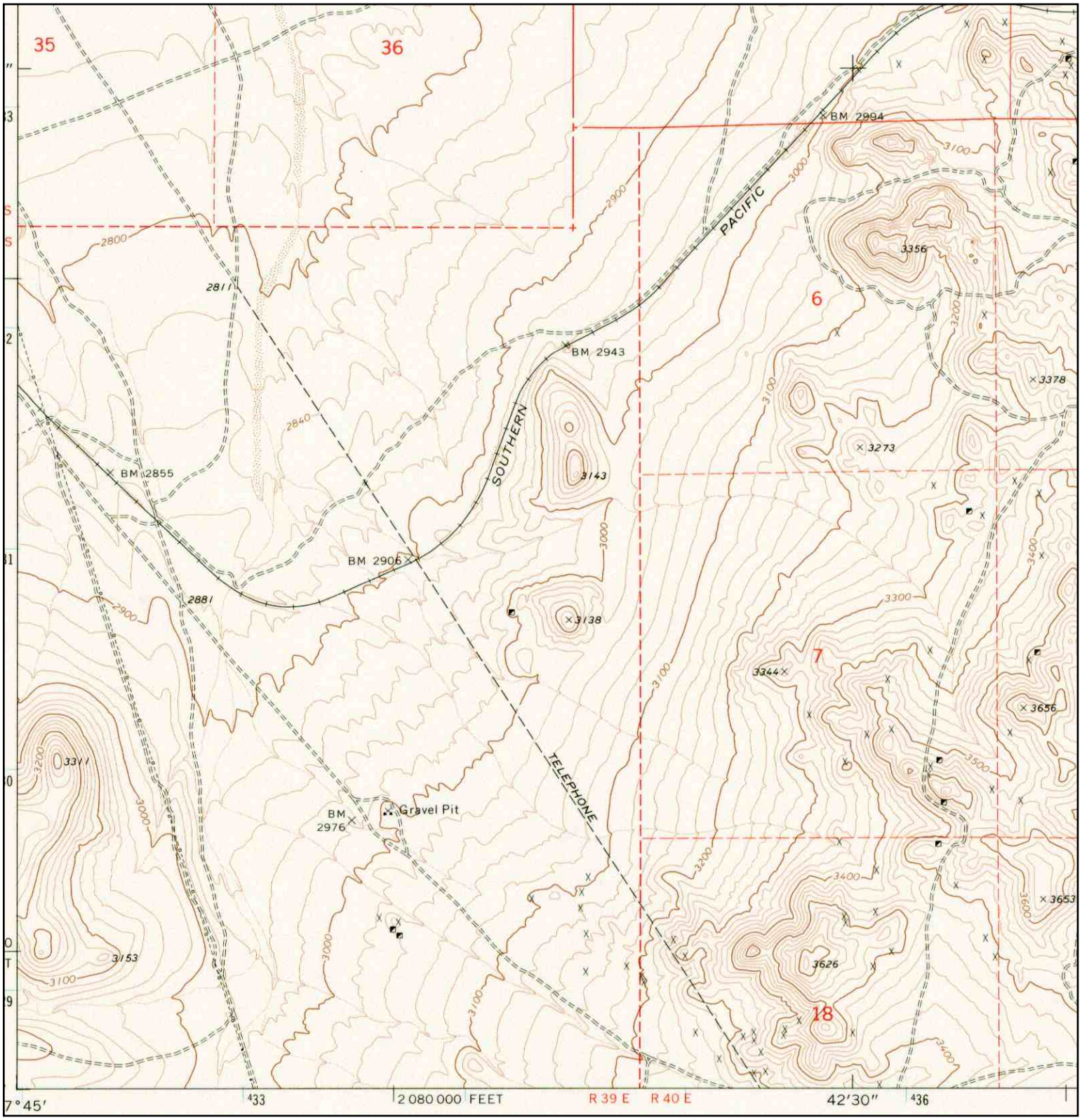
Historical Topographic Map



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