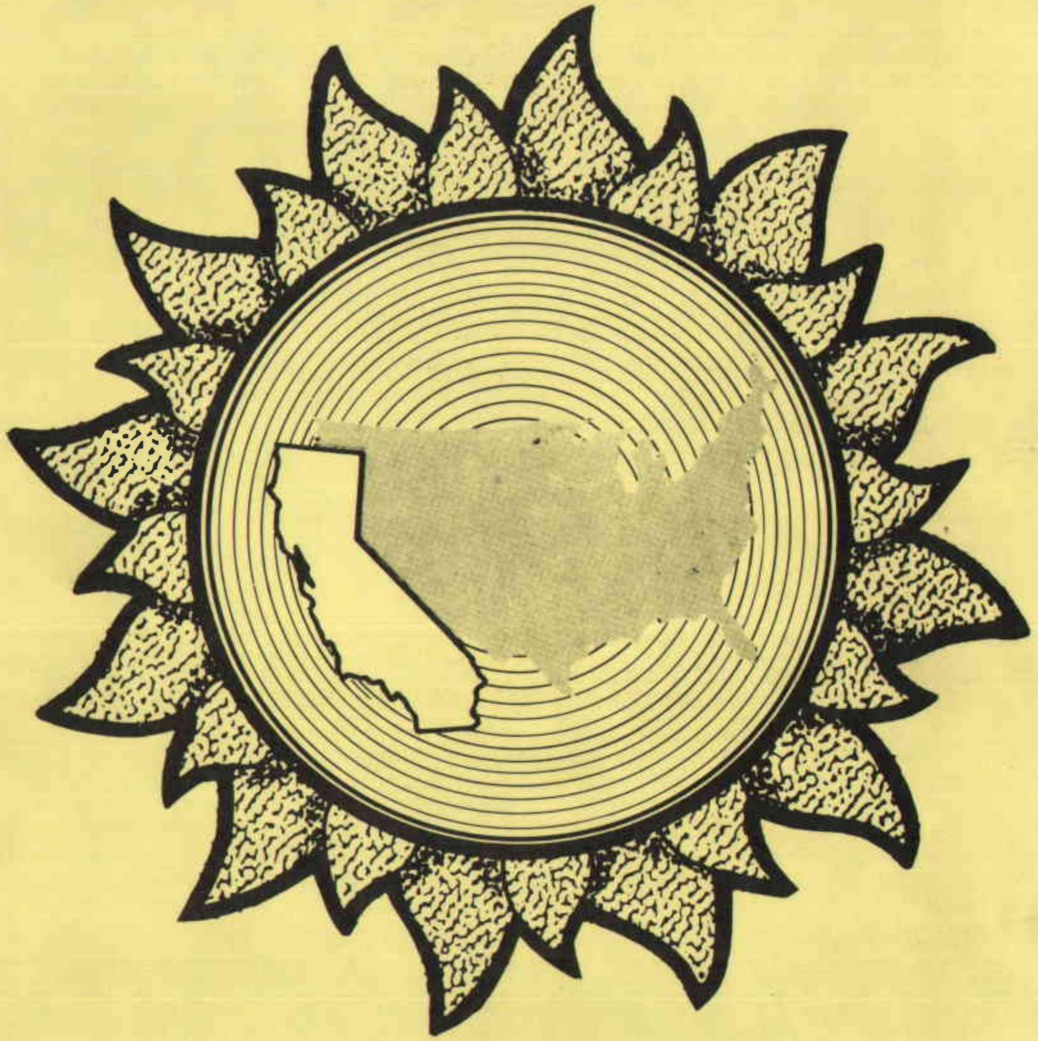
DOE/SF/10501-003
STMPO-063

FINAL IMPACT ASSESSMENT/ENVIRONMENTAL IMPACT REPORT

10 MEGAWATT SOLAR POWER PILOT PLANT



June, 1978

Prepared by:
Environmental Improvement Agency of
San Bernardino County, California

1- Russell JR
1a- Harris
2- RNS
3- File

February 13, 1979

Mr. Robert E. Bradley
Engineer of Mechanical Design
Los Angeles Department of
  Water and Power
P.O. Box 111, Room #604
Los Angeles, California 90051

RECEIVED
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STMPO

Attention: Mr. Martin Grayman

Dear Marty:

Subject: Solar One Project
Environmental Impact Assessment/
Environmental Impact Report (EIA/EIR)

Attached for your information and records is the final EIA/EIR on the Solar One Project prepared by San Bernardino County. An addendum covering comments on the Draft EIR has been included with this printing.

Should you wish to discuss any part of the report or require additional copies, please call me at your convenience.

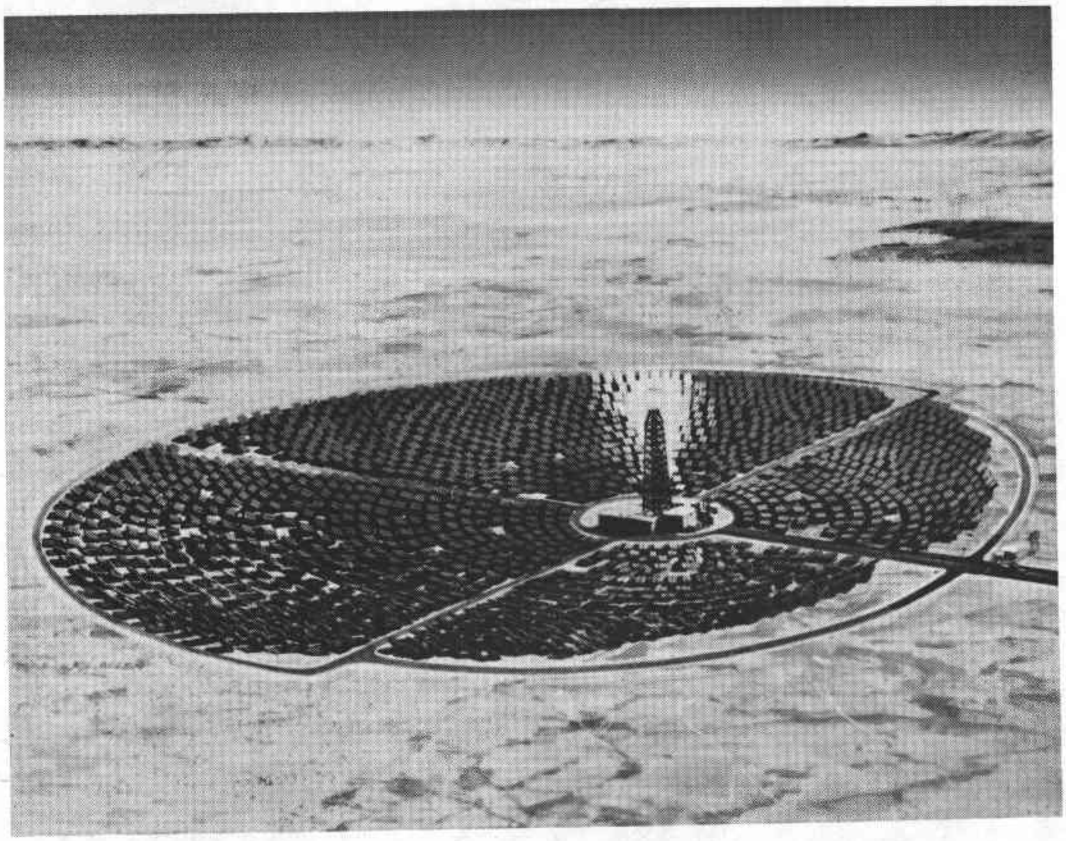
Sincerely,

Original Signed
J. N. Reeves
J. N. Reeves
Program Director

Enclosure
cc: R. N. Schweinberg, DOE-STMPO, w/enclosure

FINAL ENVIRONMENTAL IMPACT ASSESSMENT/ENVIRONMENTAL IMPACT REPORT

10 MEGAWATT SOLAR POWER PILOT PLANT



June, 1978

Participants:

United States Department of Energy
Southern California Edison Company
Los Angeles Department of Water and Power
California Energy Resources Conservation and Development Commission

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LIST OF TERMS AND ABBREVIATIONS

ALBEDO	- Ratio of the radiation reflected by a surface to that incident on it
AT&SF	- Atchison, Topeka & Santa Fe
BLM	- Bureau of Land Management
BTU/SEC	- British Thermal Units per second
CEQA	- California Environmental Quality Act
CO	- Carbon Monoxide
Commission	- California Energy Resources Conservation and Development Commission
County	- San Bernardino County
DOD	- Department of Defense
DOE	- United States Department of Energy
DSE	- DOE's Division of Solar Energy
DWP	- Los Angeles Department of Water and Power
EIA	- Environmental Impact Assessment
EIR	- Environmental Impact Report
EIS	- Environmental Impact Statement
EPGS	- Electric Power Generating System
ERDA	- Energy Research and Development Administration
g	- acceleration of gravity
gpd/ft^2	- gallons per day per square foot
gpm	- gallons per minute
insolation	- Downward-directed solar radiation
kWh	- kilowatt hour
kW/m^2	- kilowatts per square meter
kWh/m^2/day	- kilowatt hour per square meter per day

LISTS OF TERMS AND ABBREVIATIONS

mm	-	modified mercali
mph	-	miles per hour
MW_e	-	Megawatt Electric
MW_t	-	Megawatts Thermal
NEPA	-	National Environmental Policy Act
NO_2	-	Nitrogen Dioxide
NO_x	-	Oxides of Nitrogen
NSF	-	National Science Foundation
OSHA	-	Occupational Safety and Health Administration
Pilot Plant	-	10 MW_e Central Receiver Solar Pilot Plant
PON	-	Program Opportunity Notice
ppb	-	parts per billion
ppm	-	parts per million
psf	-	pounds per square foot
SBCM	-	San Bernardino County Museum
SCAQMD	-	South Coast Air Quality Management District
SCE	-	Southern California Edison Company
SO_2	-	Sulfur Dioxide
SRE	-	Subsystem Research Experiment
STE	-	Solar Thermal Electric
STTF	-	Solar Thermal Test Facility
UP	-	Union Pacific
USFS	-	United States Forest Service
Utility Consortium	-	SCE, DWP & Commission

I

REPORT SUMMARY

I. REPORT SUMMARY

A. Project

The project is the construction of a 10 Megawatt, Solar Thermal Electric, (STE) Pilot Plant in the Mojave Desert of California. It's purpose is to research, over a 5 year period, the technologic, economic and environmental feasibility of future STE utility application. The Pilot Plant will consist of a field of 2300 collector mirrors (heliostats) that will focus solar radiation on a boiler at the top of a 325' tower for the purpose of producing steam to drive a conventional turbine generator. The plant will require approximately 100 acres of a 130 acre site owned by Southern California Edison (SCE). It will be located 1 mile east of SCE's existing Coolwater Generating Station, 10 miles east of Barstow (120 air miles northeast of Los Angeles).

Project participants are the U.S. Department of Energy (formerly the Energy Research and Development Administration), SCE, the Los Angeles Department of Water and Power and the California Energy Resources, Conservation and Development Commission. This combined Environmental Impact Assessment/Environmental Impact Report was prepared by San Bernardino County with assistance from the project participants as requested for the purpose of fulfilling DOE's and the County's environmental review responsibilities.

B. Environmental Setting

The site is located on a flat alluvial plain adjacent to the normally dry Mojave River bed. Alfalfa was previously raised on the parcel, therefore vegetation primarily consists of pioneering native and exotic species. Surrounding wildlife habitat has been altered due to farming, rural and industrial development, and utility and transportation rights-of-way. The area's groundwater basin is in an overdraft condition. The region's low annual precipitation and high intensity solar radiation offer distinct advantages to Pilot Plant siting.

C. Land-Use Issues

The Pilot Plant's location adjacent to SCE's existing power plant eliminates most of the land-use impacts normally associated with utility siting. The proposed zone change from DL to M2 could facilitate longer term utility development on the parcel after the Pilot Plant is dismantled.

D. Energy Benefit

The Pilot Plant will primarily be used to research STE technology, therefore it will not generate significant amounts of electrical power for the regional utility grid system. Its major contribution will be data for use in future solar-related commercial power plant designs and operation.

E. Summary of Major and Moderate Adverse Impacts

1. Misdirected solar radiation beams could present significant on and off-site hazards.
2. The region is subject to potentially damaging seismic activity.

3. Disturbed soils will be subject to wind erosion, resulting in fugitive dust. Existing ambient air pollutants could absorb and diffuse incoming radiation, thereby affecting plant efficiency. Climatological factors will affect plant operation.
4. Chemical additives in heliostat wash water could effect soil, vegetation and wildlife in the collector field.
5. The Pilot Plant will require approximately 220 acre-feet of water per year for cooling and other in-plant uses, but will not require a net increase in SCE's historic pumping rates at the Coolwater site.
6. The Pilot Plant's contribution to the long-range utilization of STE generation could induce both beneficial and adverse impacts in the southwest relative to plant siting, land use and water consumption.
7. 100 acres of semi-productive vegetation and wildlife habitat will be removed, but the site may be revegetated. Weed growth in the collector field might hinder operation and maintenance. The receiver tower and radiation beam may present hazards to bird life.
8. The Daggett community could experience some economic advantages and disadvantages.
9. Traffic impacts will generally be minor except during peak periods. The 325' tower may be a potential hazard to off-course private aircraft.
10. Pilot Plant visibility will alter the area's aesthetic values over the short-term.

11. Surface archeological remains will be removed from the site prior to construction. Undiscovered subsurface artifacts, (if any) could be damaged.

F. Alternatives

1. Other sites in the nation and in California have been thoroughly considered by the project participants and DOE.
2. Various design concepts have been reviewed in detail.
3. Funds could be used to develop other types of solar technology.
4. No project.

G. Agency Coordination, Correspondence and Hearing Input

Unresolved environmental issues, various governmental findings, certification results and public comments will be described in the final EIA/EIR.

II
PROJECT CHARACTERISTICS

II. PROJECT CHARACTERISTICS

A. Introduction

On January 6, 1977, the United States Department of Energy (DOE), formerly the Energy Research and Development Administration (ERDA), selected an offer by Southern California Edison (SCE), the Los Angeles Department of Water and Power (DWP), and the California Energy Resources Conservation and Development Commission (Commission) - hereinafter referred to collectively as the "utility consortium," - to participate in the design, construction and operation of a 10 Megawatt Electric (MWe) Solar Power-Steam Generating Pilot Plant (Pilot Plant) for research and development purposes. The Pilot Plant will be constructed on a site near SCE's existing Coolwater Generating Station near Daggett, approximately 12 miles southeast of Barstow in San Bernardino County.

The Environmental Improvement Agency of San Bernardino County (the County) prepared this Environmental Impact Report (EIR) as "lead agent" pursuant to the requirements of the California Environmental Quality Act. Much of the content was supplied by SCE, DOE and the Commission. DOE will utilize this document as part of its requirements under the National Environmental Policy Act (NEPA).

This report contains project and environmental data that are relevant to the needs of reviewers and decision makers for the determination of environmental effects. Detailed project information from which this EIR is written is on file with the County and all participants and is available to the public. Most of the specific material referenced in this report is not included in the Appendix in order to reduce copying and paper costs.

B. Participants

Following is a summarized description of the project participants:

- DOE is a federal agency created by the Department of Energy Organization Act of 1977 and charged with the responsibility of implementing programs for research, development and demonstration of new energy sources and technologies. DOE became the successor to ERDA on October 1, 1977.
- SCE is Program Director for the utility consortium and is an investor-owned utility serving over 7.5 million people in a large portion of Southern California.
- DWP is a municipal utility serving a population of 2.7 million in the City of Los Angeles.
- The Commission is a state agency charged with developing state energy conservation regulations and with helping to accelerate the development of alternative electrical energy sources. The Commission is also the lead state agency in approving sites for thermal electric power plants above 50 MWe.

C. Coordination

The members of the utility consortium have entered into an agreement whereby SCE will be the Program Director. SCE will act as primary agent for:

- Performance of environmental and planning work
- Provision of plant site
- Providing the steam turbine generator facilities (non-solar portion of the Pilot Plant)
- Acquiring all required licenses and permits for the turbine generation facilities and operation of the entire plant.
- Operation and maintenance of the entire Pilot Plant
- Capital improvements and integration of the electrical generation into SCE's distribution system which is interconnected with DWP and others.

DWP will provide:

- Participation in the preparation of environmental documents and planning work as required by the Program Director
- Completion of a study of the potential use of this technology in conjunction with hydroelectric pumped storage
- An evaluation of the technology as a potential generation resource

The Commission will provide:

- Information dissemination/technology transfer services
- Funding of some small environmentally related research activities to be identified during the course of the project
- Development of expertise for evaluating future sites

DOE will provide:

- Solar Plant design
- Design, material, equipment and services to install and start the solar portion of the Pilot Plant
- Complete heliostat field (collector system)
- Complete receiver system (tower and boiler)
- Complete thermal storage system
- Complete master control system to integrate the solar and non-solar plant portions
- Obtain all necessary permits and licenses to construct the solar facilities.

D. Cost Summary

The solar portion of the plant is estimated to cost approximately $100 million, to be funded by DOE.

The turbine generator costs will be paid by the utility consortium as follows:

	Costs	Ownership[1]
SCE	$15,330,000	80%
DWP	3,490,000	20%
Commission	800,000	None

The Commission's total contribution of $800,000 over the life of the project will be utilized for services rather than a capital commitment. The total non-solar costs are $19,620,000

E. Procedural Requirements

The California Environmental Quality Act (CEQA) requires environmental evaluation of projects and preparation and certification of necessary documents before state and local permits can be issued. Preparation of the necessary CEQA documents requires designation of a Lead Agency. The Commission's siting authority for thermal electrical power plants is limited to facilities of 50 MW_e capacity or more. Thus, the commission has no permit responsibility for the 10 MW_e Pilot Plant.

Section 15065(d) of the California EIR Guidelines allows a group of public agencies involved in one project to agree among themselves which of them will be the Lead Agency for EIR preparation. On August 4, 1976, a meeting was held in Sacramento to resolve the Lead Agency issue. Attending the meeting were representatives from: the Energy Commission, the California Public Utilities

Commission, the Governor's Office of Planning and Research, the Los Angeles Department of Water and Power, the Department of Water Resources and the County of San Bernardino. At this meeting, it was agreed that the County would be the Lead Agency for this Project because it has responsibility for issuing the principal permits.

Under the provisions of NEPA, the use and administration of federal funds by DOE in connection with the proposed Pilot Plant requires the preparation of an environmental assessment. During discussions among the project participants, San Bernardino County and DOE, it was agreed that DOE would participate in the preparation of the County's EIR and use it as an Environmental Impact Assessment (EIA) for the purpose of determining the need for a full Environmental Impact Statement (EIS) under NEPA. Therefore this document is a joint EIA/EIR pursuant to DOE's and the County's respective NEPA and CEQA guidelines.

County permits include the following:

- Zone change from DL (Desert Living) to M2 (Manufacturing) which is compatible with power plant siting (Board of Supervisors).
- "Site Approval" - (Planning Commission)[2]
- Grading and building permits - (Building and Safety Department)
- Sanitation - (Environmental Health Services)
- Fire protection review - (County Fire Warden)

Because the Pilot Plant size will be less than 50 MW_e, a site certification from the State Energy Commission and a California Public Utility Commission Certificate of Convenience and Necessity will not be required.

Additional permits required from other agencies include:

- Federal Aviation Administration height variance for the receiver tower
- California Occupational Safety and Health Administration Permit for certain construction activities
- State Department of Industrial Relations - Division of Industrial Safety permit for the pressure vessels.

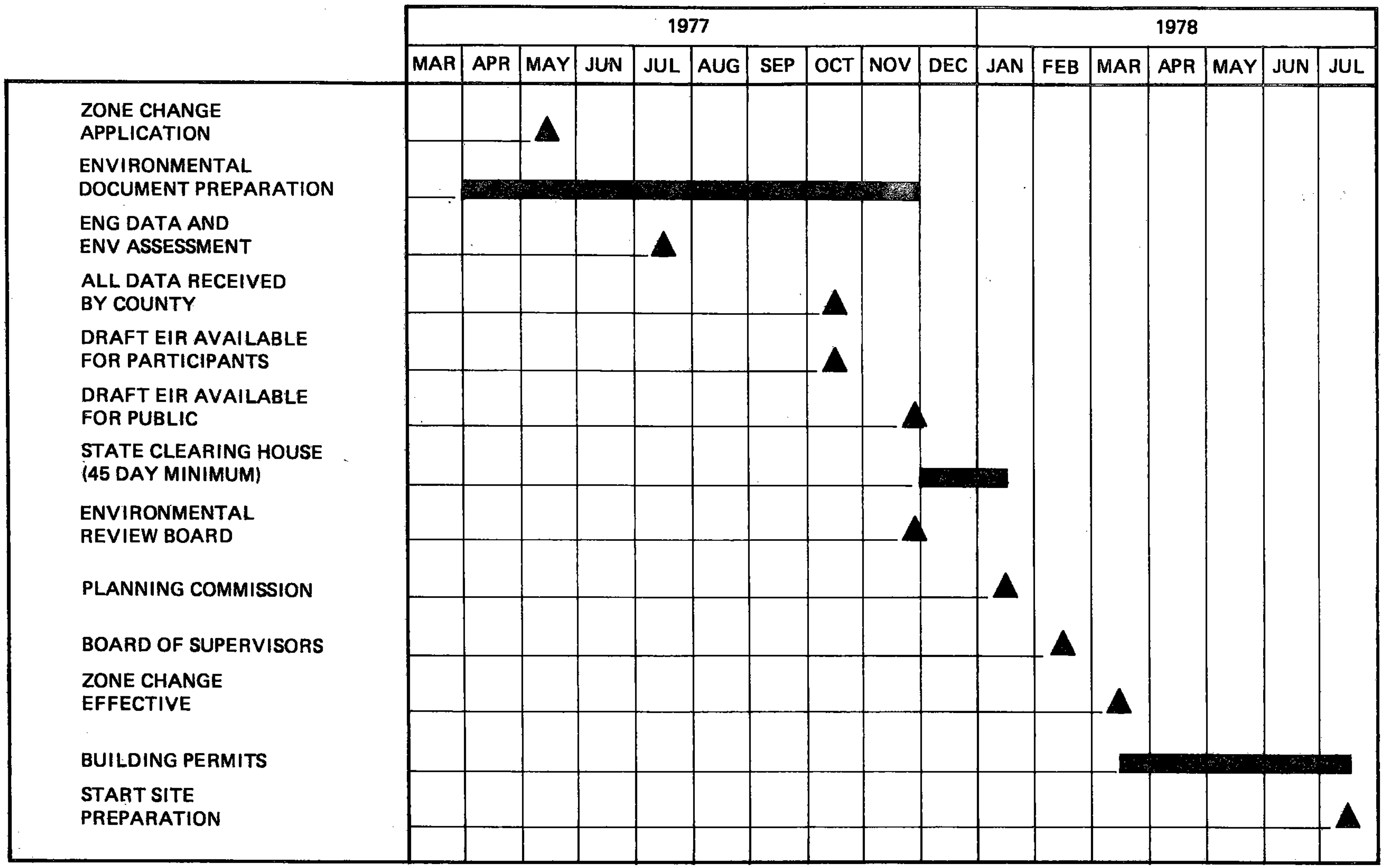
Exhibit II-1 is a project review and permit schedule.

F. Project Need, Objectives and Benefits

1. Need

Constraints on the supply, distribution and use of conventional energy sources have prompted the need for research and development of alternate energy sources including solar powered energy systems.

While fossil fuel based generation will continue to play an important role in meeting future energy needs, utilities cannot indefinitely continue to depend on fossil fuel supplies as the primary fuel feedstock for generating facilities. New technologies must be developed and implemented which will satisfy energy demands in an economically viable manner while producing the least



10 MWe SOLAR PILOT PLANT

PROPOSED PERMIT PROCESS SCHEDULE
EXHIBIT II-1

abrasive effects upon the environment. The construction of the Pilot Plant represents a combined industry/government effort to achieve this goal through research and development.

2. Objectives and Benefits

Through its Division of Solar Energy (DSE) DOE is engaged in an effort to develop the technology for the practical and economic collection and conversion of sunlight into electricity. An objective of the DSE Solar Thermal Energy Conversion Program is to demonstrate engineering understanding and identify economic and environmental factors, which may lead to subsequent purchase of Solar Thermal Electric (STE) plants by the utility industry. As a first step to verify the technical feasibility and collect the data to evaluate the economic feasibility of the solar central receiver concept, the Pilot Plant is planned for construction and operation by late 1980. Since it is a pilot project of relatively small size, it may not generate sufficiently economical amounts of electricity into the grid system to warrant its long-term use. If the full potential for research of the plant's technology is complete within 5 years of construction, it may be dismantled.

The objectives of the Pilot Plant are:

Principal

- To establish the technical feasibility of a solar thermal power plant of the central receiver type.

- To obtain sufficient development, production, and operating data to indicate the potential economic operation of commercial power plants of similar designs.
- To determine the environmental impact of solar thermal receiver plants.

Additional

- To gather operational data that can be analyzed to determine system stability and safety characteristics.
- To develop both utility and commercial acceptance of solar thermal central receiver systems.
- To stimulate industry to develop and manufacture solar energy systems.
- To enhance public acceptance and familiarity with solar energy systems.

It is not anticipated that this plant will be economically competitive with present power generation systems on either a capital or energy cost basis, nor is it anticipated that the system will be optimized for performance at the 10 MW_e level. This Plant is considered to be the first step towards development of commercial plants that will produce power economically competitive with other types of intermediate capacity power plants. The Pilot Plant's benefits would be the demonstration of technical feasibility and the hard data needed for assessment of the potential for economic competitiveness of such plants at commercial power production levels (100-300 MW_e), for peaking and intermediate-load applications.

G. Relationship to Other Solar Related Federal Projects and Programs

DOE is engaged in an effort to develop the technology for the practical and economic conversion of sunlight into electricity. As part of this effort, DOE has started construction of a 5 MW_e Solar Thermal Test Facility (STTF) located at Sandia Laboratories, Albuquerque, New Mexico. The test facility will allow component and system testing of receiver concepts, characterization of materials, and materials processing studies. The facility is planned to be operational at a reduced capability in late 1977. The 10 MW_e Pilot Plant will represent the first integration of solar system hardware on an engineering scale into a functional power generating plant whose performance and reliability will be assessed in a utility operational context.

Present DOE planning provides for a second generation of 10 MWe pilot plants of an improved design. Demonstration plants (50 to 100 MWe) may be built as an intermediate step between the pilot plants and 100 to 300 MWe commercial plants. Projects between the first Pilot Plant and the commercial scale plant may be dropped or accelerated, depending on the rapidity with which improved technologies can be developed. This Plant Plant will be constructed in order to demonstrate the concept's economic, technological and environmental feasibility. Other solar-related research and development projects are also federally and locally funded, but limited to STE application for utility usage.

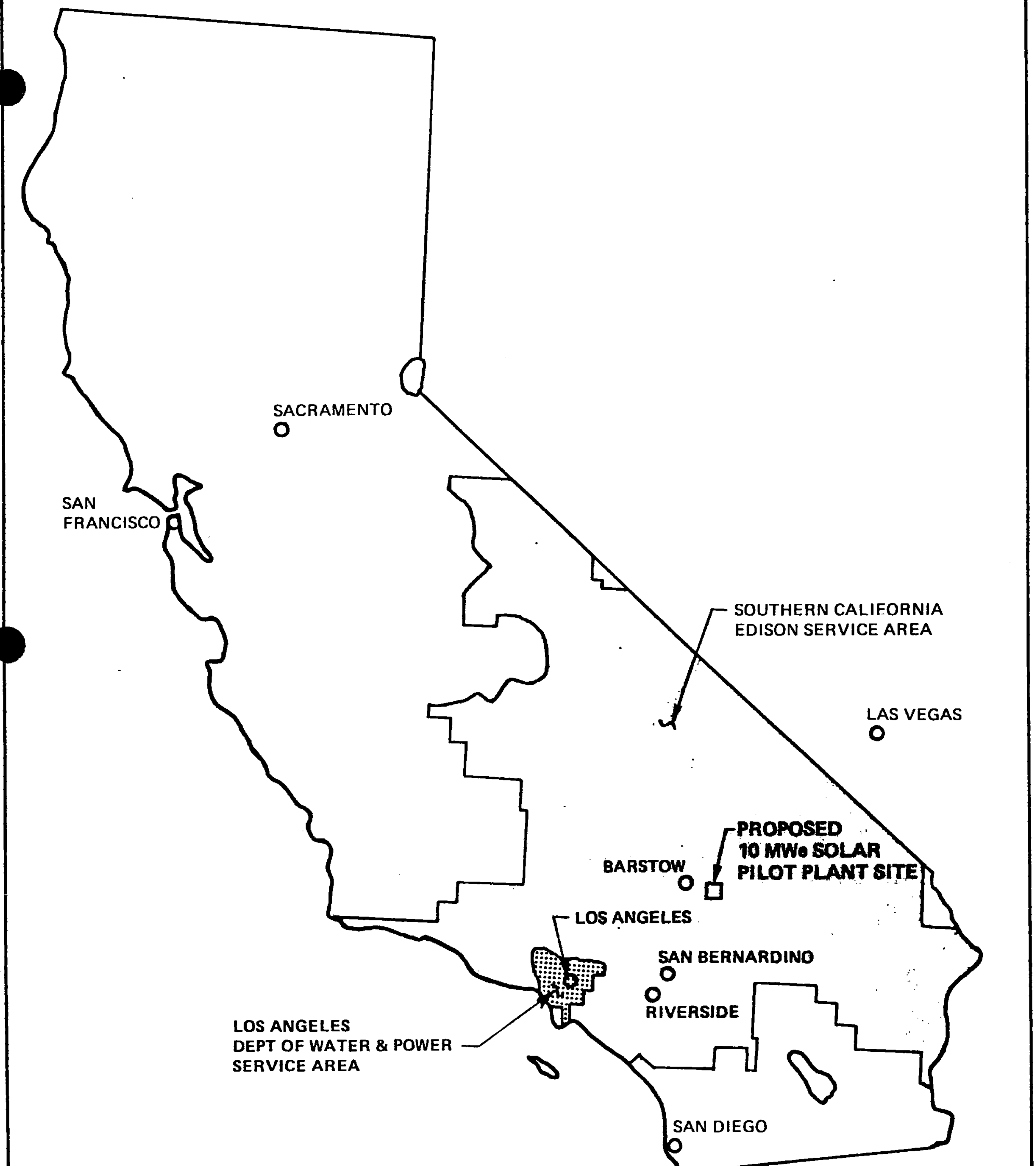
The intent of researching a mix of solar powered systems is to determine the most efficient use of solar radiation as an alternate energy source. The viability of solar powered centralized power stations that produce the electricity for indirect space cooling and water and space heating must be quantitatively compared with the efficiency of localized solar collection devices that directly convert insolation into useful heat or air cooling. Therefore, in these beginning stages of study, all solar research programs will have to be coordinated in order to determine the net benefit of certain devices or mix of devices relative to environmental factors, land-use requirements, net energy benefits and cost (See Chapter VIII - "Alternatives" - for an analysis of various options.)

H. Location

The proposed Pilot Plant will be located on SCE property near the existing Coolwater Generating Station, which is situated in the Mojave Desert in northwestern San Bernardino County, approximately 12 miles southeast of the City of Barstow and 120 miles northeast of Los Angeles (Exhibit II-2 and II-3). The facility itself will occupy approximately 130 acres of the west half of Section 13, Township 9 North, Range 1 East, San Bernardino Base and Meridian. SCE presently owns a 2337 acre site at Coolwater (as shown in Exhibit II-4 and II-4a). Exhibit II-5 is an aerial photograph depicting the proposed Pilot Plant site in relation to the existing Coolwater plant.

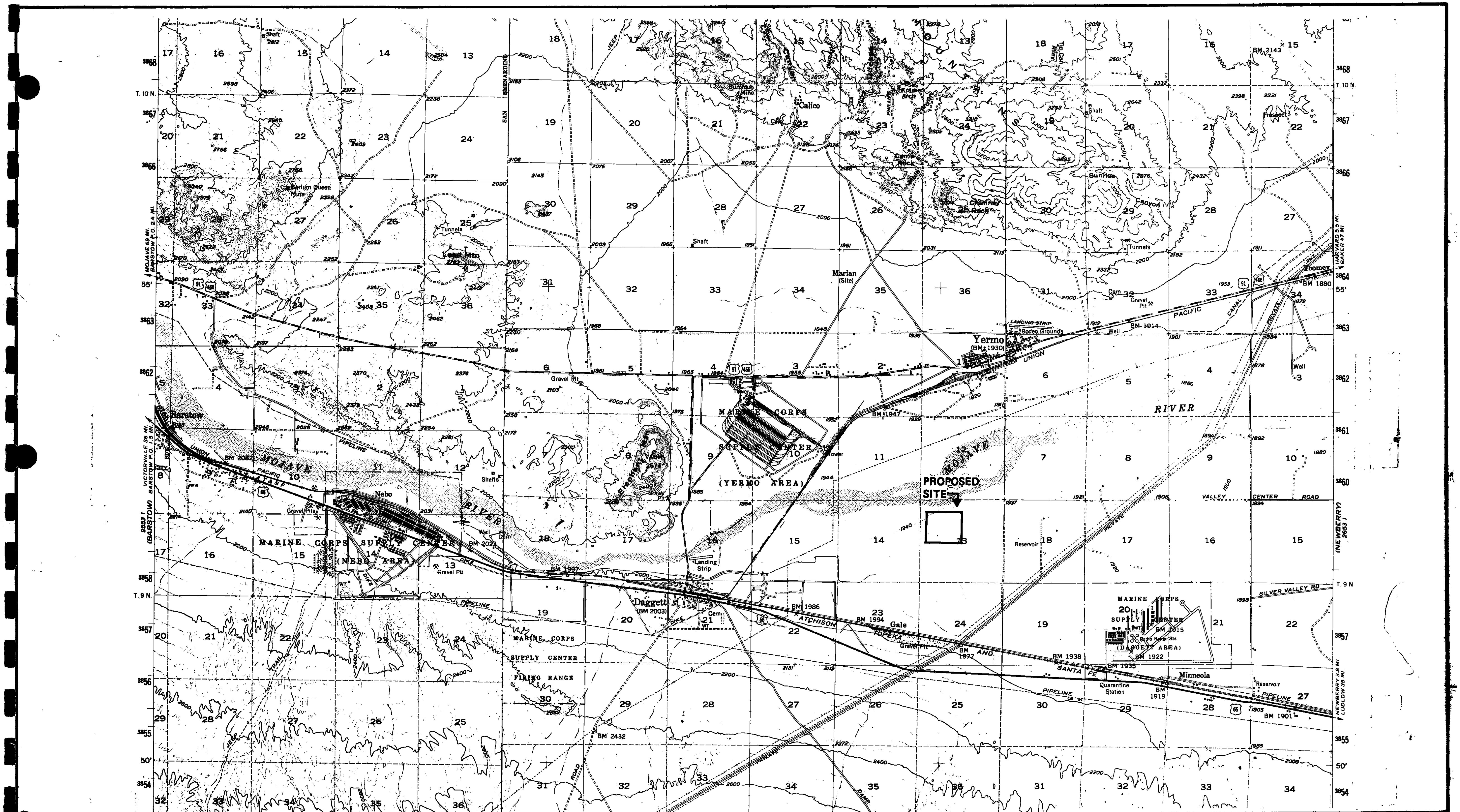
I. Siting Criteria

A study of nine sites was carried out by the utility consortium in selecting the proposed location near the Coolwater Generating



10 MWe SOLAR PILOT PLANT

REGIONAL LOCATION OF SITE
EXHIBIT II-2



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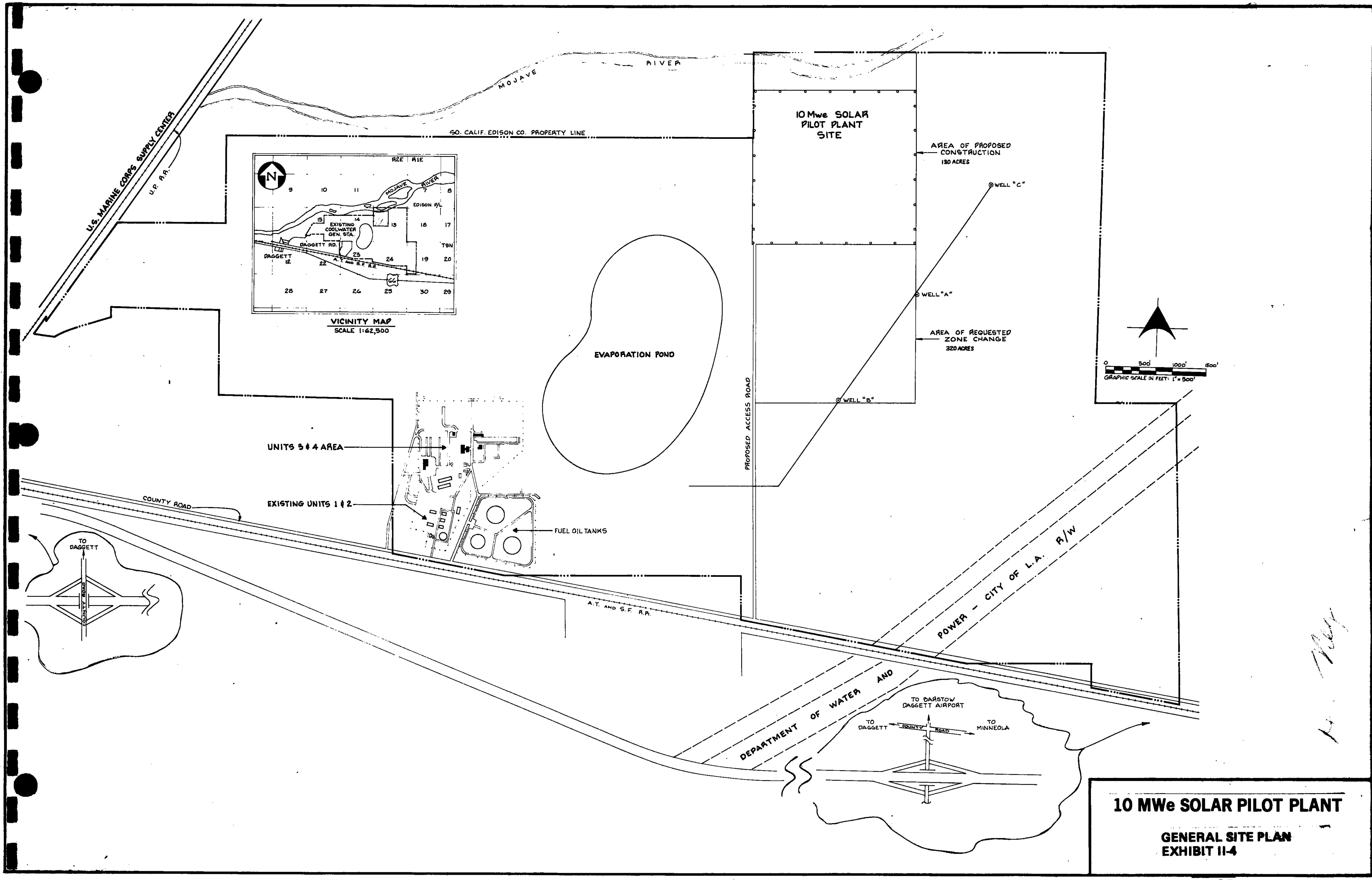
LOCATION MAP
EXHIBIT II-3



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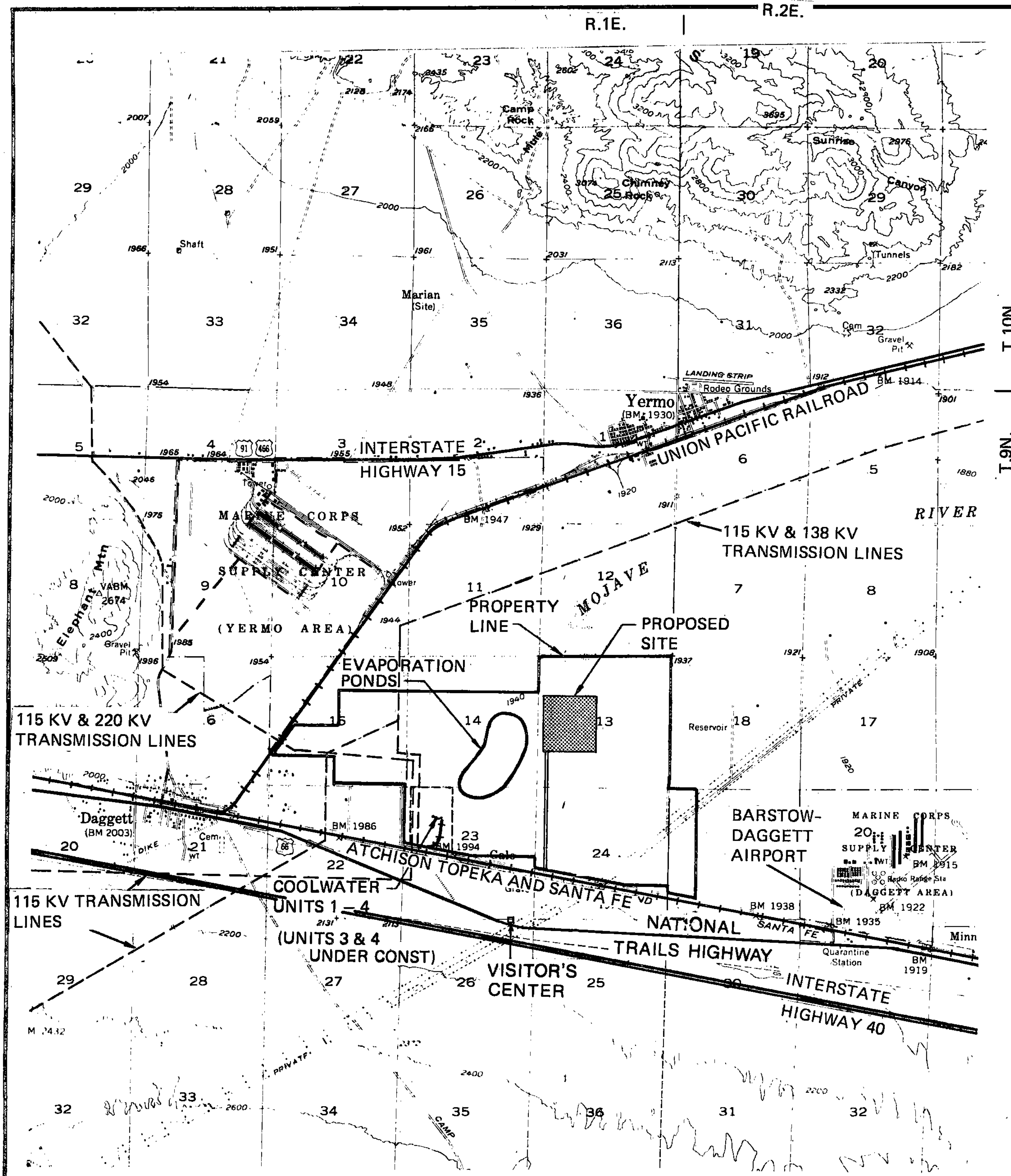
GENERAL SITE PLAN
EXHIBIT II-4



PORTION OF U.S.G.S. TOPOGRAPHIC MAP
DAGGETT, CALIFORNIA QUADRANGLE

10 MWe SOLAR PILOT PLANT

GENERAL SITE PLAN
EXHIBIT II-4a

10 MWe SOLAR PILOT PLANT
AERIAL PHOTOGRAPH OF
COOLWATER SITE LOOKING EAST

EXHIBIT II-5

Station. Criteria used in the siting study included the 13 site characteristics required in DOE's Program Opportunity Notice (PON)[3] plus five additional aspects including the effect of air quality on plant operation, utility system interface and impacts on biology, archaeology and aesthetics.

Based primarily on the criteria outlined in the PON, the Coolwater site was selected as the preferred in California. Particular attributes of the site include the following:

- The site receives high average annual total insolation at 5.8 kilowatt hours per square meter per day ($kWh/m^2/day$), which is well in excess of the 5 $kWh/m^2/day$ required in the PON.
- An adequate supply of good quality groundwater is available from currently developed resources.
- Access to the site is excellent with two Interstate highways within four miles and paved roads adjacent. There are also several railroads in the immediate vicinity, including a spur onto the site for equipment and material unloading. Additionally, a helistop will be provided to complete the means of access.
- The site is ideally located for public exposure and is 12 miles from the City of Barstow which has excellent visitor facilities.
- Site topography and seismicity are such that design and construction will require only normal considerations.

- Electrical system access will be available at the site through existing substation facilities.
- A more than adequate amount of land is available at the site.
- Environmental impacts are minimized by the fact that the site has limited vegetation and wildlife with no apparent rare and endangered species.
- The site is not within the control zone of any airport, though it is about 2-1/2 miles from the Barstow-Daggett Airport.
- Wind velocities are considered acceptable with 30 miles per hour (mph) exceeded only 2-3% of the time and 40 mph exceeded 1% or less of the time.

A detailed discussion of site characteristics and project impacts is provided in Section X.

J. Regional Setting

When viewed in a regional context, the proposed Pilot Plant site is located within a crescent of scattered urban and rural development (Exhibit II-6). From the Newberry area located ten miles east of the plant site, the band of development extends westerly along Interstate 40 to include Daggett, the plant site, and the community of Yermo located on Interstate 15 a few miles north of the plant site. Continuing to the west the band of development follows the course of the Mojave River and former U.S. Highway 66 through Barstow and Lenwood. It then tends to the south including the communities of Helendale, Oro Grande, Tab 52

Final Environmental Impact Assessment/ Environmental Impact Report

Box 7

E 1

Adelanto, Victorville, and Hesperia and then east to the communities of Apple Valley and Lucerne Valley. The interior of the crescent of development is mountainous or rough terrain. The major private land uses within the developed area are agricultural and residential, including both permanent residences and second homes (i.e., "rural retreats"). In addition, there are major government and public land holdings in the region under jurisdiction of the U.S. Forest Service (USFS), Bureau of Land Management (BLM) and Department of Defense (DOD). To the south of Apple Valley is the San Bernardino National Forest (USFS) and to the north of Barstow are the Calico Mountains with the Calico Mountains National Recreation area (BLM) and Calico Ghost Town (Country Regional Park). To the south of Daggett is the Rodman Mountains National Recreation Area (BLM). Active mining occurs in both the Rodman and Calico mountain regions. The entire eastern open end of the crescent is occupied by the Marine Corps Twentynine Palms Training Center (DOD).

The area immediately around the Pilot Plant site is sparsely populated except for the incorporated City of Barstow and the community of Daggett. This area contains mixed residential, commercial, and industrial land uses interspersed along the major highways and railroad lines. Agricultural plots, mainly alfalfa, are scattered throughout the Mojave River Valley. Employment in the study area is largely in the transportation (21.5%) and government (25.3%) sectors, primarily attributable to the Santa Fe Railroad freight classification yard and U.S. Marine Corps Supply Center. In addition, 21% of employment is in the retail trade sector of which a significant portion is tourism-related. Although agriculture is a major land use in the study area, it accounts for less than 3.0% of employment.

1. Major Cities and Towns

The population of the study area as estimated for April 1977 by the San Bernardino County Planning Department is approximately 27,900. Of this, less than 10% is located in rural areas and the remainder live in the communities discussed below. Population has been declining in the study area since 1970 and is projected to further decrease by 1980 (San Bernardino County estimates).

a. Barstow

The City of Barstow is located twelve miles west of the site at an elevation of 2,142 feet. It is the hub of three major highways: Interstate 15, Interstate 40, and Highway 58, and several major rail lines. Very few of its employed residents work outside the County (2.8%) and very few (5.8%) work in the City of San Bernardino.

The population of the city was estimated to be 16.9 thousand for 1977. Population growth to 1990 is expected to be modest, only about 1,900 persons, due in large part to the lack of employment opportunities and the distance separating the community from the highly urbanized San Bernardino Valley region.

The education facilities for Barstow consist of elementary, junior, high schools, and a junior college. Recreation facilities consist of: 1 golf course, 1 museum, 12 public parks, 3 campgrounds, 2 swimming pools, and 13 tennis courts.

b. Daggett

Daggett is located 2 miles west of the proposed site. The estimated population of the unincorporated town is 646 residents. Daggett has an elementary school, two churches, a general store, a garage, three gas stations, three trailer parks, a cafe, and motels.

c. Lenwood

Lenwood is located 14 miles west of the site, and has a population of approximately 3,900. Lenwood residents rely on the shopping and civic facilities of Barstow which is only three miles to the east. The area's agriculture potential has declined due to groundwater overdrafts.

d. Yermo

Yermo is located 16 miles east of Barstow and 4 miles due north of the proposed site. The unincorporated town has a population of 1,200 people with a hotel, motels, three markets, eight service stations, five garages, eight cafes, a general store, one elementary school, and two churches. An annex to the U.S. Marine Corps Supply Center tends to stabilize the recreation-tourist influenced economy.

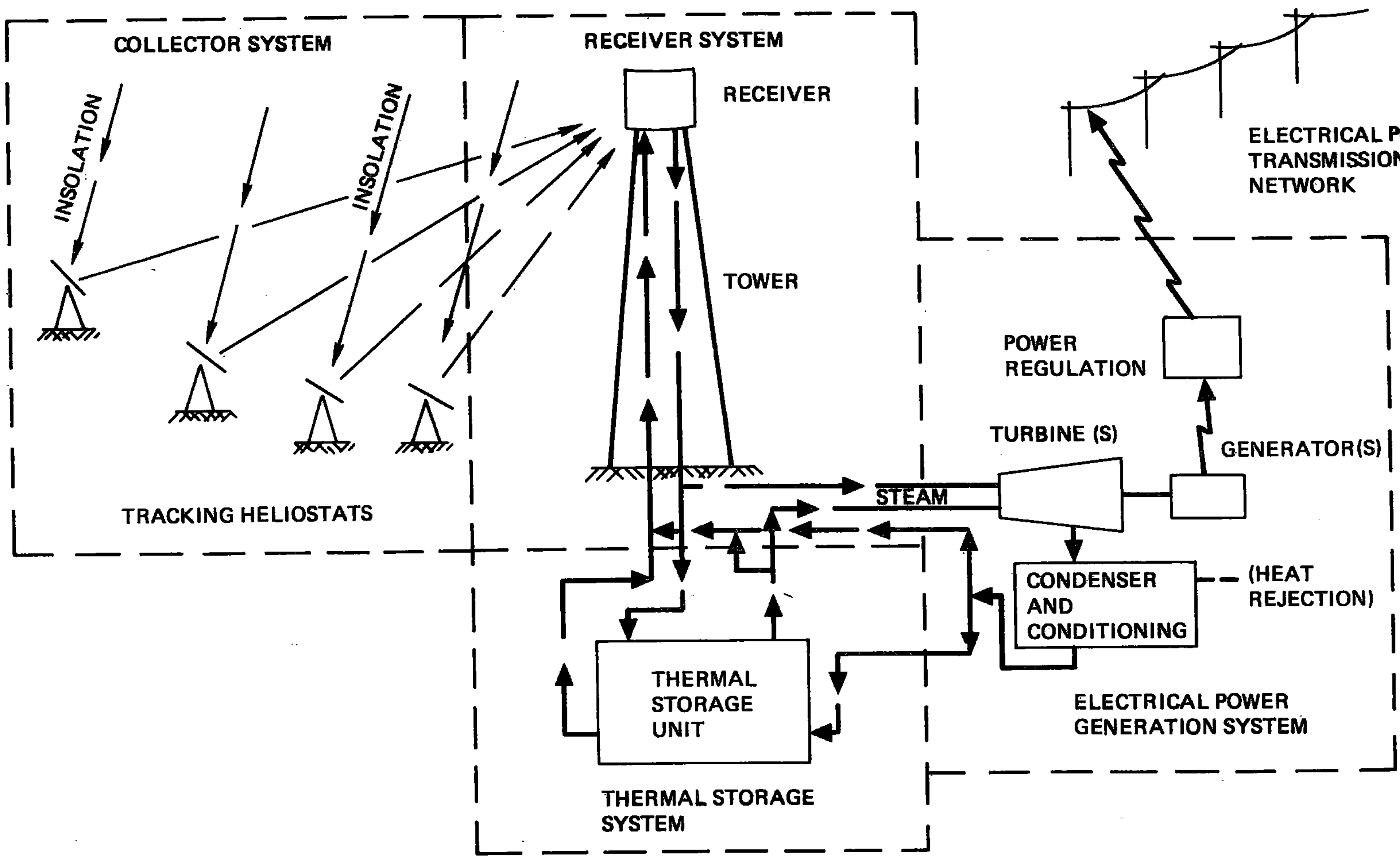
K. Project Description

The following description of the proposed solar collection/steam driven Pilot Plant is generally confined to those characteristics that either influence or will be influenced by environmental factors.

DOE contracted with the firms of Boeing, Honeywell, Martin Marietta and McDonnell Douglas (MDAC) for conceptual studies of plant design. The MDAC conceptual design was chosen by DOE in August of 1977 as the reference engineering concept, therefore it forms the basis of this project description. The readers should note that final conceptual design of the plant is in preparation, and that preliminary and final design engineering is planned for calendar years 1978 and 1979. Therefore, the numerical solar plant/component specified parameters are conceptual estimates and may be expected to vary by ±20%. The alternative conceptual designs will be summarily described in Section VIII - Alternatives. DOE will soon select contractors to design and manufacture the various solar-related components based on the reference design. (See Cover Sheet Artist Rendering.)

1. <u>General Description of Solar Thermal Concept</u>

The proposed Pilot Plant will utilize a central receiver concept wherein a large field of heliostats (sun tracking mirrors) is employed to redirect and focus radiant energy from the sun toward a central receiver at the top of a tower. At that point the concentrated solar energy is utilized as a heat source to produce steam from water. This steam will be directed to either, or both of two places: 1) to a conventional steam turbine-generator which will then be utilized to produce electricity (Exhibit II-7), and 2) to a thermal storage unit.



10 MWe SOLAR PILOT PLANT
CENTRAL RECEIVER SOLAR THERMAL
POWER SYSTEM
EXHIBIT II-7

The plant will be rated at approximately 10 Megawatts Net Electric output when receiving steam directly from the receiver, and approximately 7 Megawatts Net when receiving steam from the thermal storage unit. The Pilot Plant is expected to have a capacity factor of approximately 55% (45% downtime out of 24 hour day due to lack of radiation, research and development activity (DOE).

The main components of the Pilot Plant are illustrated in Exhibit II-8 and are as follows:

Collector System

- Heliostat field
- Sensors and control equipment

Receiver System

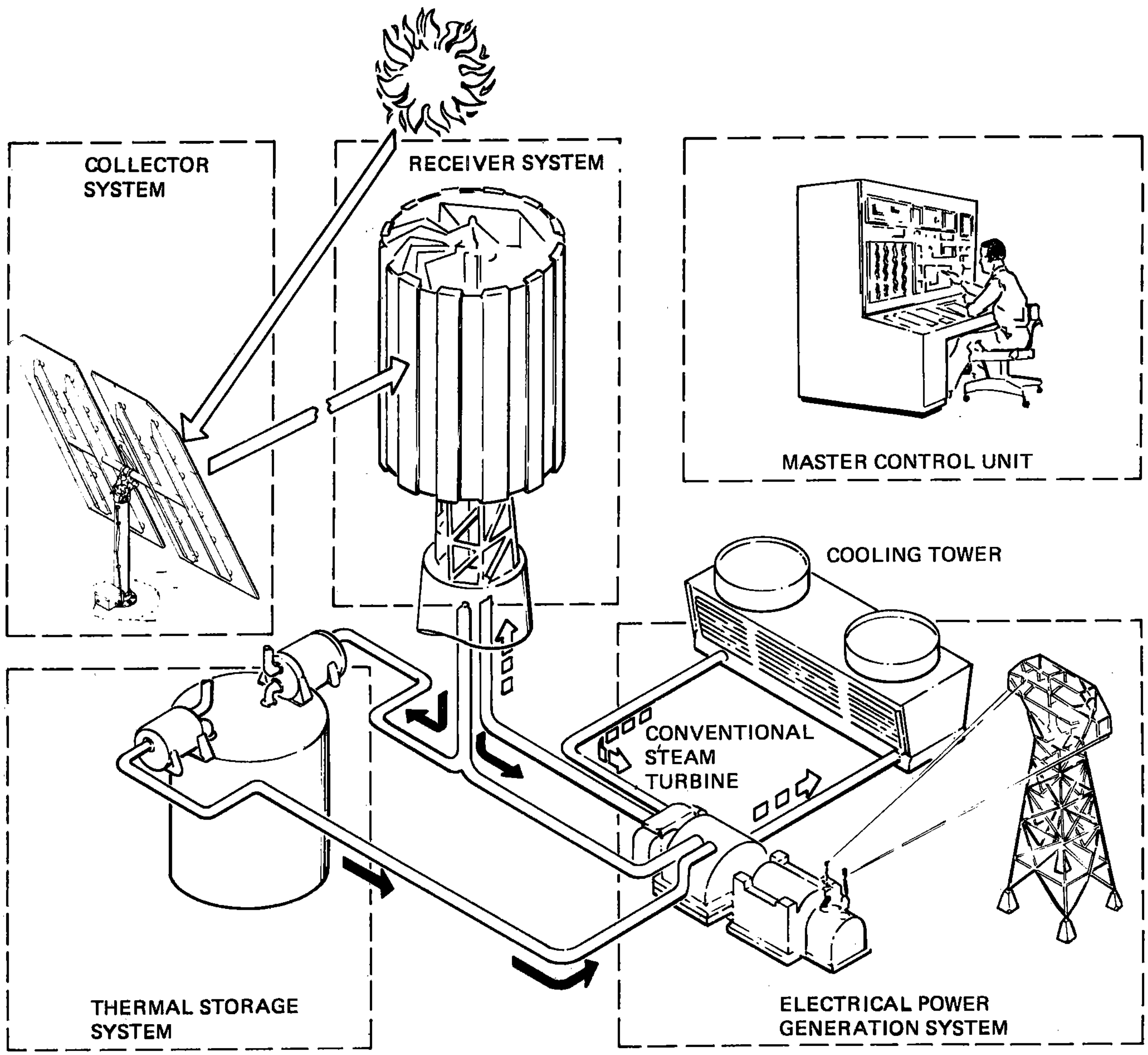
- Receiver support tower
- Receiver (or steam boiler)
- Steam and water piping within the tower
- Controls

Thermal Storage System

- Heat exchanger
- Heat storage tank filled with oil and rock

Electric Power Generating System (EPGS)

- Steam turbine
- Electric generator
- Associated piping and mechanical equipment
- Associated electrical equipment
- Controls
- Heat Rejection Components
- Water Treatment Facilities



10 MWe SOLAR PILOT PLANT

CENTRAL RECEIVER BASELINE CONCEPT
EXHIBIT II-8

Master Control System

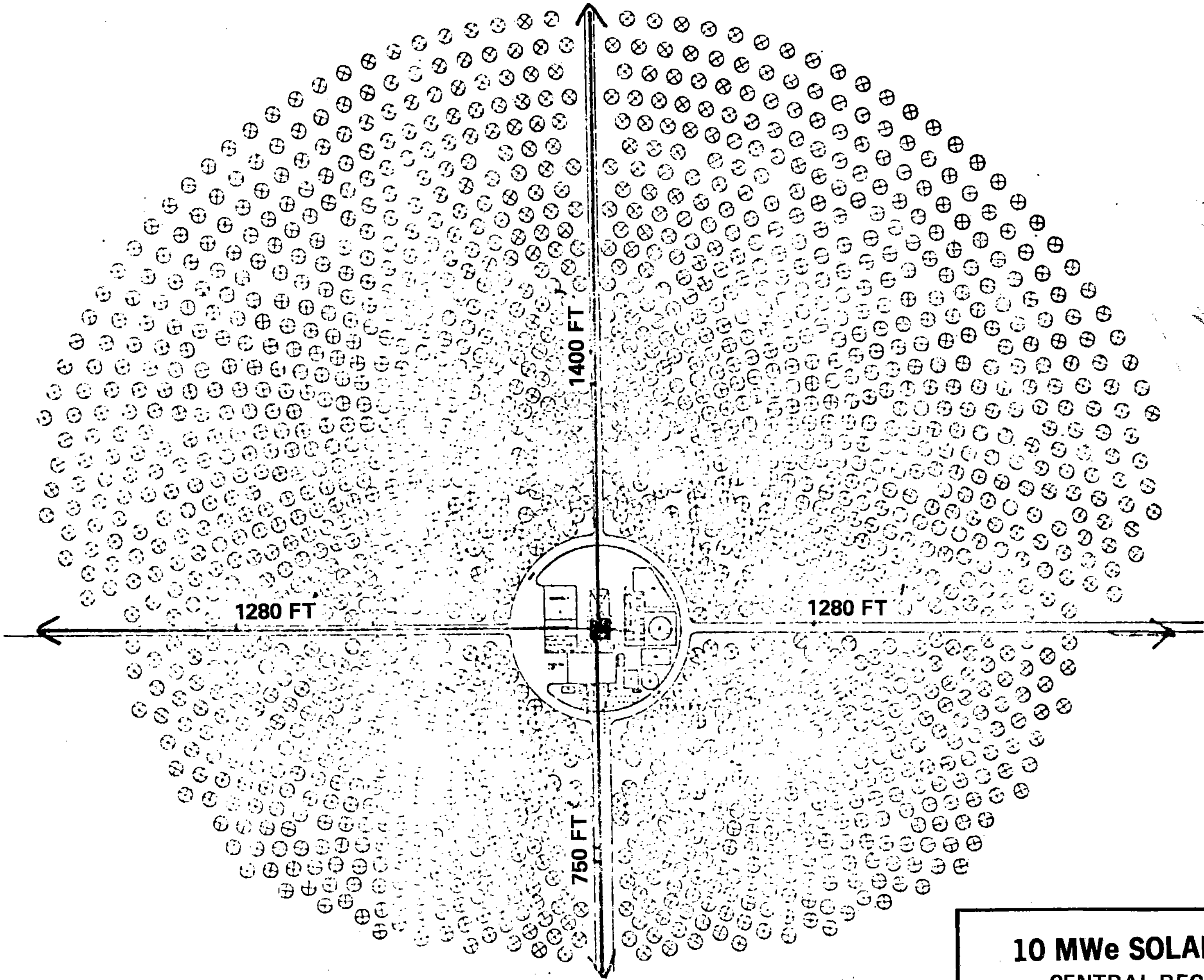
- Interface controls between above systems
- Data logging computer

The facility will occupy approximately 100 acres of the 130 acre site. Estimated land-use requirements, broken down by major components, are approximately as follows:

• Heliostats	3×10^6 square feet (90 acres)
• Tower Receiver	4,000 square feet
• Conventional Plant Facilities (including master control)	20,000 square feet
• Parking	3,000 square feet
• Thermal Storage System	50,000 square feet

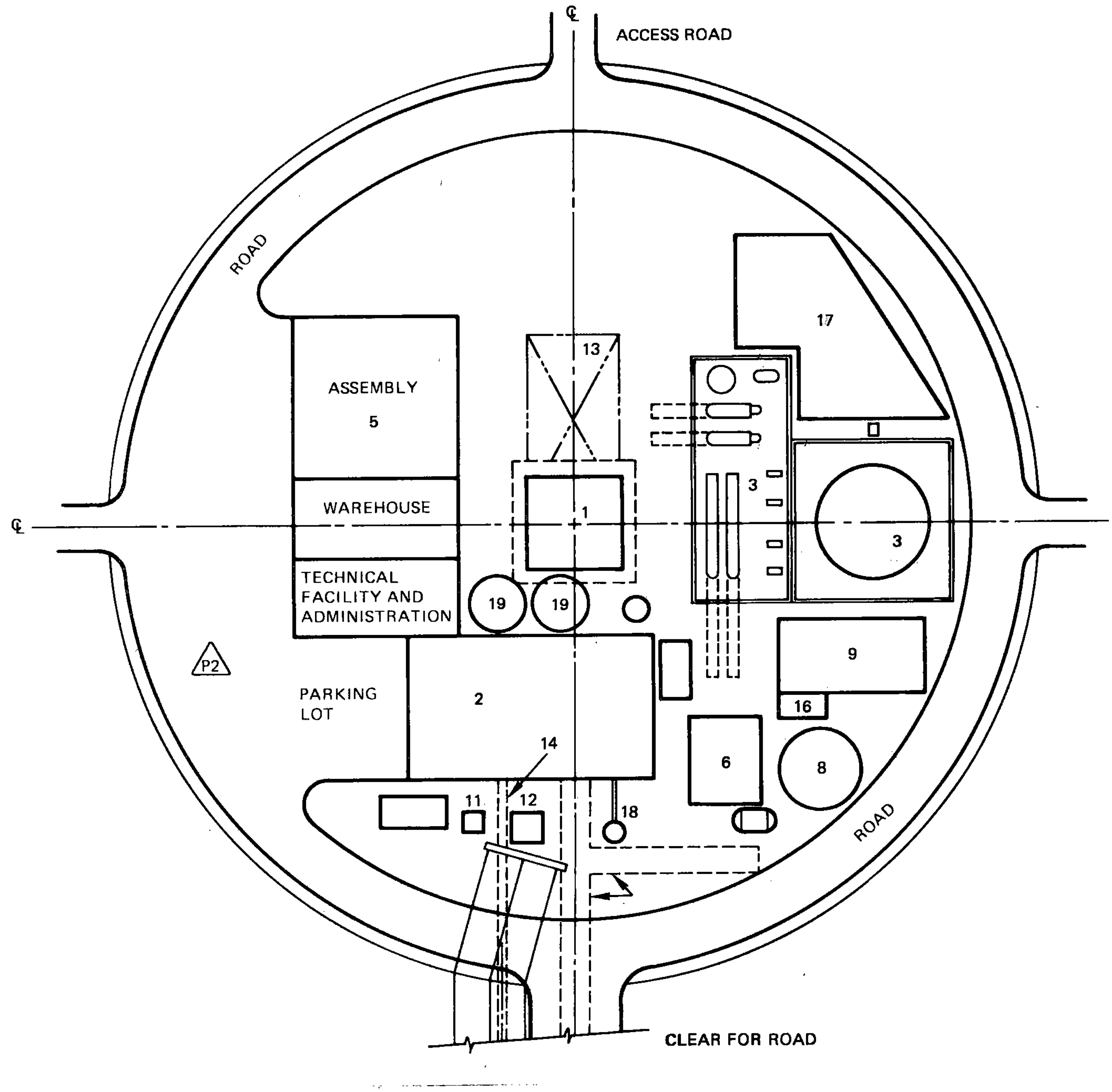
Following is a summary of total plant facilities: (see Exhibits II-9 and II-10).

- Collector Field
- Receiver Tower
- Power House
- Thermal Storage System
- Heat Rejection Condensers
- Administration/Control Building
- Maintenance Building/Warehouse
- Access Roads
- Fencing



10 MWe SOLAR PILOT PLANT

CENTRAL RECEIVER
COLLECTOR FIELD LAYOUT
(CONCEPTUAL)
EXHIBIT II-9



1 RECEIVER TOWER AND FOUNDATION
2 POWER HOUSE
3 THERMAL STORAGE SUBSYSTEM
4 CONDENSATE STORAGE TANKS
5 ASSEMBLY. AS NOTED
6 WATER TREATING BLDG
7 DEMINERALIZER ACID STORAGE TANK
8 LIME SOFTENER
9 CLEARWELL (COVERED)
10 SEWAGE UNIT
11 AUX TRANSFORMER
12 MAIN TRANSFORMER
13 RECEIVER PANELS LAYDOWN AREA
14 POWER AND CONTROL CABLE TRENCH
15 BURIED PIPING LANE
16 TREATED WATER AND FIRE PUMPS
17 ROCK-FILLED CATCH BASIN
18 LUBE OIL STORAGE TANK
19 CONDENSATE STORAGE TANKS P2

10 MWe SOLAR PILOT PLANT

CONCEPTUAL POWER HOUSE AND AUXILIARIES

EXHIBIT II-10

2. Detailed Description of Proposed Solar Thermal Operation

In the conceptual design stage, Pilot Plant sizing to produce 10 MW_e output at the design point (2pm, day of worst collector field cosine) has been based on an insolation level of 0.950 kilowatts per square meter (kW/m^2), which is the typical insolation value used for desert areas. Final sizing of the plant will be done using insolation data that has been collected by SCE near the actual Pilot Plant site. (See Section X-E-e Solar Radiation.)

The central receiver system requires:

- Collection and concentration of solar energy;
- Conversion of solar energy to thermal energy and thermal energy transport to an electric generator;
- Conversion of the thermal energy to mechanical energy and transformation and distribution of electrical energy produced
- Storage of thermal energy in excess of that needed in the conversion process to cover periods when solar energy is not available; and
- Master plant supervisory control for operation and safety;

and therefore consists of five main systems:

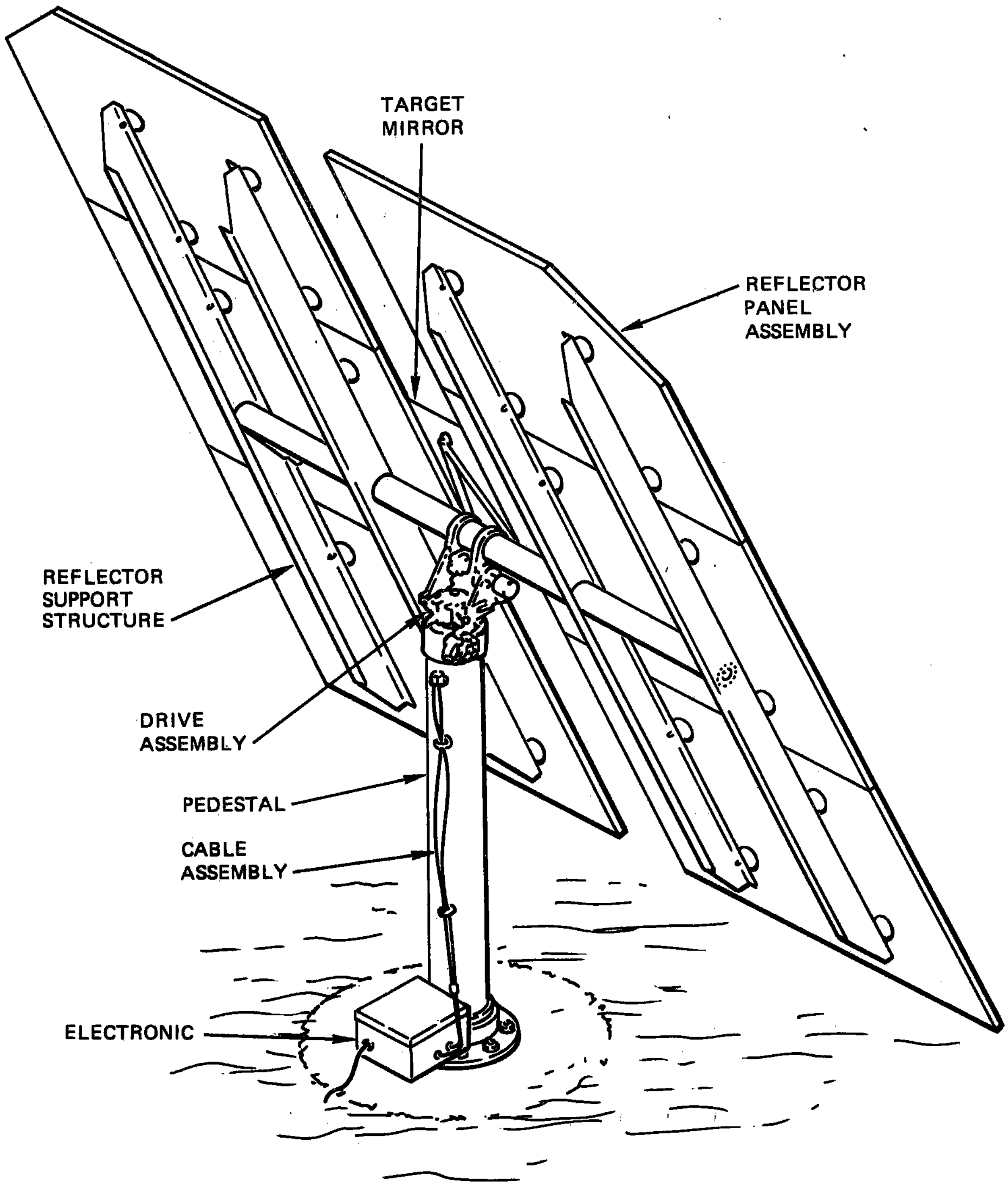
1) Collector System
2) Receiver System
3) Electric Power Generation System (EPGS)
4) Thermal Storage System
5) Master Control System

a. Collector System

The collector system has as its basic function the interception, redirection, and concentration of direct solar radiation to the receiver system. The collector system consists of a field of heliostats (reflecting mirrors) and a computerized control system to continuously track the sun and maintain focus on the central receiver on top of the tower. The high temperatures produced by this focused concentration of solar radiation (heat) results in approximately 21% overall (sunlight to electricity) conversion efficiency.

The selected system uses an external surface receiver. Heat is absorbed on the outside surface of the receiver and can accept energy from all directions. Accordingly, the tower could be placed in the center of the field. However, because the sun is always in the southern hemisphere at Barstow's latitude, more effective energy collection will be accomplished by placing the tower somewhat south of center.

Each heliostat will consist of panels of flat glass mirrors bonded to a backing sheet. (See Exhibits II-11.) Each heliostat will provide a total reflective surface area of about 430 square feet. The conceptual design calls for approximately 2300 complete heliostat units comprising a "mirror" of approximately 22 acres (an overall heliostat ground covering density of approximately 24% of the 90 acres required). This number of heliostats provides for design point power generation plus excess to charge the thermal storage system. This excess is called solar multiple and is



10 MWe SOLAR PILOT PLANT

HELIOSTAT
ASSEMBLY
EXHIBIT II-11

approximately 1.5. The heliostats rotate on axes, which enable sun-position tracking and allow for rotation to a "stowed" position (mirrors facing ground) during nighttime, sand storms and inclement weather. The mirrors will require periodic washing. (See Section X-C-2-b.)

Facilities appurtenant to the collector field will consist of:

- Field wiring for distribution of power, command/control and grounding cable (underground).
- 8 foot high galvanized chain link fencing around collector field.
- Approximately 200,000 square feet of asphalt paved road surface.
- Approximately 3,000 square feet of asphalt paved parking surface.

b. Receiver System

The receiver system consists of the support tower, the receiver/boiler and the working fluid (water/steam) conduits. The outer surface of the externally heated receiver/boiler absorbs the focused radiant energy from the collector field. Boiler tubes with an absorptive coating containing the working fluid are placed on the exterior side of the receiver. The water in the tubes is heated until it is completely vaporized and then heated further to super heated steam. The steam is collected from all tubes and then transported down the tower for conversion and/or storage.

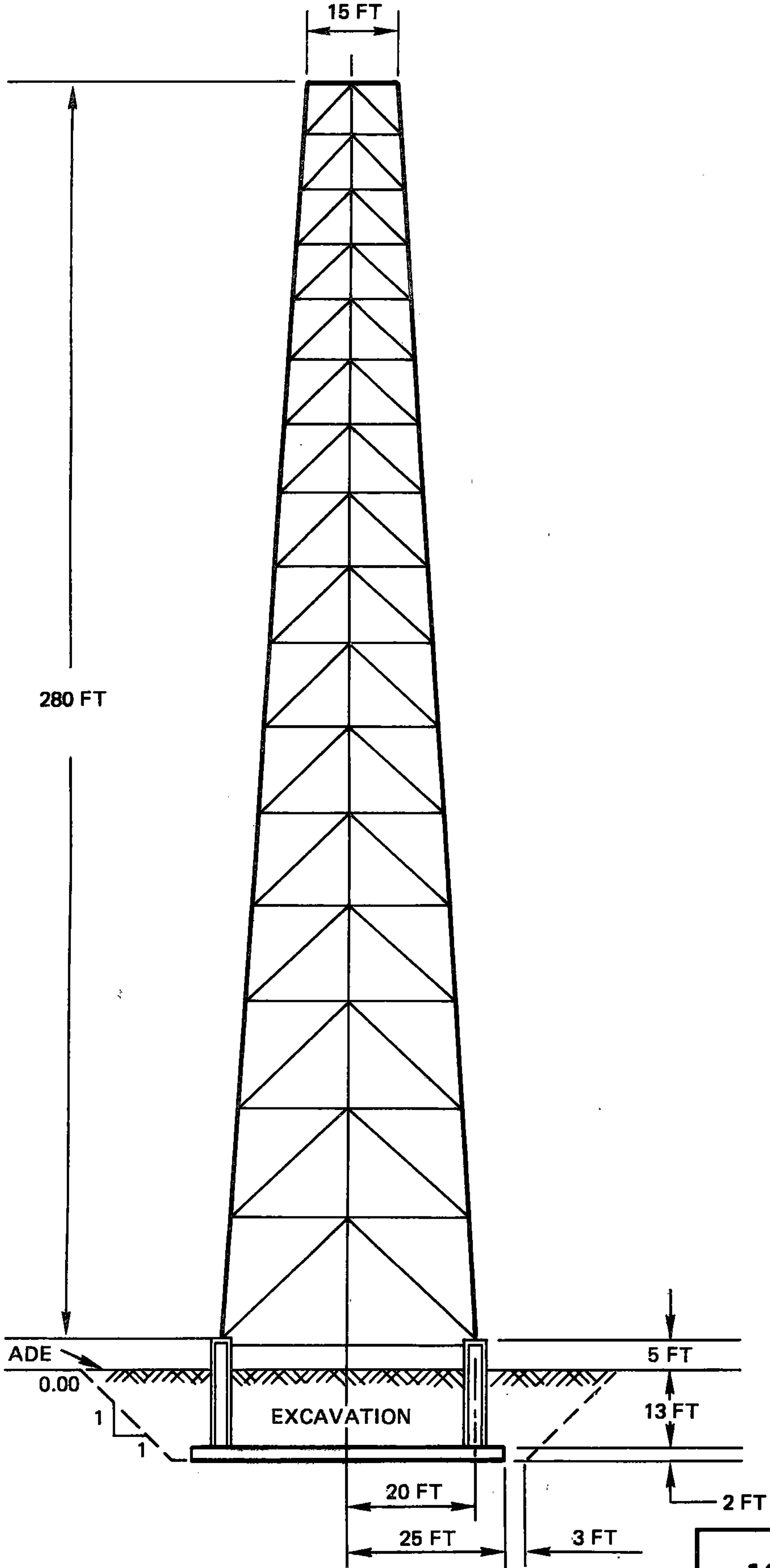
The structural steel tower (without receiver) will be approximately 280 feet high from the ground surface and will be approximately 40 square feet at the foundation and 15 square feet at its top at the connecting point with the receiver. The tower foundation will be an approximately 50 square foot reinforced concrete mat. Fifteen feet of the tower foundation will be below the ground surface. (See Exhibit II-12.)

The cylindrical receiver at the top of the tower will be approximately 46 feet in height with a 26 foot diameter. (See Exhibit II-13.) A riser will conduct water between the ground and the receiver at the tower top. Similarly a downcomer will transport steam down the tower. The total height of the combined tower and receiver will be approximately 325 feet.

c. Electric Power Generation System (EPGS)

The main function of the EPGS is to transform the thermal energy from the solar-heated working fluid into electric power. A conventional steam turbine electric generator is used to convert the thermal energy of high pressure/high temperature steam into rotative mechanical energy in the turbine which then transmits this energy to the generator where electrical energy is produced. The spent steam is then transported to the wet cooling towers for waste heat rejection to the atmosphere. The turbine condensate (condensed spent steam) is returned via the feedwater train to the receiver unit where the cycle begins again.

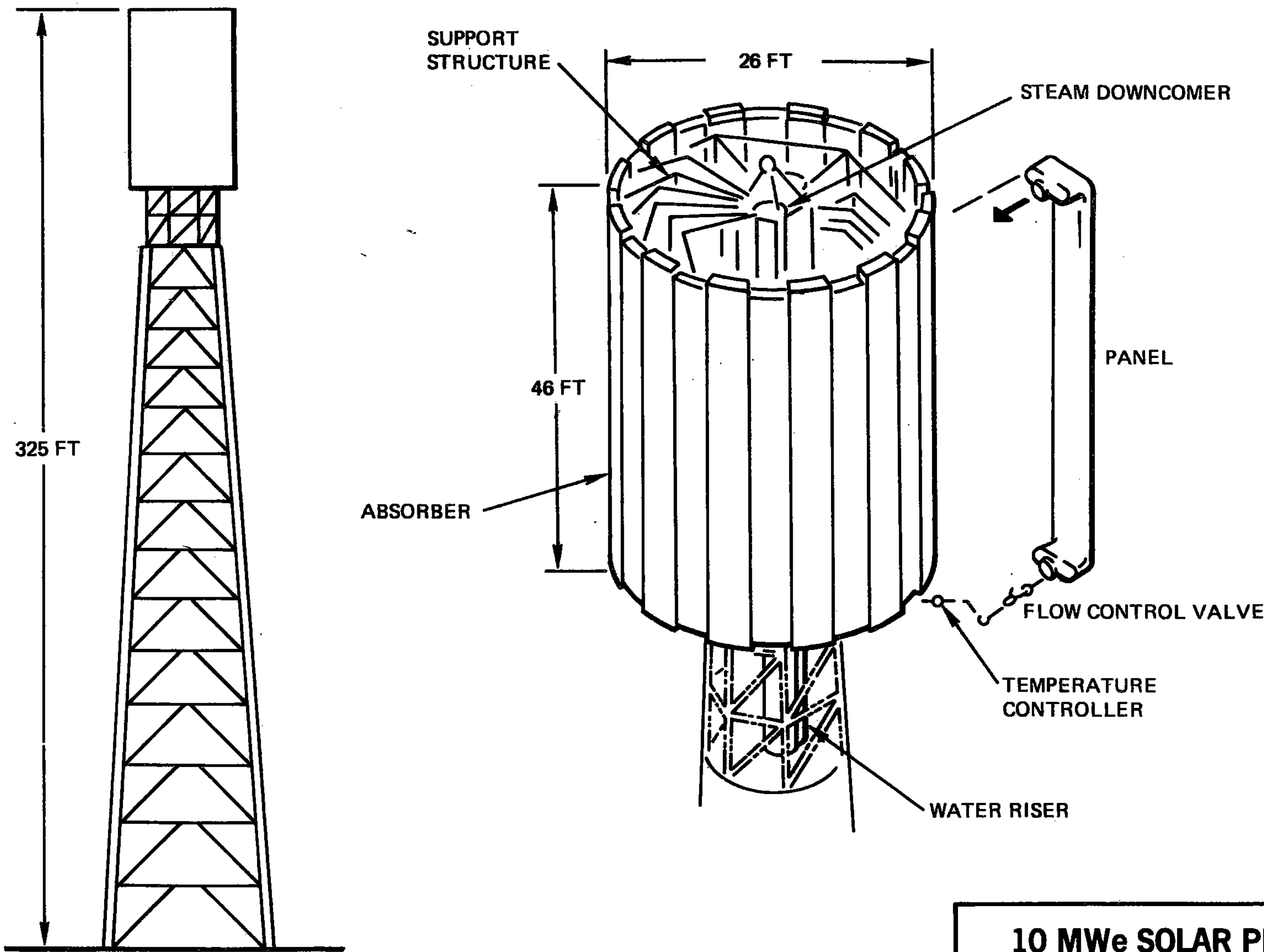
The turbine generator facilities will include a steam turbine generator set, a heat rejection system (condenser and cooling tower), feedwater heaters, pumps, water treatment facility and electrical power conditioning equipment for distribution of the



10 MWe SOLAR PILOT PLANT

PILOT PLANT STEEL RECEIVER TOWER

EXHIBIT II-12



10 MWe SOLAR PILOT PLANT

PILOT PLANT RECEIVER
EXHIBIT II-13

plant output. The turbine generator will transform the thermal energy of the steam originating in the solar receiver, into 60 Hz electrical power at 10 MWe net or originating in the thermal storage system at 7 MWe net. The power conditioning equipment will include transformers, switches, regulators and controls needed for the proper integration into an existing power transmission network.

The output from the turbine-generator facilities will be fed into the SCE transmission system which is interconnected with utilities in Arizona, New Mexico, Nevada, throughout California and the Pacific Northwest. The SCE system is also interconnected at four points with the DWP transmission system. The Pilot Plant will be connected to the transmission system through existing sub-station facilities at the Coolwater site. No new off-site trans-mission lines or microwave stations will be required.

d. Thermal Storage System

The function of the thermal storage system is to store thermal energy generated by the collector and receiver systems collected in excess of that required for normal plant operation and to later supply this stored energy for use at times when direct solar radiation is not available (i.e., because of cloud cover or darkness). The storage system will utilize the favorable thermal properties of granite rock and high temperature oils which will absorb and retain heat from the working fluid via heat exchangers. When storage energy is required, heat from the oil/rock media is transferred to receiver feedwater to produce steam for the EPGS.

The round, steel-shelled thermal storage tank will be installed adjacent to the receiver tower. A thermal storage system schematic is shown in Exhibits II-14.

The heat storage/exchanger system, when fully charged, can store sufficient thermal energy to generate approximately 7 Megawatts of electricity for 5 hours without sunlight.

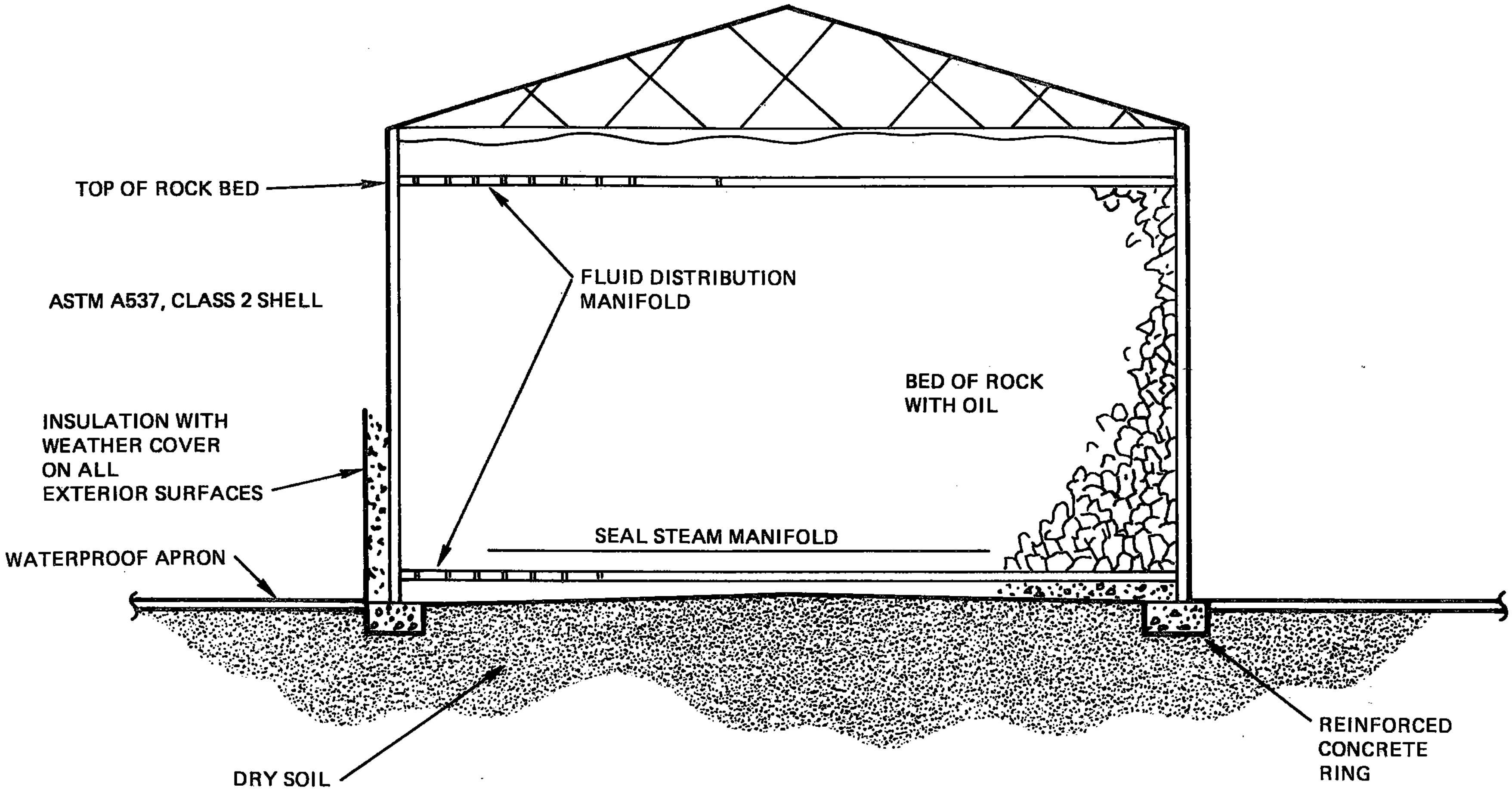
A dirt containment basin and dike will surround the thermal storage unit in order to contain petrochemicals in the event of spills and leaks as part of the fire protection system.

Heat exchangers and pumps are utilized to transfer heat from steam to charge storage and for the reverse extraction process.

e. <u>Plant Master Control System</u>

The plant master control system is a series of computers which are preprogrammed to perform supervisory activity over all of the plant subsystems. These computers are dedicated to control the plant in response to operator demand for power and also provide automatic plant protective functions.

The master control functions to assure that the subsystems operate in concert with one-another and that the entire plant responds to the demands in a rapid and safe manner. Exhibit II-7 presents basic schematics on the integration of each system.



10 MWe SOLAR PILOT PLANT

PILOT PLANT THERMAL STORAGE UNIT

EXHIBIT II-14

3. Additional Plant Description

a. Water Use

Preliminary estimates indicate that approximately 220 acre-feet of water will be required annually for cooling and other uses such as boiler make-up water and heliostat washing. This will be supplied by water diverted from agricultural use and will not require additional pumping from the ground water basin. (See "Hydrology" for detailed assessment of water use.)

b. Access

Access to the Pilot Plant site is available from Interstate Highway 40, Interstate 15, County and private roads. Unpaved portions of the private roads will be improved and adequately maintained during and after the construction period.

Two main railroad lines cross the Mojave Desert and pass near the Coolwater site. The Atchinson-Topeka and Santa Fe (AT&SF) Railroad extends northwest and southeast of Barstow and is adjacent to the south property line of the Coolwater Generating Station. The Union Pacific (UP) Railroad is northeast of Barstow and passes north and west of SCE'S property. Both railroads share portions of the same roadbed from the community of Daggett to Riverside. Both the highways and rail lines will be used to transport construction materials to Daggett.

The Barstow-Daggett airport is located 2.5 miles east of Coolwater on 1,082 acres of land. A heliostop (without refueling facilities) will be located near the Pilot Plant site.

c. Visitor Center

The novelty and uniqueness of the Pilot Plant will attract the curiosity of the travelling public. Availability of information will enhance the development of a general public understanding of solar power and its application. As part of this effort, a visitor's center will be constructed on the north side of International Trails Highway (old Route 66) approximately 1-1/2 miles south of the Pilot Plant site. (See Exhibit II-4 and II-4a). The facility will include a small building and a paved parking lot.

d. Development Schedule

As presently scheduled, site preparation and construction will begin mid-year 1978. Construction is expected to be completed in July of 1980. Initial plant operation will commence in December of 1980 and the test period will continue over a five year period.

e. Construction Practices

A construction management firm will act as prime contractor for all site construction work within DOE responsibility. SCE's construction management group will manage all site work within the utility consortium responsibility.

Standard practices used throughout the utility industry will be followed in the construction of the Pilot Plant. Access for material transport to the construction site will be permitted by an existing paved road, an existing overland dirt road to the construction site and if necessary, a railroad spur already next to the existing power plant.

Major excavation work will be required to construct the central receiver tower, heliostat foundations, steam turbine generator pedestal, storage tanks, cooling tower basin and the circulating water system between the cooling towers and the condenser.

On completion of construction activities, the contractors will be required to remove construction debris from the site for recyling or for deposition in a sanitary landfill.

Temporary facilities will be provided as follows during the construction period.

- Power - Initial construction power may be derived from onsite diesel-driven generators or electrical tie lines to the existing Coolwater Generating Station.
- Water - Construction water supplies will be obtained from existing wells located on or adjacent to the site.
- Sanitary - Sanitary waste facilities for administrative forces will be provided by a septic tank and leach line system, which will become a part of the permanent facilities for normal plant operation. Portable chemical units will be provided for construction forces.
- Communication - A communication system utilizing both microwave and common carrier that can be integrated into the existing Company network is presently planned.
- Storage - A conventional combined warehouse, shop and assembly building will be constructed.
- Worker Facilities - The use of air conditioned trailers is being considered for the construction-related offices.

4. Total Plant Operation and Maintenance

SCE will be responsible for providing the services necessary to operate and maintain the Pilot Plant in a competent manner. As the plant may only be in service for 5 years, the manner in which services are provided must recognize its temporary status.

Objectives will be altered somewhat from those that would be assumed in a conventional or commercial electrical generating station. The purpose of the Pilot Plant is to provide information necessary to evaluate equipment selection and design changes that would be required to construct a full-sized commercial solar plant. Operating procedures will be designed and implemented to maximize the conversion of solar incident energy into electrical energy while accomplishing the research and development objectives of the projects.

The project participants will prepare detailed test and evaluation plans and schedules which will delineate the required operating and testing tasks to be performed. These plans will be given to the Pilot Plant operating supervision who will assume the responsibility for preparing, implementing, and reporting upon the detailed procedures necessary to accomplish the plan.

Operating and maintenance supervision and administrative services will be provided by the existing Coolwater Generating Station personnel with support from other SCE groups. Substantial technical support will be provided by SCE's Research and Development Department, DWP, DOE, Sandia Laboratories, and equipment vendors.

Operating manpower will require a minimum of three men on day shift, three men on swing shift, and two men on graveyard shift. During normal daytime working hours, many technical personnel will be on duty to aid operations and to obtain and analyze test data.

Maintenance manpower assigned full time to the Pilot Plant will consist of two men on day shift and two men on swing shift. In addition, approximately six men may be assigned full time to accomplish heliostat mirror washing; however, this function may be assigned to outside contractors. Additional maintenance manpower will be provided as required from the Coolwater Generating Station. Maintenance requirements that cannot be completed by SCE will be contracted.

A typical day is envisioned as beginning shortly before sunrise when operators begin placing equipment in service in preparation for receiving the early morning solar energy. When the sun rises to a predetermined elevation above the horizon, a portion of the heliostat field will be moved from their stowed position and directed so as to reflect the solar energy on the receiver. A warm-up process then begins to raise the metal temperature of the receiver, piping, turbine and other equipment to the proper operating level. The generator will then be connected to the electrical network and the remaining heliostats placed in service to increase the receiver input energy to the maximum available. Receiver output energy will be used to directly generate power. Excess output energy, as it becomes available, will be directed to the thermal storage unit for recharge and later recovery. In the event that sufficient solar insolation is unavailable, thermal storage can be tapped to supplement receiver steam. The EPGS can accept receiver and storage produced steam simultaneously. As sunset approaches, the reverse of morning start-up procedures takes place. If thermal storage is to be used for generation, it will be placed in service as the receiver is being removed from service. At the termination of thermal storage operations, the remaining systems will be placed in hot lay-up, which minimizes heat losses to facilitate a rapid start-up on the following morning.

III
ENVIRONMENTAL
SETTING

III. ENVIRONMENTAL SETTING

(The following environmental factors are described in detail in Section X.)

The site is located in the Western portion of the Mojave Desert Geomorphic Province, in a broad alluvial valley on the old flood plain of the ephemeral Mojave River. The 4 mile wide valley is flanked by the Calico Mountains to the north and the Newberry and Rodman Mountains on the south, which are primarily of volcanic and sedimentary origins.

Mid valley topography is generally flat along the flood plain. The site elevation is 1942 feet. The 130 acre parcel has a relief of approximately 2 feet, falling in a northerly direction toward the Mojave River channel.

The valley's deep, sandy soil results from ancient river flooding and from deposition of alluvial material from the sloping plain to the south.

The site is in a region of moderate seismicity due to the existence of active northwest trending faults within a 25 mile radius and due to a potential quake on the more distant San Andreas fault to the southwest.

The region is drained by the mostly ephemeral Mojave River which flows northward from its primary watershed in the

San Bernardino Mountains through Victorville, then eastward through Barstow and Daggett, along its course immediately north of the site, terminating at Soda Dry Lake in the eastern Mojave Desert 40 miles east of Daggett. The 130 acre plant site is drained by minor sheet and rill flow. Various closed basins in the region contain dry (ephemeral) lake beds.

The site's and region's water is pumped from the Lower Mojave River Valley's groundwater basin. Water quality is generally good except where polluted by the migrating "slug" of untreated domestic and industrial wastewater percolated into the upstream river bed many years ago.

This region's low annual precipitation and high rate and intensity of solar radiation (somewhat unique even to the arid Mojave Desert) offer distinct advantages to solar plant siting. Occasional high winds are common. Ambient air quality is periodically degraded by gaseous and particulate pollutants, primarily migrating from the upwind and populated South Coast Air Basin which contains the Southern California metropolis.

The viability and diversity of the valley's typical desert plant and animal life have been partially reduced due to urbanization and land clearing. However the natural creosote-scrub habitat on peripheral BLM lands is fair to good except in those regions heavily mined or degraded by off-road vehicle use. The proposed 130 acre Pilot Plant site had been an alfalfa field in conjunction with the SCE Coolwater Ranch operation. The parcel has been fallow long enough to produce a variety of native and exotic pioneering desert vegetation. The property immediately east of the site is a climax creosote community. Site soils are partially re-stabilized.

The site contains no man-made improvements other than marginal dirt roads, 2 recently drilled water wells on the south and east boundaries, and a buried water pipeline.

The existing Coolwater Generating Station, evaporation ponds and alfalfa fields are west of the site, and wooden pole and steel tower transmission lines cross the parcels on the east. The 130 acre site is in the eastern portion of the SCE-owned 2,337 acre Coolwater property (ranch and generating station). See Exhibits II-4 and II-5.

IV
SUMMARY OF
ENVIRONMENTAL EFFECTS

IV. SUMMARY OF ADVERSE AND BENEFICIAL ENVIRONMENTAL EFFECTS

The following summary lists impacts in three categories: Major; Moderate and Minor. Impacts under each category are not ranked by degree. Mitigation potential is listed as full, partial or none. Some impacts are both adverse and beneficial. For a detailed assessment refer to the pertinent section in this report. Many of the impacts will stem from the existing environment and will effect Pilot Plant operation.

IMPACT	MITIGATION	SECTION	ADVERSE	BENEFICIAL
MAJOR:				
If chemical additives are used in heliostat wash solutions, effects on soil, vegetation and wildlife could be significant.	Partial	X-C-2-b-(2) X-F-2-b	X	
Misdirected solar radiation beams and in-plant power outages could present significant on and off-site hazards.	Partial-full	XI-F-2-3), 4) and 5)	X	

IMPACT	MITIGATION	SECTION	ADVERSE	BENEFICIAL
The Pilot Plant's contribution to the long-range commercialization of STE generation could be extremely beneficial to society and the national environment, however siting-related impacts in the southwest could be significant.	Partial	XI-c-2-b and V - VII	X	X
MODERATE:				
There is a 2½% probability of a seismic event causing .25g (or greater) acceleration on the site within 5 years and 14% within the next 30 years.	Partial	X-A-2-b	X	
Levelling and excavating will disturb soils and induce fugitive dust during construction. On-site vehicle use will perpetuate dust during operation.	Partial	X-B-2-a & b	X	

IV. SUMMARY OF ADVERSE AND BENEFICIAL ENVIRONMENTAL EFFECTS (Continued)

IMPACT	MITIGATION	SECTION	ADVERSE	BENEFICIAL
The Pilot Plant's water requirement will not constitute a net increase in SCE's historic groundwater withdrawal, but it will be an increase over SCE's 1977 pumping rates. More water will be evaporated than formerly lost via irrigation. The project will contribute to groundwater basin overdraft. Surface subsidence will be negligible. Pumping from the new wells will elongate cones of depression to the east of the site.	Partial	X-c-2-b-(1)	X	

IV. SUMMARY OF ADVERSE AND BENEFICIAL ENVIRONMENTAL EFFECTS (Continued)

IMPACT	MITIGATION	SECTION	ADVERSE	BENEFICIAL
Blowing sand could pit mirror surfaces. Plant operation may induce micro-climatic alterations to the site's air-flow, ambient temperature balance and humidity levels. Meteorological factors in turn will affect solar collection and reflection efficiency by an undetermined amount.	Partial	X-D-2	X	
Particulate matter, Coolwater Plant emissions, water vapor and imported ambient pollutants will absorb and scatter incoming and reflected solar radiation, reducing optimum plant efficiency by a small but undetermined amount.	None-Partial	X-E-2-c	X	

IV. SUMMARY OF ADVERSE AND BENEFICIAL ENVIRONMENTAL EFFECTS (Continued)

IMPACT	MITIGATION	SECTION	ADVERSE	BENEFICIAL
Construction will remove approximately 100 acres of semi-productive vegetation and wildlife habitat, displacing some animal species. Replanting in the collector field may be dependent on composition of heliostat wash fluids and soil compaction. Use of vegetation in collector field by wildlife will be dependent on availability of access through perimeter fencing. Weeds may become a problem. The receiver tower and radiation beam may present hazards to bird life.	Partial	X-f-2	X	
Net socio-economic effects on Barstow and Victorville will be negligible, however the Pilot Plant's novelty will induce tourist visitation.	Partial	X1-B-2		X

IV. SUMMARY OF ADVERSE AND BENEFICIAL ENVIRONMENTAL EFFECTS (Continued)

IMPACT	MITIGATION	SECTION	ADVERSE	BENEFICIAL
The 130 acre zone change to M-2 would facilitate other utility-related development on the site subsequent to Pilot Plant dismantling.	Partial	X1-C-2-a	X	X
Capitalizing on the Pilot Plant's novelty could result in unwarranted, short-term, non-beneficial development in Daggett.	Partial-Full	X1-C-2-b and X1-E-3-b-(2)	X	
The effects of increased traffic from construction, operation and visitation will be minor except during peak periods.	Partial	X1-D-2	X	

IV. SUMMARY OF ADVERSE AND BENEFICIAL ENVIRONMENTAL EFFECTS (Continued)

IMPACT	MITIGATION	SECTION	ADVERSE	BENEFICIAL
Noise, conventional safety hazards, security requirements, tower-related obstacles to aircraft, and boiler/heat storage failures could present potentially significant problems during construction and operation.	Partial	X1-f-1	X	
The Pilot Plant's visibility will moderately alter the area's aesthetic values over the short-term.	Partial	X1-G-2	X	X (Tourist attraction)
MINOR:				
Plant material requirements are relatively intensive per unit of power produced.	None	X-A-2-c	X	X
Construction will require approximately 100 acres of minimal topographical alteration.	Partial	X-A-2-a	X	

IV. SUMMARY OF ADVERSE AND BENEFICIAL ENVIRONMENTAL EFFECTS (Continued)

IMPACT	MITIGATION	SECTION	ADVERSE	BENEFICIAL
Soil compaction is possible, especially when wet.	Partial	X-B-2-d	X	
Sheet flow run-off from the unpaved site after project completion may increase by 15%.	Partial	X-C-1-b	X	
Pilot Plant operation will have minimal effect (if any) on groundwater quality (assuming a chemical mirror-washing solution will not be used).	Partial-Full	X-C-2-b-(3)	X	
Air quality impacts from Pilot Plant construction and operation will be negligible, mostly in the form of fugitive dust.	Partial	X-E-2- a and b	X	

IV. SUMMARY OF ADVERSE AND BENEFICIAL ENVIRONMENTAL EFFECTS (Continued)

IMPACT	MITIGATION	SECTION	ADVERSE	BENEFICIAL
At worse case, the Pilot Plant may only produce as many units of usable energy as it consumes.	Partial	X-G-2	X	X (if R&D is productive)
Construction personnel will average 250-300 at any given time during 1977-80. Operation will only require 12 permanent employees. R&D related visitation will periodically be substantial.	None	X1-A-2-a, b and c		X
Subsurface archeological and palentological remains (if any) could be damaged during construction.	Partial	X1-E-1-b and 2-b	X	
Project impact on general utilities and public services will be minimal.	Partial-Full	X1-H-2	X	

V
SHORT—TERM/
LONG—TERM

V. THE RELATIONSHIP BETWEEN SHORT-TERM USE OF RESOURCES AND LONG-TERM PRODUCTIVITY

The site, construction materials, fossil fuel energy, human resources and time will be utilized over a 5 year period for promoting and researching the long-term use of solar radiation for electricity production. This Pilot Plant can be considered a capital investment in the attempt to reduce our nation's use of exhaustible energy sources.

If the results of the Pilot Plant research project indicate that central receiver/solar thermal electric technology will not be economically suitable for our future needs, the project's short-term use and consumption of resources will be of less direct benefit. However it must be realized that the credibility of the rejection or even limitation of STE application without a thorough test program afforded by the Pilot Plant study would always be in question. Technological advancements in our society have generally proceeded through an orderly transition from bench or lab scale to pilot and demonstration scale. Solar research experiments established the feasibility of individual components. The Pilot Plant will be used to validate the feasibility that such components can operate reliably together. If the Pilot Plant establishes technical feasibility, then future demonstration plants will be used to demonstrate economic feasibility.

Even the indirect benefits associated with a less than totally successful pilot STE endeavor could hasten the implementation of other forms of efficient solar technologies. Whatever benefit results, it is the present intention that the gain in technology will be worth the expenditure of resources.

VI
RESOURCE COMMITMENTS

VI. IRREVERSIBLE ENVIRONMENTAL CHANGES – IRRETRIEVABLE COMMITMENT OF RESOURCES – SITE RESTORATION

At the end of the 5 year Pilot Plant test period, two options are viable: SCE could purchase the solar portion of the facility from DOE and operate the Pilot Plant for electricity generation for an additional 25 years, or all structures could be dismantled. The 5 year (or longer) period of the Pilot Plant's existence on the site will not necessarily commit the parcel to irreversible environmental alterations. Site disruption and use will definitely lengthen the period before native biotic resources will re-occur, but assuming no subsequent degradation, the site will eventually revert to a resemblance of its present condition. It could even regain its native climax condition over the extreme long-term. On the other hand, the M-2 zoning on the 130 acre site could result in its long-term commitment to utility-related uses.

The Pilot Plant will not significantly induce irreversible off-site changes unless it contributes significantly to the conversion of fossil fuel electrical generation to solar generation. In this case, the change could be beneficially irreversible, but not without imposing new but hopefully less adverse impacts on society and the environment.

The only resources that will necessarily be irreversibly commited to or by the Pilot Plant will be: the fossil fuels consumed in material mining and manufacture, plant construction and operational support; and irreplaceable hours of human time required for construction, operation, research and support. If plant materials (mirror glass, common and rare metals, etc.) would be salvaged for re-use or recycling, they could be considered a "bank" of materials available for future use and therefore not irreversibly committed to the Pilot Plant. However, if buried in a landfill, they would constitute an irretrievable commitment to a short-term single use.

Eventual uninduced restoration of the site to a status similar to its present quasi-natural state could be accomplished 10-20 years after the Pilot Plant was dismantled. This assumes that heliostat and tower building foundations would also be removed and that dike breakdown and substantial grading would be required to fill in the holes. Net topographical alterations would be minimal. Reseeding with a variety of annual and perennial, pioneering and climax native desert plants (plus initial irrigation) would greatly hasten site restoration to a condition more advanced than what presently exists. SCE's continued use of the site for other utility related projects, facilitated by the potentially permanent M-2 zoning, would of course preclude restoration at least in the near term. Therefore the degree of site restoration is dependent upon SCE's future plans for its use. Farming could also be re-established after Pilot Plant dismantling.

VII
GROWTH
INDUCEMENT

VII. GROWTH-INDUCEMENT CHARACTERISTICS

The Pilot Plant is not a large enough project to be growth-inducing beyond its minor net contribution of operation populations to the Barstow region. Neither the Pilot Plant nor its personnel will directly initiate a substantial multiplier effect on local or regional economic characteristics. The Barstow/Victorville infrastructures can accommodate the minor increase in population without ramifications, however house-hunting might induce a few extra housing starts in Barstow. Any dwelling vacancies resulting from project completion should quickly be filled by the city's normal future growth.

Daggett's growth rate has not noticeably been affected by the installation of SCE's Coolwater Generating Station increments, and the even shorter-term Pilot Plant is not expected to induce or allow any substantial net population or economic expansion in the community. However, it is possible that developing interests could capitalize on the uniqueness and novelty of the project in an attempt to impose various quick profit-making schemes on the community. Daggett could benefit from basic and necessary economic advancement promoted by the Pilot Plant, but it cannot afford the development of an unstable infrastructure that is directly tied to the novelty of the new plant which may be dismantled after 5 years.

If present residents desire that the community maintain a sense of perspective while promoting beneficial long-term development, the County planning process could be a useful tool for them to meet that end.

The Pilot Plant's degree of direct contribution to the advancement of the long-term use of solar radiation for the centralized production of electricity is only speculative. However, since its purpose is for research of the environmental technological and economic viability of STE application, it will at least influence the role that large centralized, commercial STE projects will fill in the future. Success could result in the use of large areas of the southwest desert for solar plant siting which in turn will induce growth of rural or undeveloped regions at or near such sites. The impact would be magnified if water requirements for plant cooling were eliminated or even reduced, thus removing the major constraint to desert siting.

The long-term net growth impact to the southwestern deserts from large-scale STE projects would be similar to that anticipated from coal mining and large coal fired generating plants in the plateau country of Utah.

The long-term implications of commercial STE development in the southwest should be thoroughly assessed in a regional energy plan before siting decisions are made on a local basis without regard to regional resource-use efficiency.

VIII
ALTERNATIVES

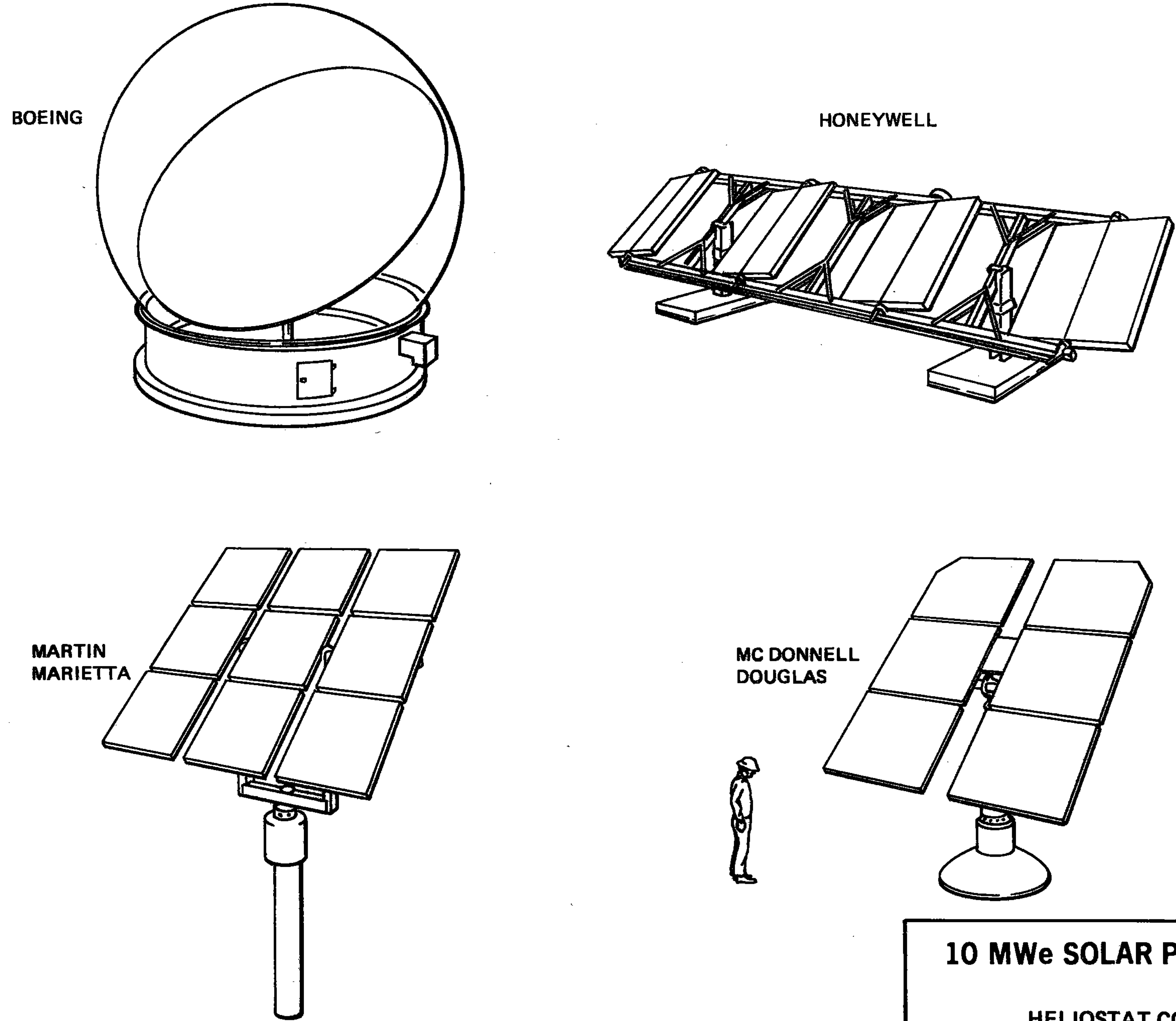
VIII. ALTERNATIVES TO THE PROPOSED PROJECT

The following description of project alternatives reflects those considered by DOE and the utility consortium prior to the selection of the Coolwater site and the MDAC design concept.

A. Central-Receiver Concept Design Alternatives

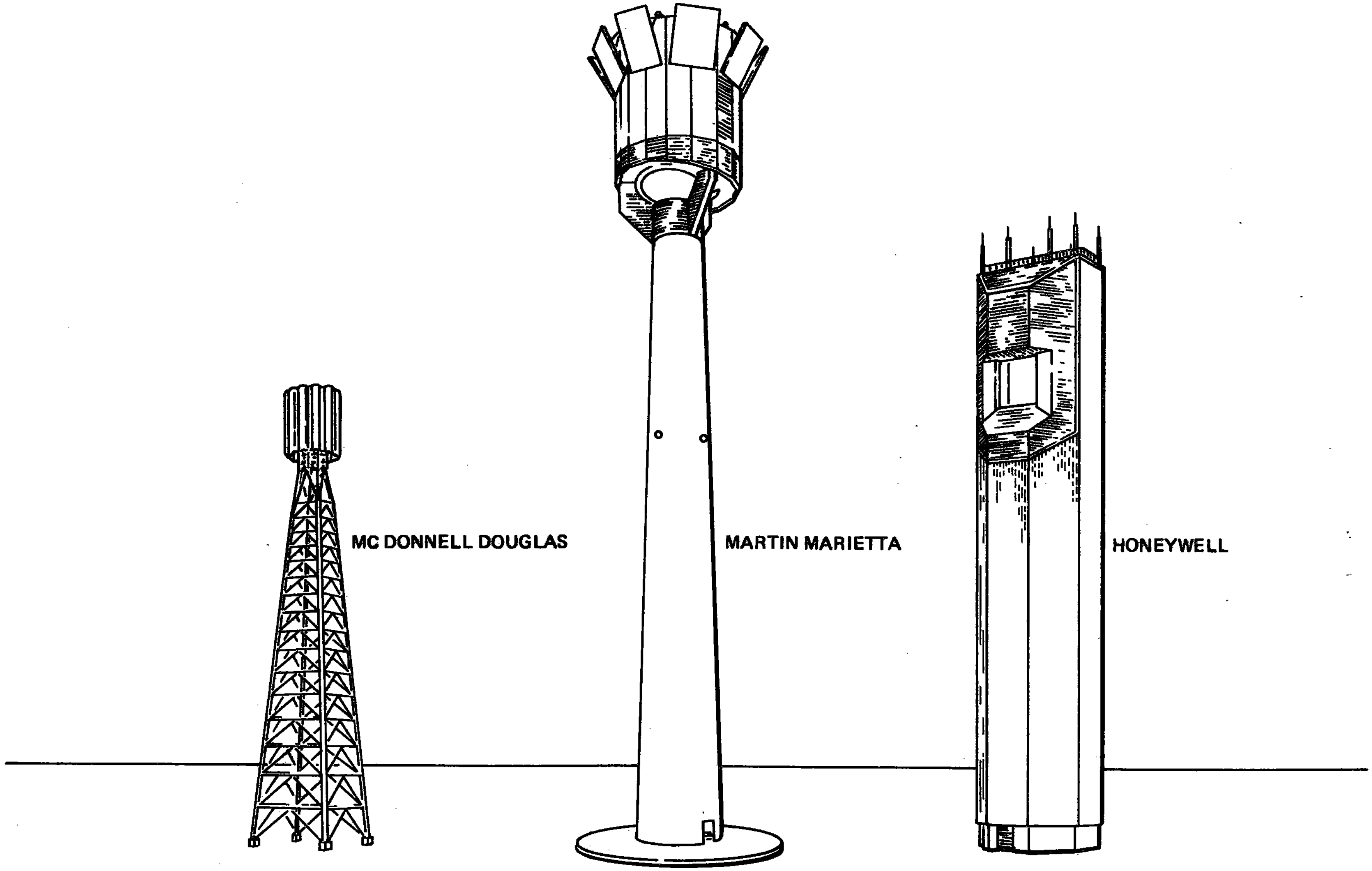
DOE considered central receiver-water/steam conversion cycle designs from four contractors before selecting the MDAC concept for the Coolwater site.

All of the systems developed for the Pilot Plant are based on the same overall concept of reflected energy from the sun being concentrated on a central receiver to generate steam. The differences are in technical detail to provide a broad base for optimization. Alternative heliostat, tower and collector field and tower arrangements considered by DOE, are shown in Exhibits VIII-1, VIII-2 and VIII-3, respectively. A detailed discussion of conceptual design alternatives and recommendations is presented in Sandia Laboratories Report No. 77-8035, entitled "Recommendations for the Conceptual Design of the Barstow, California, Solar Central Receive Pilot Plant - Executive Summary."



10 MWe SOLAR PILOT PLANT

HELIOSTAT CONCEPTS
EXHIBIT VIII-1



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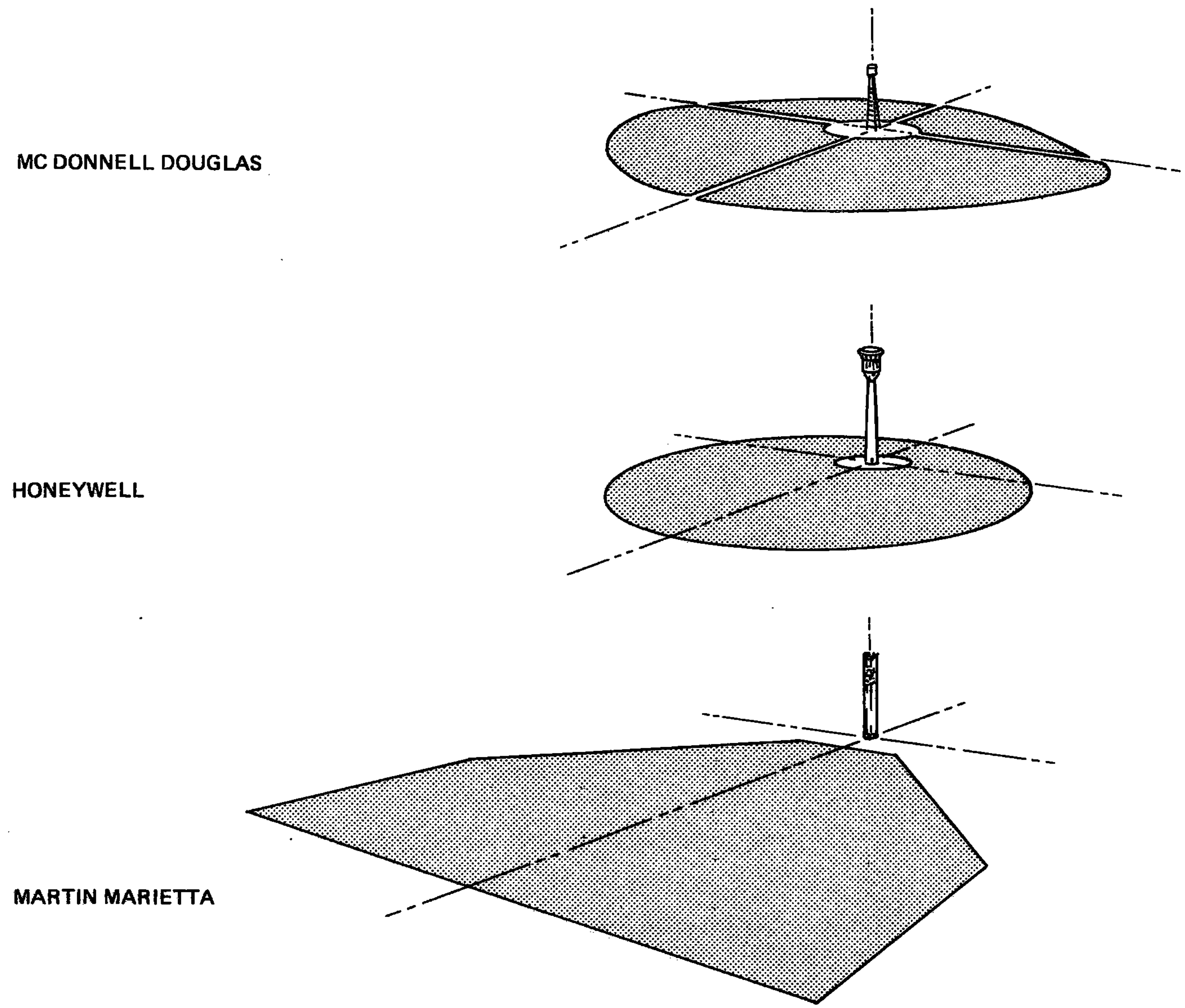
TOWER DESIGNS
EXHIBIT VIII-2



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COLLECTOR FIELD AND TOWER ARRANGEMENT
EXHIBIT VIII-3

B. Other Alternate Plant Designs

Detailed feasibility studies conducted by the National Science Foundation (NSF) and DOE in 1974-1975 indicated that the favored design for the first approach to solar thermal electric conversion plants, taking into account the state-of-the-art, costs, and technical risks, should be the central receiver concept, using the water/steam conversion cycle. Other approaches to plant design such as gas cycles, combined cycles (gas turbine-steam turbine), liquid metal working fluids, and chemical, electrical or compressed gas storage, were considered "advanced" technology systems and not appropriate technical risks for the first Pilot Plant.

Distributed collector systems (instead of the central receiver concept) were also considered. Distributed collectors focus solar radiation directly on an interconnected absorber pipe network which carries the heated working fluid to a heat exchanger unit which in turn generates steam to power the turbine generator.

Because of the limited working fluid temperatures associated with such systems, pumping losses due to extended absorber piping, and consequent lower conversion efficiencies, analyses to date have indicated that distributed collector systems are probably not suited to large-scale central station power generation. Thus it has been concluded that the central receiver system offers the most economic application of solar thermal energy to the production of electricity on a utility industry scale. Distributed collector systems, however, appear to be economically competitive for solar total energy systems and small community power plants (DOE).

Voltaic electrical generation (direct conversion of sunlight into electrical current via cells) would not require steam generation or plant cooling. Presently it is not viable, but prices per unit of production are dropping with each technological advance. This system may eventually compete with STE for solar electric application if land requirements can be reduced, price reductions per unit of production can be achieved and conversion efficencies can be increased.

C. Dry Cooling

STE plants operating in areas of low water availability may use dry cooling towers (DOE). However, dry or wet/dry towers transfer heat to ambient much less efficiently than do wet evaporative towers, thereby decreasing the power output of generating plants using dry cooling towers. Since the primary purpose of the Pilot Plant is the study of STE technology, the project participants decided not to incorporate variables (such as dry cooling) into this pilot project.

D. Heliostat Washing Alternative

A mirror washing method considered viable by DOE prior to identification of the potential requirement to collect wash and rinse water due to chemical cleaning additives in the solution (see Section X-C-2-b-(2) involved a "drive through" washing concept utilizing one or more pairs of trucks, with washing being accomplished while driving slowly past the heliostat (or pausing only briefly). Rinsing would be accomplished by a following truck in a similar manner. Apparent advantages of this concept would be effectively negated by a requirement to collect both wash solution and rinse water since the trucks would have to remain at the heliostat for a much longer period. A system of drainage trenches and sumps to trap run-off could be installed during site construction; however, a detailed evaluation and cost analysis would be required to determine the feasibility and economics of such an approach.

It should also be pointed out that the mirror washing concept presented here assumes that the wash water mixture would be disposed of in the evaporation pond. If water availability is very critical, the used water could be filtered and reclaimed for subsequent reuse, although the costs would probably be substantial. The technical and economic implications of this approach have not been addressed at this time.

The most viable method may still be the use of a wash solution without chemical cleaning additives so that mirror run-off could be utilized as irrigation for ground cover.

E. Alternate Sites

1. DOE Site Selection (Nation-wide)

Nine candidate sites were originally considered for the Pilot Plant. After thorough review and evaluation, using evaluation criteria which included site characteristics, schedules, organization and management, and environmental factors, the following three sites were considered acceptable by DOE:

- Barstow site, Southern Calif. Edison
- Gila Bend site, Arizona Solar Power Project
- Austin site, City Public Service Board, San Antonio, Texas

In the evaluation weightings, environmental factors such as land use, plant discharges, erosion control, etc., were assigned a maximum of 3.0 points for sites showing minimal potential adverse environmental impact of the plant on the site. Each of the above sites was assigned a value of 2.8 points, indicating (a) minimal and acceptable environmental impact, and (b) no "better" or "worse" site among the three finalists from an environmental viewpoint.

2. Utility Consortium Site Selection (California)

The utility consortium's criteria for the selection of a site were essentially the same as the evaluation criteria considered by DOE in reviewing proposals submitted in response to the PON.

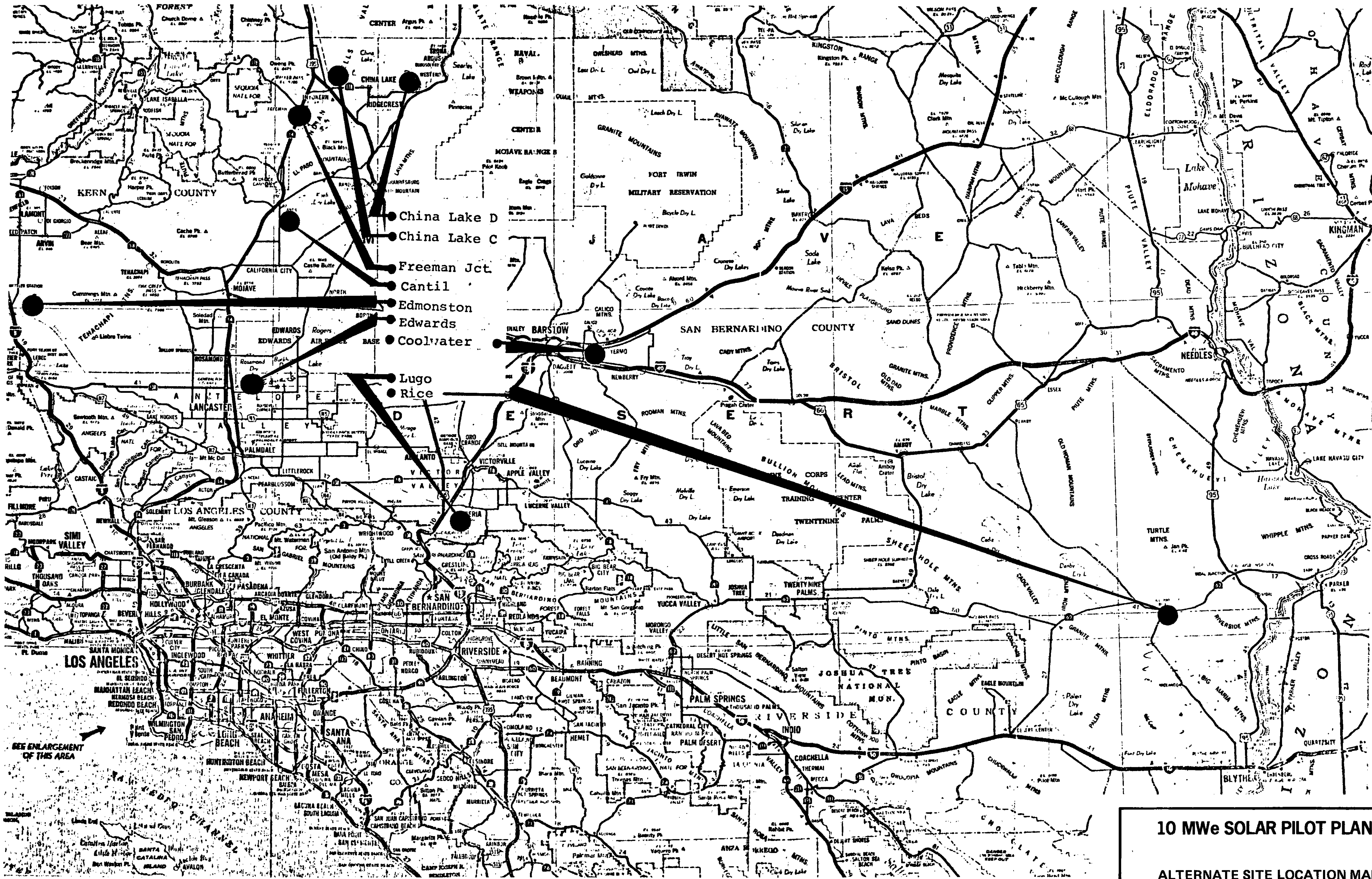
A group of nine initial sites were selected based on conformance with the above mentioned criteria. The sites were selected from several sources including:

- Previous studies conducted for DOE
- A Navy study evaluating sites on the China Lake Naval Weapons Center.
- Previous siting studies conducted by SCE and examination of currently developed sites where the Pilot Plant could most readily be integrated into the utility distribution system.
- High electric load requirements at one site near the Edmonston Pumping station.

All sites were observed via helicopter and ground reconnaissance. The locations of the nine sites are shown on Exhibit VIII-4, and are identified as follows:

- Lugo
- Coolwater
- China Lake D
- China Lake C
- Freeman Junction
- Cantil
- Edwards
- Edmonston
- Rice

Exhibit VIII-5 is a concise summary of technical information on each site.



10 MWe SOLAR PILOT PLANT

ALTERNATE SITE LOCATION MAP
EXHIBIT VIII-4

PARAMETER	LUGO	COOLWATER	CHINA LAKE D	CHINA LAKE C	FREEMAN JUNCTION	CANTIL	EDWARDS	EDMONSTON	RICE
1. Location	15 mi SE Victorville 4 mi SW Hesperia Adjacent & north of Lugo 500 kV Substation	12 mi E Barstow 2 mi E Daggett	9 mi E China Lake Southeast corner China Lake Naval Weapons Center	1 mi E Inyokern 8 mi W China Lake Southwest corner China Lake Naval Weapons Center	10 mi SW Inyokern	22 mi NE Mojave	7 mi NE Lancaster Pumping Station	1 mi N Edmonston	1 mi E Rice
2. Insolation									
a. Mean Annual Daily Insolation	Between 5.2-5.8 Kwh/m^2 a 450-500 Langleys b	Within 5.8 Kwh/m^2 contour within 500 Langley contour	568 Langley (inyokern)	568 Langley (Inyokern)	568 Langley (Inyokern)	Within 5.8 Kwh/m^2 contour within 500 Langley contour	Within 5.8 Kwh/m^2 contour within 500 Langley contour	5.2 - 5.8 Kwh/m^2 450 - 500 Langley	5.8 Kwh/m^2 500 Langley
b. Mean Total Annual Hours of Sunshine	3400-3600a	Approx. 3600	3870 (Inyokern)	3870 (Inyokern)	3870 (Inyokern)	3600 - 3800	3600 - 3800	Approx. 3400	3800 - 4000
c. Physical Shading	None	None	None	None	None	None	None	Moderate from mountains substantial from haze	None
3. Precipitation	6.1 days thunderstorms 2.6 in. snow annually	12.2 days thunderstorms 0.4 in. snow annually	2.4 days thunderstorms 0.1 in. snow annually	2.4 days thunderstorms 0.1 in. snow annually	2.8 days thunderstorms 0.1 in. snow annually	(Assumed) 2.8 Days thunderstorms 0.1 in snow annually	4.6 days thunderstorms 0.5 in snow annually	2.7 thunderstorms 0.0 in snow annually	8.9 days thunderstorms 0.0 in snow annually
4. Wind	30 mph 8.5 percent 40 mph 0.4 percent	30 mph 16.3 percent 40 mph 1.9 percent	30 mph 12.3 percent 40 mph 1.4 percent	30 mph 12.3 percent 40 mph 1.4 percent	30 mph 12.3 percent 40 mph 1.4 percent	30 mph 12.3 percent 40 mph 1.4 percent	30 mph 11.8 percent 40 mph 0.3 percent	30 mph 1.0 percent 40 mph 0.0 percent	30 mph 6.0 percent 40 mph 0.4 percent
5. Area	Proposed 100 acres, more available for purchase	Proposed 100 acres, more available	Proposed 100 acres, more available w/Navy approval	Proposed 100 acres, more available w/Navy approval	Proposed 100 acres, more available w/BLM approval	Proposed 100 acres, more available for purchase	Proposed 100 acres, more available for purchase	Proposed 100 acres, more available for purchase	Proposed 100 acres, substantially more owned by SCE
6. Topography	Even 2% slope, no flooding minimum site preparation	Nearly flat, sufficient slope for drainage, minimum site preparation	Locally rolling terrain net slope 4%, moderate site preparation	Nearly flat, sufficient slope for drainage, minimum site preparation	Even 3% slope, minimum site preparation	Nearly flat, minimum site preparation	Locally rolling, net nearly flat, moderate site preparation	Even 2% slope, minimum site preparation	Even 2% slope, minimum site preparation
7. Geology	Course sandy soil, good foundation	Consolidated alluvium, good foundation	Erroded alluvium good foundation	Consolidated alluvium good foundation	Consolidated alluvium good foundation	Coarse sandy soil on apparent alluvium	Dry lake bed type deposits of expansive soil. Poor foundation	Consolidated alluvium good foundation	
8. Seismicity	Near San Andreas Fault, ground acceleration .5+g	Estimated 0.2g ground acceleration	Minor faults, no estimate of ground acceleration	Important faults, no estimate of ground acceleration	Important faults, no estimate of ground acceleration	Not known	Not known	Not known	
9. Hydrology	No flooding	No flooding, ground water excellent	No flooding, ground water poor	No flooding, ground water variable in depth and quality	No flooding, ground water unknown	No flooding, possible groundwater	Much flooding apparent possible groundwater	No flooding, probable groundwater	No flooding, no groundwater
10. Rights of Way and Access	Site is private and would require purchase, Interstate 15 3 mi, access by paved and dirt roads	Site owned by SCE Interstate 15 4 mi, Interstate 40 2 mi, access by paved and dirt roads	Site owned by Navy, Hwy 178 3 mi, access road would have to be built	Site owned by Navy, Hwy 178 adjacent, Hwy 395 1/2 mi access by dirt road	Public land controlled by BLM, Hwy 14 1/2 mi, access by dirt road	Site is private and would require purchase. Highway 14 3 mi. Access by paved roads	Site is private and would require purchase. Hwy 14 5 mi. Access by paved road	Site is private used for cattle grazing would require purchase. I-5 6 mi access by paved and dirt road	Site is owned by SCE current open space. Adjacent to Hwy 62
11. Facilities and Services	Water supply California Aqueduct 1 mi, electricity from Lugo Substation, sewage disposal by leachfield, trash disposal same as substation. Traveler accommodations Victorville 15 mi	Water supply existing site wells, electricity from existing substation, sewage disposal by leachfield, trash disposal same as existing facilities. Traveler accommodations Barstow 12 mi	Water supply from Navy wells or sanitary effluent piped 7 mi, no nearby electricity sewage disposal by leachfield, trash hauled to dump. Traveler accommodations very limited in China Lake 9 mi	Water supply from Navy wells, Owens River Aqueduct or sanitary effluent, elect from distribution lines, other same as China Lake D	Water supply from Owens River Aqueduct 1 mi	Possible water supply from groundwater. No local electricity, possible sewage disposal by leachfield, probable haul trash to dump. Traveler accommodations limited in Mojave 22 mi	Possible water supply from groundwater. Local electric distribution lines, sewage disposal by sewer, probable haul trash to dump. Excellent travel accommodations 7 mi Lancaster	Water supply from aqueduct. Electricity 1 mi at pumping station, sewage disposal by leachfield, probable haul trash to dump. Travel accommodations 30 mi in Bakersfield	Water supply from Colorado River Aqueduct, sewage disposal by leachfield, trash to dump, Limited travel accommodations Parker 40 mi
12. Zoning and Land Use Restrictions	Land use is open space	Currently zoned "Desert Living." Requires zone change	Land use controlled by Navy. Within electromagnetic danger zone	Land use controlled by Navy. Within low level flight pattern	Land use controlled by BLM. BLM designation unknown	Land is open space adjacent to irrigated agriculture	Land is open space, we irrigated by flooding	Land use is cattle grazing	Land is open space
13. Air Quality	Substantial air pollution is blown over site during certain wind conditions source of pollution is San Bernardino area	Essentially clear	Essentially clear	Essentially clear	Essentially clear	Essentially clear	Essentially clear	Substantial fog and haze	Essentially clear
14. Airways	The site is not in the control zone or adjacent to any airport	The site is not in the control zone or adjacent to any airport	The site has limited effect on Navy flight patterns	Navy flight patterns would have to be altered	No known flight interference	No known flight interference	No known flight interference	No known flight interference	No known flight interference
15. Availability of Materials	Basic construction material available from Victorville 15 mi or San Bernardino 20 mi	Basic construction material available from Barstow 12 mi	Limited construction material available locally. Most would have to be trucked 75-150 mi	Limited construction material available locally. Most would have to be trucked 75-150 mi	Limited construction material available 20 mi Most must be trucked 40-50 mi	Basic construction material available Mojave 22 mi or Lancaster 40 mi	Basic construction material available from Lancaster 7 mi	Basic construction material available in Bakersfield 30 mi	Basic construction material Parker 40 mi Blythe 70 mi
16. Utility System Interface	Lugo Substation could be modified to receive power. However stepping up to high kV is not ideal	Through existing substation facilities	3 mi from 115 kV line. Substation would have to be built	115 kV substation adjacent could be modified to receive power	One mi from 138 kV line. Substation would have to be built	No nearby interface available	No nearby adequate interface available	Power would be tied to substation at Edmonston and used for pumping energy	No nearby power interconnection available
17. Environmental Impact a. Biology b. Archaeology c. Aesthetics	a. Limited b. Moderate probability c. Receiver would be visible from I-15, Hesperia, Victorville, all populated sections in the area. Impact considered moderate	a. Very limited b. Moderate probability c. Receiver would be visible from I-15, I-40, Marine storage depots, Daggett, Calico ghost town	a. Moderate b. Moderate probability c. Limited visibility	a. Very limited b. Low probability c. Receiver would be visible from Inyokern, China Lake, Ridgecrest, Hwys 395, 178, 14	a. Moderate b. Low probability c. Interferes with natural views	a. Moderate b. Low probability c. Receiver would be visible from scattered ranches. Red Rock Road, Hwy 14	a. Moderate b. Moderate probability c. Receiver would be visible from Rosamond, Lancaster, Palmdale, Hwy 14, Edwards AFB	a. Minimum b. Low probability c. Receiver would be visible from Wheeler Ridge, Mettler, I-5, local ranches	a. Moderate b. Low probability c. Limited visibility

10 MWe SOLAR PILOT PLANT

TECHNICAL SUMMARY
EXHIBIT VIII-5

Based on a detailed assessment of site conformance with required criteria (on file with the County and DOE), the following conclusions were reached regarding individual site potential:

a. Conclusions

- Lugo - Considering most criteria, Lugo is acceptable but not the preferred site. Its major drawbacks being that: the land is privately owned and would require purchase; a pipeline would be required for water supply; and occasional substantial air pollution from San Bernardino reduces insolation.
- Coolwater - Coolwater is determined to be the best site and is rated excellent on most criteria. The least favorable factor is wind which will be considered during design.
- China Lake D - This site is determined to be unacceptable for the following reasons: Topography would require earth moving and drainage for site preparation, access roads would have to be built, facilities and services are poor, material availability is limited, use of the site may conflict with other Navy plans, and utility interface would require several miles of transmission line and construction of a substation.
- China Lake C - Considering most criteria, this is an acceptable site. The major drawback, interference with low level aircraft operations, would require mitigation by the Navy.

The site is excellent considering most solar specific criteria and water may be available from Navy wells. Other than aircraft, the local availability of materials and travel facilities are the site's only limitations.

- Freeman Junction - By most criteria, this is an acceptable site, but there are several considerations which combine to render it infeasible for the Pilot Plant. These include the following: A pipeline would be required to supply water; the land is controlled by the BLM and site approval could be difficult to obtain; local facilities and services are very limited; a substation would have to be built for interface; and natural aesthetic views would be disturbed.
- Cantil - By most criteria, this is an acceptable site. Its drawbacks are limited services, possible difficulty obtaining water, private land ownership and no local utility interface.
- Edwards - This is generally a poor site. By many criteria, it is marginal, but it is poor considering flooding, water supply, private land ownership, biological sensitivity, and no local utility interface.
- Edmonston - The site complies with most criteria, however, overriding considerations of substantial shading by haze and fog and private land ownership used for grazing livestock render it unacceptable.

- <u>Rice</u> - Based on most criteria, this is an excellent site for solar development. However, the site is best suited for large scale development rather than for a pilot plant. The site's drawbacks for the Pilot Plant are related to its remoteness. Transmission lines would be required which cannot be justified for a 10 MWe facility. Also, lack of visitor facilities limit the site's usefulness for public accessibility.

Based on this analysis, it was concluded that Coolwater is the preferred site in California for development of the 10 MWe Solar Pilot Plant.

F. Alternate Use of Funds

1. DOE Alternatives

The 10 MWe Pilot Plant is an essential part of DOE's Solar Electric Program, which is an important element of the National Solar Energy Program which, in turn, is an important element of the overall National Plan for Energy Research, Development and Demonstration. These two National Plans were prepared in response to the requirements of the Energy Reorganization Act of 1974 (PL93-438), the Solar Research, Development and Demonstration Act of 1974 (PL93-473) and other legislation, and represent the optimum balance of funding for the various energy projects, including the subject project.

2. State Energy Commission Alternatives

The Commission's commitment of up to $800,000 over the life of the project is subject to approval by the Legislature for each year's allocation. The Commission's current solar program places emphasis on 6 program areas:

- Active hot water and space heating
- Passive space conditioning for buildings
- Wind-electric generation
- Solar thermal electricity
- Consumer and professional information services
- Planning and governmental projects

Funds must be allocated each year to the program areas. Alternative uses of the Pilot Plant funds would be to increase the budget allotments of some or all of the remaining 5 solar program areas.

One of the purposes of this Pilot Plant is to determine the net benefits and drawbacks of solar thermal electric generation as compared with these other solar programs.

G. No Project

If the Pilot Plant is not constructed, certain research-related benefits will not be available for commercial STE application. Important elements of DOE's solar research program will not be realized. Utilities and DOE will be confined to data provided by research of the 5 MWe STE test facility located at Albuquerque, New Mexico.

IX
ENVIRONMENTAL
TRADE-OFFS

IX. ENVIRONMENTAL TRADE-OFF ANALYSIS

A. Short-Term

The Pilot Plant's research benefits relative to the future application of commercial solar technology offset the plant's minor, short term environmental effects. However, the beneficial aspects would be somewhat negated if it was later determined that STE research and development activity never should have been performed due to unforeseen lack of merits relative to a superior form of solar generation.

B. Long-Range

The Pilot Plant will contribute to future decisions influencing the commercial use of solar energy which in turn will set in motion a series of environmental trade-offs. Assuming that coal, nuclear and solar energy forms will provide the major mix of future electrical generation, it is probable that solar energy's contribution will result in beneficial trade-offs. However, commercial STE application will not be without some adverse affects.

The degree of STE generation utilized could eliminate a proportional amount of coal mining, coal-induced air quality degradation, nuclear safety hazards and nuclear waste disposal. On the debit side, commercial STE plants will probably require (per unit of electricity produced) more mineral extraction for their material-intensive development and significantly more land area.

STE plant siting will not only be restricted by land and water constraints, but also by sunlight-diffusing air pollution. Locations near coal electric complexes where infrastructures could be conducive to increased populations in the southwest may prove to be unacceptable STE sites due to the consistent existence of fine-particle ash in the ambient air.

STE development will still require large amounts of oil and gas for mining, construction, operation and support in the foreseeable future.

Solar thermal development will probably be less net growth-inducing than similar capacity coal-fired plants due to less reliance on fuel mining, transportation and distribution; and due to its reduced manpower, air pollution control and other appurtenant requirements.

X
NATURAL
RESOURCES

X. DETAILED ANALYSIS: NATURAL ENVIRONMENTAL RESOURCES

The significance and magnitude of many of the following solar-specific impacts are generally unquantifiable and probably will remain so until the full benefits of the Pilot Plant's research aspects are realized. This Pilot Plant is in essence a "capital investment" in the determination of future impacts.

Sections X and XI contain an assessment of this Pilot Plant's potential impact on the environment and the effect of the existing environment on the plant's operation. Commercial development of solar/thermal electric stations would magnify these effects, but this report is confined to the proposed Pilot Plant. The longer term issues and impacts associated with construction and use of commercial solar/electric facilities are generally described in various energy publications and should be specifically analyzed prior to large-scale development. Sections V through IX do, however, contain references to the Pilot Plant's contribution to the realization of some of these inferred long-range impacts. An objective of the plant design, construction and operation is to determine the environmental impacts of solar thermal central receiver plants.

A. Geology

1. Current Status

a. Regional Geologic Setting

The site is located in the western portion of the Mojave Desert Geomorphic Province, one of eleven major geomorphic provinces within California. This province is bounded by the Tehachapi Mountains and the Garlock fault on the north and northeast, by the San Andreas fault, the mountains of the Transverse Ranges and the Colorado Desert on the south and southwest; and by the Basin and Range geomorphic province on the east.

The western Mojave Desert consists of broad alluvial filled plains and basins ranging in elevation between 2,000 and 3,000 feet, interrupted by isolated hills and valleys. Discontinuous northwest trending mountain ranges rise from several hundred to almost 3,000 feet above the surrounding terrain. Alluvial fans blanket the base of the mountains. There are many basins of interior drainage, resulting in the formation of dry lakes ranging in area from hundreds of acres to about sixty square miles.

The western Mojave Desert is drained by the ephemeral Mojave River, which flows northward from the San Bernardino Mountains through Victorville, then eastward by Barstow and Daggett, terminating at Soda Dry Lake in the eastern Mojave Desert, fifteen miles east of Afton.

This desert area is underlain principally by Mesozoic intrusive igneous rocks ranging from granite to diorite. There are also limited occurrences of older metamorphic rocks. These basement rocks form many of the topographic highs in the region. Tertiary volcanic rocks intrude or overlie the basement rocks in many areas.

Tertiary non-marine sediments occur in limited regions. Alluvial deposits of Pleistocene and Holocene age, ranging to several hundred feet in thickness, cover more than 50% of this desert area.

The dominant structural features in the region are the many northwesterly trending faults, several of which are at least sixty miles in length. Many of the longer faults are active based on evidence of ground displacement during Holocene time and on earthquake epicenters located on or near their traces. Vertical displacements along these faults has formed many of the hills and mountains as well as adjacent basins of interior drainage. Most of the older igneous rocks are strongly jointed from the regional stresses which produced the faulting.

b. Site Geology

The site is located on the old flood plain of the Mojave River in a 4 mile wide alluvial-filled valley. A five mile long dry lake bed occurs two miles north of the site and about a mile north of the river bed.

The valley is flanked by the Calico Mountains to the north and the Newberry Mountains to the south, both of which are composed principally of Tertiary volcanic and sedimentary rocks. Rocks of a portion of the Calico Mountains have been folded and faulted and dip about 35^{o} to the southwest. They are unfaulted in the portion of the mountains north of the Coolwater Generating Station.

Alluvial deposits in the valley consist of sand and gravel hundreds of feet in depth. These deposits, in turn, are underlain by indurated Pleistocene fanglomerates possibly several hundred feet in thickness. Based on sedimentary outcrops along the borders of the valley, Tertiary shale, sandstone and conglomerates many hundreds of feet in thickness are believed to underlie the alluvium and fanglomerates. Basement rock in the area consists of granite and diorite.

The site area was previously in alfalfa production and is nearly flat. Occasional small mounds of accumulated blow sand and small depressions exist throughout the 320 acre parcel that will contain the actual 130 acre plant site. A borrow pit exists at the southern portion of the 320 acre parcel.

c. Seismicity and Faulting

The site is considered to be in an area of moderate seismicity. The closest potential source for a major earthquake of magnitude 8 or more is the San Andreas fault, which passes sixty-five miles southwest of the site through Cajon Pass and north of the City of San Bernardino.

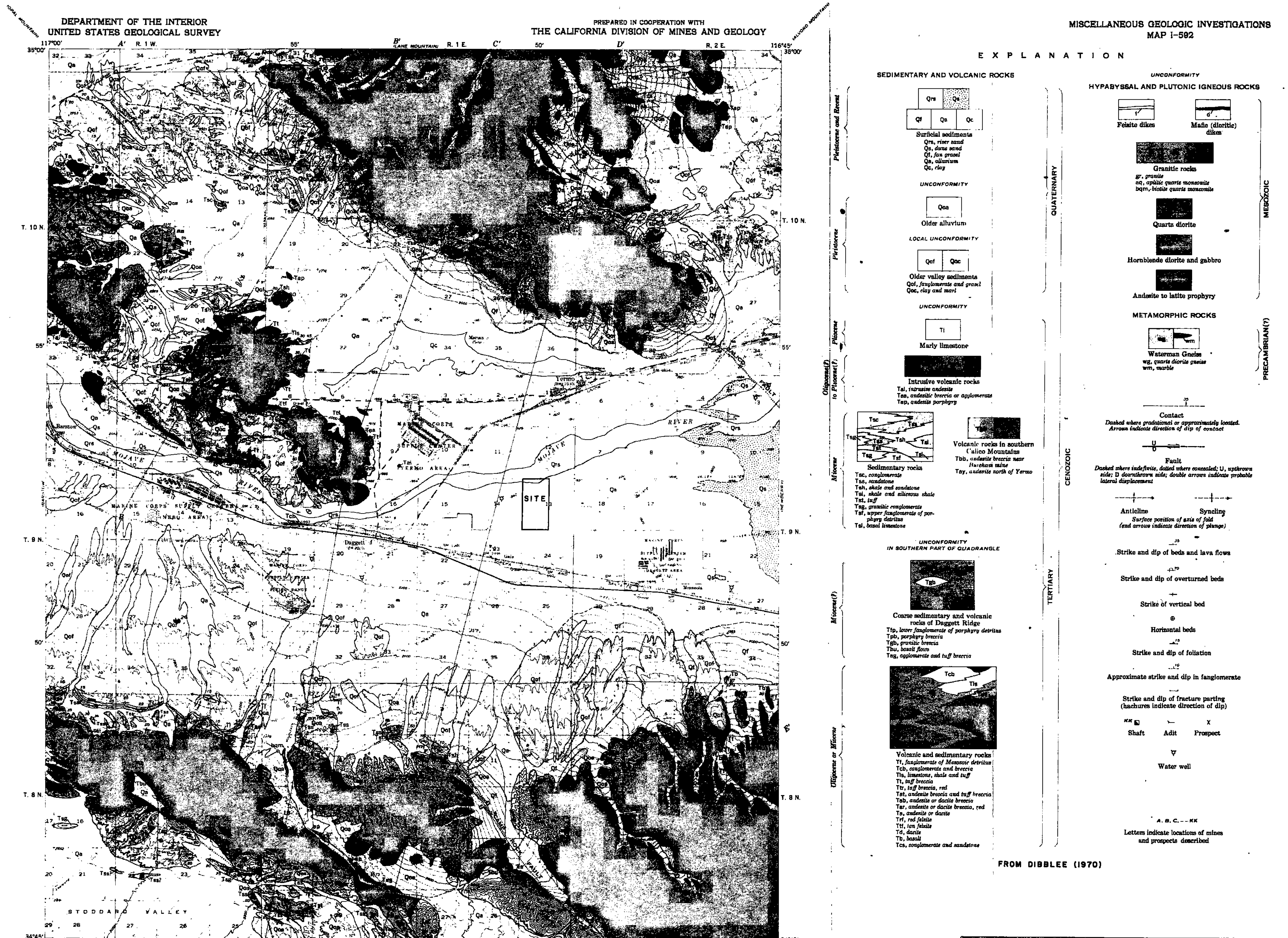
Within a radius of twenty-five miles from the site, there are five faults from fifteen to at least sixty miles in length, all of which can be considered active based on displacement of late

Holocene sediments and/or historic seismicity (Exhibits X-1 and X-2). All of these, except for the Manix fault, trend in a northwest-southeast direction. The faults appear to be steeply dipping with vertical displacements in the range of several thousand feet although there is also evidence for lateral displacement.

The longest of the five faults previously noted is the sixty mile-long Helendale fault, twenty-three miles southwest of the site. The forty mile-long Lenwood fault and the thirty mile-long Camp Rock faults are to the southwest, nine and three miles, respectively. The 50 mile-long Calico-Newberry fault is six miles to the northeast. The Manix fault, which trends east-northeast against the regional structural grain, ranges from eight to twenty-five miles northeast of the site.

Of the five faults previously noted, the Manix generated the largest historic earthquake, a magnitude 6.2 in 1947. A scattering of earthquake epicenters ranging from a magnitude of 4 to 4.4 have been recorded near the northern limit of the Calico-Newberry fault about nine miles northwest of the site. In addition to numerous earthquake epicenters near the southern terminus of the Helendale fault, recent trenching across its trace in Lucerne Valley, thirty miles south of the site, indicates relatively recent (Holocene) activity. (Exhibit X-2)

Probably the most likely source of strong shaking on the site would be an earthquake of a magnitude 8 or more on the San Andreas fault in the Cajon Pass/San Bernardino area or an earthquake on the Manix of a magnitude similar to the shock of 1947. It is

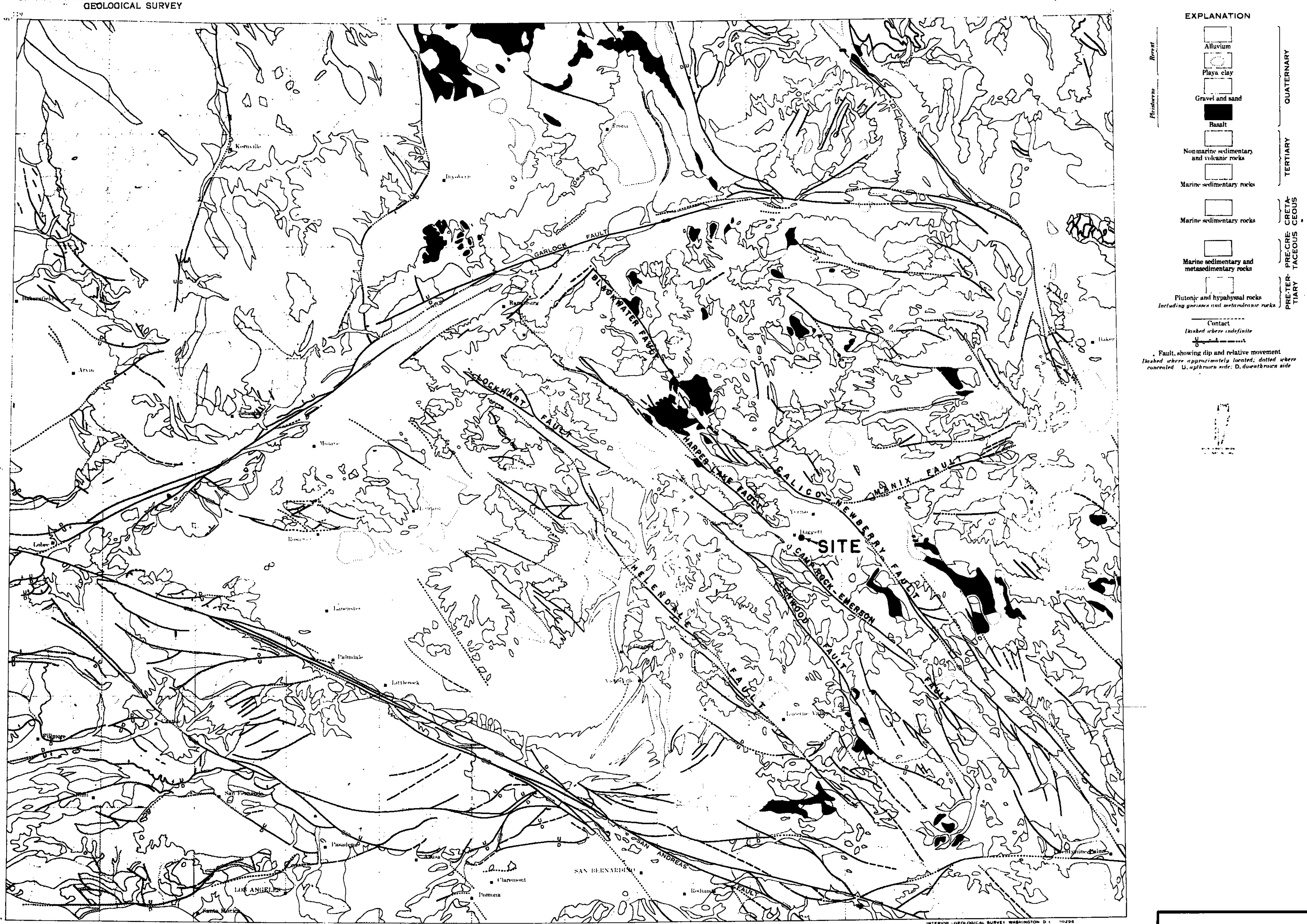


FROM DIBBLEE (1970)

10 MWe SOLAR PILOT PLANT

SITE GEOLOGY
EXHIBIT X-1

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY



GENERALIZED GEOLOGIC MAP OF THE MOJAVE DESERT REGION, CALIFORNIA

Scale 1:500 000

5 0 5 10 15 20 25 30 35 40 45 50 Miles

10 MWe SOLAR PILOT PLANT

REGIONAL FAULT MAP
EXHIBIT X-2

estimated that either event would produce an acceleration at the site on the order of 0.20 g to 0.25 g and a shaking intensity of about VII to VIII on the Modified Mercalli (MM) scale. Perhaps a slightly higher acceleration and more intense shaking would result from an earthquake centered near the site on the Calico-Newberry fault, but the possibility of such an event during the life of the project does not appear to be as great as strong shaking from an earthquake on the San Andreas or Manix faults.

d. Mineral Resources

Gold and silver have been mined in the Calico Mountains and Rodman Mountains north and south of the site respectively. Borates were taken from the region north of Daggett at the turn of the century.

Close inspection of the site did not disclose any economic mineral deposits or evidence of present or past mineral exploration, commercial mining or quarrying operations, other than the on-site borrow pit. The closest evidence of major commercial mineral production in the area is an old, deep borrow pit approximately a mile in length by 1000 feet wide adjacent to the railroad approximately 0.6 miles to the south (Exhibit II-4a). The coarse fanglomerate material removed was used for railroad track base. The river deposites at the site are much finer grained and do not contain sufficient gravel for this purpose (boring logs on file). The lack of gravel also precludes the potential for a profitable aggregate operation.

Bedrock is at least several thousand feet in depth and consists of continental sedimentary rocks and tuff breccia which would preclude the occurrence of oil and gas. Bowen (1954) states that Paleozoic rocks would be so highly metamorphosed that the possibility for the presence of oil and gas is extremely remote.

Within the near vicinity of the site there are no known faults or other structures which might be considered likely zones of significant mineral deposits. The great depth of alluvium in the area would essentially preclude bedrock mining operations even if valuable minerals were discovered in bedrock under or near the site.

2. Project Impact/Mitigation

a. Topographical Alteration

A minimum of surface ground leveling will be required over approximately 100 acres for heliostat and facility installation. Any new access roads to and around the site will follow the natural ground contour, therefore, landform alteration will be extremely minor. Although unlikely, if excess dirt is needed on the site, it will be taken from the local, existing borrow pit. (See Section B, "Soils", for additional impact assessment.)

- Mitigation

None Required.

b. Seismicity

Ground shaking from an earthquake is an impact of the existing environment on the Pilot Plant itself. Environmental impacts are not just those stemming from a project's effect on the environment. The only significant geologic hazard to the site would be ground shaking produced by a large magnitude earthquake on the San Andreas fault or an earthquake of moderate magnitude generated on a relatively nearby fault. There is no evidence to suggest surface faulting through the site area.

The probability of accelerations of 0.25g or greater at the site was computed knowing the life expectancy of the Pilot Plant and the number of events that are expected to occur. The probability of an event causing 0.25g acceleration or greater at the site within the next 5 years (expected period of research and development activity) is about 2-1/2% and about 14% within the next 30 years (SCE).

A quake of lesser magnitude might result in the need for major facility repairs. Surface rupture during ground shaking is a minute possibility. Vulcanism has historically occurred in the region, but its potential for affecting the site is unquantifiable and remote.

Even slight ground shaking could affect heliostat/receiver alignment, however the computerized solar tracking system would automatically make minor adjustments.

- <u>Mitigation</u>

The granular nature of the alluvium on the site, and the relative depth of the water table will preclude settlement or liquefaction from earthquake shaking.

The steel tower and the receiver structure will be designed to withstand a 0.25 "g" horizontal seismic load input at the base of the tower. (The Coolwater Generating Station is designed for a maximum ground acceleration of 0.25 g). This is based on a probable magnitude 6 quake, 10 miles from the site.

The occurrence of significant ground shaking during the Pilot Plant's 5 year research and development period might prove valuable in determining seismic design criteria for possible future commercial solar plants.

(c) Off-Site Geology

The mining of the minerals needed to produce the Pilot Plant equipment may be intensified since more glass and steel per megawatt capacity is required for a solar collection plant than for a fossil fuel station. (See Chapters V and VI and IX). Type B407 (nickel and chrome) material may be used in the receiver, requiring mining of semi-rare metals. (Exhibit X-3)

- Mitigation

The utilization of improved technology resulting from research and development of this Pilot Plant to reduce material requirements would be of significant value.

B. Soils

1. Current Status

The surface soils on the site are predominately well to poorly graded sand. Below 5 feet, the soils are predominately sandy. At depths greater than 10 feet, the soils are generally well

EXHIBIT X-3

CRITICAL MATERIALS REQUIREMENTS FOR STE PLANTS*
(tons/MWe)

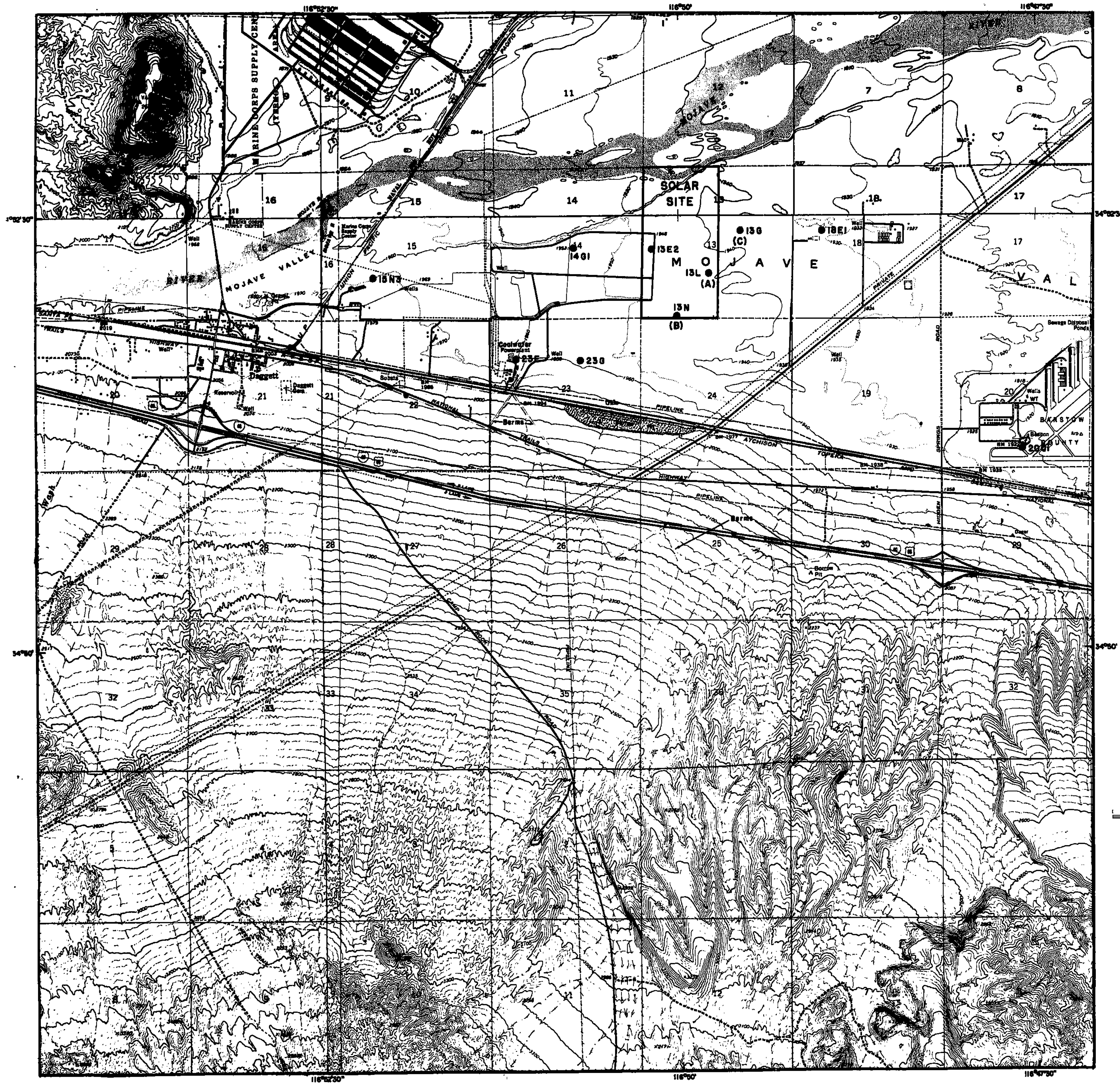
	Central Receiver
Steel	500-700
Concrete	1500-2500
Glass	50-100
Aluminum	20-50
Copper	5-10
Plastic	5-20
Insulation	20-40
Chrome/Titanium	1-2
Silver	0.01-0.05
Miscellaneous	5-10

*Source: MITRE Corporation, Analysis & Planning Support for DOE DSE.

graded sand with some silt and some gravel. Soil within the top five feet is only moderately firm and contains some silty sand lenses. Where moderately heavy foundation loads were imposed on spread or mat type foundation at the Coolwater site the top 5 feet of material was excavated and recompacted. Very heavy loads are adequately supported on the cemented, dense gravelly sands at a depth of 10 feet. There are no soft, compressible layers below a depth of 5 feet. At a depth of 5 feet, spread or mat type foundations have a bearing capacity of 5,000 pounds per square foot (psf).

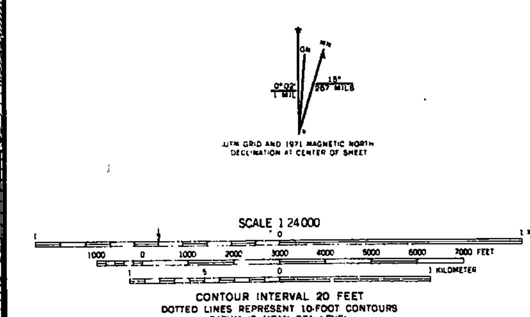
At a depth of 10 feet the bearing capacity is 10,000 psf. Both of these recommended bearing capacities consider a settlement of about 1/2-inch with 90% of the total settlement occurring during construction. The angle of internal friction of these sandy soils is approximately 35°. Foundation problems at this site due to weak or compressible soils are not anticipated even for very high loading.

In late 1976, and early 1977, three new water wells (A,B&C) were drilled for Coolwater Units 3 and 4. These wells are located in Section 13 to the south and east of the preferred 130 acre site (Exhibit X-3a) and are the closest deep borings to the site. Boring depths were 371 feet for Well A, 400 feet for Well B and 380 feet for Well C. Each boring was continually logged and sampled every 10 feet. (Boring logs are on file for reference.) Soils logged from Well A, consisted of a medium to coarse grained sand. Well B showed predominately medium to



EXPLANATION

● 13E2 WATER WELL



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TOPOGRAPHIC MAP OF SITE REGION WITH LOCATION OF WATER WELLS
EXHIBIT X-3a

coarse grained sand to 300 feet. Below 300 feet a distinctive lithologic change occurred with a high percentage of volcanic gravel in a sandy clay matrix. This is interpreted to be Pleistocene fanglomerate originating in and sloping north from the Newberry Mountains. Well C material consisted primarily of medium to coarse sand. A cross section was not made because of the lensing nature of the river deposits.

In 1972, percolation tests were conducted for the design and installation of a commercial sewage disposal system for the Coolwater Generating Station. Six trenches were excavated near the existing cooling towers to depths ranging from 58 to 132 inches. Soil logs are presented in Appendix A. Hand-dug percolation holes 6 to 18 inches in diameter and 8 to 12 inches deep were then placed in the bottom of the excavations. The percolation holes were pre-saturated overnight before the tests were conducted. Procedures used for the tests are outlined in the "Manual of Septic Tank Practices", 1971 edition, published by the U. S. Department of H.E.W.

The percolation time of the test holes ranged from a low of 2 to a high of 4 minutes per inch with an average of 3 minutes per inch. The percolation time is considered adequate for septic tank usage. A tabulation of the test results is shown on Exhibit X-4.

2. Project Impact/Mitigation

a. Surface Leveling - Wind Erosion

Approximately 100 acres may be surface graded if necessary to provide adequate drainage off of the heliostat field and central

EXHIBIT X-4

PERCOLATION TEST RESULTS

Test Hole	Depth Below Adjacent Grade in Inches: Bottom Backhoe Pit	Depth Below Adjacent Grade in Inches: Bottom Percolation Hole	Percolation Time in Minutes per Inch
1	66	77	3
2	62	74	2
3	69	77	3
4	58	68	4
5	62	73	2
6	63	73	2

facility area. (The site's topography includes small depressions and dune hummocks that possibly formed after farming ceased.) Leveling will strip the parcel of vegetation and will break the recently formed thin soil crusts created by particle sorting thereby exposing some of the finer silts and clays in the top soil layer (see log borings) to wind and water erosion. Since the site is essentially flat, most soil loss will be via wind erosion. After an unknown period of time the fines will have been carried off by moderate to heavy winds and/or will combine by rain action to form additional crusts. Even the relatively large sand particles will be moved by heavy wind storms. This lack of ground cover and soil crusts will persist well beyond the construction stage and resulting dust may effect the heliostat's solar collection potential, thereby necessitating a more intense mirror washing schedule.

A non-SCE farming operation 1/2 mile east of the site would be the closest downwind recipient of blowing dust and sand.

- Mitigation

Surface leveling might be avoidable if sufficient alignment compensation for slightly uneven terrain could be incorporated into each heliostat base. However, construction activity alone will probably disturb site soils as much as would leveling. Temporary erosion control measures are available including sprays, blanket materials and wind screens, but will probably not be required. The heliostats, combined with alterations of ground heating, may decrease wind speeds thereby reducing wind erosion within the collector field, but increased turbulence could create the need for additional mirror washing. (See X-D/Climate) Water run-off to the ground from heliostat cleaning will aid in combating wind erosion.

Shade tolerant grasses could be planted under the heliostats for soil retention and dust prevention. (See X-E/Air Quality). A layer of gravel could also be considered. However, soil erosion and dust are probably not significant enough constraints to the Pilot Plant operation to warrant paving or other forms of soil cover or treatment since the projected use of the Pilot Plant is relatively short term. (See "Air Quality" section for an additional analysis of fugitive dust potential.)

b. Various Excavations

Construction of tower, heliostat and building foundations will result in an approximate net soil displacement (excavated volume) of 5000 cubic yards. Trenching for cable and pipeline laying will probably not displace significant amounts of soil. The containment basin to be constructed around the heat storage unit (to retain oil leaks) should not result in excess excavation since all excavated dirt from the basin will be used for the dikes.

- Mitigation

The well logs indicate that soil types are fairly consistent to the depth that would be excavated for the deepest foundation. Therefore the excess soil could be distributed over the 100 acre portion of the parcel to be distributed without substantial effect, other than a possible increase in fines susceptible to short-term wind erosion and a slight dilution of soil organics. The excess soil could also be utilized for the containment basin dikes. Plant construction will not require soil stock piling on or exportation off the site since any excess can be spread out over the disturbed area.

c. Soil Settlement/Consolidation

The 200 ton, 325 foot high receiver tower will result in significant pressure under its 50 square foot foundation. Settlement, especially after soil saturation from heavy rains, could affect tower (and even heliostat) alignment. Slight ground subsidence from ground-water overdraft is also a possibility (see "Hydrology").

- Mitigation

The foundation design will incorporate soil constraint engineering data stemming from recent construction of Units 3 and 4 at SCE's Coolwater Generating Station, 1/4 mile west of the Pilot Plant site. The proposed foundation (built to a depth of 15 feet below surface) should adequately support the tower at that soil depth. Site-specific soil strengths will be determined and utilized in foundation design.

d. Soil Compaction

After site leveling is finished, construction and operation vehicles will compact soils, especially on dirt roads and in the collector field along heliostat washing routes. Soil compaction increases velocities and amount of runoff, decreases percolation, decreases aeration, reduces soil moisture, increases soil temperature fluctuations, restricts plant growth/seed germination and displaces or kills burrowing wildlife. (Wilshire et al. - See Bibliography).

- Mitigation

Moist soils will be more susceptible to compaction than when dry. Roots of bermuda or other type grasses could help to keep soil pores open even along paths used by trucks for automated heliostat washing. Off-road driving should be held to a minimum. Rejuvenation and aeration of the site's sandy soils for future farming uses (for example) could be achieved by deep plowing.

C. Hydrology

1. Surface Runoff

a. Current Status

Precipitation accumulates in the Newberry Mountains south of the site and flows down the alluvial fan toward the Mojave River bed via dendritic channels and ephemeral washes. Most of the runoff that would normally reach the site is diverted by the railroad berm and the deep borrow pit south of Interstate 40 and is also channelled away from the site through culverts. The remainder of the runoff is directed to a drainage course through the Coolwater site and channelled eastward where it spreads over the flat terrain in Section 23. The Department of Water Resources (1967) estimated that 800 acre-feet of water was the annual runoff from the 140,000 acres of mountains surrounding the entire lower Mojave

Basin using a higher than average annual rainfall of 6.9 inches. Only a small portion of this total runoff flows along the fan as indicated by its lack of significant erosion.

The extreme northern portion of the SCE property is traversed by the wide ephemeral multi-braided Mojave River bed. Surface river flow in the site area occurs only during floods. Over-flowing of the river banks is a minute possibility and therefore does not pose a serious threat to the site (County Flood Control Department). Major site flooding has never occurred during SCE's tenure on the property.

The site is located on a nearly flat, (maximum 2 foot relief) old flood plain adjacent to and above the existing flood plain of the Mojave River. The surface of the site contains several broad shallow channels crossing from the southwest toward the northeast. Runoff on this surface would be sheet flow toward the river. There are no major gullying or other forms of severe erosion on the site. A small closed depression exists in the southwestern portion and probably ponds water during heavy storms. Some gullying and headward erosion occurs at the river bluff on the northern part of the site. The potential for water induced erosion on the site is very low due to the flat terrain, permeable sandy soil and the diversion of most of the runoff from the Newberry Mountains away from the site.

b. Project Impact/Mitigation

(1) Surface Runoff

Surface levelling will remove ponding depressions and will generally augment sheet flow along the existing north east trending gradiant to the River. Small runoff diversions may be constructed around the various foundations to prevent localized ponding. The thermal storage containment basins and surrounding dikes will require slight channelization of normal sheet flow drainage.

The heliostats, with mirrors in a "collection position", will actually cover approximately 22 acres (24%) of the 90 acre collector field. Rain water running off the imprevious collector surfaces will therefore be more concentrated, but should not significantly increase runoff amounts or velocity since the porous sandy soils will still accomodate normal precipitation. Runoff from heavy rainfall (i.e., thundershowers) falling on the field may be slightly increased, resulting in some gullying, but will not require major channelization. Paving the surface under the 90 acre heliostat field would definitely increase runoff velocity and amounts thereby affecting downstream conditions, but such impacts will not be quantified since paving is not presently being considered. Compacted dirt roads in the heliostat field used for automated heliostat washing will tend to channel and increase speed and amounts of runoff. General soil compaction will increase runoff. Application of a dust control chemical could decrease soil permeability and thereby also increase runoff.

The off-site visitor center's paved parking lot will also concentrate runoff, slightly modifying down stream flow patterns. The Pilot Plant would be more affected by flooding than would the adjacent Coolwater Generating Station due to the large, spread out collector field, however, the proposed site is not vulnerable to significant flooding potential.

The following quantification (cubic feet/second) of increase in storm runoff from the site after project completion was performed by the County Flood Control District.

An accurate value for increase in runoff from the site cannot be calculated at this time because the final plant layout has not been developed and detailed studies of soil and hydrologic conditions have not been made. However, an approximation of the surface runoff can be made based on using a runoff coefficient typical of flood plain deposits occurring along the Mojave River and by taking the average historic maximum intensities between stations at Red Mountain, 56 miles to the northwest, and the town of Needles, 112 miles to the east.

The maximum land area to be covered by structures and parking facilities is expected to be approximately 80,000 square feet. Assuming an additional 80,000 square feet of paved roadway and considering that the total area of the heliostat foundations would probably not exceed 40,000 square feet, the combined area of essentially 100 percent runoff would be 200,000 square feet, or approximately 5 acres within the 130 acre site. Site earthwork and grading in unpaved areas is not expected to significantly affect the runoff coefficient. Using a runoff coefficient for the existing undeveloped site of 0.2 and a one hour maximum rainfall intensity of 1.1 inch, maximum runoff from the site under present conditions would be 26 cubic feet per second. Runoff from the developed site would total approximately 30 cubic feet per second, representing an increase of 15%.

Because of the nearly flat terrain (0.004 percent gradient) and near absence of well developed drainage courses, most of this runoff would be in the form of sheet flow which would not cause significant erosion on or off the site.

- Mitigation

If heavy runoff from the heliostats causes gullying in the collector field, the mirrors could be placed in vertical positions thereby significantly reducing the amount of impervious surface (mirror faces) and increasing available porous surface (soil).

Paving in the collector field should be avoided if possible. If dust control measures requiring paving or some sort of soil erosion control become necessary, runoff collection devices should be installed north and east of the field to accomodate increased flows and keep them from eroding non-paved areas. Possibly a culvert would be required to channel runoff to the river bed in order to reduce chances of headward erosion on the river bank.

Roads in the heliostat field should include runoff berms or channels. Less total net soil compaction might result over the field

field if dirt or paved roads were not constructed along each row or "arc" of mirrors. Heliostat-washing trucks could probably traverse the field without graded roads. A study should be made to determine the actual need for roads in the field and runoff facilities should be designed accordingly.

The actual 130 acre site consisting of 90-100 acres of concentrated facilities should be positioned on the 320 acre parcel far enough south of the Mojave River bluff to be free of erosion channels leading to the bluff and the headward erosion affecting the bluff.

2. Ground Water Supply and Quality

a. Current Status

(1) Hydrogeologic Conditions

The Lower Mojave River Valley is an irregularly shaped north-easterly trending valley that covers an area of about 300 square miles. It contains the Lower Mojave Hydrologic Subunit, the Troy Hydrologic Subunit and the Caves Hydrologic Subarea as delineated by the Department of Water Resources.

These various subunits and subareas essentially cover the Mojave River tributary drainage area between the U.S. Geologic Survey stream gaging stations at Barstow and Afton. The groundwater within the Lower Mojave River Valley occurs primarily within alluvial deposits. The recent alluvial channel between Barstow and Daggett is quite narrow. East of Daggett in the vicinity of the site, the alluvial area widens considerably.

The alluvial materials that comprise a large part of the water-bearing deposits in the Lower Mojave River Valley are composed of sand, gravel, silt and some clay. A study of available water well logs indicates that there are no continuous fine-grained beds that would create confined or perched water conditions. The fine-grained materials appear to be in the form of lenses within sand and gravel deposits.

Rising water occurs at several locations along the channel of the Mojave River, namely, upstream of the Calico-Newberry fault at Camp Cady Ranch and at Afton Canyon.

The heterogeneous, water-bearing alluvial deposits that constitute the ground water basin are primarily the result of stream erosion of the adjacent highlands. These alluvial deposits average about 300 feet in thickness, within a range of a few feet to over 1,000 feet. The saturated portion of these deposits averages about 360 feet in depth.

The specific yield of the water-bearing alluvial deposits varies throughout the basin. The average specific yield is approximately 14% with a range from 3 to 25%.

(2) Groundwater Movement

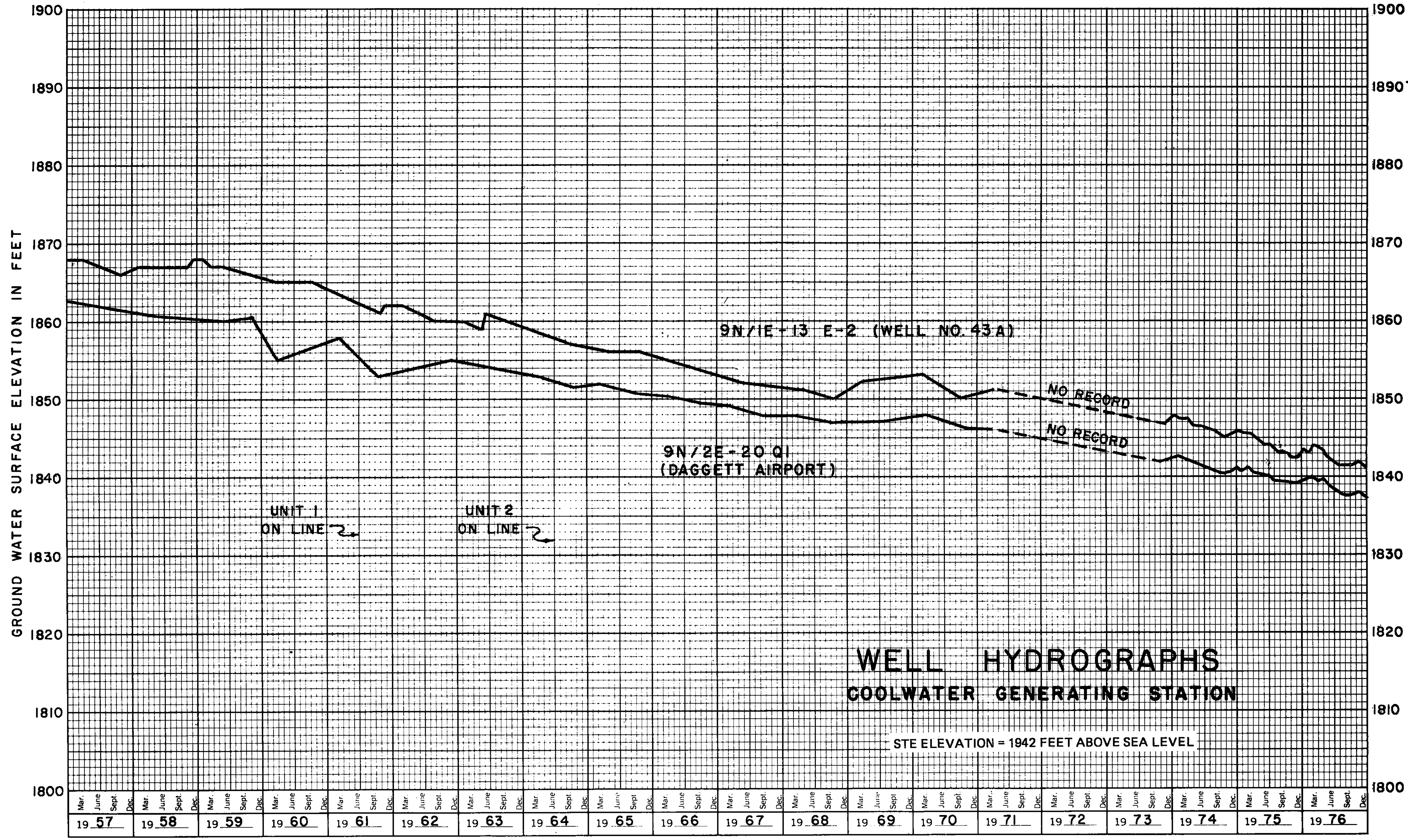
The groundwater within the Lower Mojave River Valley moves in a general easterly direction. The source is the north slopes of the San Bernardino Mountains to the south.

There are at least two faults in the lower Mojave River Valley that have a known effect on the movement of groundwater. The

Waterman fault creates an offset in the ground water surface of about 45 feet just easterly of the Nebo Supply Depot as determined by exploratory drilling performed by the U.S. Geologic Survey. The Calico-Newberry fault causes a difference in water levels of 50 to 60 feet on either side. It diverts the groundwater (on the western side) southeasterly toward Newberry and therefore it has the most pronounced effect on the movement of groundwater in the Lower Mojave River Valley.

Exhibit X-5 illustrates historic fluctuations in groundwater level in the vicinity of the site and downstream in the Lower Mojave River Valley. A cumulative water supply surplus or deficiency curve is presented in DWR Bulletin No. 84 for the base period of 1936 to 1961. Comparison of the two figures shows that, in general, water levels in the area increased from 1936 to about 1945, but decreased from 1945 to the present. Overdraft conditions began in about 1953. Coolwater Units 1 and 2 went on line in 1961 and 1964, respectively, (as shown on Exhibit X-5), using ranch water previously used for farming.

Groundwater gradients through the Lower Mojave River Valley vary widely. The narrow alluvial trench between Barstow and Daggett has a very steep gradient of about 20 feet per mile. The area between the site and the Calico-Newberry fault has a very flat gradient of about 1.5 feet per mile. The gradient from the Calico-Newberry fault to Camp Cady is about 10 feet per mile.



10 MWe SOLAR PILOT PLANT

WELL HYDROGRAPHS
EXHIBIT X-5

(3) <u>Sources of Water Supply</u>

a) <u>Surface Water</u>

The main source of surface water into the Lower Mojave River area is that of the Mojave River through the Barstow Narrows. The U.S. Geological Survey (U.S.G.S.) has established gaging stations on the Mojave River at Deep Creek, West Fork of the Mojave, Victorville, Barstow and Afton. The surface flow into and out of the lower Mojave River Valley is measured by the gages at Barstow and Afton. It should be noted that the cumulative flow at Victorville generally exceeds 25,000 acre-feet in a water year before any surface flow is measured at Barstow. The studies of W. P. Rowe indicate that 12,500 acre-feet must pass Barstow before water levels in the Lower Mojave River Valley rise. As mentioned above, rising water occurs at Afton, therefore, surface flow occurs throughout most of the year. The mean annual surface flow passing the Barstow gage for the period 1930-1965 is 16,430 acre-feet per year. The average surface discharge at Afton based on 16 years of record is 1,350 acre-feet per year.

b) <u>Subsurface Inflow</u>

A reliable estimate of underflow does not seem possible at present because of the absence of more data pertaining to permeability of the river alluvium and adjacent older alluvium, an area of the saturated underflow section. The minimum estimated annual underflow, using the U.S.G.S. estimated permeability and an average hydraulic gradient, is about 1,750 acre-feet per year. The maximum underflow estimated by employing the Department of Water Resources average measured permeability of 2,700 gallons per day per square foot (gpd/ft^2) and the same average hydraulic gradient is about 4,700 acre-feet per year. A reasonable reconciliation of these could be obtained by using a median permeability of about 2,000 gpd/ft^2, therefore the average annual underflow is estimated to be about 3,500 acre-feet per year. For comparison, SCE pumps approximately 8,000 acre-feet of water per year.

(4) Chemical Analysis of Groundwater

Chemical analysis of groundwater from those wells located in the area of the project are on file with the County. U.S.G.S. well number 9N/1E-15N3 is located approximately 2 miles west of the site. U.S.G.S. well number 9N/1E-13E2 is located on the site and U.S.G.S. well number 9N/2E-18E1 is located approximately one mile east of the site. These analyses cover a period from 1952 to present. The groundwater is considered to be of high quality, suitable for beneficial uses as outlined in the following section.

(5) Beneficial Water Uses

The California Regional Water Quality Control Board, Lahontan Region, is the agency responsible for water quality control in the Barstow area. In its "Water Quality Control Plan Report" May, 1975, Lahontan has identified beneficial water uses for the Mojave River groundwater as follows:

- Municipal and domestic supply - includes usual community use and individual use for domestic purposes.

- Agriculture supply - includes crop, orchard and pasture irrigation, stock watering, and all uses in support of farming and ranching operations.
- Industrial supply.
- Water-contact recreation - includes all recreational uses involving actual body contact with water, such as swimming, wading, water sports (water skiing, skin diving and sport fishing).
- Non-water-contact recreation - recreational uses which involve the presence of water but do not require contact with water, such as picnicking, sun-bathing, hiking, aquatic life study, camping, aesthetic enjoyment, pleasure boating, and water fowl hunting.
- Freshwater habitat - provides freshwater habitat for fish, water fowl and wildlife.

(6) Groundwater Pumpage

It is estimated that about 1/3 of the pumpage for the City of Barstow or about 1,500 acre-feet comes from the area downstream of the Barstow stream gaging station. The 1969 pumpage within the Lower Mojave River Valley is estimated to be on the order of 45,900 acre-feet (approximately 6 times that of SCE's). The 5-year average pumpage of SCE has been 7,836 acre-feet. This includes agricultural use as well as industrial use.

SCE and the 13 other parties, who pump more than 1,000 acre-feet per year, constitute more than 55 percent of the pumpage in the Lower Mojave River Valley. Municipal and other industrial uses account for about 10 percent of the pumpage, the remainder being agricultural use.

(7) Well Water Characteristics

Water needs at Coolwater Generating Station are supplied by deep well turbines at SCE Well No. 11, 12, and 13, developed in 1957, 1961 and 1972, respectively. Three new supply wells designated A, B and C were developed in late 1976 to early 1977 for Coolwater Units 3 and 4. Available data on these wells are shown in Appendix B. Well logs are on file and well locations are shown on Exhibit X-3a. The water-bearing formation is predominately a medium to coarse grained sand. Twelve hour pump tests show that the sediments have a high permeability with a 30 minute recovery for a 30 foot drawdown. The tests show a sustained yield of 3,000 gallons per minute (gpm) for 35 feet of drawdown. Wells A, B and C were designed for a sustained yield of 2,000 gpm. The tests results are on file.

(8) SCE's Current Water Use

Edison currently pumps approximately 8,000 acre-feet of water annually from groundwater beneath the site. Approximately 2,800 acre-feet are used for Coolwater Units 1 and 2 and the remainder is used for irrigation in SCE's agriculture operations. In 1978, Coolwater Units 3 and 4 will be in operation and will divert an additional 4,000 acre feet annually from agriculture use. For the purpose of this EIR, it is assumed that 50% of the Ranch's irrigation water (flood application) will percolate to groundwater. This estimate is probably high, but is accepted by the State Department of Water Resources and the local Mojave Water Agency (per Coolwater EIR).

The net water use will be as follows:

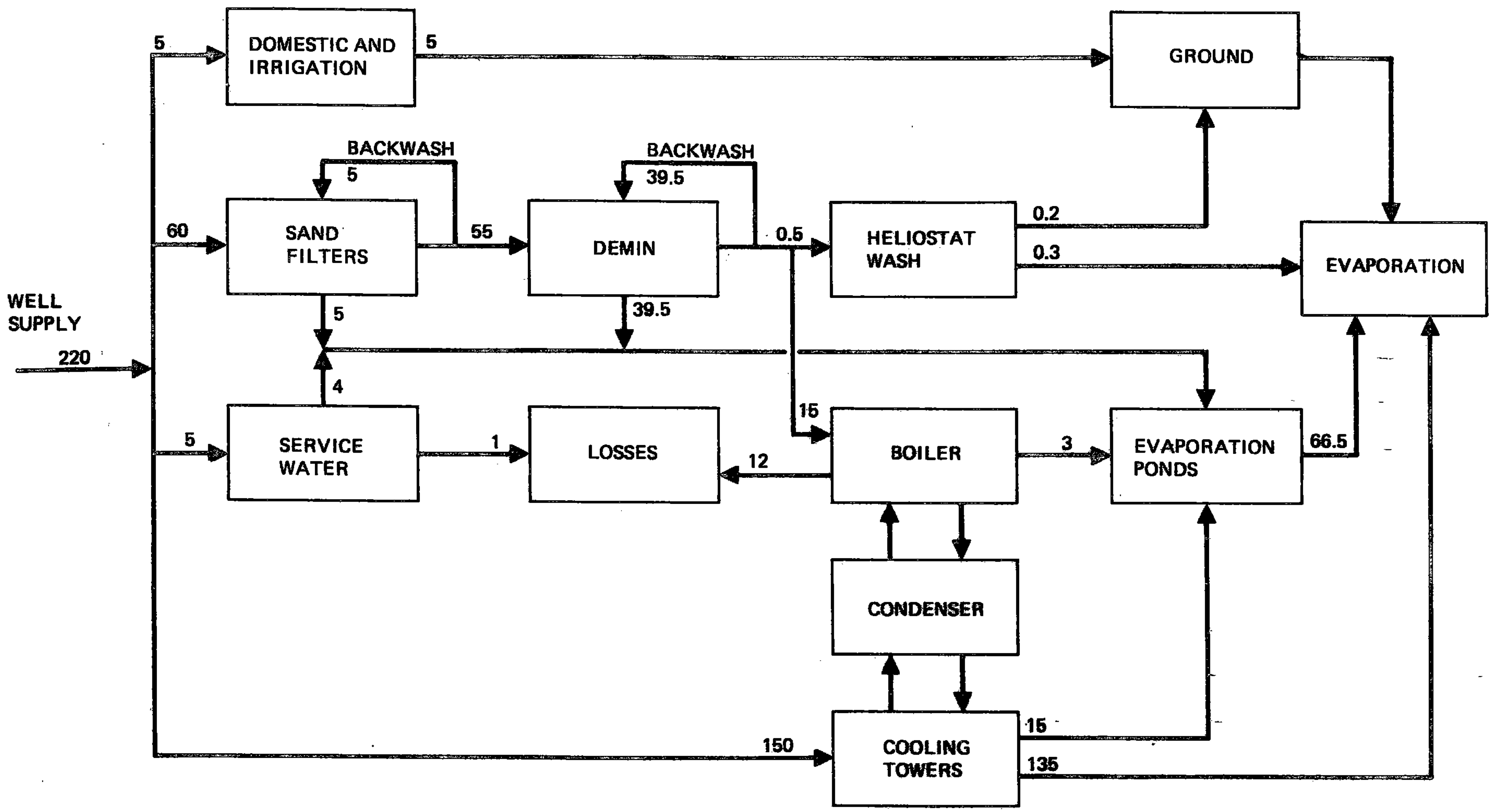
Coolwater Units 1 and 2	-	2,800 acre-feet
Coolwater Units 3 and 4	-	4,000 acre-feet
Pilot Plant	-	220 acre-feet
Irrigation	-	980 acre-feet
Total		8,000 acre-feet

b. Project Impact/Mitigation

(1) Groundwater Use

The Pilot Plant will require approximately 220 acre-feet of water per year for plant cooling, steam supply make-up, heliostat washing, domestic uses, etc. (See Exhibit X-6 for a graphic description of water requirements). This water will be supplied by one or a combination of the new wells (A, B & C) recently drilled on and adjacent to the site. (See Exhibit X-3a) A net increase in SCE's pumping rates will not be required since the Pilot Plant's water will be diverted from recent SCE agricultural use. It must be noted that some of SCE's Coolwater Ranch alfalfa plots were taken out of production in the past few years, so while the 220 acre-feet of water will not constitute a net increase in SCE's historic groundwater withdrawal, it will be an increase over SCE's present pumping as of 1977.

The Pilot Plant's water requirements will be approximately 3% of SCE's most recent 5-year average agriculture and power plant pumpage. After Coolwater Units' 3 and 4 are on line, the Pilot Plant's requirements will constitute the same percentage since the new units



NOTE: NUMBERS ARE IN ACRE-FEET PER YEAR AND ARE BASED ON PARTICIPANTS BEST ESTIMATE UTILIZING PRELIMINARY ENGINEERING DATA.

10 MWe SOLAR PILOT PLANT

WATER USE DIAGRAM
EXHIBIT X-6

annual 4,000 acre-foot requirement will be diverted from agriculture.

An exchange of water from alfalfa irrigation to Pilot Plant use results in more consumptive water use. Approximately 50% of irrigation water (by flooding method in the sandy soil of the Coolwater Ranch) is eventually recharged to groundwater and the other 50% is transmitted to the relatively dry atmosphere by evapo-transpiration (combination of direct evaporation and transpiration to air through vegetation). The Pilot Plant's use of water for cooling will result in direct evaporation to the atmosphere via the cooling towers. The remaining water's total dissolved solids (TDS) content will be too high to allow percolation to groundwater since groundwater quality is superior to the plant's wastewater. High TDS blowdown effluent will be conveyed to the existing Coolwater evaporation ponds where it will evaporate to the atmosphere, leaving behind a mineral residue. Therefore the use of 220 acre-feet of water for irrigation recharges 110 (+ or -) acre-feet to groundwater but the project's use of approximately 220 acre-feet of water is almost totally consumptive. Only a small fraction of the heliostat wash water and treated domestic waste water will reach the groundwater table. Although the project will require no net increase in historical or recent pumping, approximately 110 acre-feet more water will be consumed, assuming worst case condition.

This impact is not considered significant due to the Pilot Plant's low water requirement relative to available groundwater. However any use of overdrafted groundwater in the desert should be totally assessed. Presently proposed increases in upstream pumping by the City of Barstow and others may eventually contribute to the Lower Mojave River Basin's overdraft.

The potential for significant surface subsidence due to ground water withdrawal in the vicinity of the Pilot Plant is small. The water table at well No. 43A, at the west side of the site, has dropped 27 feet in the last 19 years, at an average rate of 1.4 feet per year. No significant settlements have been observed in this time interval. In the proposed 5 year life of the project, the water table will drop approximately 7 feet. It is unlikely that significant settlements due to groundwater withdrawal will occur during this period because the aquifers are composed of dense river alluvium. The amount of further consolidation expected to occur as a result of the removal of water is very slight.

Current information indicates that the project's required water pumping rates can easily be met by existing wells without significant drawdown or "cone of depression" interference with adjacent wells. The cone of depression for SCE supply wells 11, 12, and 13 has been closely monitored. At the end of 1976 the limit of the cone of 10 foot drawdown covered an area of approximately 3 square miles, centered at well no. 11. The limit of 30 feet of drawdown covered about 2/3 square mile, and occupied the lower portion of section 14. With the addition of three new wells to the supply system, the cone of depression due to SCE's industrial and agricultural use will expand in area. Because the total withdrawal of groundwater will remain constant at 8,000 acre-feet per year, the maximum drawdown will be less at any location than that produced by a smaller well field. The new wells - designated A, B, and C - are located in section 13, and will therefore cause the cone of depression to elongate to the east, parallel to the Mojave River.

The Pilot Plant's water requirement is compared with that of a fossil fuel combined cycle plant approximately as follows:

$$\text{Solar} - \frac{220 \text{ acre-feet/year}}{10 \text{ megawatts}} = 22 \text{ acre-feet/megawatt/yr.}$$

$$\begin{array}{l}\text{Combined Cycle}\\ \text{Fossil Fuel}\end{array} - \frac{15{,}000 \text{ acre-feet/year}}{1250 \text{ megawatts}} = 12 \text{ acre-feet/megawatt/year}$$

The higher water requirement of the Pilot Plant (relative to a combined cycle plant) per unit of electricity production is due to the reduced cycle efficiency of the Pilot Plant when compared with fossil fuel cycles.[4]

- <u>Mitigation</u>

Although the Pilot Plant's use of groundwater does not constitute a significant environmental impact, certain mitigation measures relative to the use of overdrafted groundwater supplies should be considered by the utility consortium.

SCE could eliminate even additional alfalfa production in order to further negate the impact of the Pilot Plant's water requirement and also to reduce SCE's contribution to the Lower Basin's groundwater overdraft. However, SCE has leased the farming operation not only for profit, but also for the ability to continue groundwater pumping in order to establish historical pumping "rights" in case groundwater is adjudicated (apportioned) in the future. Groundwater is presently available to any legal landowner who can install a well. However, if groundwater was to be adjudicated, only certain users would be allowed to pump certain amounts based on a factor of their past usage.

SCE is caught in a dilemma typical to regions where groundwater is being overdrafted. In order to "preserve" the legal right to continue pumping at historic rates when water rights are adjudicated, pumpers must presently extract groundwater, thereby contributing to the overdraft, even if they would prefer not to. If SCE determined that alfalfa farming was not marginally profitable relative to its use of water that could be "preserved" for future power plant cooling purposes, SCE would still be obligated to continued pumping to protect longterm water interests. In essence, water must be currently used to protect rights to its future use. This system is hastening the need for eventual importation of water from northern California.

The Pilot Plant's water consumption rates per unit of electricity could possibly be reduced comparable to those required by combined cycle plants by increased technology. The research aspects of this Pilot Plant could include reduction of water requirements. If the desert areas of the nation are to become logical sites for solar thermal plants, the critical siting constraints related to water shortages will have to be circumvented. It should be noted however, that the main purpose of the Pilot Plant is to develop and demonstrate solar related technology. Adding another variable (such as dry cooling) to the effort may only complicate the research and development program.

A significant reduction in the project's slight contribution to groundwater overdraft could be achieved by SCE's utilization of the polluted subsurface "slug" of historic wastewater that is presently creeping downriver toward the marine supply station, which is upstream from SCE's property.

This "slug" is thought to contain phenols, high levels of TDS, detergents, etc. all stemming from historic, unregulated percolation of waste effluents from Barstow's old sewage system and from the Santa Fe Railroad switching yard's oil disposal and train washing operation.

SCE, the City of Barstow, AT&SF Railroad, and the Lahontan Regional Water Quality Control Board staff are presently determining the feasibility of using 500-1500 gpm of this wastewater in the cooling towers of Coolwater Units 1 and 2. (1000 gpm = 1612 acre-feet per year assuming full time pumping. This is 57% of Units 1 and 2 annual requirement.) A recent Lahontan mandate requires the slug's withdrawal from the groundwater basin (by pumping) and subsequent disposal by means other than percolation. The wastewater plume is probably sufficiently intact to allow extraction via strategically placed wells. SCE's use of this "water" would fulfill Lahontan's order and would reduce extraction of good quality groundwater by a like amount. Ownership of the "slug" would have to be negotiated prior to actual use. It is possible that the City of Barstow could obtain federal and state Clean Water Grant Funds and reimburse SCE for subsidizing the City's and Santa Fe's cleanup responsibilities. SCE's customers will not have to absorb the cost.

The wastewater could probably not be used in the Pilot Plant's cooling towers because:

1. The plant requires high quality water for research and development purposes. (Detergents in the "slug" could create foam in the cooling towers).
2. The Pilot Plant is 1/2 mile further from the "slug" than Coolwater Units 1 and 2.
3. The Pilot Plant's operating lifetime of 5 years is too short to justify the extra capital cost of accomodating the wastewater (purifiers, anti foaming chemical, mixing tanks, extra pipelines, etc.).
4. The City of Barstow, Santa Fe Railroad and Lahontan would require a longer term commitment for the use of the water since it could take 10-35 years to cleanout both the "slug" and the mixed groundwater that will eventually be drawn into the "slug" due to heavy pumping.

If 1600 acre-feet of the "slug" could be used annually in Coolwater Units 1 and 2, a like amount of good quality water will remain in the basin, thereby more than mitigating the Pilot Plant's annual with-drawal of 220 acre-feet per year. This assumes that SCE could still retain pumping credit relative to use of the wastewater slug.

The possible use of wastewater for Coolwater Units 1 and 2 will not be described further since it only indirectly mitigates the Pilot Plant's water-related impact. It can be concluded that the benefit to groundwater conservation would be well worth the effort if it is feasible and if grant funds can be obtained.

(2) Heliostat Washing

Mirror washing could be required at least once a month in order to allow optimum solar reflectivity to the receiver (DOE). This section will include a detailed description of washing techniques. The water requirement probably constitutes mirror washing's greatest degree of impact, however periodic cleaning could also provide added moisture to soil at localized areas, distribute mirror cleaning additives onto the soil and into the surface/subsurface water supplies, and contribute to vehicular traffic over otherwise undisturbed areas of the Pilot Plant site. (See other related sections for additional analysis of the impact).

The following is exerpted from MDAC's proposal to DOE:

- Mirror Washing Frequency

Reflector cleaning may be required every 30 days rather than as corrective maintenance, thereby permitting realistic washing equipment quantity/sizing and manpower estimates with the least risk of error. Variable weather conditions are the most important factor in determining when cleaning is required; however, the data obtained during the limited test period tends to indicate a 30-day frequency is a reasonable approach. The scheduled maintenance concept requires two tanker trucks (operated by two men each) approximately four hours to clean 88 mirrors each day. Cleaning will be accomplished in the pre-dawn and early morning hours and will require approximately 20 working days to complete an entire field of approximately 2300 heliostats.

Only limited data have been obtained to date for heliostat washing and reflectivity degradation under field conditions. The above maintenance approach is based on these data and the relative merit of alternative concepts to provide an acceptable cleaning technique. Additional field test data are required to fully define reflectivity degradation rates, especially for seasonal effects and severe weather conditions. Natural cleaning resulting from dew, frost deposits, rain and snow also need to be further evaluated to determine the effects on cleaning frequency requirements. The optimum heliostat orientation during various weather conditions needs to be identified to minimize reflectivity degradation and/or take advantage of natural cleaning.

- <u>Quantity of Cleaning Solutions Used</u>:

The MDAC mirror washing procedures developed during the Collector Subsystem Research Experiment (SRE) Program may utilize a proprietary cleaning concentrate made by the McGean Chemical Company, Inc., designated CB120.

- Approximately one gallon of wash solution is used, comprised of 5% cleaning concentrate and 95%

deionized water. (Deionization is necessary to rid groundwater of total dissolved solids and will be performed on site. Details of this procedure are not yet available.)

- Approximately five gallons of deionized water are used for rinsing each of the mirrors. (Assuming 6 gallons of water for each heliostat per month, total water requirements will amount to 1/2 acre-feet per year or approximately .2% of total project water use.)

- <u>Mirror Washing Concept and Procedures</u>:

Results of the testing program performed during the Phase I contract indicate that the heliostat reflective surfaces can be effectively washed using pressure spray nozzles and the following application technique:

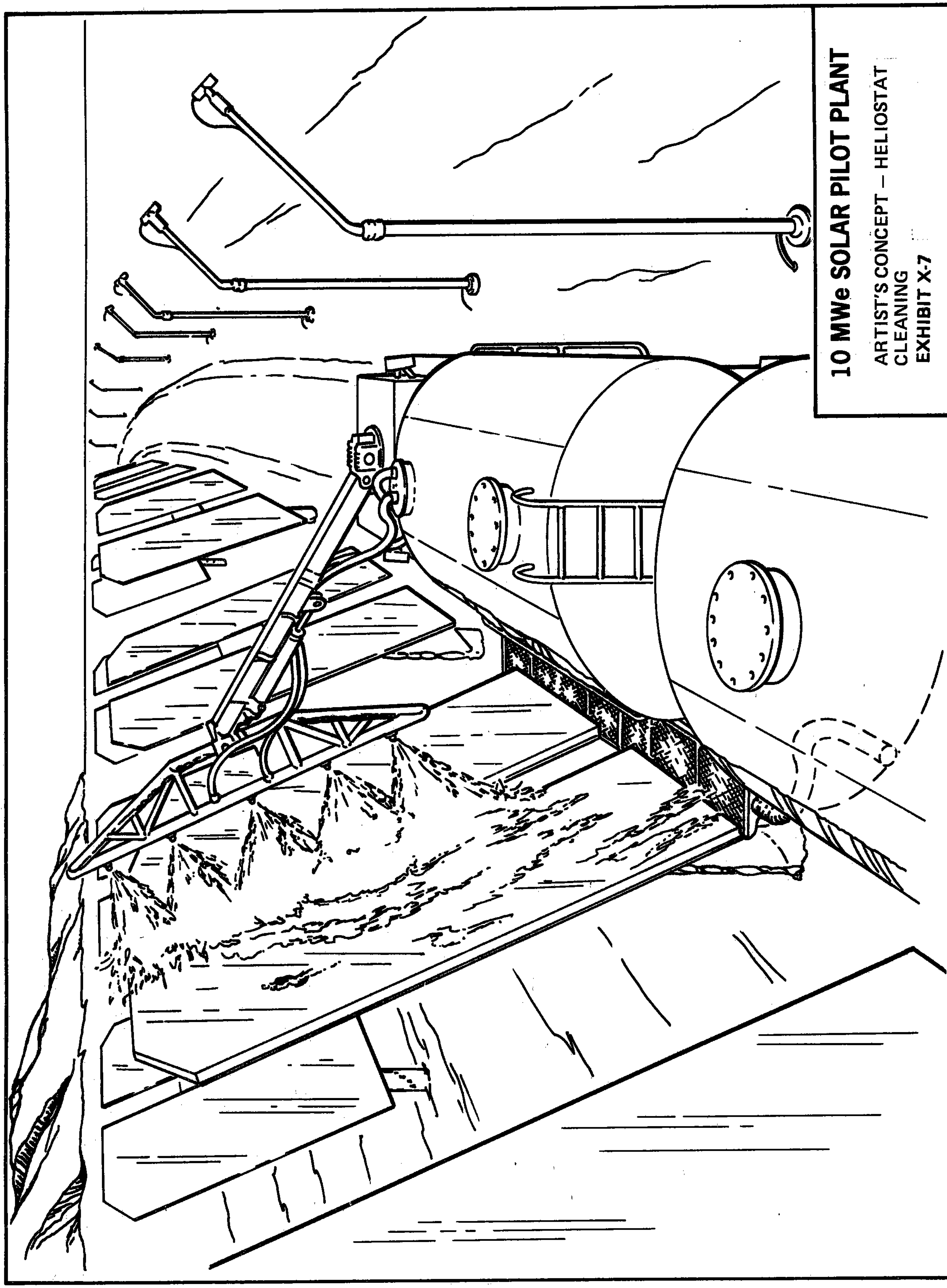
1. Apply approximately one gallon of wash solution (5% cleaning concentrate, 95% deionized water) in approximately one minute to heliostats oriented with surfaces near vertical.
2. Allow approximately one minute dwell time for the wash solution to act on surface contaminates.
3. Rinse with approximately 5 gallons of deionized water applied in approximately 2 minutes.

The washing operation should be conducted with the heliostat surfaces facing away from the sun and/or preferably during the pre-dawn and early morning hours. This procedure takes advantage of the cleaning action afforded by any dew which may have formed and avoids premature drying of wash solution or rinse water.

Implementing this technique involves utilization of a tanker truck (see Exhibit X-7) which carries both the wash solution and rinse water, as well as a holding tank. The truck is fitted with the necessary valving, controls, and pressurization system for fluid application at the flow rates indicated. Fluid is applied by a multiple nozzle array which extends from the side of the truck and provides the controlled spray patterns necessary for both wash and rinse functions. A fluid catch basin extends from the truck and is positioned under the heliostat to retrieve and transfer the wash solution and rinse water into a holding tank. This assumed requirement to prevent spillage of wash solution and rinse water was a significant factor in selecting this approach over other promising alternative methods.

- Mitigation

It has been assumed by DOE that the wash/rinse water solution would be collected by the cleaning trucks either for reclamation and re-use or for disposal to the existing Coolwater evaporation pond. Since cleaning water availability is not a significant constraint (unless made so by the deionization process) and since heliostat washing requires a small amount of water relative to the total plant's requirements; energy - equipment - manpower costs could be reduced by allowing the used washwater to percolate into the soil. This assumes that the cleaning solvent proposed by DOE does not contain chemical substances harmful to soil, vegetation, wildlife, humans, etc. As long as the solvent's contents remain proprietary, it is difficult to assess its net impacts and the best re-use and disposal methods. Modification of



10 MWe SOLAR PILOT PLANT

ARTIST'S CONCEPT — HELIOSTAT CLEANING

EXHIBIT X-7

the MDAC cleaning method could be very cost effective, especially in terms of less energy requirements for shorter truck operating times for both washing and disposal. The washwater could irrigate shade tolerant vegetation (i.e. bermuda grass) which would reduce both soil erosion and fugitive dust. If the cleaning solvent would be harmful to soil, vegetation or groundwater quality (assuming it would percolate through 110 feet of sandy soil), and if some form of vegetation under the heliostats is desirable, it might be cost effective to use another, less harmful solvent or none at all. Firm commitments to a particular cleaning fluid should not be made until various products have been tested. (See Sections VIII and X-F.)

(3) Groundwater Quality

Water quality degradation resulting from the Pilot Plant's normal operation is not a significant concern for the following reasons:

1) There is no perennial surface water on or near the site.
2) The groundwater table is 100-110 feet below the surface.
3) Percolation through most desert soils purifies domestic wastewater of most harmful bacteria.
4) No new technology specific to solar power is required. As in the case of a conventional electric plant, the bulk of the Pilot Plant's blowdown wastewater from cooling towers, filters, boiler, and demineralizers will be ejected to the existing 130 acre sealed Coolwater evaporation pond in a controlled manner. Wastewater will not percolate to groundwater.

The evaporation pond contains cooling water effluent from the existing Coolwater Units 1 and 2, and is large enough to accomodate wastewater from pending Coolwater Units 3 and 4 plus wastewater from the Pilot Plant. Appendix C contains a description of the normal and potential sources, quality and disposal of plant wastewater.

- Mitigation

The level of project effect on potential groundwater quality is low due to the inherent mitigating factors described in Appendix C. The existing Coolwater evaporation ponds will easily accomodate the cooling and blowdown effluent emenating from normal operation of the Pilot Plant. The ponds have been constructed to withstand any flooding or seismic shaking expected on the site, thereby protecting groundwater from percolating pond spillage. An on-going groundwater monitoring program further protects groundwater quality from percolating effluents.

The content of heliostat wash water should be confined to demineralized water (without chemical cleaning additives) in order to allow "irrigation" of ground cover on the heliostat field and to eliminate the minute possibility of groundwater contamination.

Site soils will adequately "treat" coliform and other bacteria in septic tank effluent before it reaches groundwater. Its TDS content will not noticeably add to the groundwater's dissolved solids.

The possibility of spillage of heat storage oils is remote. The containment basin and dikes would prevent spilled oil from spreading, however the unsealed basin bottom would allow slow percolation. The relative depth to groundwater minimizes the impact.

The containment structure's primary purpose is fire control. Spent fluids should be reclaimed and re-used. Presently available industrial chemical disposal methods will be adequate to handle non-reclaimable flushed fluids.

D. Climate/Meteorology

1. Current Status (provided by SCE, ERDA, & County)

In 1972 Hovind, et al.,[5] conducted an on-site meteorological field study for the Coolwater Units 3 and 4 expansion approximately 1 mile west of the 10 MWe Pilot Plant site. The data provides significant insight to the area's existing climatology.

The field program was designed to provide the following data:

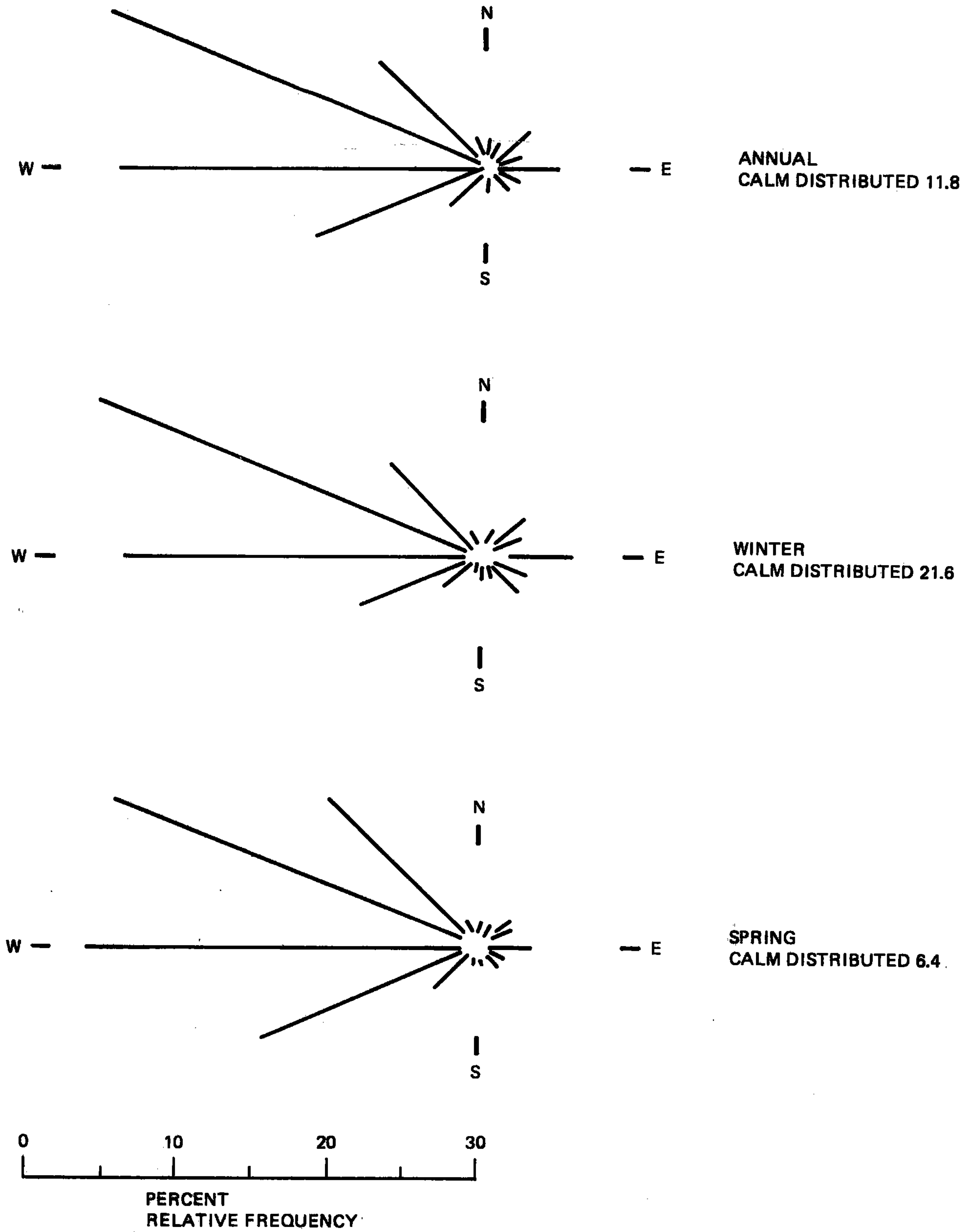
- Continuous collection of wind and temperature data at the Coolwater site and Barstow-Daggett Airport during the period from February 4, 1972 to May 31, 1972, in order to determine the suitability of extrapolating the climatological data from airport records relating to site data.
- Operation of special aircraft flights during morning and afternoon twice per week, during the period February 21 to March 30, 1972, to record vertical profiles of temperature and humidity above the station.
- Collection of air quality data to determine the concentrations of basic air pollutants in the immediate vicinity of the station.

The results of this analysis are presented in this report. Since these data are the most recent and representative available, and in view of the positive correlations between the separate meteorological data collected at the station and the airport, the results provide a reasonable representation of the year-around meteorological conditions likely to exist at the Coolwater Generating Station and the Pilot Plant site.

a. Winds and Streamline Patterns

The basic wind flow patterns over Southern California are largely the result of seasonal semi-permanent weather features in the general circulation pattern of the atmosphere. In addition, the low level winds in the complex terrain of the desert are influenced to a large degree by local topographical features. The historical wind data available for the Barstow-Daggett Airport with the annual and seasonal wind roses for the period (1955-1964) are shown in Exhibit X-8. The predominance of wind from the west-south-west, west, west-northwest, and northwest directions at the airport are the direct result of wind channeling and large scale flow through the Mojave River area west of the Coolwater Generating Station. The above four direction sectors comprise a total of 74% of the annual wind direction frequencies.

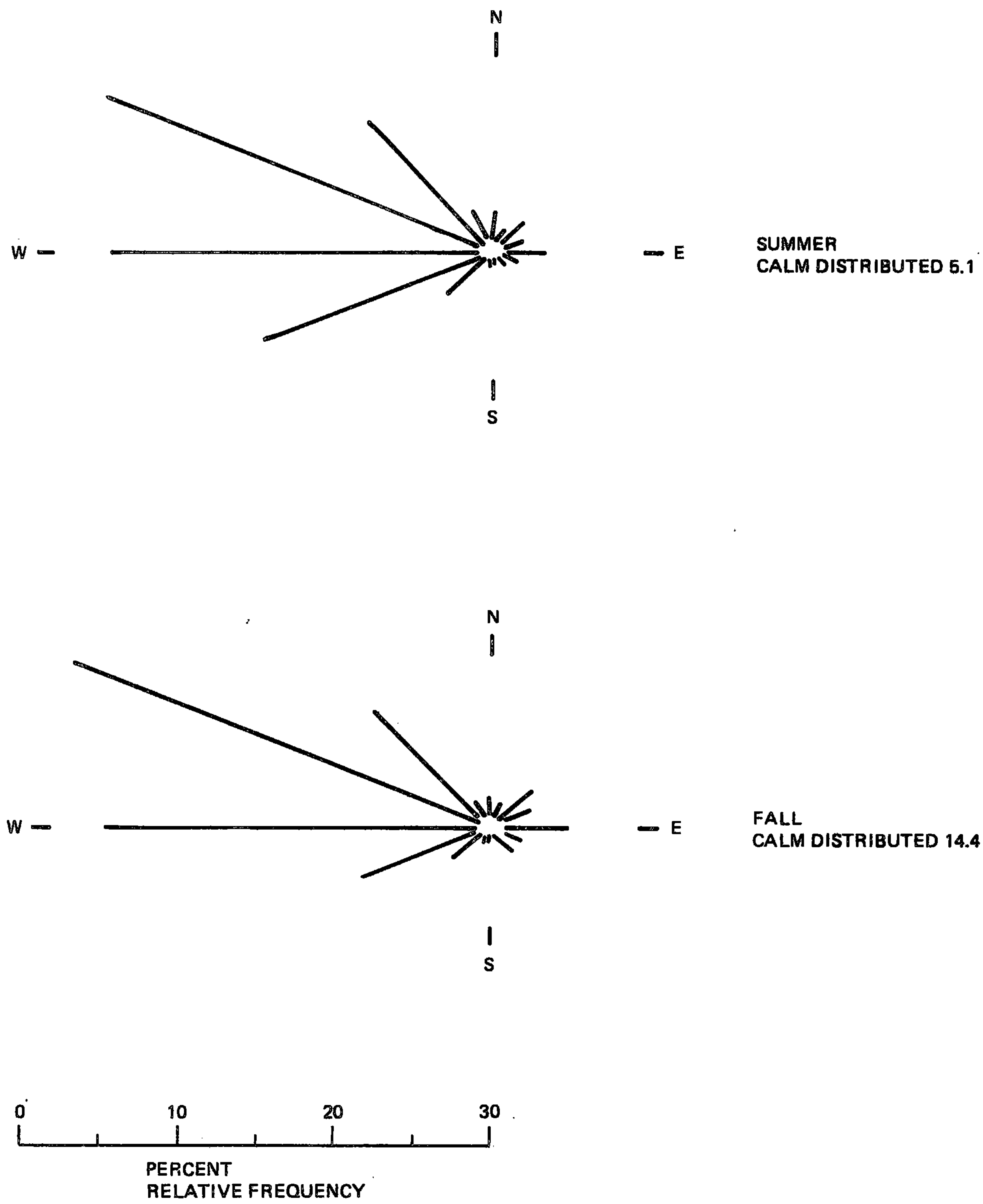
A recording aneometer was installed at Coolwater during the period February 4 to April 12, 1972 in order to determine whether the historical wind records from the airport 2-1/2 miles east of the Pilot Plant site were suitable for making dispersion calculations appropriate for the station. Concurrent wind records for both



10 MWe SOLAR PILOT PLANT

ANNUAL AND SEASONAL WIND ROSES (1955-1964) BARSTOW-DAGGETT AIRPORT

EXHIBIT X-8



10 MWe SOLAR PILOT PLANT

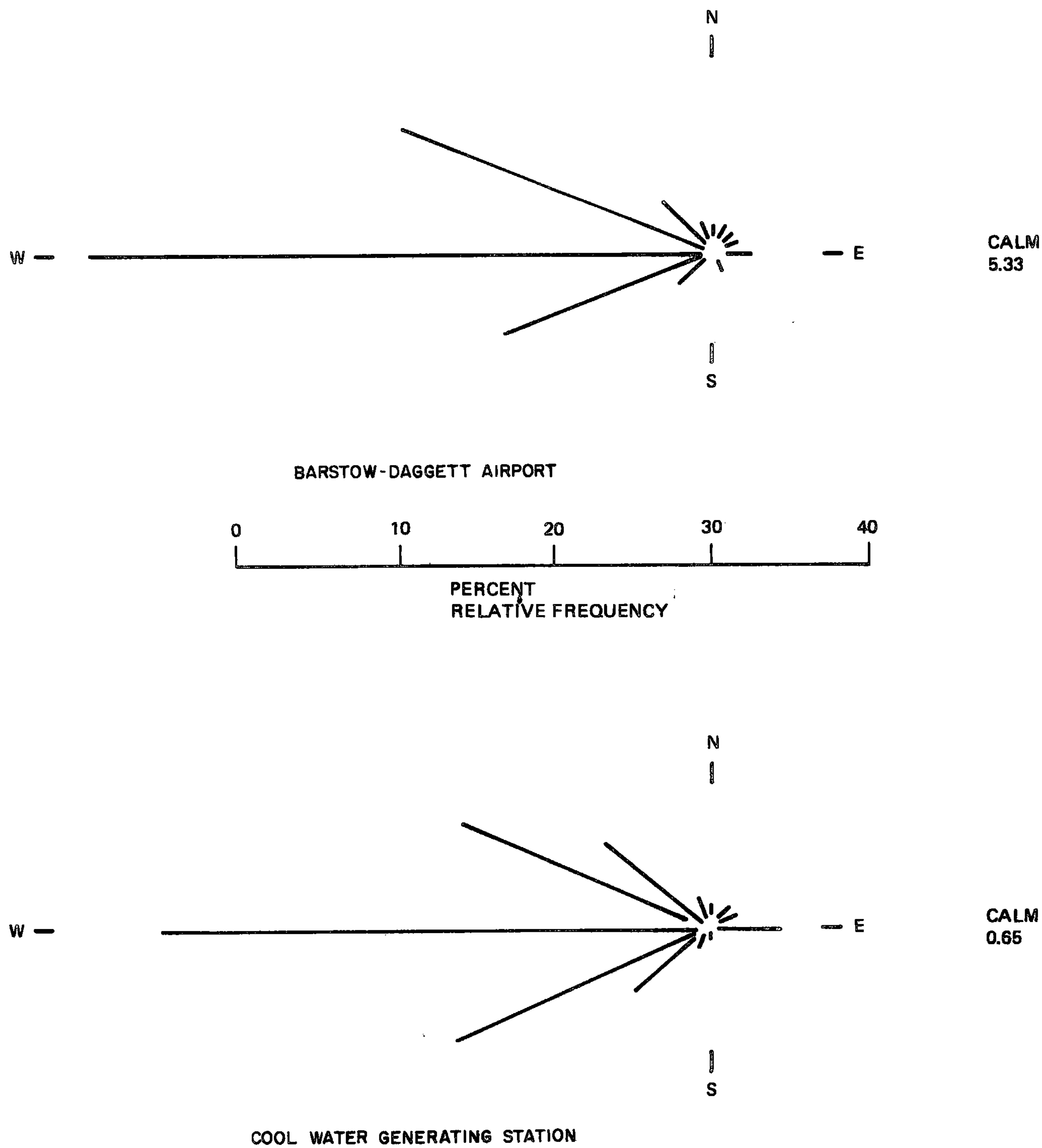
ANNUAL AND SEASONAL WIND ROSES (1955-1964)
BARSTOW-DAGGETT AIRPORT
EXHIBIT X-8 (CONTINUED)

locations for the above period were tabulated into wind rose form, the results of which are shown in Exhibit X-9. This exhibit shows that there are no significant differences in wind direction between the site and the airport during the two-month sample period. The remaining part of the year is expected to be equally as comparable, however, there may be slight variations (SCE).

A comparison of average wind speeds between the two sites was also made. Calm conditions occurred less frequently at the Pilot Plant site (0.65%) than at the airport (5.33%). This difference is due in large part to differences in anemometer sensitivity, the Coolwater anemometer being more sensitive than the wind sensor at the airport. Overall, however, wind speeds tended to be slightly greater at the airport than at Coolwater. This difference is attributed to wind speed measurement procedures. Wind speed measurements at the airport are taken on ten minute averages. The measurements at Coolwater were determined by an observer making an hourly, quantified observation typically over a one- to two-minute period.

It was concluded from the above analysis of concurrent wind measurements that: (1) significant wind differences between the two sites were not evident and (2) historical wind data from the airport were applicable for determining air-mass dispersion characteristics at the Pilot Plant site.

From all the data available, it can be concluded that the percentage of occurrence for winds of 30 mph velocity would be approximately 2-3% of the time, and winds with a velocity of 40 mph



10 MWe SOLAR PILOT PLANT

WIND ROSE (FEBRUARY 4 – APRIL 12, 1972)
BARSTOW-DAGGETT AIRPORT (UPPER)
AND COOLWATER GENERATING STATION
(LOWER) EXHIBIT X-9

would occur 1% or less. Blowing dust and sand may be a problem in the region 7-10 days out of a year.

b. Temperature and Relative Humidity

The temperature and relative humidity variations in the Coolwater-Daggett area are typical of the desert. Diurnal temperature fluctuations are large, ranging up to 30^{o} to 40^{o}F or greater.

Maximum temperatures in January range from 55^{o} to 65^{o}F. The maximum July temperatures vary from 95^{o} to 105^{o}F. An analysis of fifteen years of data (1956-1970) presented in Exhibit X-10 shows a January average maximum temperature of 60.0^{o}F and a July average maximum of 103.3^{o}F. The January average minimum is 34.9^{o}F, and the July average minimum is 72.6^{o}F.

Humidity values in the Coolwater-Daggett area are typically low during the afternoon (15-25%) increasing to a maximum in early morning as the minimum temperature is reached. Based upon data from nearby locations, the typical morning maximum humidity should be on the order of 60-70% during winter and 30-40% during the summer. This pattern is altered with the passage of winter and spring storm systems and with the periodic intrusion of tropical air over Southern California during the summer.

c. Precipitation

Precipitation in the high desert area is quite variable from season-to-season and year-to-year. Analysis of fifteen year of precipitation data (1956-1970) for the airport is listed in Exhibit X-11 The monthly average precipitation is at a minimum in May and June

Exhibit X-10. Temperature Data Barstow-Daggett Airport (1956-1970)
10 MWe Pilot Plant Site

Temperature (F)	Month J	F	M	A	M	J	J	A	S	O	N	D
Mean Maximum*	60.9	65.7	70.9	77.9	87.2	96.8	103.3	101.4	94.2	82.8	69.2	61.1
Mean Minimum**	34.9	39.9	44.0	49.7	57.7	65.9	72.6	71.7	64.2	54.1	42.7	35.2
Monthly Average	47.9	52.8	57.4	63.8	72.4	81.3	87.9	86.5	79.2	68.4	55.9	48.1

Average Annual 66.8

*Mean Maximum - Average of daily maximum values
**Mean Minimum - Average of daily minimum values

Exhibit X-11. Precipitation Summary Barstow-Daggett Airport (1956-1970)
10 MWe Pilot Plant Site

Precipitation (Inches)	Month J	F	M	A	M	J	J	A	S	O	N	D
Average	0.31	0.32	0.28	0.31	0.07	0.05	0.31	0.60	0.51	0.22	0.37	0.35
Maximum 24-Hour	0.73	0.70	0.88	0.65	0.37	0.32	0.96	2.06	1.11	0.66	1.08	1.01
Maximum Monthly	0.98	1.50	1.01	1.83	0.49	0.32	0.96	3.22	2.31	1.01	1.74	2.02
Minimum Monthly	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Average Annual 3.70

with 0.07 and 0.05 of an inch, respectively. The maximum usually occurs in August and September with 0.060 and 0.51 of an inch, respectively, reflecting the occurrence of late summer thunderstorms. Both the 24-hour maximum of 2.06 inches and the greatest monthly average of 3.22 inches of precipitation have occurred in August, however it should be noted that thunder shower activity is not widespread. The average annual precipitation at the site is 3.70 inches.

Precipitation in the area is usually in the form of rainfall. Occasionally, however, an exceptionally strong cold frontal system will move through the area with precipitation in the form of snow. During the period 1956-1970, a total of fifteen snowfall occurrences have been noted at the airport, with eleven amounting to only a trace. The greatest monthly snowfall during the above period was 13.0 inches in December, 1967.

d. Air-Mass Dispersion Characteristics

Distributions of atmospheric stability were determined from hourly meteorological data from the airport according to a method recommended by Turner[6]. The data base covered a ten-year period (January 1955 - December 1964). The stability distributions are divided into six classes that range from extremely unstable (A) to moderately stable (F). Unstable conditions (A, B, C) typically occur during the late morning and afternoon hours with clear skies and light wind speeds. Neutral conditions (D) are commonly associated with overcast conditions and moderate winds during day or night. Plume dispersion is most effective with unstable and neutral atmospheric stabilities and least effective with stable conditions.

Neutral stability (D) occurs most frequently from February to September. Stable conditions (E, F) are most frequent from October through January. In desert regions, a large portion of stable conditions occur at night or early morning hours during calm, clear conditions. Unstable conditions (A, B, C), while occurring less frequently than either neutral or stable conditions, reach a maximum frequency of occurrence during the summer months, especially during thunder storm and frontal activity.

Exhibit X-12 lists the monthly seasonal relative percent frequency of occurrence of each stability class. The exhibit shows, for example, that for a typical December, meteorological stability types A, B, C, D, E, and F occur 0, 5.6, 12.8, 30.8, 20.5, and 30.3% of the time, respectively. Exhibit X-13 presents the annual distribution of stability class categorized by wind direction. This exhibit shows, for example, that a north-westerly wind is associated with the meteorological stability types A, B, C, D, E, and F: 0.3, 1.0, 2.4, 3.1, 1.7, and 1.5% of the time, respectively. Vertical temperature soundings were made over the Coolwater Generating Station, during the period February 21 to March 10, 1972, by an instrumented aircraft in order to define the inversion characteristics at the site. A total of twelve days of soundings (morning and afternoon) were made. The results showed that in six of the morning sounds, a low level temperature inversion base existed between the surface and 2000 feet above ground. By afternoon, the low level or surface based inversions, in all cases, were destroyed by the strong afternoon heating. More intense inversions are known to occur in the fall and winter months (EAD).

Exhibit X-12. Barstow-Daggett Airport Monthly and Seasonal Relative Percent Frequency of Occurrence of Stability Types* 10 MWe Pilot Plant Site

	A	B	C	D	E	F
January	0.3%	5.4%	12.1%	36.3%	17.9%	27.8%
February	2.0	6.1	10.1	42.7	18.6	20.5
March	1.8	5.8	10.0	53.7	16.4	12.3
April	3.0	6.4	13.1	56.5	14.0	7.0
May	3.2	5.6	15.5	60.9	11.8	2.9
June	4.1	7.1	17.8	54.6	13.2	3.2
July	4.9	9.5	17.0	47.4	17.8	3.5
August	5.5	9.3	15.7	42.4	21.2	5.8
September	3.3	8.7	14.6	37.4	22.9	13.1
October	2.9	8.1	11.9	35.9	21.8	19.4
November	1.1	6.0	11.4	34.1	22.8	24.6
December	0.0	5.6	12.8	30.8	20.5	30.3
D, J, F (Winter)	0.7	5.7	11.7	36.4	19.0	26.4
M, A, M (Spring)	2.7	6.0	12.9	57.0	14.1	7.4
J, J, A (Summer)	4.8	8.7	16.8	48.0	17.4	4.1
S, O, N (Fall)	2.5	7.6	12.6	35.8	22.5	19.0
Annual	2.7	7.0	13.5	44.4	18.2	14.1

*Meteorological Stability Types

A - Extremely Unstable
B - Moderately Unstable
C - Slightly Unstable
D - Neutral
E - Slightly Stable
F - Moderately Stable

Exhibit X-13. Barstow-Daggett Airport Annual Average
Percent Frequency Occurrence of Stability Types*
Categorized by Wind Direction (1955-1964)
10 MWe Pilot Plant Site

N	0.3%	0.6%	0.4%	0.3%	0.2%	0.2%
NNE	0.1	0.4	0.3	0.4	0.1	0.2
NE	0.3	0.7	0.8	0.6	0.2	0.3
ENE	0.2	0.5	0.7	0.5	0.1	0.3
E	0.3	0.7	1.4	1.2	0.3	0.7
ESE	0.1	0.3	0.6	0.7	0.2	0.5
SE	0.1	0.2	0.4	0.3	0.3	0.7
SSE	0.0	0.1	0.1	0.1	0.1	0.3
S	0.0	0.1	0.0	0.1	0.1	0.5
SSW	0.0	0.0	0.0	0.2	0.1	0.2
SW	0.1	0.1	0.1	2.3	0.5	0.6
WSW	0.1	0.2	0.5	8.8	1.5	1.1
W	0.2	0.5	1.7	12.5	6.2	3.4
WNW	0.2	0.9	3.6	12.6	6.4	3.3
NW	0.3	1.0	2.4	3.1	1.7	1.5
NNW	0.2	0.5	0.6	0.4	0.2	0.3

*Meteorological Stability Types

A - Extremely Unstable
B - Moderately Unstable
C - Slightly Unstable
D - Neutral
E - Slightly Stable
F- Moderately Stable

e. <u>Solar Radiation</u>

SCE has established a network of solar monitoring stations over the Southern California area.[7] Study of the data collected suggests a similarity of solar radiation characteristics among the sites in the desert. The closest of these stations to the Pilot Plant site is in Barstow. The data indicate daily total radiation on a horizontal surface ranges from a low of 3.0 kW-hrs/m^2 in December up to 8.4 kW-hrs/m^2 in June, with an annual average of 5.8 kWhrs/m^2/day. These values follow closely other solar ratiation measurements available in the region[8]. The Pilot Plant site will average approximately 3500 hours of sunshine annually. Additional insolation data is available from the Jet Propulsion Laboratory, via monitoring at the Goldstone Tracking Station 25 miles north of the Pilot Plant site.

Cloud cover that would inhibit solar radiation occurs less frequently over the site than almost any other region of the relatively developed western portion of the California desert. Scattered cumulus clouds can still provide large amounts of diffuse radiation, according to a September 1977 progress report prepared by Arizona State University under contract to DOE

Lawrence Berkeley Laboratory is also performing studies on the effect of radiation diffusion from cloud cover.

2. Project Impact/Mitigation

Pilot Plant construction will not noticeably affect local meteorological conditions. Pilot Plant operation will induce minor alterations to the site's air flow, ambient temperature/ heat balance, and local humidity levels - all on a micro-climatic scale that will in most cases be immeasurable. Various climatic factors will in turn influence plant operation. (Most of the following assessment stems from existing DOE and SCE data with an analysis provided by the County.)

a. Wind Velocity and Air Turbulence

Site wind patterns will be slightly modified on the lee side of the receiver tower, and probably to a similar extent as wind patterns downwind of the existing Coolwater emission stacks.

Air flow near ground level in the flat collector field will be modified and slowed due to drag forces created by the upwind heliostats.[9] The net effect in the field will be a reduction of wind velocity near ground level which could naturally aid in mitigating potential soil erosion and resulting fugitive dust. Wind speed above the heliostat field will resemble normal profiles above open terrain except for minor but distinct vertical swirls and eddies (DOE).

Disturbances in air flow patterns over and within the heliostat field may alter the convective and conductive transfer modes of the site's solar heating budget (DOE). (See following analyses.)

Heliostat shading will cause net ground cooling.
Light wind speeds and cooler temperatures beneath the heliostats would probably also reduce evapotranspiration within the field. Light wind speeds at this level also could increase snow accumulation, snow-drifting, and the deposition of windblown debris within the site enclosure. Otherwise, modification of the air flow patterns attributable to the heliostats is not expected to be important.

- Mitigation

Pilot Plant research should include a determination of air flow pattern changes in the collector field that will result from commercial STE development.

b. Ambient Temperature/Heat Balance/Heat Transfer

The following analysis of the Pilot Plant's potential micro-climatic effect on the site's natural heat balance is primarily excerpted from DOE's Solar Program Assessment. (See bibliography.)

(1) Natural Balance

Solar energy entering the earth's atmosphere undergoes a variety of transformations and exchanges within the atmosphere before being lost as long-wave radiation back into space. As radiant energy from the sun (which is primarily in the short-wave region of the spectrum) enters the atmosphere, it is reflected, scattered, absorbed, and converted to other energy forms by the earth's surface and various constituents of the atmosphere. Diffuse or scattered short-wave light from the sky and direct insolation which arrive at the ground surface are the primary sources of all forms of energy for both the desert microclimate and the global atmosphere as a whole. For any given region, the interaction between the energy response characteristics of the ground surface and these two components of solar radiation determines to a large extent the state of the local climate.

The ratio of diffuse to direct insolation varies considerably with latitude, the water vapor content of the air, cloud cover, particulate concentrations, and site elevation. However, it is possible to obtain annual average values at different latitudes. Between the latitudes 30°N and 40°N in the southwestern United States, approximately 60 percent of the solar radiation reaching the ground is direct and the remaining 40 percent is diffuse. Although desert skies are likely to have somewhat higher proportions of direct insolation, these figures are adequate for a general consideration of the site's radiation budget.

A surface exposed to radiation absorbs part of the radiation and reflects the remainder back into the atmosphere. The percent reflected is called the "albedo." Typical albedos for various surfaces are listed in Exhibit X-14. Desert soils can be expected to reflect about 30 percent of the total incident short-wave radiation. One of the potential sources of STE plant impacts to be discussed in this section is the effect of heliostat mirrors on the average short-wave reflectivity of the STE facility and any resultant impact on climate.

Exhibit X-14. Albedos (Percent) For The Shortwave Portion*
of The Electromagnetic Spectrum
(Wave Lengths Less Than 4.0 Microns)

Snow, Fresh Fallen	75 - 95
Snow, Several Days Old	40 - 70
Desert	25 - 30
Savanna, Dry Season	25 - 30
Savanna, Wet Season	15 - 20
Chaparral	15 - 20
Meadows, Green	10 - 20
Forest, Deciduous	10 - 20
Forest, Coniferous	5 - 15
Dundra	15 - 20
Crops	15 - 25

*Source: W. D. Sellers, Physical Climatology.

Radiation absorbed at the ground can be converted to soil heat storage, long-wave radiation from the surface, conductive heat transferred between the ground and the air, convective transfer, and latent heat of evaporation. The intensity of long-wave radiation depends on the surface temperature and is directly proportional to a parameter known as the infrared emissivity. Conductive, convective, and latent heat transfer are each functions of several variables. It is therefore difficult to relate these three components of the energy balance to STE site conditions. However, this section will address approximate magnitudes of energy balance charges when possible and consider the general tendencies of those relevant aspects of the balance that are impossible to quantify in a generic analysis of this sort.

(2) Heliostat Field Impacts on the Energy Balance

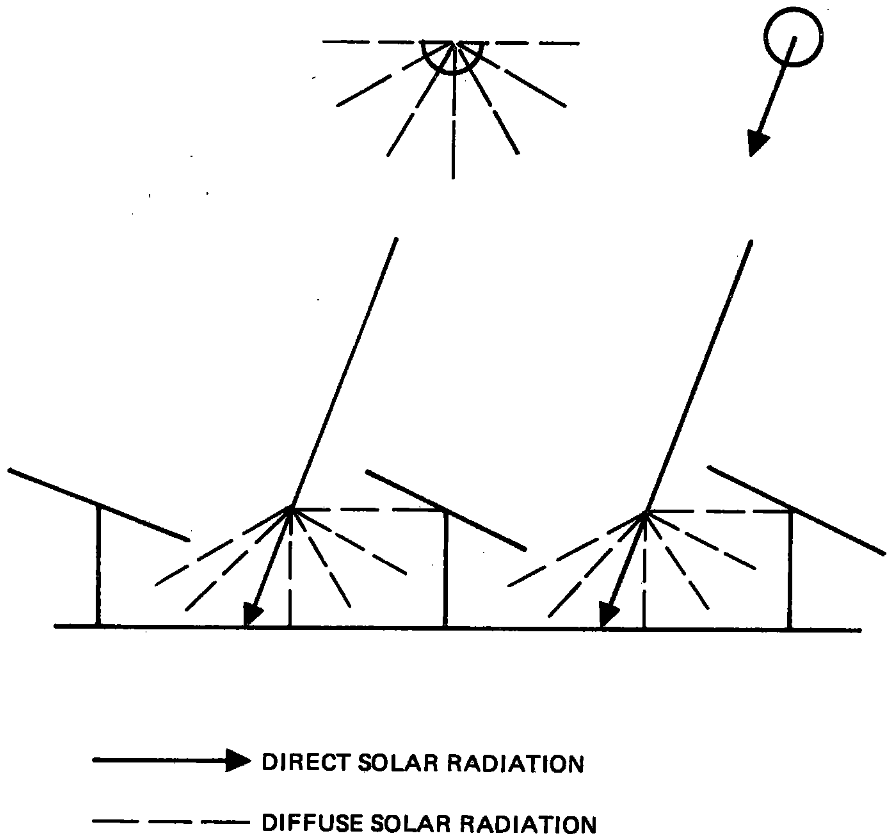
It is expected that the array of heliostats will modify significantly the net absorption of direct and diffuse insolation within the site boundaries. The extent of this modification can be approximated.

The ratio of mirror surface area to ground area in the heliostat field will average 0.23 for the Pilot Plant. Consequently, mirrors will intercept as little as 23% of the direct insolation incident on the field at summer solar noon and could intercept as much as 90% of the direct radiation when the sun is low on the horizon.

Interception of diffuse radiation by heliostat mirrors is complicated by the fact that this type of radiation arrives at nearly uniform intensities from all points in the sky (see Exhibit X-15). When a heliostat is tilted with respect to the horizontal plane, both sides of the mirror are exposed to diffuse light. Therefore, the effective absorptive area for diffuse radiation within the field will be greater than the absorptive area for the same quantity of land under natural conditions. In this case 40 percent represents an upper limit for effective interception of diffuse light by reflective mirror surfaces. The lower limit cannot be estimated as easily.

For purposes of approximating the change in the net shortwave albedo, the lower limit for direct radiation shading (23%) and the upper limit for the diffuse radiation shadings will be used in the same analysis. This strategy provides the most direct approach and tends to yield a net albedo figure which falls in the mid-range of possible estimates.

Heliostat mirrors will reflect about 90% of the incident direct solar radiation. The other 10% is either absorbed or reflected diffusely. For this approximation it will be assumed that 5% of the incident light is absorbed and 5% is reflected diffusely (each of these two components can vary between 0% and 10%, but the actual choice of values has only a slight effect on the final calculations). It follows that 95% of the diffuse insolation reaching the mirrors will be reflected diffusely, while the other 5% is absorbed.



10 MWe SOLAR PILOT PLANT

SCHEMATIC OF RECEPTION OF DIRECT AND DIFFUSE SOLAR RADIATION WITHIN THE HELIOSTAT FIELD

EXHIBIT X-15

Based on these assumptions and estimates for the mirror to ground area ratio, the average annual proportions of direct and diffuse light, and the albedo of the desert land within the site boundary, it is possible to calculate the distribution presented in Exhibit X-16. Some of the original insolation is directed to the central receiver and removed from the intermediate microclimate of the heliostat field. Some is reflected by mirrors and the soil. The resulting albedo is almost twice as high as the albedo for land outside of the plant, and it is close to the typical albedo for a several-day-old snow layer.

This increased reflectivity could cause an appreciable cooling of air flowing over the mirror field during the daytime hours. With less energy absorption, the total input of energy into the air in the form of long-wave radiation, convective, conductive, and latent heat will be less. Since these portions of the heat budget are responsible for sensible heat increases in the air, some cooling would necessarily occur in the lower layers of the air over the field. It should be noted, that while collectors will decrease in-coming solar radiation in the daytime, they will also trap some out-going long-wave radiation during the day and night. Net heat loss will therefore be tempered somewhat. Shading of the desert surface has a more significant influence on diurnal variability of environmental temperatures than an absolute or mean values. Winter night-time temperatures under heliostats could be warmer than in adjacent open areas unless winter "inversion" conditions are created (University of Arizona, 1977).

Exhibit X-16. Heliostat Field Solar Heat Balance *

Short-Wave Radiation Directed to Collector	-
Short-Wave Radiation Reflected Diffusely by Mirrors	-
Short-Wave Radiation Absorbed by Mirror	3%
Short-Wave Radiation Reflected by Desert Soil	17%
Short-Wave Radiation Absorbed by Desert Soil	41%

*Source: DOE

So far the discussion has centered on a consideration of the impact of modifications on the short-wave radiation absorption of the energy balance. Long-wave radiation is operative at all hours of the day and is the primary night-time output of radiation energy from the surface. The long-wave absorptivity of a substance is equivalent to its infrared emissivity. Since mirror glass has an emissivity of 0.87 to 0.94 and desert land has an emissivity of 0.91, there should be no significant differences between overall long-wave radiation absorption within the field and in the surrounding environment. Consequently, differences between nighttime temperatures of the air over the heliostat field and the surrounding environment should not be encountered.

The previous change in ground albedo due to the reduction of alfalfa production has insignificantly contributed to the local area's net heat balance alteration.

(3) Heat Loss From Receiver

The receiver will lose 3-6% of the heat conveyed to it by the collectors before the heat can be converted into steam (SCE). Receiver heat losses are transmitted to the atmosphere in the vicinity of the receiver by convection, radiation and, to a much lesser extent, by conduction. Radiated heat losses are relatively constant while the convection losses will be dependent on wind velocity and direction. Heat loss to the atmosphere via the receiver constitutes a shift of long-wave radiation normally dispersed throughout the undeveloped site to a concentrated long-wave radiation that will be emitted from a single point (receiver at the top of the tower).

c. Waste Heat Rejection and Cooling

STE power plants can be expected to operate at efficiencies of about 24%. Therefore, of the 21% fraction of the total solar energy incident of the mirrors, 5% will be converted to electrical energy via the receiver and will be transported out of the region. The remaining 16% will be rejected into the atmosphere as waste heat (unusable heat collected at the site) and most of this will leave the power plant system via the cooling tower. For the entire STE facility, roughly 60% of the total incident solar radiation is absorbed and returned to the atmosphere as sensible heat, latent heat, or long-wave radiation. This compares to 70% for the undisturbed desert environment, excluding alfalfa. Despite heat rejection from the cooling tower, the establishment of an STE facility could conceivably cause a net loss of energy available to drive local climatic processes.

Because of the high intensity of concomitant energy fluxes, heat rejection from the power generation system and cooling tower has the potential to disturb the microclimate. For example, a commercially feasible 100 MWe STE plant occupying one square mile (2.6 million square meters) will have a power generation complex that occupies about 13 acres (52610 m^2). A wet cooling tower for a 100 MWe steam turbine plant can release heat at a rate as high as 232 MW. Even if the cooling tower occupied the entire 13 acres (52610 m^2) of the complex area, the heat flux would still be as high as 410 watts per square foot (4410 watts/m^2). This compares to a typical annual average daytime heat flux away from the ground surface of about 36 watts per square foot (390 watts/m^2).

This concentrated release of waste heat could enhance convective updrafts, turbulence, and possibly the formation of small cumulus clouds above the plant. This especially would be the case if the locus of the heat rejection is in the center of the heliostat field where there could be strong contrasts between the temperature of the ambient air cooled by passage over heliostats and the temperature of the air heated by waste heat rejection.

A preliminary study of the impacts of cooling towers associated with nuclear power plants suggests that waste heat rejection from plants with capacities as high as 1000 MWe is not likely to have a significant large-scale effect on the local climate. In other words, there is little likelihood for changes in convective storm or precipitation frequencies. Consequently, it is not anticipated that the Pilot Plant will alter the characteristics of the atmosphere beyond the microclimate scale. (This ends DOE's generalized - not project specific - assessment of solar-related impacts to the natural heat balance.)

External surfaces of other plant thermally charged components will be warmer than ambient, contributing to the total redistribution of thermal energy (waste heat) from the collector field. For example, the thermal storage unit will lose to the atmosphere 5400 kWhrs thermal per day (based on 3% of 180 MWHr thermal loss/ 24 hours - per MDAC).

When comparing the heat rejected by a fossil plant with that rejected by the Pilot Plant, it should be recognized that the fossil fuel plant adds imported heat at a rate of approximately 1-2 MW of thermal energy to the atmosphere for every 1 MWe generated, whereas the Pilot Plant removes about 10% of the net incident solar radiation. The local heat output by the cooling tower per unit of electricity output will be equivalent for the Pilot Plant to a fossil fuel plant because its turbine efficiency is comparable to that of a fossil fuel power plant (DOE).

- <u>Mitigation</u>

The Pilot Plant's temperature/heat balance impacts, at least those that present technology has enabled us to understand, will be minimal. Monitoring of the plant's operation should include an assessment of the potential magnitude of such impacts relative to operation of commercial-size STE facilities.

It should be noted that the characteristic of a solar-thermal plant is that the total thermal emission level is less than the former site's natural emission level, by the amount of energy transported away from the site in electrical form. But regardless of the design's total thermal emission load, there will be a concentration of heat and a redistribution of long wave radiation different than that occurring on the site in its natural condition. The site's convective thermals may be altered accordingly.

d. Humidity Levels

Moisture release to the atmosphere will primarily occur via evaporation of water from: the cooling tower, blow down effluent in the evaporation ponds, heliostat washing, and domestic use. The total annual amount of water to be consumed (evaporated) will approximate 198 acre-feet, or roughly 90% of the 220 acre-feet annual plant requirement (County estimate). The cooling tower will directly emit the bulk of this evaporation. Of the remaining 20 acre-feet some water from heliostat washing and domestic/general plant use will remain as soil moisture and a minute amount may percolate to groundwater. Evaporation from the Pilot Plant's operation will be approximately 3-5% of that from Coolwater Generating Station and farming operation after Units 3 and 4 are on line. This amount is relatively minimal, resulting in an increase in local ambient humidity of approximately .2%.

Cloud and fog formation directly above the Pilot Plant is a slight possibility since condensation may form by the mixing of moist, waste heated air from cooling tower and receiver emissions with the ambient air cooled by its passage over the relatively cool heliostat field (see previous assessment). This vapor could periodically diffuse and scatter insolation, thereby reducing plant output.

- Mitigation

Since the Pilot Plant's incremental contribution to local humidity is slight, and since the receiving ambient air is relatively dry, no mitigation is required. Existing groundwater supply constraints will preclude significant cumulative additions to humidity levels in the future unless water is imported to the area.

Dry cooling would eliminate most of the evaporation but the impact is not important enough to warrant the extra cost.

The reduction in alfalfa production to provide water for pending Coolwater Units 3 and 4 will result in a slight contribution to ambient humidity since more water will be evaporated by plant use than by agricultural use.

No net increase in evaporation will occur from the existing evaporation ponds stemming from added Pilot Plant waste water. Pond surface areas will not be enlarged since the present pond will accommodate all of the Coolwater Generating Station's and the Pilot Plant's projected flows.

e. Climatic Effects on Plant Facilities and Operation (Primarily Supplied by the County)

Climatic factors could in turn significantly effect plant operation and maintenance. The ideal weather condition for plant operation is bright sunlight with calm winds. Overcast skies associated with winter storm fronts (from the northwest) and summer thunderstorms (moist tropical air from the gulf) will decrease plant utility. Occasional cloud cover and precipitation during winter months when electricity demand is relatively low will be of less significance than rain and cloud cover during summer months when electricity demand usually peaks. However these infrequent summer thundershowers are usually of short duration.

Of more concern to plant operation and maintenance will be the effects of natural climatic hazards such as wind, dust, rain, hail, snow, lightning and temperature variations, all of which have been considered in the plant design. Environmental design criteria are listed in Exhibit X-17.

Extremely high winds could rock the tower, but should not be permanently damaging. Blowing sand will pit the glass mirror surfaces and reduce effective reflectivity if the heliostats are not stowed during high winds. Settling dust will also reduce mirror efficiency. Hail could also pit glass surfaces at certain sizes and speeds if the heliostats are not stowed during such storms (see Exhibit X-17). Heavy rain storms would not be permanently damaging, unless heavy runoff affected heliostat and tower foundations. Commonly occurring during desert storms is wind blown dust integrated with light rainfall which would require immediate heliostat washing. Snowfall in the site region should never be so heavy as to overload the heliostat structures. Lightning could be attracted to the receiver tower resulting in repairable damage to the tower's electrical system. Extreme wintertime diurnal ambient temperature variations on the site can range from a low of $20^{o}F$ to a high of $70^{o}F$, but will probably not be rapid enough to create differential stress on the glass and

Exhibit X-17. Environmental Design Criteria

Parameter	Pilot Plant Value
Wind Speed:	
Operational	30 MPH
Survival	90 MPH
Temperature (Operational)	0F to 120F
Humidity (Relative)	5% to 70%
Operational without permanent damage	
Hail	0.8 in. dia @ 50 mph
Survival without damage	
Lightning	
Survival with repairable damage	
Earthquake	UBC Zone 3, NRC Reg. Guide 1.60. 0.25 g horizontal
(Survival without damage)	
Rain	*2.95 inches max/24 hr.
Snow	5 lb/ft^2 loading

*It is unlikely that 2.95 inches of rainfall would be evenly distributed over a 24-hour period in the Mojave Desert. Such a relatively high amount would most likely result from a cloudburst (i.e., .80-1.20" in 30 minutes or at a rate of 6"/hour for 1 or 2 minutes).

steel heliostats. Although a remote occurrence, rapid temperature variations could however cause the mirror glass to crack (i.e., heliostat washing during daylight hours). Interrupted insolation by transient clouds will change the local wall temperature in the receiver, possibly causing stress fatigue of the metal, thereby reducing receiver life expectancy. Freezing "working fluid" water could crack the receiver tubes.

- Mitigation

Periodic cloud cover during periods of peak electricity demand will not severely affect the Pilot Plant's contribution of power to the utility grid system since it is not expected to be a significant net energy contributor. Plant research will take precedence over power generation.

The Pilot Plant components and systems will be designed to produce the specified performance when subjected to the credible ranges of environmental conditions. Further, these facilities will be designed to survive the extremes of environmental conditions to which they may be exposed. The design process will employ the accepted techniques applicable to the engineering disciplines involved and in accordance with the techniques invoked by the applicable regulatory agencies to which portions of the plant are subject (DOE).

The heliostats can be stowed (mirror face down) during periods of blowing dust and sand, hail, rain, etc. to eliminate damage to reflective surfaces. Snow will fall from the mirror faces by rotating heliostats to a vertical position. It is presently known that the scraping action of snow on mirror faces acts as a non-scouring, natural cleaning agent.

The receiver tower will be grounded to mitigate lightning strikes.

Differential stress on metal and glass caused by extreme temperature fluctuations may be reduced by stowing heliostats face down during cold winter mornings.

At present, the exact effect of the varying stresses has not been quantified, however the receiver and heliostats will be designed to compensate for foreseeable fluctuations. Heliostat washing will be performed during morning hours when mirror surfaces are relatively cool. The boiler will be drained during freezing temperatures.

Monitoring of Pilot Plant operations will provide a data base for determining climatological impacts from and on large scale, commercial STE facilities.

E. Air Quality

1. Current Status

The Pilot Plant site is within the Southeast Desert Air Basin of California. Air quality in the San Bernardino County portion of this air basin is administered by the County Desert Air Pollution Control District. The County Board of Supervisors has the authority to adopt and implement District air quality rules and regulations, but it contracts with the South Coast Air Quality

Management District (administrator of air quality in the southern California coastal air basin) for personnel, monitoring equipment, enforcement and technical services.

The air quality monitoring stations maintained by the Air Quality Management District closest to the site are in Victorville and Barstow. Both stations measure levels of nitrogen oxides (NO_x), nitrogen dioxides (NO_2), oxidants, carbon monoxide (CO), and ambient suspended particulates on a daily basis. There is an insufficient amount of available site-specific air pollution data to assess the exact ambient quality over the Daggett area, therefore site air quality can only be extrapolated from upwind data.

The bulk of the air pollution affecting the region around the site originates in the populated South Coast Air Basin to the southwest and migrates to the desert through canyons of both the San Bernardino and San Gabriel Mountains. Victorville's monitoring station data indicate that the Hesperia and Victorville areas probably receive the heaviest concentration of pollutants that flow north over the San Bernardino mountains. The Barstow station's data indicate that some of the pollutant concentrations disperse between Victorville and Barstow. Pollutants are carried over the Pilot Plant site via normal air flow through the Mojave River "Valley".

Air pollution generated in the site region stems from mobile sources such as automobiles, trains and aircraft; and from stationary sources such as industry, mining, populated communities and fugitive dust from soil disturbance.

Pollution data for the following assessment is taken from Victorville and Barstow station records. Daggett could be expected to have better air quality than Barstow, at least relative to oxidant and NO_x concentrations.

When Coolwater Units 3 and 4 are on line, utilizing liquid distillate fuel, at a 25% capacity factor, maximum one hour ground level concentrations of .047 ppm of SO_2 and .022 ppm of NO_x will result. These maximums are expected to occur less than .1% of the time on an annual basis (SCE). Since existing average ambient air quality has not been determined on the site, it is difficult to project net ambient quality after all units are operating.

Pollutants that diffuse or scatter sunlight will be the most detrimental to plant operation. Pollutants found or expected to be periodically found in the region's ambient air, and their recent concentrations, are described in Appendix D (Form S. B. County APCD 1974 Annual Report). Pollutants existing in the site's air shed may diffuse and absorb solar radiation by an undetermined amount. Of primary concern is particulate matter (fine particulate aerosols) and possibly NO_2 and SO_2.

2. Project Impact/Mitigation

a. Plant Construction

Plant construction will disturb delicate soil crusts, resulting in periodic emissions of fugitive dust during heavy winds (30 plus mph). Motorized equipment used for material hauling and plant assembly will emit an undetermined amount of combustion contaminants during the construction period. Long-distance commuting by construction workers will slightly contribute to highway source emissions. The Pilot Plant's research-related activity (primarily vehicular use) will also produce conventional contaminants. These emissions will be relatively insignificant but will incrementally contribute to the region's advancing air shed degradation.

- Mitigation

Disturbed soils will be water sprayed when necessary to reduce dust and sand blow. Vehicular and equipment emissions can be reduced by normal measures, but adequate mitigation will require more efficient internal combustion systems, etc. that are beyond the scope of the project. Commuting distances could be reduced by temporarily housing workers on or near the site.

This Pilot Plant's contribution toward successful development of non-polluting commercial STE generation will be a significant air quality mitigation measure within itself.

b. Effects From Plant Operation

Plant operation does not require combustion of fossil fuels for steam generation. The only gaseous pollutants produced will be limited to that from support vehicles and research and development equipment. Periodic driving over the collector field for general maintenance purposes and heliostat washing will not allow soil stabilizing crusts to form over much of the field, therefore fugitive dust (from fine grain particles mixed with sandy loam) may coat heliostat surfaces during high winds. Dust settlement on mirrors will reduce the efficiency of solar collection and plant operation.

- Mitigation

The peripheral heliostats will automatically slow wind speeds within the collector field, thereby reducing dust blow. Periodic heliostat washing will remove mirror dust. The wash water should contain non-toxic elements (preferably deionized water only) so that runoff would be of sufficient quality to irrigate shade-tolerant, soil-binding vegetation on the collector field.

c. Effects On Plant Operation

The most potentially significant air quality effect will be diffusion and absorption of incoming solar radiation by existing ambient pollutants in the site's air shed. This is a good example of an environmental impact on the project. Solar collection efficiency will be reduced during certain meteorological and ambient air quality conditions. The extent of interference cannot presently be quantified due to lack of technical data, however the following assessment generally describes possible effects that should be studied during project research.

(1) Particulate Matter

Disturbance of site soils will induce dust fall on mirrors (see previous section). The stowing of heliostats (mirror down) will reduce sand pitting and dust deposition, however blowing silty soil particles occurring over parts of the site may still adhere to the mirrors even when they are in inverted positions. Upwind soil disturbance and general urbanization in the valley will increase periodic levels of ambient, radiation-diffusing pollutants, which may or may not be of consequence to the Pilot Plant over its relatively short life expectancy.

The removal of some Coolwater ranch land from cultivation in order to balance water requirements for Coolwater Units 3 and 4 and the Pilot Plant has left land in a fallow condition upwind of the Pilot Plant site. High winds will carry fine soils over the collectors until the former fields are restabilized by formation of crusts and by growth of ground-covering, pioneering weedy species.

Particle size is an important factor in insolation interference (South Coast Air Quality Management District - SCAQMD). Aerosols (extremely small particles) probably diffuse more light than would an equivalent portion of larger particles. Relatively coarse particulate matter generated from the natural desert environment has less effect on the visible spectrum than does the finer, man-made particle matter migrating to the region from the South Coast Air Basin (SCAQMD). Therefore exported matter will probably interfere with insolation more than local sources. Variables relative to solar diffusion potential also depend on organic vs. inorganic composition of particles, and the wavelength of incoming radiation.

Fugitive dust size measurements are not available from the Coolwater site. Such measurements have, however, been made at the JPL Goldstone tracking station located some 38 air miles north of Coolwater. These measurements were collected as a part of an extensive aerosol characterization study sponsored by the California Air Resources Board and reported by Hidy, et al, 1974[10]. On the basis of several samples obtained from Goldstone, the following conclusions were drawn:

- During "typical" desert conditions, the number of particles in the submicron size range were considerably less than measurements made in urban atmospheres.
- During the conditions sampled, about 60 to 70 percent of the aerosol volume was greater than 1 μm in diameter (aerosol volume provides a useful measure of aerosol mass).
- Although large amounts of windblown dust were expected, no evidence of such dust was recorded during the 1-week sampling period (regional data suggest that visibility reducing dust storms will occur about 0.5% of the time).
- Aerosol size distributions are dependent on origin of air reaching the Mohave Desert.

Although ambient particulate levels in the region exceed Federal and State standards, particle size and composition and level and frequency of occurrence will have to be determined before the site's constraints to efficient radiation collection can be accurately measured. Special emphasis should be placed on the effect of fine, aerosol-type matter exported long distance from the South Coast Air Basin.

- Mitigation

Disturbance of area soils should be kept to a minimum during plant operation. Soil-binding, shade-tolerant vegetation could be planted in the collector field and irrigated with non-toxic heliostat wash water. This ground cover should be hardy enough to withstand truck traffic from heliostat washing, general maintenance, etc. A layer of gravel over collector field soil might be a secondary option. Alfalfa fields taken out of production should not be disturbed (i.e., leave plant roots intact, keep vehicles off, etc.) in order to allow natural crust formation and natural revegetation of exotic, pioneering weeds. If fallow fields become significant sources of fugitive dust, they could be replanted with fast growing native vegetation and irrigated a few times to establish natural plant regeneration.

Mirrors will be stowed at night and during wind storms. Heliostat washing will provide the best means of maintaining optimum collection and reflection efficiency.

Migration of aerosols and fine particulate matter from the South Coast Air Basin to the area, and fugitive dust from regional soil disruption will continue and possibly increase over the 5 year anticipated life of the plant. The only reasonable mitigation available is to research all the variables associated with particulate-induced radiation interference (i.e. particle size, organic/inorganic composition, fallout rate, distribution, concentrations, etc.) in order to determine total impact on commercial STE development.

(2) Agricultural Spraying

Spraying and dusting of alfalfa fields adjacent to the Pilot Plant for pest and weed control will have an insignificant soiling effect on heliostats compared to that from local natural dust sources. However certain agricultural spray mists could induce corrosion of heliostat metals.

- Mitigation

Alfalfa spraying (dusting) should be done only under favorable wind conditions in order to reduce spray drift into the heliostat field.

(3) Existing and Potential Emissions From Coolwater Units 1 - 4

The Pilot Plant will be located generally downwind of the Coolwater Generating Station. Coolwater Units 1 and 2 are conventional steam turbines presently fired by natural gas. Daily average emissions in 1974 were as follows (from S. B. County APCD 1974 Annual Report):

Organic Compounds	.01 tons/day
Particulates	.02 tons/day
NO_x	1.92 tons/day
SO_x	.20 tons/day
CO	.18 tons/day
Total	2.33 tons/day.

(This total reflects predominate use of clean-burning natural gas and is representative of 1976 emission totals.)

Coolwater Units 1 and 2 are presently among the last electrical generators in Southern California predominately fueled with natural gas. It is possible that future restricted gas supplies may be unavailable for Coolwater especially since it is in the Southeast Desert Air Basin which is much less populated and has better air quality than the South Coast Air Basin. If Units 1 and 2 were to be fired by conventional oils containing higher sulfur and ash content than natural gas, SO_2 and particulate emissions would undoubtedly increase and the resulting periodically-appearing plume may diffuse incoming radiation. The impact cannot be accurately quantified, but is expected by SCE to be of minor importance except for periods of air inversions occurring mostly during winter mornings.

Coolwater Units 3 and 4 will be operating by the time the Pilot Plant is completed. The only fuel that can be combusted in this combined-cycle plant is a low sulfur/low ash distillate, somewhat resembling jet fuel. Conversion to more polluting oil or coal combustion would require major burner alterations.

Projected daily average emissions from Coolwater Units 3 and 4 are as follows: (assuming 45% capacity factor)

Particulate	.2 tons/day	(per 1975 Coolwater EIR)
NO_x	3 tons/day	
SO_x	2.3 tons/day	
Total	5.5 tons/day	(assuming the probable predominate use of distillate fuel).

Units 3 and 4's contribution of radiation-scattering pollutants to the ambient air cannot be quantified yet, but are expected to be minimal due to combustion of relatively clean fuels.

The combined effect of emissions from all Coolwater units on radiation diffusion may generally be insignificant except for periods of intense plume-trapping inversion layers. Such instances of poor dispersion may occur for approximately 5-10% of the time when stable atmospheric conditions prevail during winter mornings from October to January (See Climate Section). In comparison, local sources of fugitive dust will be ambient more often in spring months when wind velocities are normally high.

Gaseous pollutants (hydrocarbons, CO, etc.) at the relatively low concentrations likely to exist over the site in the near future will probably not reduce plant efficiency. NO_x may present more of a problem.

- Mitigation

Effects of the Coolwater Units emissions on the Pilot Plant's operation can and will be mitigated in a number of ways. The collectors will be located northeast of the Coolwater Units. Available wind data for the site area indicate that Coolwater's combustion and vapor emission plumes will be transported over the collector field only about 1-2% of the time on an annual basis during daylight hours. Also, SCE believes that high ash and sulfur fuels will probably not have to be burned in the Coolwater units during the planned life of this Pilot Plant.

As indicated in other chapters of this report, the optimum location of the collector field within the available 320 acre parcel relative to anticipated Coolwater plume travel can still be determined. (A position in the northern portion of the 320 acre parcel would probably be least affected by the most consistent plume travel.) A site-specific study could be initiated to determine if the impacts from Coolwater plumes would be significant enough to warrant consideration of an alternate site on the Ranch upwind of Units 1-4. It is also possible that operation of Units 1-4 could be adjusted to reduce plume formation during atmospheric inversions.

Monitoring the impact of Coolwater emissions on solar collection should be an integral part of the research effort. It might even be feasible to intentionally produce "worst case" emissions from the units during certain wind conditions in order to accurately measure the actual radiation diffusion properties of various pollutants.

(4) Water Vapor

Operation of Units 3 and 4 and the Pilot Plant will result in increased evaporation of water. Of the annual 8000 acre-feet/ year withdrawal on the SCE property, 7020 acre-feet will be almost totally consumed (evaporated) by use in the old and new generating facilities, and approximately 1/2 of the remaining 980 acre feet/year that will be used for farming will evaporate to the atmosphere. This substantial increase in evaporation (approximately 1/2 of the 5200 acre feet/year previously used for irrigation percolated to the water table) will have a slight effect on the site's micro-humidity patterns.

Blowdown waters from all the Coolwater Units and the Pilot Plant will be evaporated via the existing ponds. Exchange of the water from the pond to ambient air will be relatively constant depending on climatic conditions and should not form vapor clouds except during cold mornings. Such vapor or condensation will remain close to the water surface and should dissipate by the time solar radiation is sufficient to operate the Pilot Plant, thereby not significantly interfering with insolation. The increased humidity from the pond (and some from alfalfa transpiration) could contribute to early morning dew formation on the heliostats when the metal and glass will be cooler than moist ambient air. Condensation on mirror surfaces will be minimal if the heliostats are stowed face down.

The cooling towers from the Coolwater Units and Pilot Plant will emit most of the latent heat to the atmosphere via evaporation. Condensed vapor that might diffuse solar insolation would mostly form during cold mornings when the Pilot Plant would not be at full operating efficiency. However such vapor plumes from the Coolwater units could drift over the mirrors during the day and slightly reduce insolation, at least until dispersed by convection from ground heating or quicker dispersion by winds. Since the ambient temperature directly over the heliostat field will be slightly cooler than surrounding temperature (see X-D Climate), the vapor might persist longer than otherwise. The above possible conditions would occur over relatively short periods and during low levels of radiation, thereby not significantly affecting net plant operation.

The general increase in humidity from cooling towers and evaporation ponds and relatively wet collector field soils (heliostat wash runoff) should not hinder average radiation at a level that would significantly reduce plant efficiency. (The above analysis is primarily conjecture and cannot be accurately quantified until research of the finished Pilot Plant is under way.)

- Mitigation

The only mitigation available to reduce evaporative emissions potentially affecting solar radiation would be reduction or elimination of water use in the Pilot Plant itself (dry cooling, etc.). The Coolwater Units and alfalfa operation are committed to water use and will directly or indirectly account for approximately 94% of the total amount of evaporative losses immediately upwind of the Pilot Plant. Therefore conversion of the solar facilities to dry cooling would not reduce area-wide vapor formation substantially enough to warrant the relative high cost. Pilot Plant research should include a study of the comparative effects of water vapor vs. particulates on solar diffusion.

(5) Synergistic Effects

Water vapor from the cooling towers and evaporation ponds could combine with local and ambient concentrations of SO_2 and dust to form sulfuric acid mist and sulfates which could diffuse radiation and accelerate corrosion of the heliostats. SCE's analysis of this potential is as follows:

Limited sulfur dioxide emissions will be released to the atmosphere from the operation of Coolwater Units 1-4. At the same time, water vapor will be exhausted from the cooling towers and evaporated from the ponds. The potential for sulfate aerosol formation would exist during periods of interaction between the SO_2 emissions and water vapor emissions. The possibility of this occurrence is, however, expected to be minimal due to the differences in emission heights of the emission sources. Except during highly unstable meteorological conditions, during which the behavior of the plumes is relatively unpredictable, the SO_2 plumes from the generating stacks will be several hundred feet above the cooling tower plumes and even higher than the moisture evaporated essentially at ground level from the ponds. During unstable meteorological conditions, interaction of the SO_2 and moisture plumes is theoretically possible. However, these conditions are also associated with the most rapid dispersion and, therefore, the lowest concentrations of water vapor and SO_2 plumes. Concentrations of sulfate aerosols formed during these conditions would be small and rapidly dispersed.

In addition to the above, the rate of sulfate formation in power plant plumes is dependent on several other factors such as high ambient pollution levels and high relative humidity levels (>70%). Ambient pollution levels in the site region are typically low and relative humidities during the daylight hours are also low as is typical of desert regions. Therefore, the rate of sulfate formation is expected to be very slow and the level of sulfates that could form would not be substantial until the emissions are transported downwind of the facility (>25-30 KM).

- Mitigation

The combined effects (if any) of vapor interacting with pollutants can only be mitigated by a reduction of one or the other. Radiation diffusion and heliostat corrosion resulting from pollutant and vapor synergism should be monitored during the Pilot Plant's research phase in order to better determine siting constraints for commercial STE development.

F. Biotic Resources

1. Current Status

a. Regional

The productivity, diversity and stability of vegetation and animal life on private land in the lower Mojave River Valley near the proposed Pilot Plant site have been reduced and altered due to urbanization and rural development. Rights-of-way (utility, railroad, highway, etc.) have restricted movement of certain ground animals. Land clearing has displaced wildlife and the resulting introduction of pioneering and exotic vegetation created new and less diverse plant/animal relationships. Rural developments in Daggett, Yermo, Newberry and surrounding areas have displaced certain animals and concentrated others. Alfalfa farming has allowed higher than normal concentrations of animal population. Fish farming in the Newberry region has created localized, semi-productive aquatic habitats.

During periods of adequate precipitation the native Creosote Bush Scrub and Alkali Sink Communities within surrounding BLM-administered public land provide good wildlife habitat except in areas where heavy mining and off-road vehicle activity have occurred.

b. Site Specific

The mid and southern portions of the 320 acre parcel were previously farmed for alfalfa in conjunction with SCE's Coolwater Ranch operation. The land has been fallow for a number of years and produces a variety of native and exotic pioneering plant species. The northern quarter of the site shows less disturbance and is a mixture of climax and pioneering plants. The varied habitats provided by alfalfa fields to the west of the site, climax creosote-scrub on the south and east, the River-Bed/Sand Dune association immediately to the north, and by the site itself all combine to form a slightly mixed, but viable wildlife community.

In 1972 a biological reconnaissance of the general site area was conducted in conjunction with the permit process for the Coolwater Combined Cycle Project, Units 3 and 4. The terrestrial plant community most prevalent in the site area was identified as the Creosote Bush Scrub Community with overlapping areas of the Alkali Sink Community. During the 1972 survey, it was determined that no rare or endangered plant or animal species were present in the site area and that construction of Units 3 and 4 would produce no inreversible environmental effects upon the local biotic resources. The 1972 biological assessment provides a general overview of the site area (Appendix E) and is incorporated into this assessment.

In April, 1977, the Pilot Plant site area was surveyed for biological significance by staff of the San Bernardino County Museum Association and the University of California at Riverside. The purpose of the study was to update previously recorded data and determine the presence of any site specific areas of biological sensitivity.

This last survey also indicated that no rare or endangered species of plants or animals exist on the site. Some additional species may occur in the river bed to the north (Appendix E). (Both complete surveys are on file with the County.)

(1) Flora (See Plant List in Appendix

Site vegetation includes annual and perennial plants normally found in previously disturbed sandy soils. Native wildflowers, exotic mustards, tumble weeds and other weedy species grow in the mid and southern portions. The less disturbed northern (especially northwest) portion contains creosote, burrobush, and annual plants associated with a native Creosote-Burrobush environment. Riverbed dune hammocks contain similar vegetation but also include mormon tea, cat claw and other species not found on the site. The river bluff constitutes a minor division in the occurrence of some vegetative forms.

(2) Fauna (See Regional Animal List in Appendix E)

The Creosote Scrub, Alkali Sink and semi-dune vegetation communities on the alluvial plain, lowlands and in the riverbed respectively provide a suitably diverse habitat for quite a few species of native and non-native wildlife. Grain and alfalfa production on the ranch augments habitat diversity by providing cover and feed for concentrated populations of rodents, rabbits and birds which in turn serve the higher food chain. Habitat disturbance and alterations have induced the introduction of non-native animals to the area, which in turn continue to modify the ecosystem. The site does provide marginal food and cover, however its usefulness is primarily a factor of its benefit to adjacent wildlife populations.

Very few species of birds were found on the day of the recent survey. Those observed included the Horned Lark, American Kestrel, White-crowned Sparrow, Sage Thrasher, and Swainson's Hawk. (It should be noted that a one-day survey does not provide a valid representation of actual bird use of or occurrence on the site.)

Many other species of birds pass through the area during migration and winter, but only one species, the Horned Lark, would breed in the area. A list of birds recorded over the past several years at the Coolwater Generating Station evaporation ponds by an Edison employee is included in Appendix E. No rare or endangered birds would be expected to be adversely affected by developing this site.

The only mammal observed was a Black-tailed Hare, however, dung and burrows indicate the presence of the desert kangaroo rats (Dipodomys deserti and Dipodomys merriami).

The following lizards were observed:

Zebra-tailed (Callisaurus draconoides)
Desert iguana (Dipsosaurus dorsalis)
Long-tailed brush uta (Urosaurus graciosus)
Western Whiptailed (Cnemidophorus tigris)

Tracks of a desert tortoise (perhaps a two-to-three-year-old individual) were observed adjacent to the edge of the bank above the Mojave River course.

Insects were not abundant, with the possible exception of skippers and periods following the flyway of the Mojave River.

(3) Ecological Relationship

The most commonly occurring introduced animals found in the area include pocket gophers, starlings, flickers, song sparrows, meadowlarks, and ravens; all of which are attracted by increased and altered food and water supplies. These animals have displaced less-gregarious native wildlife over the years, gaining a definite foothold in the altered habitat. Wildlife displacement will gradually continue due to additional encroachment by urbanization, industrialization and recreational pursuits. Habitat productivity and stability will decrease, affecting diversity of native species accordingly.

(2) Project Impact/Mitigation

a. Plant Construction

Plant construction will destroy the majority of vegetation and wildlife habitat on at least 100 acres of the 130 acre parcel. Soil loss via wind erosion could effect soil productivity over the long term. Burrowing animals such as tortoises (if any), lizards and rodents may be crushed or displaced during initial levelling operations unless observed and removed prior to site preparation. Tortoise populations that thrive on spring annuals will lose the site as a feeding area. The small amount of displaced wildlife will attempt to relocate burrows and feeding grounds to adjacent land. Relocation will only be minimally successful since adjacent habitat is probably already at its optimum carrying capacity. Some if not all displaced wildlife will be eliminated as a result of competition from resident populations and the inability of adjacent resources to absorb the increased demand. The reduction of acreage in alfalfa as a compensation for water requirements of both Units 3 and 4 and the Pilot Plant will also result in the elimination of this important habitat. The dispersion and loss of rodents (rabbits included) will affect predator species accordingly.

Plant construction and alfalfa reduction will combine to induce a short-term displacement and an eventual net loss of wildlife populations. The magnitude of the regional impact will not be significant over the long term and is probably not important over the short-term. Habitats of unique species or scientific values will not be affected.

- Mitigation

If heliostat wash water could be used for irrigation of shade-tolerant grasses in the collector field, the introduced exotic grasses will provide a somewhat specialized food source that will benefit some area wildlife, assuming access will be available through the perimeter fence. Wildlife access to collector field vegetation should not be restricted. Rodents are important to the desert food chain.

Construction workers will be advised to remove any observed tortoises from the site to an area specified by SCE biologists. Although not entirely successful, this procedure is the best currently available mitigation measure. The length of the period between loss of existing habitat from construction and the reintroduction of grasses in the collector field will partially determine the net loss of wildlife numbers and diversity. The type of wildlife characteristics which may be reinstated on the site long after the project is dismantled will depend on whether agriculture will be resumed or the site will be allowed to naturally regenerate exotic and native plant life. Persistent bermuda grass (if used to stabilize collector field soils) would have to be killed by spraying before alfalfa could be planted.

The consultants determined that biotic resources would not be significantly affected and therefore major mitigation measures are not required.

b. <u>Collector Field</u>

Shade-tolerant weeds may grow under heliostats at the periphery of the foundations where direct sunlight and diffuse radiation will penetrate and where soils are not overly compacted. Massive weeds such as Russian Thistle could interfere with mirror rotation and access for mirror washing. Weed removal by direct labor will be laborious and herbicide spraying would kill beneficial vegetation and could accelerate corrosion of the heliostat's moving parts, at least those not specially formed of corrosion-resistant metals. Persistent weeds may become a definite problem.

Relative to impacts of plant-area microclimatic changes on local ecosystems, DOE's "Solar Program Assessment"[11] states the following:

> With the reduction in surface temperatures, reduced wind speeds, reduced evapo-transpiration (increased soil moisture), and shading of the ground beneath the heliostats, the field may simulate the microclimatic conditions of a north-facing slope located in the vicinity of the STE facility. These conditions might be favorable to the establishment and growth of shade-tolerant arid-zone plant species within the field, and in this case it is conceivable that plant cover would support good populations of native wildlife. However, various Pilot Plant functions (e.g., heliostat maintenance and dust suppression) could counteract these conditions and make the field area inhospitable to vegetation and wildlife. Actual field studies will have to be made to determine the specific effects of altered micro-climatic conditions on the ecosystem. (See Ch. X-D.)

It is possible that localized convection currents resulting from spot concentration of heat output via the receiver and cooling tower will affect bird flight in a manner different than does normal convection when spread out over the site's radiating surface. The degree of impact is unknown and probably is minimal.

- Mitigation

Pavement, gravel layers or herbicide application would eliminate most weed interference. SCE is not presently considering paving, gravelling or herbicide treatment for weed interference since these measures could create a number of hydrologic, biologic and microclimatologic impacts. One of the most effective measures to assure dust suppression, provision of marginal habitat and weed control would be the growing of tough, low lying, root-spreading, shade-tolerant grasses that can withstand a relatively moist micro-climate, cooler than normal desert temperatures and compacted soil. Runoff from mirror washing would be a natural form of irrigation, but wash solutions should preferably contain only deionized water. Other weed control measures will be considered.

c. Tower/Reflector

The 325-foot high receiver tower will present only a minimal physical interference to birds in flight unless they are blinded by collector glare. Blinding is possible, but can only be quantified by research and observation.

Birds flying into the reflected radiation beam at its focus near the receiver on top of the tower will be killed by incineration. Determination of the span from the focus to a point along the beam that will be dangerous or fatal to birds will have to be studied during research phases. Data concerning the potential impact on birds entering the focused beam is naturally limited. The one source of experimental data comes from the French Solar Furnace Research Facility. The French report states that there are no indications that birds are attracted to or are they adversely affected by the focused solar flux beam, and that birds have been observed to divert their flight paths to avoid the beam. Consumption of flying insects in the flux beam does occur regularly, and they seem to be attracted to the beam. Limited operation of the $5MW_e$ Solar Thermal Test Facility in Albuquerque, New Mexico, has confirmed these observations. It is possible that convective transfer of heat from the beam, along its length, to surrounding air might deter birds from even entering the focused beam path (County).

- Mitigation

The minute possibility that the tower top (receiver) could become a fatal attraction to birds (primarily predators and insect eaters) during daylight hours might be avoided by installing a periodically-ringing alarm on the tower. Glare from the collectors may be sufficient to keep birds away, however blinding could be a problem that cannot easily be mitigated.

The human activity associated with plant construction, operation and research will be a major contribution towards wildlife, disturbance. When human involvement is temporarily reduced, certain animals will make use of the site for varying purposes (food, cover, etc.), unless they are fenced out.

d. General Plant Operation

Accidental release of hot water, working fluids, blowdown effluents, heat storage oils, etc. would be detrimental to the area's biotic resources.

- Mitigation

See Chapter XI-F. Environmental Health and Safety Implications.

G. Energy

1. Current Status

The site currently utilizes only solar energy for vegetative growth. The Coolwater Generating Station on the west will produce approximately 750 MW_e of electricity when Units 3 and 4 are on line and transmission systems adjacent to the east transfer electricity from the Colorado River vicinity to the utility grid system. The local area's resources have been committed to the generation and transmission of electrical power.

2. Project Impact/Mitigation

a. Energy Use

A resource assessment of a conventional generating station would include an analysis of the plant's net energy benefit to the market system. This net input would be determined by subtracting the amount of energy consumed (i.e., permit processing, material mining, fuel extraction and transportation, construction, operation, transmission and efficiency losses, water and air pollution clean-up, etc.) from the gross amount of power produced by the plant. The net energy benefits of some generating systems are surprisingly low when all resource and environmental costs are factored in.

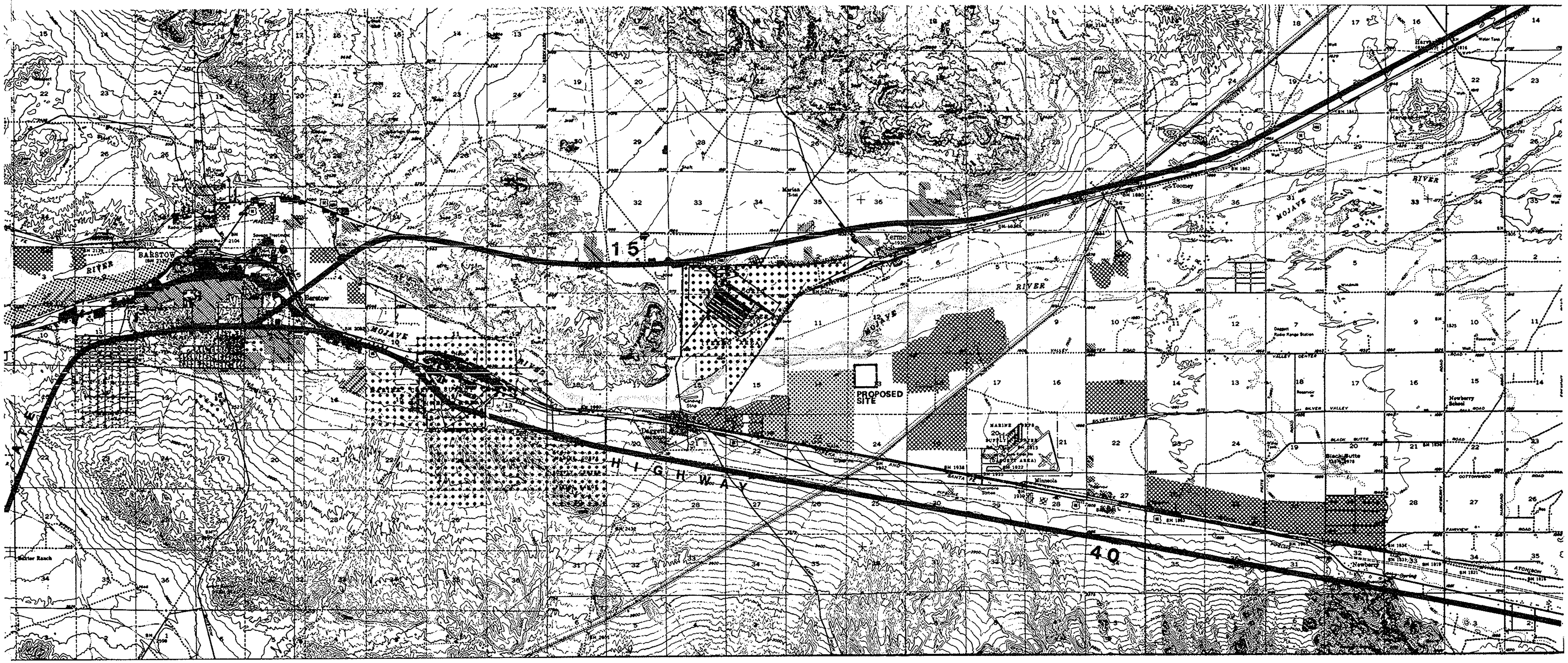
The Pilot Plant will be a solar research facility requiring down-time and therefore will not consistently provide 10 MW_e of electricity to the utility grid over its 5 year research and development life span. A relatively large amount of material and fossil fuel energy per unit of power output will be expended during design, construction, research and operation due to the plant's unique, pioneering technology (See Chapters VI and IX).

At worst case the Pilot Plant may only produce as many BTU's of energy over its life as it consumes, however the utility consortium assumes that it may become a small net energy contributor if the design allows optimum solar collection efficiency and if mechanical problems are not significant.

- Mitigation

Although this project might possibly consume as much energy as it produces over the short-term, it should be considered a capital investment for the long-term efficient use of solar energy as an alternative to our present use of fossil fuels. However, Pilot Plant research should include a determination of the amount of fossil fuels required to manufacture material, construct and operate the Pilot Plant, support research and development activity, etc. Using this data, a projection could be made relative to the net energy advantage of commercial STE development over conventional fossil fuel and nuclear generation.

XI
HUMAN
RESOURCES



10 MWe SOLAR PILOT PLANT

STUDY AREA LAND USE
EXHIBIT II-6

LEGEND

- Military
- Residential
- Commercial
- Agriculture
- Utilities
- Industrial
- Vacant (Private and BLM Lands)
- Parks
- Freeways
- Transmission Corridor
- Railroads
- Airport

CHAPTER XI. DETAILED ANALYSIS: HUMAN ENVIRONMENTAL RESOURCES

A. Population

1. Current Status

The population of the study area[12] as estimated for April, 1977 by the San Bernardino County Planning Department is approximately 27.9 thousand as shown in Exhibit XI-1. (See also XI-2 and XI-3 for reference.) In late 1980 when the Pilot Plant is expected to be operational, the study area population is projected to decrease slightly to 27.7 thousand. During the period 1977-80, the County is forecasting minor population declines for the Lenwood/Daggett area and the U. S. Marine Corps Supply Center at Nebo. After 1980, the County projections indicate that the study area population would increase at the average annual rate of 0.7 percent, reaching 29.8 thousand in 1990.

Between 1970 and 1977, the study area experienced a population decrease of 1.5 thousand or 5.1 percent relative to the 1970 total. The reduction of nearly 2.5 thousand military and civilian personnel at two local bases accounted for most of the decline[13]. Force reductions occurred at the USMC Supply Center at Barstow. Fort Irwin (the Sixth Army's Armor and Desert Training Center) located 40 miles north of Barstow was deactivated in 1970 and is now only used for periodic National Guard Training. Recent population growth in the area appears to have offset much of the military population loss.

Exhibit XI-1

POPULATION, SAN BERNARDINO COUNTY AND SOUTHERN CALIFORNIA

1970 - 1990
(in Thousands)

	1970	1975	1980	Percent Change 1970-80	1985	1990	Percent Change 1980-90	Percent Change 1970-90
Desert Region*, San Bernardino County	116.4	122.0	132.2	13.5	139.1	146.0	10.4	25.4
San Bernardino County	682.2	696.1	781.6	14.6	832.3	881.8	12.8	29.3
Southern California**	11,248.4	11,895.1	12,887.5	14.6	13,693.0	14,497.3	12.5	28.9

*Includes census tracts 89.01-107.

**Includes the counties of Imperial, Los Angeles, Orange, Riverside, San Diego, San Bernardino and Ventura.

Sources: San Bernardino County Planning Department, "1977 Estimate of Population and Housing Population Projections to 1995"; San Bernardino County Planning Department, "The 1975 Special Census", January 1976; Southern California Association of Governments, SCAG-76 Growth Forecast Policy, January 1976; California Department of Finance, Population Projections for California Counties 1975-2020, June 1974; Williams-Kuebelbeck and Associates, Inc.

Exhibit XI-2

POPULATION, STUDY AREA AND COUNTY, 1970-1990
(in Thousands)

	1970	1977	1980	Percent Annual Growth	1990	Percent Annual Growth
Study Area	29.4	27.9	27.7	-0.6%	29.8	0.7%
C.T. 90.02 Yermo**	1.3	1.1	1.1	-0.1	1.2	0.9
C.T. 93.00 Barstow N	1.3	1.3	1.3	-	1.4	0.7
C.T. 94.00 Barstow	4.2	3.3	3.2	-2.1	3.4	0.6
C.T. 95.00 Barstow S	7.3	6.6	6.6	-0.9	7.2	0.9
C.T. 96.01 Lenwood/Daggett	11.8	12.0	11.9	0.1	12.9	0.8
C.T. 96.03 Nebo Ctr. - USMC Base	1.8	1.8	1.7	-0.5	1.7	-
C.T. 103.00 Newberry/Baker**	1.7	1.8	1.9	1.1	2.0	0.5
Desert Region***	116.4	128.8	132.2	1.3	146.0	1.0
San Bernardino County	682.2	737.9	781.6	1.4	881.8	1.2

*C.T. is abbreviated for census tract.

**C.T. 90.02 includes the community of Yermo only; C.T. 103.00 includes the Communities of Newberry and Minneola only. Population totals are estimates only.

***Includes census tracts 89.01 - 91.02, 93.00 - 100.02, and 103.00 - 107.00

Sources: San Bernardino County Planning Department, "Preliminary Population and Housing Population Projects to 1995"; Williams-Kuebelbeck and Associates, Inc.

Exhibit XI-3

POPULATION DISTRIBUTION, STUDY AREA AND COUNTY
1970 - 1990
(in Thousands)

	1970		1977		1980		1990	
	Total	Percent Total	Total	Percent Total	Total	Percent Total	Total	Percent Total
Study Area	29.4	4.3%	27.9	3.8%	27.7	3.5%	29.8	3.4%
Desert Region	116.4	17.1	128.8	17.5	132.2	16.9	146.0	16.6
San Bernardino County	682.2	100.0	737.9	100.0	781.6	100.0	881.8	100.0

Sources: San Bernardino County Planning Department, "Preliminary Population and Housing Population Projections to 1995"; Williams-Kuebelbeck and Associates, Inc.

Barstow is the only incorporated city within the study area. The April, 1977 estimate of 16.9 thousand for Barstow represents about 60.9 percent of the study area. The population of neighboring communities is as follows: Lenwood, 3,900; Menneola/Newberry area, 1,800; Nebo Center, 1,800; Yermo, 1,200; and Daggett, 464.[14]

Historically, the growth rate of the study area has been less than the larger desert region (of which it is a part) and the county as a whole. This trend is projected to continue through 1990 due to fluctuation of military populations. While the 1970-80 annual growth rate for the study area is expected to be negative, the desert region and county annual rates in this same period are both forecasted to be about 1.3 to 1.4 percent. Between 1980-90, the annual growth rate for the study area is projected at 0.7 percent as compared to the desert region and county rates of 1.0 and 1.2 percent respectively. The results of the differing growth rates are seen in Exhibit XI-2 where the study area represents an increasingly smaller share of the county and desert region populations. The study area's share of county population is projected to decrease from 4.3 percent in 1970 to 3.4 percent in 1990.

2. Project Impact/Mitigation

a. Construction

The number of fulltime personnel supervising the construction of the project has been estimated by SCE to be approximately 50, most of whom will be non-county residents. Because housing opportunities are limited in the City of Barstow and the surrounding unincorporated communities, some of the management personnel and their families would locate in Victorville (30 miles southwest of Barstow).

The maximum on-site construction force is projected to be approximately 500 during the first quarter of 1980, averaging out to approximately 270 at any given time. Since the majority of these workers will be hired from within the County through DOE and SCE contractors, most will probably commute from their present residences. However a sufficient amount of overtime work would induce many to temporarily lodge in a motel, trailer or camper in or around Barstow. For the purposes of this assessment, it will be assumed that the majority of the construction workers will commute to and from their homes.

Of the 50 more permanent supervisorial construction personnel, approximately one-third or 16 could obtain housing in the City of Barstow with the remaining 34 residing in the City of Victorville [15]. Assuming a household size of 2.8, the construction population would temporarily increase the population of the cities of Barstow and Victorville by about 45 and 95 persons respectively.[16] The construction population increment to each city is insignificant representing 0.3 percent of the 1977 estimated Barstow population of 16.9 thousand and 0.7 percent of the 1977 estimated Victorville population of 13.9 thousand.

- Mitigation

The influx of Pilot Plant construction workers in mid 1978 will have a negligible effect on existing populations. The current work force of approximately 450 involved with Coolwater Units 3 and 4 have not noticeably affected local communities.

The project participants could alleviate the burden of long-distance commuting by helping workers find temporary quarters in Barstow and by providing lists matching workers with geographical areas in order to promote car-pooling, especially for those commuting from the non-desert regions of the county.

b. Operation

Approximately 12 new permanent employees (operators, technicians, maintenance workers, etc.) will be required to operate the Pilot Plant. Assuming that plant personnel will be hired from outside the study area and that the household size would average 2.8, approximately 34 new residents would move to the area. Pilot Plant population would represent less than .1% of the forecasted 1980 study area population. Assuming that the 12 additional households would probably locate in Barstow where future housing may be more plentiful than in adjoining unincorporated communities, plant population would increase the 1980 Barstow population forecast of 17,100 by .2%.[17]

- Mitigation

The introduction of permanent plant personnel to the study area will not upset existing population balances and therefore mitigation is not required. (See Exhibit XI-4 for a summary of project effect on population.)

Exhibit XI-4

POPULATION IMPACT SUMMARY

- Construction period will be from mid 1978 through 1980 (1-1/2 year period).
- 50 permanent employees during 1-1/2 year construction period - constituting 140 new temporary residents - 45 would reside in Barstow (.3% of 1977 population) - 95 would reside in Victorville (.7% of 1977 population).
- 270 temporary workers off and on during construction periods - most commuting from their existing residences in County (desert and coastal basin) - some will spend few nights at Barstow motels, trailer parks, etc. Families will probably not join workers.
- 12 permanent employees during 5 year operation period - constituting 34 new residents - most residing in Barstow (.2% of projected 1980 Barstow population).

c. Research and Development Visitation

The Pilot Plant will be the largest STE operation in the country and will therefore draw the attention of people in the energy profession. Plant visitation by research-development personnel may be heavy during the first year of operation, but will probably taper off thereafter. Barstow's visitor accommodations will be sufficient to handle research-related, periodic population increases without necessitating construction of extra tourist support facilities.

- Mitigation

No special mitigation is required. The project participants will have the ability to schedule professional visitation and research so as to not over-tax the study area's infrastructure.

d. Public Visitation

SCE has prepared an analysis of the locational characteristics of the visitor center which projects the potential population from which the center would both draw and capture. The report is on file with both the County and SCE and is available for public review.

Attendance at the Pilot Plant Information Center (visitor's center) is projected by SCE to total approximately 49,000 in 1981, the first full year of plant operation. This projection is considered to be a conservative estimate and is based on: 1) the attendance patterns observed at the information center for the San Onofre Nuclear Generating Station located near

San Diego and the Calico Ghost Town located near the Pilot Plant site, and 2) Traffic patterns along nearby interstate highways.

Attendance at the Pilot Plant's visitor center will be a function of the local residential population and the transient population. The local residential population will provide the most immediate source of attendance. The transient population includes persons who live outside the local area and travel to the area to visit local points of interest and/or through the area destined for other locations (i.e., Las Vegas, Arizona, etc.) The transient population is and will be far greater than the local residential population.

The number of visitors per year at the information center is projected to be comprised of approximately 1.0 percent of the local residential population and 0.3 percent of the transient population. The primary impact of visitation will be traffic related and will be dealt with in Chapter XI-D.

- Mitigation

The proposed establishment of the visitor's center constitutes an acknowledgement by the consortium of the future public interest in the Pilot Plant. The facility's parking lot and information room will automatically and passively act to control flows of visitors and should be sized to accommodate anticipated use.

B. Socio-Economic Factors

1. Current Status

The economic base of the study area reflects its location along major transportation corridors and near military installations. The highway and railroad routes have resulted in the development of a sizable transportation industry (railroad repair, truck freight distribution) and an extensive highway and recreation supported retail trade industry in Barstow. The travel-related retail trade in Barstow is generated by those who drive from southern California to Las Vegas and/or places of interest in the desert and find Barstow a convenient stop for fuel and food. Military installations (USMC Supply Centers) have historically accounted for a large proportion of total employment.

Exhibit XI-5 indicates the 1970 employment distribution of the study area, the desert region and the county. The concentration of employment in transportation and government indicates the importance of these two industries to the study area economy. Of the 9.9 thousand jobs held by local residents in the study area in 1970, approximately 4.6 thousand or over 46% of the total were employed by the transportation industry or government. The corresponding percentage relationships for the desert region and the County are noticeably less at 30% and 16% respectively. The relationship between trade employment and total employment (21%) in Barstow is comparable to that of the desert region and the

Exhibit XI-5

DISTRIBUTION OF EMPLOYMENT BY MAJOR INDUSTRY GROUP, STUDY AREA AND COUNTY, 1970

	Study Area*		Desert Region		San Bernardino County	
	Total	Percent Total	Total	Percent Total	Total	Percent Total
Construction	350	3.5%	2,254	6.9%	15,811	7.1%
Manufacturing	230	2.3	2,915	9.0	42,611	19.1
Transportation, Public Utilities	2,120	21.5	5,106	15.8	18,180	8.1
Trade	2,070	21.0	6,952	21.4	48,025	21.5
Finance, Insurance, Real Estate	240	2.4	1,178	3.6	9,307	4.2
Services	2,080	21.1	7,938	24.5	61,285	27.4
Public Administration	2,500	25.3	4,437	13.7	17,818	8.0
Other Industries**	280	2.9	1,661	5.1	10,226	4.6
Total	9,870	100.0%	32,441	100.0%	223,263	100.0%

*Employment estimated for parts of Census Tracts 90.02 and 103.00.

**At the census tract level, the U.S. Bureau of the Census aggregates Agriculture, Mining and the entertainment and recreation portion of the Services Industry Group into the Other Industries category.

Sources: U.S. Bureau of the Census, 1970 Census of Population and Housing, Census Tracts, San Bernardino-Riverside-Ontario SMSA; Williams-Kuebelbeck and Associates, Inc.

county. Apparently, employment in highway-oriented retail trade is offset by the leakage of employment in the consumer goods component (apparel, general merchandise, furniture and appliances and specialty retail) of retail trade to places outside the study area.

There are approximately 4000 people employed within a ten mile radius of the site at the Marine Corps Supply Center, airport and Calico Regional Park. In 1975, about 6.1 thousand or 64 percent of the estimated 9.5 thousand jobs in the study area were located in Barstow.(18) When government employment is included, over 90 percent of the study area's jobs are located in Barstow.

The mean family income level of $10.6 thousand reported in 1970 for the study area is comparable to that reported in the county as indicated in Exhibit XI-6. In comparison with the mean family income in the larger desert region, the mean income in the study area was slightly greater.

2. Project Impact/Mitigation

The impacts induced by the development of the Pilot Plant are presented relative to the construction and operation phases of the project. The short term impacts are defined as those impacts which would likely arise during the construction of the Pilot Plant. Long term impacts are those impacts which would occur both after the Pilot Plant becomes fully operational and after its use is discontinued.

Exhibit XI-6

MEAN FAMILY INCOME,
STUDY AREA AND COUNTY, 1970 *

	Families	Mean Income	Percent County Mean Income
Study Area	7,100	$10,600	100.8%
Desert Region	29,976	9,550	90.8
San Bernardino County	173,119	10,513	100.0

* Sources: U.S. Bureau of the Census, 1970 Census of Population Housing, Census Tract, San Bernardino-Riverside-Ontario SMSA; Williams-Kuebelbeck and Associates, Inc.

a. Employment

(1) Short-Term

The construction labor force is projected to have an insignificant employment impact on the study area and the larger desert region. Most of the construction craft workers would not require temporary housing in the study area because they would likely commute to the site from their existing residences within the County. Each contractor is anticipated to hire a number of management personnel to oversee the development of the project over the entire construction period. It is assumed that nearly all of the management personnel would not be residents of the county and thus would require temporary relocation to the communities adjacent to the plant site (See previous section).

While a few construction laborers are likely to be hired from the study area, the majority is expected to be hired from the more populous valley area (Ontario-San Bernardino-Redlands). It is anticipated that these workers would commute daily to the project site for the following reasons: 1) the workers would be hired for a brief duration as their skills are required; 2) most would have an existing residence in the valley area of the county from which to commute (80-100 miles one-way); and 3) limited motel accommodations and rental housing units are available in the Barstow area. Thus construction employment impacts in the study area would be negligible.

(2) Long Term

The 12 new full time jobs will have little or no effect on the employment characteristics (total, industry distribution, and unemployment) of the study area.

The economic multiplier effect of the Pilot Plant employment on the study area is projected to be inconsequential. The local economy should be able to absorb the minimal increase in the total demand for local goods and services without expansion of the secondary labor force.

- Mitigation

An attempt should be made to man the construction force with as many local residents as possible.

b. Housing

(1) Short-Term

The local temporary housing requirements of the construction workers would be minimal. Nearly the entire labor force would be hired from areas (most probably the valley cities) within the county. The construction craft workers would likely commute from their present residences as their skills are required. Exclusive of the estimated 50 personnel who would supervise the building of the Pilot Plant over the 30-month construction period, the balance of the work force should not affect the local housing market.

The construction management personnel will probably find adequate housing, although at greater distances from the plant site than they would otherwise prefer. Given the length of the construction period, it has been assumed that the management personnel would be accompanied by their families. Unless the study area housing market changes dramatically prior to the construction start-up date of mid-1978, there is likely to be an insufficient number of vacant standard housing units available in the Barstow area to satisfy the housing requirements of the 50 managers and their families.[19] Consequently, many of these construction households would locate in Victorville where more vacant housing is available.[20] (See preceding section regarding population.) At the time of initial project construction, this residential distribution would shift depending on the vacancy rate in each city.

(2) Long-Term

The low vacancy rate in the study area as a whole suggests that the plant operation personnel would be attracted to Barstow where the only new housing in the study area is available close to the plant site. In addition, Barstow is the dominant retail center in the study area offering a variety of consumer goods and services which are not available in the other nearby communities.

The Barstow housing market could support the single family housing demands of the Pilot Plant households. Since the 1970 Census, there have been approximately 30 single family housing starts per year and no multiple-family housing starts. Because no new and few existing multiple family housing units would be available, it is assumed that the Pilot Plant household would occupy single family homes. If 30 new single family homes continue to be built each year through 1980, the housing market should be able to absorb the one-time Pilot Plant household demand of 12 units.

New industry often induces, or at least acts as a justification for increased housing starts. It is doubtful, but possible that the Pilot Plant's existence might indirectly promote more housing construction than can be filled by plant-related households over the relatively short plant life.

- Mitigation

The Victorville, Barstow and County planning departments and commissions, for their respective incorporated and unincorporated jurisdictions, may have to closely quantify the infrastructural needs of Pilot Plant personnel in order to limit over-reaction on the part of promoting developers. However it is probable that developers will not substantially displace natural supply and demand factors for housing by any grand attempt to reap short-term advantage from the Pilot Plant's existence. (See "Land-Use/Planning" - Section XI-C for an analysis of this unique project's long-term planning implications.)

c. Retail Sales

(1) Short-Term

The Pilot Plant construction workers and resident population would have an insignificant effect on the level of goods and services purchased in the Barstow and Victorville areas. The negligible increase in taxable retail transactions would be easily absorbed by the existing retail establishments located in these two areas.

Since most of the skilled laborers will commute to the plant site on a daily basis, it is unlikely that they would substantially contribute to local spending. Assuming that the per capita purchase of retail goods by the temporary resident population is similar to the 1976 county average of $2.4 thousand, the temporary resident households would add annually $107.5 thousand or 0.1 percent to the 1976 Barstow retail base of $78.7 million and $228.5 thousand or 0.3 percent to the 1976 Victorville retail base of 73.7 million.[21]

(2) Long-Term

The retail expenditures of employees and families associated with the Pilot Plant over its period of operation would be an insignificant amount relative to the total 1976 Barstow retail trade transactions of $78.7 million ($4.7 thousand per capita). Per capita retail trade in the county averaged $2.4 thousand. The difference in the two (per capita) figures reflects the local consumption of retail convenience goods (food accommodations and auto supplies) by the substantial external highway market. Assuming that the per capita purchase of retail goods by the permanent population is similar to the county average of $2.4 thousand, the additional households would add $81.2 thousand in 1976 dollars to the local retail trade base.[18] The increment is about 0.1 percent of the total retail trade reported in Barstow for 1976.

- Mitigation

No mitigation is required since retail trade will not be significantly increased by or become dependent on Pilot Plant personnel. Trade reductions after plant operation is terminated will be minimal and could easily be absorbed by the normal expanding economy of the study area.

d. Local Governmental Services

(1) Short-Term

The construction force population is not expected to create a significant additional demand for local governmental services, i.e., general government, police and fire, water and sewer, street maintenance, etc. This conclusion is based on the expectation that:

- Most of the construction trade workers will originate in San Bernardino County and will commute to the project site, thereby requiring no additional public services beyond those normally provided regardless of the proposed project.
- The temporary management-related resident population would represent insignificant additions to the Barstow and Victorville populations.

(2) Long-Term

It is anticipated that each of the plant's 12 permanent employees probably will choose to reside in new homes in the

City of Barstow, less than 15 miles from the project. This assumption is based on the current low vacancy rate among housing units in the city.[22]

The addition of 12 households in Barstow represents a 0.2% increase in household numbers and therefore would create a nearly imperceptible new demand for local governmental services.[23] However, in contrast, the Pilot Plant households would enhance the city's tax base in excess of 0.5 percent.[24] This finding indicates that any new demands for local government services resulting from these additional households might be offset by their net contribution to the city's revenues.

Pilot Plant population will add approximately 14 additional students to the elementary and secondary schools;[25] and only one new student to the community college.[26]

- <u>Mitigation</u>

The relatively short life-span and low support requirements of the Pilot Plant will not result in increases in levels of government services (except perhaps road maintenance - see "Traffic Section") that cannot be easily absorbed by normal economic growth after plant operation is terminated.

e. <u>Pilot Plant Cost (See Ch. II-D)</u>

DOE's payment of approximately $100,000,000 for the solar-related portion of the Pilot Plant will be dispersed throughout the national economy to the concept and equipment designers, equipment manufacturers, contractors, laborers, etc. Approximately $25 million of these DOE funds will be spent via the DOE contractor for collector/tower assembly and installation at the site itself.

The approximate $20 million cost of the non-solar, turbine generator portion of the plant will be paid by the utility consortium and will be distributed to vendors under contract. Construction of the Pilot Plant will approximate $12,000/kW. Operational costs will be more accurately determined after the plant is tested.

- Mitigation

The high cost of this Pilot Plant per unit of generated output is a factor of its uniqueness and pioneering technology, and therefore cannot be productively compared with the cost of power from a conventional system. This capital investment is a contribution to the future economical application of solar technology and is not intended to be cost-effective per MW_e output in the traditional sense.

Regions other than just the site study area will economically benefit from the project.

f. Fiscal Impact on Local Taxing Jurisdictions

(1) Short-Term

The construction labor force will create no substantial fiscal impacts on Barstow and Victorville. This conclusion is based on the expectation that the commuting workers and the insignificant population additions would have no effect on the size of local government. Barstow and Victorville will receive some additional sales tax revenues.

Additional students associated with the temporary resident population would add less than 1.0 percent to the 1975-76 Average Daily Attendance reported for each of the involved school districts (Barstow Unified, Victor Elementary, and Victor Valley Joint Union). (SCE) Moreover, the tax base of the Barstow Unified School District would be augmented by the assessed value of the partially completed Pilot Plant.

(2) <u>Long-Term</u>

The long-term fiscal contributions of Pilot Plant-related permanent populations should be favorable. Net monetary contributions from new households to the tax base will probably offset their service requirements.

The remainder of this section discusses the effect of the Pilot Plant on the following taxing entities: San Bernardino County General Fund, San Bernardino Library, Barstow Unified School District, Barstow Unified School District - Daggett Component, Barstow Community College, San Bernardino County Service Area 70 and Flood Control Zone 4.

The property tax contribution of the Pilot Plant during its projected five year life may range from approximately $150,000 to $1,900,000 per year. More precise tax estimates can be determined after an opinion is rendered by the State Board of Equalization regarding the taxable possessory interest in the proposed facility to be levied against SCE. Since it is not yet clear what portion of the plant will be subject to property taxation, the range cited above utilizes a few assumptions to arrive at a probable estimate. Those assumptions are:

- The Pilot Plant is assumed to value over $100 million when it becomes operational in 1980.
- In 1977 dollars (discounting at an annual rate of 8.0 percent), this value translates to over $80 million current dollars.
- The "constant rate" method of calculating tax revenue has been used. This approach holds constant the property tax rate of a given jurisdiction although the assessed valuation of the jurisdiction would increase. This method yields a hypothetical increase in the total revenues available to the taxing district which the district may use to increase total output and/or quality of public services.
- These property tax payments would be made annually for five years and would vary directly with changes in the tax rate of the taxing jurisdictions.
- The percent of the plant subject to taxation can range from 100% to 7%, depending on the final determination by the State Board of Equalization.

\- <u>Mitigation</u>

Since both the Pilot Plant and its support populations will provide more revenue to the local taxing jurisdictions than they in turn require via services, the project should result in a net fiscal benefit. The magnitude of this tax benefit depends on the State Board of Equalization's final determination of the amount of the plant's taxable assets. The higher these revenues are over the relatively short 5 year period; the more dependent the jurisdictions may become on them. This potential for a "boom/bust" situation can be avoided by long-range fiscal planning and by sensible use of these short-term revenues.

g. Localized Economic Analysis

It should be noted that this Pilot Plant will have a minute socio-economic impact on Daggett and the study area relative to the probable significant effects of large commercial STE plants on the remote, rural communities of the southwest. However Daggett and vicinity could experience some of the more obvious economic effects associated with the uniqueness and novelty of this first major pilot STE project. Daggett land values might increase disproportionately to adjacent property worth only because of accelerated land sales and speculation stemming from its proximity to the solar site. Values would soon peak and stabilize when investors realized that the local infrastructure could not accommodate the supposedly intended development; but even if it could, its own growth would not be warranted in light of the Pilot Plant's relatively limited purpose and short life-span. In the meantime, however, local residents might be forced to pay higher property taxes than "true" property values would dictate. This and other land-use issues will be further discussed in the next section.

C. Land-Use/Planning Relationships

1. Current Status

a. General Land Use (See Exhibit II-6)

Chapter II-J describes the study area's regional infrastructure. The major land-uses consist of rail and highway transportation networks, urban and rural residential/commercial centers, electricity production and transmission, alfalfa farming, military supply stations, mineral extraction and processing, tourism, recreation, and natural resource values. This particular land-use mix evolved more from a natural, historic utilization of area resources and topography than it did from a concerted planning effort. However, the major adverse effects resulting from such uses (ground water degradation and overdraft, air pollution, mining and land-clearing scars, off-road vehicle damage, natural vegetation loss, etc.) are more factors of resource mismanagement and waste than they are direct results of land-use inconsistencies per se. The County, Barstow, Lahontan Water Quality Control Board, Marine Supply Stations and the Bureau of Land Management (BLM) are attempting to rectify these problems via major clean-up and long-range resource planning efforts. Success will be slow and expensive, but is necessary to insure the study area's viability.

b. <u>San Bernardino County General Plan</u>

The San Bernardino County General Plan was adopted in 1967 and contains several subsequently adopted amendments. In 1973, the County updated the conservation and open space elements. In 1974 the Plan's seismic safety, public safety, noise and scenic highway elements was revised. Land use elements are currently being reviewed as part of an update program, and the Joint Utility (energy) Management Plan has already been adopted.

The General Plan recognizes the existing and developing urbanization patterns in the desert region. It indicates Urban Centers and Urbanizing Areas in the Barstow area, Daggett, Yermo and Newberry. The Plan map shows urban areas connected by bands of agriculture and areas designated as Rural Retreat. According to the plan text, Rural Retreat areas would contain improvements such as desert cabins or second homes, on 2-1/2 to 5 acre parcels (classified for such use by the Bureau of Land Management under the Small Tract Act).

The region to the south of these urbanizing areas is generally designated on the plan as Recreation-Conservation or Resource Reserve. The plan text states that the "Recreation-Conservation areas are especially large blocks of land, primarily in public ownership, where the scenic wildlife and recreation values and the potential enjoyment thereof, are superior. . .". Resource Reserve areas are "those lands in the desert portion of the

San Bernardino County not otherwise designated for specific uses or reservation... It is anticipated that minor development will occur in these areas during the next twenty years..."

The Pilot Plant will be located on the Coolwater Ranch, a 2,337 acre parcel owned by SCE. The Ranch lies at the western end of an extensive agricultural area as designed by the General Plan. Those areas of the ranch not presently used for energy generation continue in agricultural use. The planned land-use to the south of the agricultural zone is "rural retreat" residential; to the southwest - the Daggett "urban center"; to the northwest, - the U.S.M.C. defense reservation; and to the north, - the Yermo "urban center" and its surrounding residential areas.

(1) Scenic Highway Element

The protection and enhancement of scenic areas adjacent to selected highways and travel routes is the primary objective of this General Plan Element. It identifies an initial system of scenic routes, outlines specific objectives and policies, and prescribes methods of implementation designed to preserve scenic lands.

The Scenic Highway Element was adopted by the Board of Supervisors on September 10, 1975 and includes five routes in the vicinity of the Pilot Plant.

Of the five routes, only Interstate 40 has been adopted by the State Legislature and included in the California Master Plan of State Highways, dated January 1, 1974. Others have been adopted by the county as proposed routes pending action by the State Legislature.

Priority Class I routes are for immediate action by a county for inclusion in the County Scenic Routes System. None of the routes in the vicinity of the Pilot Plant are in this category. Priority Class II routes will be the subject of Plan Implementation Programs by the County. Priority Class III routes are outside the County's immediate jurisdiction, however support will be lent to the effort. The five routes are as follows:

Route	Priority Class	Distance From Site
I-40	II	1/2 mile south
Camp Rock Road	III	1 mile south
Old Government Military Road	III	1/4 mile north
Mojave Trail	II	1/4 mile north
Calico Loop Road	III	2 miles north

(See Chapter XI-G for assessment of the project's aesthetic impacts.)

(2) Joint Utilities Management Plan Element

The purpose of the Joint Utilities Management Plan (JUMP) is to better define San Bernardino County's policy on the future location of all major energy facilities. The study identifies, on a countywide scale, critical constraints to be considered in facility sitting. In order to accomplish this objective, a special Advisory Committee was appointed by the Board of Supervisors. This 15-member committee brought to the task of plan preparation a cross-section of expertise.

JUMP was prepared for essentially four reasons. First and foremost, the plan will aid considerably in minimizing the adverse impacts associated with siting major utilities and transmission corridors. Second, it will insure that there is adequate and enlightened participation in and review of energy matters by citizens and local governments. Third, it proposes measures to conserve energy while controlling peak load demand. Fourth, it encourages the use of energy sources that have minimal impact on the environment. In sum, JUMP is intended to serve as a policy document for the Board of Supervisors, the Planning Commission, the State Energy Commission, other governmental and private agencies, and individuals on all major energy related issues in San Bernardino County. At the time the JUMP Element was prepared the Pilot Plant was not anticipated. Nevertheless, the project is compatible with the policies set forth in the JUMP Study since it is being developed in association with the existing Coolwater Generating Station and because it promotes conservation of fossil fuels and air shed.

c. <u>BLM-Administered Lands</u>

The study area is surrounded on the north, east and south by BLM-administered public lands. BLM leases portions of the Ord and Rodman Mountain areas (south of the site) to both annual cattle and seasonal sheep grazing. The Bureau is becoming more involved in regulating mining activity on the various claims throughout the adjacent public lands. The intense organized and unorganized, competitive and non-competitive off-road vehicle (ORV) use on federal lands is administered via BLM's California Desert Vehicle Program (formerly Interim Critical Management Plan).

The Ord and Rodman Mountains south of the site are included in the BLM plan as a restricted area in which ORV use is permitted on existing vehicle routes established prior to November 1973. Unrestricted "open" ORV use is allowed in Johnson Valley just south of the Rodmans. ORV use in the Calico Mountains north of the site is restricted to roads and trails designated by the Bureau, or on routes existing prior to 1973.

BLM and the National Park Service prepared a joint recreation study of the desert public domain lands of California in 1968. This study led to the establishment of the California Desert Planning Program. Specific recommendations for uses of certain lands are also made in the study. One of these areas, the Rodman Mountains, was recently dedicated as a Desert Recreation Area. It covers virtually the entire undeveloped area within the horseshoe band of more intense land use near the proposed plant site. The area covers 454,000 acres, of which 333,000 are publicly owned and BLM administered.

This area was designated by the study as part of Priority Group I based on the following factors: existing heavy recreation use, proximity to population centers, and extreme vulnerability of remaining natural values. The recreation area might eventually include parks. The commentary states: "Although the natural values within the Rodman Mountains Recreation Lands are only average, this large area is increasingly valuable for recreation purposes as the nearby urban areas grow."

The Rodman Mountains Recreation lands conforms generally in size and shape to an area designated as Recreation-Conservation in the County General Plan.

This study of the Recreation Lands of the California Desert also designated the Calico Mountains as a National Recreation Lands Area. The public lands in this area offer a wide variety of recreational opportunities: camping, rockhounding, hiking, etc. The Calico Mountains are north of the site, extending east and west, and have important scientific values as well as recreational features. At the western end, Rainbow Basin (a Natural Landmark) attracts thousands of visitors each year to view colorful geologic formations and fossilized remains of mammals of the Miocene Age. At the eastern end of the mountains, archaeologists have been conducting a search for evidence of early man on the North American continent. (See Chapter XI-E.)

Recent passage of the Federal Land Policy and Management Act (BLM Organic Act) mandates the Bureau to formulate a California desert-wide plan by 1980. This regional plan will probably result in altered and additional land-use designations for portions of BLM lands surrounding the study area.

2. Project Impact/Mitigation

a. Zone Change

The SCE-owned 320 acre parcel on which the 130 acre Pilot Plant site will be situated is presently zoned "Desert-Living" (DL). (Approximately 100 acres of the 130 acre site will actually be used and/or disturbed by plant construction and operation.) The County zoning code requires steam electric generating plants to be in a Heavy Manufacturing (M2) zone or to at least have "site approval" if in another zone. SCE will file for M2 zoning. Therefore the County Planning Commission and Board of Supervisors will need to approve a zone change from DL to M2 on the 130 acre site before the County Planning Commission will issue a "site-approval" for actual plant construction. As previously stated, the definite 130 acre site boundaries within the available 320 acre plot have not yet been determined in order to allow a full study of optimum plant placement relative to potential plumes from the upwind Coolwater emission stacks, and relative to the site's own biological, hydrologic and archaeologic contraints. Actual site boundaries will be determined by SCE, DOE and the County after review of this environmental report and after special on-site studies are performed. The actual location of the 130 acre M2 zone within the 320 acre parcel will not substantially affect land-use planning options.

The primary impact of the 130 acre zone change from DL to M2 will not be its allowance of the relatively short-term Pilot Plant per se, but the potential ability of SCE to utilize the M-2-zoned site for longer term utility development without Planning Commission review long after the Pilot Plant is dismantled. A zone change for this short-term and relatively impact-free Pilot Plant will still be valid for a future, potentially environmentally significant, longer term utility project.

- Mitigation

SCE has agreed to limit the zone change to the actual 130 acre site, the boundaries of which will be determined after initial environmental review. As a result, future utility uses on only the 130 acre M2 site will be allowable without Planning Commission "site approval." Any such use on the DL-zoned remaining portion of the 320 acre plot will require zone change and/or site approval, thus allowing optimum County review of future utility proposals on the majority of the 320 acre parcel.

More complete control over future land-uses on the entire 320 acre plot would be achieved if SCE would agree to allow the M2 zoning designation on the 130 acre Pilot Plant site to revert back to its former DL designation after the short-term solar facility is dismantled or discontinued. However, potentially significant development on the 130 acre M-2 site not requiring formal Planning Commission review would probably require CPUC or State Energy Commission approval. A condition requiring a County "site approval" for future use of the 130 acre Pilot Plant site could be imposed via the "site approval" issued for the Pilot Plant.

b. <u>Affect on Existing Land-Uses and Future Planning Options</u>

The entire available 320 acre parcel is vacant, therefore no structures or individuals will be dislocated.

The Pilot Plant will constitute a slight increase in area-wide industrialization, but its unconventional attributes will set it apart from existing forms of industry in the study area.

The project will result in a net loss of agriculture in the study area unless additional acreage is planted elsewhere in the valley.

Land-use on surrounding BLM-administered lands affected by the temporary presence of construction workers will be insignificant unless unregulated off-road vehicle recreation increases proportionately. The assignment of plant operating personnel to the study area over the life of the project will slightly promote urbanization.

The Pilot Plant will not create significant land-use changes or conflicts in the study area due to its proximity to the existing Coolwater Generating Station. It should not conflict with County, Barstow or BLM land-use plan designations. More important, its relatively short life span will not be conducive to the loss of future land-use options not presently recognized in existing plans.

The project's major threat to land-use inconsistency would be its indirect effect on Daggett. If developers decided to capitalize on the Pilot Plant's novelty and uniqueness, they could expand Daggett's residential and commercial infrastructure to a capacity that could not be sustained either by Pilot Plant-related populations or by populations remaining after plant shut-down. Neither the short project life-span nor the minor plant-support requirements warrant substantial development in Daggett. Most of the project's socio-economic benefits will be dispersed in Barstow and Victorville anyway. Any major development in Daggett even partially warranted by the plant's existence may prove to be only marginally consistent with the town's long-term future growth potential. Daggett residents could be affected accordingly.

It also should be recognized that although this Pilot Plant may not directly induce significant land-use changes by itself, its major contribution to the economic application of commercial solar technology could hasten significant alterations of land-use patterns in the southwest deserts where commercial STE plants would be built.

- Mitigation

The only efficient mitigation for controlling unwarranted and unplanned development in Daggett will be via the land-use planning process administered for unincorporated regions by the County Planning Department and Commission. Infrastructural needs will have to be carefully quantified so that community development (if any) will be profitable and not a burden to the community after plant operation ceases. An extra effort needs to be made by both the County and the community in order to avoid over-reaction to this novel, but possibly short-term solar facility.

Adequate means to prevent long-term land-use conflicts and resource waste in the southwest deserts stemming from construction and operation of commercial solar/thermal plants (if they prove to be viable for electricity generation) can only be achieved by implementation of a good, resource-oriented regional energy plan. The continued lack of initiative to plan for the best use of regional resources, even for conventional electricity production, indicates that natural resources will continue to be wasted before adequate energy conservation and more efficient production will become standard practices. Although intended otherwise, increased energy surveillance by all forms of government has resulted primarily in additional levels of reaction to utility proposals and not in necessary resource planning.

D. Traffic and Transportation

1. Current Status

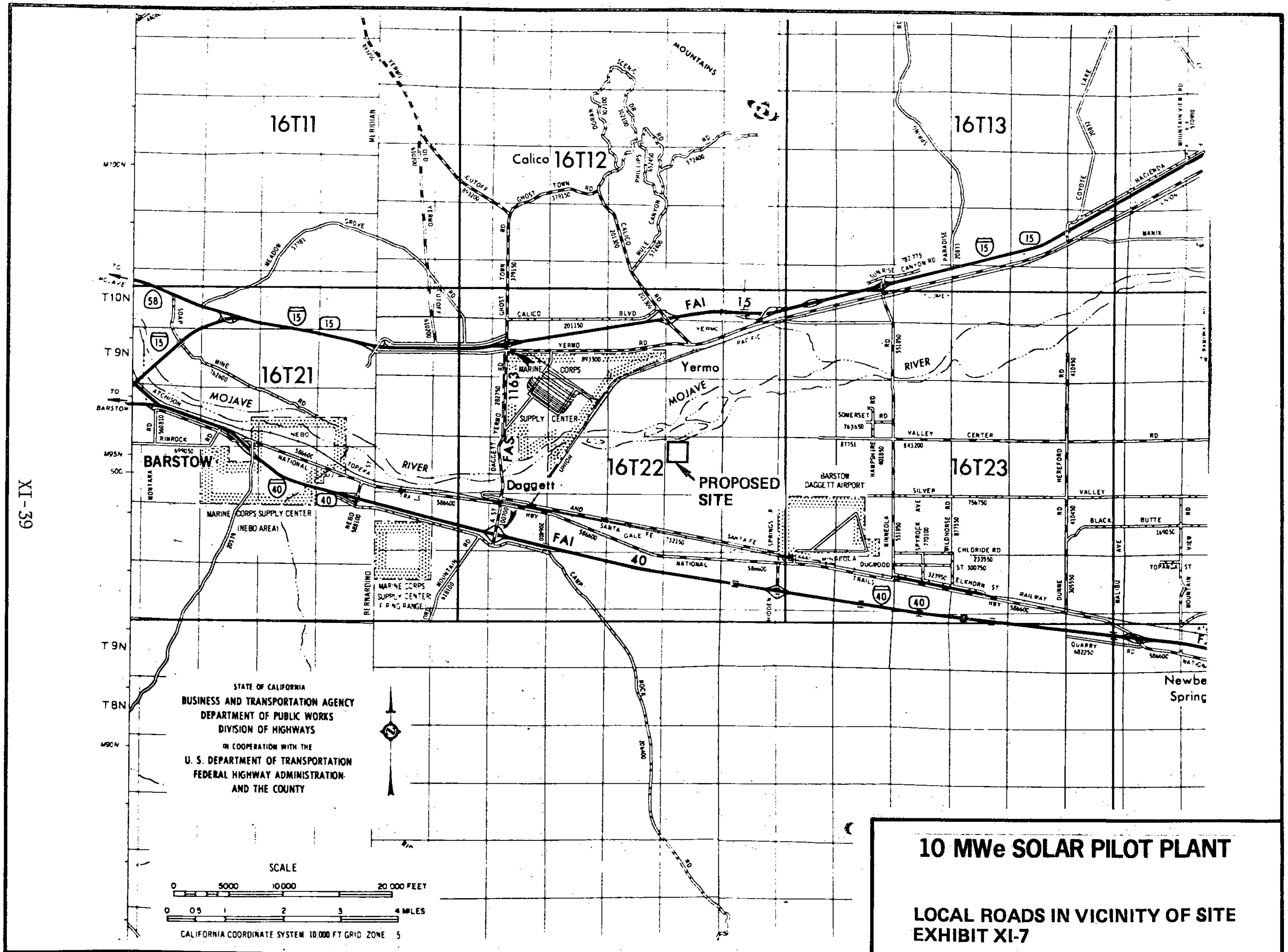
Existing traffic in the area consists of:

- Autobile & Truck Travel on Interstates 15 and 40 north and south of the site respectively, and on local roads in and around Daggett. (See Exhibits XI-7 and XI-8 for description of roads and Average Daily Traffic (ADT) counts.)
- Freight and Passenger Train Travel on the main AT&SF rail line through Daggett to Needles and on a spur to the Coolwater plant.
- Private Airplane Travel to and from the Barstow-Daggett Airport located 3 miles southeast of the Pilot Plant site.

2. Project Impact/Mitigation

a. Construction

The increase in local ADT from the construction work force is quantified in Exhibit XI-9. The increment of 712 ADT assumes round trips to and from the site in the morning and evening plus



10 MWe SOLAR PILOT PLANT

LOCAL ROADS IN VICINITY OF SITE
EXHIBIT XI-7

EXHIBIT XI-8

AVERAGE DAILY TRAFFIC (ADT)

Road	Section	Average Daily Traffic[1,2]
Interstate 15	East of Daggett-Yermo Road	13,400
Interstate 40	East of A Street	7,000
National Trails Highway	West of A Street	2,020
	East of A Street	1,400
A Street	South of Interstate 40	78 (1974)
	North of Interstate 40	2,360
Daggett-Yermo Road	North of Santa Fe Avenue	2,100
Santa Fe Avenue	East of Daggett-Yermo Road	407
	East of 4th Street in Daggett	273
	West of Hidden Springs Road	37
Hidden Springs Road	North of Interstate 40	325
	North of National Trails Highway	499 (1977)
Minneola Road	North of National Trails Highway	211
	South of Yermo Road	239 (1977)

1 ADT's are for 1976 unless otherwise indicated.

2 Sources: San Bernardino Public Works Agency, Transportation Department; California Department of Transportation, Office of Traffic.

EXHIBIT XI-9

CONSTRUCTION WORK FORCE
TRAFFIC IMPACTS

Road	Section	Current ADT* (Primarily 1976)	Construction Increment	Total ADT
Interstate 40		7,000	712	7,712
A Street	North of Interstate 40	2,360	712	3,072
Daggett-Yermo Road	North of Santa Fe Ave.	2,100	-0-	2,100
Santa Fe Ave.	East of Daggett-Yermo Rd.	407	712	1,119
	East of 4th Street	273	712	985

*Reflects traffic from current construction of Coolwater Units 3&4 which will end before or during pilot plant construction. Therefore gross ADT from Pilot Plant construction may not constitute as large a net ADT increase and total ADT could be lower than projected.

a few trips out and back for lunches, etc. Pilot Plant construction ADT will be similar to that attributable to present construction of Coolwater Units 3 and 4, which is included in "current ADT" of Exhibit XI-9. However, the increase will occur at peak periods, therefore creating some minor congestion at Daggett intersections during the 1-1/2 year Pilot Plant construction period. The capacity of local County-maintained roads is sufficient to adequately accommodate both peak and ADT increases (per Traffic Division of County Department of Transportation). The constricted Santa Fe road right-of-way in Daggett due to a vacant building situated on the road edge represents a slight constraint to future road improvements. The Daggett ramp to and from the freeway is of standard, adequate design.

Traffic from trucks hauling material to and waste from the site will increase, but again – probably no more than that presently related to construction of Units 3 and 4. Trucks will not generally be on local roads during peak traffic periods. Unusually heavy loads (under special permit) destined for the site may continue the need for a higher level of local road maintenance by the County during Pilot Plant construction.

The use of trains for hauling materials to the site will result in additional rail cars per train, but will not significantly induce a higher number of actual hauls. Use of the roads by pedestrians, bicyclists and playing children would be more hazardous during peak morning, noon and evening traffic periods.

Pilot Plant construction will require repair of old dirt roads and the blading of a few new ones within and immediately adjacent to the 130-acre plant site. Access off County-maintained roads to SCE property will only be open to construction and operation personnel and to SCE-guided tours.

Unregulated public visitation may begin during construction, creating a problem for work crews, etc.

- Mitigation

The net impact is expected to be minimal, but the County transportation Department should monitor local traffic increases, determine hazards, and act accordingly. If necessary, permanent or temporary stop signs, flashing signals, speed limit signs, spur crossing barricades, etc. would control traffic and possibly alleviate the short periods of congestion.

When construction of the Coolwater Units and the Pilot Plant are complete, ADT will be significantly reduced closer to former levels, even after both plants' operation and visitation-related traffic is accounted for.

SCE is considering building and manning the visitor center when Pilot Plant construction begins in order to accommodate early visitation by the public.

b. Pilot Plant Operation and Visitation

Increased ADT from Pilot Plant operation and visitation is displayed in Exhibit XI-10. "Current" ADT figures were taken from 1976 measurements and therefore include traffic flow stemming

EXHIBIT XI-10

OPERATING TRAFFIC IMPACTS
(Plant Personnel and Visitors)

Road	Section	Current ADT*[1] (Primarily 1976)	Project Increment*[2]	Total ADT
Interstate 15		13,400	-0-	13,400
Interstate 40		7,000	-0-	7,000
National Trails Highway		2,020	70	2,090
A Street	North of Interstate 40	2,360	40	2,400
Daggett-Yermo Rd.	North of Santa Fe Ave.*[3]	2,100	80	2,180
Santa Fe Avenue	East of Daggett-Yermo Rd.	407	50	457
	East of 4th Street	273	50	323
	West of Hidden Springs Rd.	37	12	49
Hidden Springs Rd.	North of Interstate 40	325	4	329
	North of National Trails Hwy.	499	12	511
Mineola Road	North of National Trails Hwy.	211	8	219
	South of Yermo Road	329	8	247

*[1] Reflects traffic from current construction of Coolwater Units 3&4 which will end prior to operation and visitation of Pilot Plant. Therefore, the total ADT during operation and visitation will probably be less than projected above.

*[2] Assumes visitation of 49,000/year - 3 per vehicle. - average of 45 cars/day (see Appendix F). It should be noted that project increment may be greater on certain weekends due to peak visitation.

*[3] Incremental traffic on this road would account for trips to Pilot Plant associated with trips to Calico Ghost Town to the north.

from construction of Coolwater Units 3 and 4. That construction-related traffic will cease long before Pilot Plant startup, and will be only partially replaced by traffic required for operation of the new Coolwater Units and the Pilot Plant. As a result, total ADT even including Pilot Plant operation and visitation will probably be less than that projected in Exhibit XI-11, and will be less than that occurring during Pilot Plant construction.

For this ADT analysis it has been assumed that 49,000 annual visitors will come from Interstate 15 and Interstate 40 in the same proportion as the total traffic on each freeway. For both Interstates, it is further assumed that 90% of the visitors will exit from Interstate 40 on A Street in Daggett, or from Interstate 15 on the Daggett-Yermo Road. (Per SCE's Visitor-Use analysis on file with SCE and the County. An important excerpt from this report is in Appendix F).

SCE-owned rights-of-way will only be accessible to the general public for special guided tours. Special transportation will be used for transporting certain visitors to and from the site.

A new paved road intersecting with National Trails Highway south of the plant site will be installed for access to the visitors center. (See "Project Description" — Ch. II-K).

The highest concentrations of interstate traffic utilizing Daggett roads and the visitor's center will occur on well-travelled weekends, possibly peaking on Friday and Sunday afternoons. Local visitation may also peak on weekends, more likely midday Saturdays and Sundays (EAD projection).

A heliopad has been constructed at the SCE Barstow office and a heliostop will be installed at the site. Air traffic at the Barstow-Daggett Airport will be increased by solar related research activity by an unknown amount. The Pilot Plant's operation effects on air traffic hazards are assessed in Chapter XI-F.

- Mitigation

The measures suggested for mitigating construction-related traffic flow are applicable to operation and visitation ADT. However they may not be required since long-range ADT will be reduced after the existing Coolwater Combined Cycle construction ends. A higher level of visitation than that currently projected would be the only traffic related variable that might adversely affect traffic flows over the long term. Both the information center and its parking lot will be sized to accommodate anticipated peak visitor use.

Necessary mitigating factors for airport – use control will automatically be implemented by the County Department of Airports or Civil Aeronautics Board.

E. Paleontological, Archaeological and Historical Resources

The San Bernardino County Museum Association (SBCM), under contract to the San Bernardino County Environmental Improvement Agency (via an agreement with SCE), conducted a literature and records search, as well as a field survey of the plant site. The results of that study are contained in a report entitled, "Daggett Solar Power Generating Station – Paleontologic, Archaeologic and Historic Assessment" — dated June 1, 1977. It is on file in the County EAD office for public review.

The following inventory data is summarized from SBCM's report:

1. Paleontological Resources

a. Current Status

The site is underlain by partially exposed alluvial fan and stream deposits of Pleistocene and Recent age and in part by dune sand derived from these sediments.

University of California (Riverside) and County Museum paleontologic locality site files do not indicate the presence of any known fossil remains on or near the site. However, as is the case at known fossil localities in the region where intact Pleistocene mammal remains have been found, the site's fine-grained Pleistocene alluvial sediments should be ideal for the preservation of fossil vertebrates.

The field survey resulted in the discovery of tooth fragements of Pleistocene Camelops sp. (camel) in silty-sandy sediments 600 feet east of the parcel's eastern boundary. Fossils were not found on the site's surface.

b. Project Impact/Mitigation

It is definitely possible that vertebrate fossils might be exposed (and possibly destroyed) in the site's silty sandstone during initial surface grading, levelling and trenching.

- Mitigation

SBCM recommends that trained paleontologists be present as observers during initial grading and trenching. If fossils were encountered, they would be evaluated and removed with minimum delay to project operations. These Pleistocene remains could be displayed at the visitor's center in association with interpretive graphics, dioramas and specimens or replicas of similar representative fossils.

2. Archaeological Resources

a. Current Status

The 320 acre site contains two distinct geographic units — 20-foot high bluffs separate the Mojave River bottom on the north from the relatively flat terrace on the south.

Rock fragments carried by water flows found both in the river bottoms on the terrance include volcanic porphyries, basalt, chalcedony and quartzite (all usable for toolmaking).

These lithic resources, combined with the riverbed's riparian food source and periodically available water indicate that the site and immediate area could have been utilized by aboriginals. The lack of adequate shelter suggests that the parcel most probably would have been used for lithic processing (tool making), hunting and gathering, and probably not for permanent occupation.

The Mojave River course was used as a trade route by a variety of Indian groups, including Vanyume (inhabitants of the region), Serrano, Mojave, Pueblo, coastal tribes and Paiutes.

Recorded archaeologic site SBCM 97 exists east of the parcel. Sites SBCM 86 and 98 are significant petroglyph localities at Elephant Mountain and nearby Rattlesnake Rock, west of the parcel. It is known that the Pilot Plant site region contains remnants of implements used for animal and vegetable gathering and processing (metates, manos, scrapers, blades, projectile points), lithic flaking stations for tool manufacture, and pottery shards associated with trade and water carrying. Other more exotic artifacts associated with trade along the Mojave trail (beads, shells, pendents, decorated pottery, etc.) might be encountered.

The field survey was conducted on foot in systematic transects ranging from 30 feet to 100 feet apart. Detailed surveys were also performed around the site's likely ponds and bluffs. Inspection was continued off the parcel east along the Mojave River bluff to ascertain possible associations adjacent known values.

Artifacts found along the site's bluffs include:

- A scraper plane and hammerstone (of porphyritic metavolconic rock derived from the Victorville area);
- Flakes of chalcedony (from material probably derived from Calico Mountains to the north);
- Flakes of basalt (probably collected from Newberry Mountains to the south);
- Brownware pottery shards and rim fragments.

A single flake of chalcedony derived from the Calico Mountains was found adjacent to a seasonal pond in the southern portion of the 320 acre parcel.

Scraper planes and hammerstones found along the bluffs east of the site probably are evidence of a continuous linear archeologic feature (such as a trail) along the river. No traces of actual trail were found. The archeologic values within the parcel may be an extension and a part of previously reported SBCM 97.

The parcel is 10 miles by road from the "Calico Dig" which is an "early man" site east of the Calico Mountains where Louis Leakey, Ruth Simpson and other representatives of the SBCM have discovered artifacts suggesting aboriginal habitation more than 50,000 years ago. Previous estimates of man's presence on the North American continent approached 30,000 years.

b. Project Impact/Mitigation

Discovered surface and subsurface artifacts could be lost or further destroyed during grading, levelling and trenching operations. Some could be illegally removed by construction workers.

- Mitigation

SBCM recommends detailed plotting of the known surface artifacts and systematic digging to determine subsurface values. An archeologist should also be present during initial grading and trenching operations. Artifacts found below the surface would indicate permanent or seasonal occupation and may yield information on cultural stratification, better defining prehistoric oboriginal and historic Indian use of the site. After evaluating the results, the level of preservation or salvage could be determined. Artifacts could be removed from portions of the site that would be disturbed and exhibited with interpretive graphics of the Mojave River trail in the visitor's center.

The 130 acre site could be located far enough south on the 320 acre parcel in order to avoid the more concentrated archeological values along the river bluffs. [It is also important to avoid the bluff area due to hydrologic constraints (see Chapter X-C). However it is important not to locate the collector field too far south into the more likely, periodic path of the plumes from the upwind Coolwater emission stacks (see Chapters X-D and E)].

3. Historical Resources

a. Current Status

The site region's history is a rich and varied mix of aboriginal and recent activity. Various aboriginal and historic Indian groups subsisted on the region's habitat and travelled its expanses along the Mojave River for raiding and trading purposes.

Such famous early white explorers and trappers as Francisco Garces (1776), Jedediah Smith (1826) and Kit Carson crossed the Mojave Desert from the Colorado River to the coastal basin, using Indian trails and routes that later became established travel corridors. Before the Mojave Trail was moved to the terrace north of the Mojave River, the project site could have actually been crossed by many if not most of these early nineteenth century travellers. Available historic records indicate only transitory use of the present Coolwater property by historic figures and it is unlikely that related artifacts would be found on the site.

Mid-nineteenth century intrusions by white settlers induced subsequent subjugation and annihilation of some of the more resistant Indian groups by the military. A fort was established at Camp Cady east of the site to "protect" early settlers and travellers.

Daggett started as a railroad and mining town in the 1880's and became the receiving and distribution point servicing the extensive silver mines of Calico, Ord Mountain, Lava Beds, Alvord, Solo, Silver Lake and southern Death Valley. Borax from Death Valley and from the nearby north slope of the Calico Mountains was shipped into town by 20-mule teams for processing and distribution by rail. Daggett was an important hub in the Mojave Desert until (beginning at the turn of the century) land values inflated, silver prices and production declined and the nation's borax "capital" reverted back to Death Valley. From that point on Barstow absorbed Daggett's dwindling infrastructure.

The 320 acre parcel does not contain any remnants of the area's colorful history, however a number of structures in Daggett are representative of its mining and railroad period:

- Stone Hotel - Located on Santa Fe Ave., this 102 year-old dilapidated structure was an 8 room hotel and the business center of commerce and mining in the late 1800's. The Daggett Historical Society under direction of the County Museum Association, with a budget assist from the County Board of Supervisors, will soon begin the building's restoration. The building could qualify as a "Point of Historical Interest", but has not yet been so designated. It may have potential for meeting criteria for nomination to the "National Registry of Historic Places" (per SBCM).

- Alf's Blacksmith Shop and Adobe House - Located on First and Santa Fe Streets, these structures date back to Daggett's "20-mule team" period in the late 1880's. Wagons that hauled borax from the Calico Mountain mines to Daggett were built and repaired in the shop. Descendants of Daggett pioneer and shop founder, Seymour Alf, also operate a small museum containing remnants of the town's early period. For many years they have attempted to obtain both official recognition of the historical importance of the structures and funds to assure their preservation. The blacksmith shop is presently listed as a "Point of Historical Interest" and may quality for nomination to the "National Registry."
- Various other structures, a cemetary, etc. in and around Daggett are historically important.

b. Project Impact/Mitigation

(1) Plant Construction

Cursory inspection of the Old Stone Hotel's structure on Santa Fe Avenue indicates it could be somewhat vulnerable to vibration from heavy truck traffic servicing the Pilot Plant's construction, however if it survived all the years of train traffic and SCE-related truck traffic, additional traffic may not have any substantial effect.

- Mitigation

None will probably be required.

(2) Historic Implications

The Pilot Plant will contribute to the dilution of Daggett's historic character. On the other hand this novel development signifies the advent of a new type of pioneering achievement that hopefully will influence community spirit.

- Mitigation

The project participants, the County Museums Association and Daggett leaders could take advantage of the uniqueness of the Pilot Plant by carefully associating it, via public relations and education, to the community's true historic value. This project can be considered another sequence in the region's historic achievements relative to the use of desert resources. (In this case it would be the beneficial use of the area's intense solar radiation for production of electricity and for long-term beneficial solar research efforts.) The community could also benefit from productive efforts by the County Environmental Improvement Agency (Planning and Community Development Departments), and County Office of Economic

Development in an attempt to direct subsequent development, possibly induced by the Pilot Plant, for optimum community benefit. Daggett is in more need of a productive infrastructure that incorporates the best of its past with the economic needs of its future than short-term enterprises that will be gone after the Pilot Plant is dismantled. The utility consortium could begin the effort by representing past, present, and future community characteristics in the visitor's center's display.

The area's geographic, prehistoric and historic values relating to earth science, aboriginal and recent native American habitation, nineteenth century exploration and exploitation, and relatively recent mining activity should be graphically displayed at the visitor's center, possibly under the direction of the County Museum. The Community could assist by contributing samples of historical remnants, while at the same time notifying the public of the existence of the community's historic landmarks and museums. (Grant monies for restoration of such sites would be easier to obtain if funding agencies knew visitation would be sufficient to warrant expenditures.) The utility consortium itself could use the visitor center to portray the advancement of electricity production throughout the years. The existence of the Coolwater conventional fossil fuel Units 1 and 2 built in the 1950's; adjacent to the new, relatively novel Combined Cycle Units 3 and 4; which in turn would be adjacent to the definitely unique Pilot Plant; are in themselves a "museum" of generating technologies. All of the above historic factors are related and could be effectively and graphically represented at a "multi-purpose" visitor center.

Information about the interesting tourist-oriented aspects of the area could be available to the public at the SCE visitor center, BLM's Barstow Way Station (area office with desert resource displays), and the Calico Ghost Town (County Regional Park). All these entities could in effect advertise the existence and values of each other.

F. Environmental Health and Safety Implications

1. Conventional Health and Safety Factors

a. Noise

(1) Current Status

The ambient noise levels measured at the site are low as expected in rural desert areas. The prime source of noise at the site is the wind blowing through the low brush ground cover. Additional sources include: animal life, highway traffic on Interstate Route 40, railroad traffic, the Coolwater Generating Station and occasional tractor work on the adjacent alfalfa field.

The ambient levels at the site are not constant but vary in amplitude during both short-term and long-term time intervals. Long term variations are due to changes in climatic conditions, such as temperature and wind, and changes in human and animal activity. Short term variations are random in nature and follow the instantaneous perturbations of the noise environment (aircraft flying over, bird calls, whistles, etc.).

The site is remote from all noise sources that generate levels greater than 65dBA. The nearest stationary noise source is the Coolwater Generating Station at a distance of 7000 feet. Vehicular noise sources are the AT&SF railroad at a distance of 6500 feet and Interstate 40 at a distance of 8000 feet.

Ambient sound levels are represented by a statistical distribution which depicts the percentage of time that the ambient sound amplitudes exceed a predetermined level within a given period. The L_{50} Level or median level is that level which is exceeded 50% of the time. The L_{10} level is that level which is exceeded 10% of the time.

On June 9, 1977, Southern California Edison personnel performed an ambient noise survey at the site. Ambient noise was measured as "A" weighted sound pressure levels and the data was statistically processed to obtain average noise levels throughout the 24 hour survey period. The resulting L_{50} and L_{10} A-weighted decibel averages are presented in Exhibit XI-11. The remoteness of the site from other noise sources results in a uniform ambient noise level within the site boundaries. The measurements below are taken at one location within the boundaries but is fairly representative of any location within the boundaries. (It should be noted that ambient noise levels at the vacant Pilot Plant site will increase when Coolwater Units 3 & 4 are operating).

Exhibit XI-11

AMBIENT NOISE LEVELS AT VACANT PILOT PLANT SITE

L_{50}	L_{10}	PEAK
42 dBA	49 dBA	54 dBA

(2) Project Impact/Mitigation

a) Construction Noise Levels

Construction noise levels will probably typify those associated with a major project requiring heavy machinery. The primary recipients will be the on-site workers.

- Mitigation

Federal and state noise and safety codes can be used to mandate noise suppression or the wearing of ear muffs when certain levels are exceeded.

b) Pilot Plant Generated Noise Levels

Noise levels at the facility property line are expected to be approximately 60 dBA (SCE). Levels will increase near the turbines based on experience with other generating stations. The equipment locations of the Pilot Plant have not been finalized. The impact of this noise level is dependent upon:

- The existing ambient noise level.
- The relative location of the source to the receiver of the noise.
- The type or nature of the receiver.

The property line noise level will be attenuated up to 6 dB for each doubling of distance from the noise source until ambient levels are achieved. Since the site is removed from any residential area and since the nearest human receivers are subject to vehicular or occupational noise, it is concluded that the boundary line noise levels will not adversely affect the sparsely populated human environment.

- Mitigation

To provide employee protection in compliance with the California General Industrial Safety Orders and the Occupational Safety and Health Act of 1970, the interior employee working stations will be monitored and noise controls applied where required. In addition, the working schedule of employees will be adjusted to reduce their exposure to high noise levels. Hearing protection will be provided when work is required in high noise areas.

Exterior noise levels will be controlled by the implementation of specifications limiting noise emissions from noise generating equipment. Noise controls will be added as required to installed equipment to minimize impact on the ambient sound level.

Pilot Plant noise levels should be less than those of a similar capacity fossil fuel plant since fuel combustion will not be required to make steam. However a back-up diesel generator could be installed in order to provide redundant emergency electric power for the Pilot Plant operation.

b. Valley Fever

(1) Current Status

It has not been determined if infections agents of Coccidioidomycosis (Valley Fever) exist in site soils. This is an infectious fungal disease caused by a soil fungus (Coccidiodes immitis) and is contracted externally through contact with contaminated soil. It is especially prevalent during dry summer months among western desert regions.

(2) Project Impact/Mitigation

a) Construction

Levelling and trenching operations could expose workers to Valley Fever fungal agents if soils are dry.

- Mitigation

Fugitive dust control and protective clothing should significantly reduce the risk of continued direct contact with contaminated soil.

c. Construction and Operation

(1) Current Status

The site's semi-natural state doesn't present any substantial safety risks.

(2) Project Impact/Mitigation

The normal health and safety hazards associated with major plant construction and with conventional plant operation will be present on the site for the life of the project.

- Mitigation

Standard construction and operation practices will be implemented. The project will be designed and built in complete compliance with the Occupational Safety and Health Act of 1970 (OSHA) and all other government codes (including Cal-OSHA) to protect workmen at the site.

d. Night Work

In order to make full use of sunlight for plant operation, some plant maintenance and heliostat washing will be performed at night or during early morning hours. The Pilot Plant will be manned on a 24 hour basis.

- Mitigation

Artificial night lighting will be permanently provided for the following areas:

- At appropriate access points at the site perimeter, and as warranted for site security reasons at site perimeter.

- Within the project building area complex to facilitate operational travel in that area.
- Visitors area for security reasons.
- Heliport area.
- Receiver and Support Tower.

On a temporary basis, artificial night lighting will be located within the heliostat field to facilitate overnight equipment maintenance.

e) Plant Security

The uniqueness of this Pilot Plant in the relatively remote area surrounded by major highways warrants special security provisions. Curiosity seekers, uncontrolled general public and potential vandals could create unnecessary problems for construction and operation crews.

\- Mitigation

SCE security personnel will man a guardhouse a minimum of 8 hours per day at the Pilot Plant entrance. Additionally, the plant site, as well as the visitors center, will be continuously monitored and patrolled by SCE security personnel on a 24 hour basis. These efforts normally include close liaison with local law enforcement agencies, with particular regard to observed events in adjacent non-SCE property.

Vehicular access onto the project site will be limited to contractor equipment, employee vehicles, delivery trucks, and other such vehicles necessary to accomplish job related tasks.
All vehicles entering the facility will be met by the security guard at the main gate. The security guard will determine the driver's right to enter the premises.

2. Unique Solar Features

The following assessment of construction and operation of the unconventional solar-related plant features may not include some of the lesser-known safety factors unique to STE operation. However, monitoring and research at the Pilot Plant will better quantify these unconventional health and safety impacts before commercial STE plants (if any) are developed.

a. Project Impact/Mitigation

(1) Construction

Experience from the Solar Thermal Test Facility (New Mexico) indicates the only potential health hazards arising from the construction of the collectors are: cuts from handling the glass since the edges are not ground, and the inhalation of the volatile materials from sealants and paints.

- Mitigation

These hazards can be reduced by training programs, the use of non-toxic sealants and paints, protective gear and allowance of adequate ventilation, etc.

(2) Tower Effect on Aircraft

The 325-foot Solar Tower could be detrimental to off-course private aircraft associated with the Barstow/Daggett Airport located 3 miles east of the site. However the tower should only be considered a contribution to this impact since two 250-foot high emission stacks have just been installed for Units 3 and 4 a mile southwest of the future solar tower site.

- Mitigation

A permit for the tower will be required from the Federal Aviation Administration (FAA). The receiver will be lighted in conformance with FAA requirements. The County Division of Airports (Department of Transportation) will not be required to issue a permit, but believes the tower will not be a hazard to the safe and lawful use of navigable airspace if FAA requirements are met (conversation with staff). The tower will not be in line with the southwest/ northeast positioned runway.

(3) Major Misdirected Solar Radiation (Fire, Burns and Glare)

(The following analysis relative to misdirected solar radiation is excepted from DOE's "Solar Program Assessment")

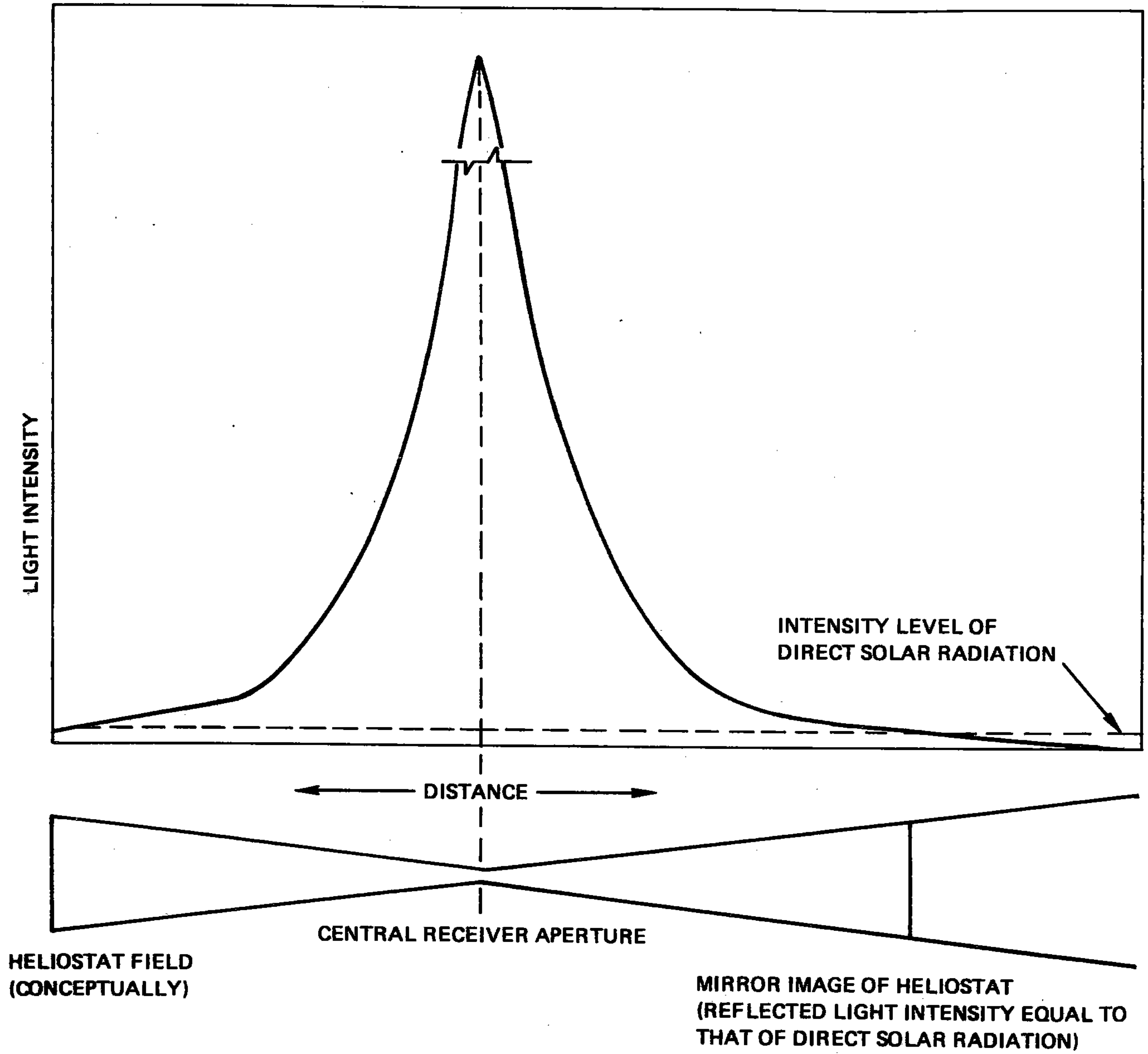
The greatest potential safety hazard associated with central receiver STE plants is that which stems from misdirected solar radiation caused by a misaligned heliostat field or by even a small group of heliostats. Inadvertent focusing of the reflected, concentrated beam on personnel or equipment during "stowing" or "unstowing" operation can potentially cause fires and burns as well as create serious glare problems and eye damage.

Typically, the heliostat field is designed to focus solar radiation at the point of the central receiver. Thus, a misdirected heliostat field will focus radiation at a point a given distance away. (This distance will vary with the angle of incidence of the incoming radiation and the degree of defocus of the field.)

At the focal point, therefore, is a concentrated beam of focused radiation. Beyond the focal point, this beam becomes increasingly dispersed and eventually becomes more diffused than the original solar radiation. Thus there is a range around the focal point where the beam is significantly concentrated to present a potentially serious safety hazard. This is conceptually illustrated in Exhibit XI-12.

The most serious potential impacts of a misdirected heliostat field will occur in the range of concentrated radiation around the focal point. The intensity of the beam in this region would be sufficient to cause blinding and severe burns. In addition, any type of combustible material could be easily ignited. In most cases, the distance to the focal point will be relatively limited; thus most burn or fire impacts would be limited to the plant site. At a distance twice that of the focal point, the beam will disperse to the point where it represents a sharp glare similar to direct sunlight.

When assessing the impacts of a concentrated beam of focused solar radiation, it is important to note that these impacts generally refer to the unison defocus of a portion of the heliostat field. In both this Pilot Plant and commercial-sized STE plants, individual heliostats are not likely to focus. (i.e., their surfaces will be flat, not concave). Thus the misalignment of one or several heliostats not in unison will not generate a concentrated beam and should not create serious burn or fire hazards. The impacts of this type of misalignment would generally relate to nuisance glare.



10 MWe SOLAR PILOT PLANT

VARIATION IN REFLECTED LIGHT
INTENSITY OVER DISTANCE
EXHIBIT XI-12

It should be noted, however, that in smaller capacity and testing units (exclusive of this Pilot Plant with its flat mirrors), concave heliostats most likely will focus individually. Thus even one misalgined heliostat could result in burn, fire or glare hazards.

While not as hazardous as burns or fire, glare is a potentially serious problem resulting from misaligned or even properly-aligned heliostats. This is due to its ability to impact both on and off-site receptors as well as those in overflying aircraft. The intensity of this glare will be a function of the distance of the receptor from the heliostat field or individual heliostat producing the glare. As this distance increases, the intensity of the glare will decrease. Aside from affecting plant personnel, glare can also affect the operators and passengers of motor vehicles on nearby roads or of overflying aircraft. Accidents could occur as a result of temporarily blinded vehicle operators.

The above discussion is not intended to imply that many of the potential hazards of heliostat use cannot be mitigated. Handled carefully, problems of misdirected reflected light can be minimized. However, it is anticipated that, particularly in the technology's infancy, accidents of a serious nature can and will occur. Just in the very limited experience to date in heliostat research, accidents have occurred due to an underestimation of this hazard's potential. A worker at a test facility experienced a severe burn on the hand when he went to move an oil drum in the path of a misdirected heliostat. An another occasion, a tent surrounding an experimental heliostat burned to the ground when the tent flap blew open on a weekend and the heliostat was exposed to direct sunlight and ignited the tent. On a third occasion a truck driver using a construction road near a test site drove through a diffused post-focus beam presenting a bright glare and potential driving hazard. The driver's union contacted the test facility and a protective barrier was eventually constructed.

- Mitigation

Heliostat manipulation should be tested prior to start-up and personnel exclusion areas should be established for certain operating conditions. Undoubtedly plant personnel will be educated as to the possible effects of misdirected radiation. Some type of protective goggles fashioned from materials such as photochrome or rapid rise glass should be worn by all plant personnel in potential danger areas. Heliostat systems should be designed for quick and safe emergency shutdown and should be kept in a safe position when not in use. In addition, all potentially combustible materials should be stored in places inaccessible to misdirection radiation. Further, plant buildings and access roads should be laid out so that they are not in pathways of possible misdirected radiation.

The Pilot Plant is situated and sited so that heavily-used public roads or highways should not be subjected to frequent glare. The Pilot Plant site will have perimeter fencing including warning signs to insure that trespassers are not harmed by glare or burned. Fencing will also guard against vandalism. (Fences should be constructed in such a manner to allow access by certain wildlife species.) In relation to aircraft, it may be necessary for regulations restricting overflight of the Pilot Plant to be formulated and administered in conjunction with the Federal Aviation Administration.

Thus, protective devices for plant personnel coupled with proper plant layout and exclusion areas should mitigate the more serious impacts of glare.

(4) Minor Reflections from Stowing/Unstowing Heliostats

DOE's impact analysis for the MDAC design concept states that helistat stowing/unstowing operations during daylight hours may create unavoidable but annoying reflections of light visible for long distances from the Pilot Plant site. Reflected light from the receivers could be a nuisance to those working, living, or traveling within visual range of the phenomenon, and may constitute a hazard under certain conditions.

While the intensity and duration of this reflected light will generally not be great enough to cause eye damage, it will be sufficient to cause plant personnel to divert their glances away from the receiver.

- Mitigation

Stowing and unstowing operations will occur primarily during periods of low insolation (i.e., morning and evening). An established control procedure for stowing and unstowing heliostats should be formulated and adhered to in order to preclude the possibility of concentrated energy damaging property in or outside the facility. Continuous control of the reflected beam and establishment of exclusion areas during the operation of the plant will also reduce the possibility of eye damage to personnel. Beam control strategies applicable to the Pilot Plant have been implemented and studied at the 5-MW_e Solar Thermal Test Facility in Albuquerque and no personal safety problems were experienced.

Quantitative analysis of reflection-related effects is the subject of a separate study for DOE. Results, including eye threshold hazard levels and requirements to provide exclusion zones to the public domain, will be reported in a System Safety Design Criteria, which is currently in process.

(5) Focusing Accuracies/Energy Loss

Related to minor misalignment of beams from the collector field is the net energy loss associated with the loss of heat input to the receiver.

The focusing accuracies and mirror imperfections expected in the heliostat designs have been analytically modelled to determine the maximum amount of energy which would miss the collector at any time(SCE). The results indicate that, depending on the collector/receiver combination selected, roughly 0 to 3% of the output of the collector subsystem is expected to miss the receiver during normal operations. This energy should pass within a few meters of the tower. The maximum spillage, corresponding to 3%, is roughly 1.5 MW_t. The absolute amount of this energy loss would drop off as the energy from the collector subsystem subsides during the early morning and late afternoon.

The amount of energy missing the receiver could be much greater during transition periods. For example, at least 15 minutes are required to complete the maneuvers necessary to bring the heliostats from their stow position to the proper orientation to redirect energy to the receiver. During this time, a maximum of 40 to 50 MW_t could be missing the tower until the energy is directed to the receiver.

- Mitigation

In all of the above cases, the reflected beams will be precisely controlled so the beams will not coincide outside the facility. These short periods of energy loss will be reduced as heliostat operation experience is gained.

(6) In-Plant Power Outages

Loss of electrical power to Pilot Plant operation could damage many parts or the total system and create definite safety hazards. Inability to stow heliostats during periods of sand blow could result in pitted mirror surfaces. Power loss during focusing or defocusing operations could result in prolonged and possibly disastrous periods of misdirected radiation. The receiver and its feedwater system could be damaged by excess heat and pressure if focused radiation from the collector field could not be quickly removed in an emergency.

Other in-plant uses of electricity would also suffer from prolonged outages.

- Mitigation

Emergency electrical power capacity will be available to allow orderly and safe plant shutdown in the event of loss of net power from the main utility network.

The emergency power requirements for the Pilot Plant have been analyzed and defined by the MDAC team as follows:

	28 kW	instrument air compressor
	3 kW	motor operated valves
	10 kW	lighting and battery charger
	13 kW	AC turbine oil pump
	3 kW	turbine turning gear
	10 kW	computer (allocated)
	33 kW	computer HVAC
	15 kW	receiver tower elevator
	235 kW	(available for collector field)
Total	350 kW	

The sequence of events that would require the use of the emergency power supply is a failure of the connection between the Pilot Plant and the main utility network, the Coolwater Units, and loss of the Pilot Plant's productive capacity. An in-plant, self-contained generator might be considered as a redundant safety feature. The thermal storage system is fail-safe, so a sudden stoppage of flow in the thermal storage unit piping could be tolerated, with the only possible consequence being a slight overtemp of the resident thermal storage fluid in the thermal storage heater (maximum temp would not exceed 650°F as compared to a normal 575°F. This affected fluid would be filtered out upon resumption of operation.

The receiver can withstand a loss of pressurized feedwater flow for periods of four minutes with the collector field in operation without suffering deleterious structural damage. When power is applied to the field to move the collectors off the receiver, so as to drop the heat flux on the receiver, the allowable time will increase to approximately 10 minutes, depending upon the rate of movement, time of year, time of day, and plant operating mode.

The collector field can be moved in elevation axis only to remove the reflected beams from the receiver in the minimum time with the least power required. The elevation drive rate is 14 degrees per minute, and with the angular displacements required to move off the receiver, this could be accomplished within a one minute time frame if sufficient power were available. The analysis of emergency power requirements was based on providing sufficient power to move one-half of the collector field in one axis at a time, that is, the power requirements could be reduced from 805 kW to approximately 202 kW. This means that the entire field could be removed from the receiver in two minutes.

If a situation should arise where the link with the grid is broken while operating the Pilot Plant, and at the same time a rapid wind rise situation requiring heliostat stowage should occur, the emergency power would be required on line for approximately 30 minutes, with half the field being stowed during each 15 minute period. This would allow a maximum angular travel of 210° for the heliostats, which is conservative.

(7) <u>Receiver - Boiler - Turbine Failures</u>

Catastrophic failure of the receiver, boiler, turbine, piping, or support structures due to an earthquake, extreme winds, fire, extreme heat and pressure, etc., could endanger human life on-site. (Even minor tower shaking could result in the rupture of pressurized steam working fluid lines which connect the boiler unit with the turbogenerator located at the tower base).

One hazard unique to solar boilers is the constant thermal cycling (temperature variations) due to diurnal cycles or cloud passages. This situation will produce creep fatigue interactions not normally encountered in typical fossil fuel-fired boilers.

- <u>Mitigation</u>

If the turbine or receiver were destroyed, the Pilot Plant would be shutdown.

The tower and receiver will be designed to withstand ground accelerations of .25 g and maximum winds of 141 mph (under certain conditions).

In case of uncontrolled focused flux from the collector field, the tower structure is capable of sustaining a temperature rise of up to 400°F above ambient for periods of up to 15 minutes without structural damage (DOE).

The MDAC external receiver, which uses "Incoloy 800" (metal) for the absorber panels, can stand the loss of feedwater flow for 4 minutes without venting or pressure relieving while the collector field is in operation without suffering serious structural damage. Longer periods can be tolerated if safety valves, etc. are operated. The heliostats are designed so that the field can be moved off the receiver in less than 2 minutes (assuming no power outages).

Components of the storage system, tankage, piping, and heat exchangers are standard in design and will be built to the applicable code requirements.

In the event that shutdown of the boiler system became necessary, the redirected solar flux (from the receiver) could be removed from the boiler in a maximum of 15 seconds.

(8) Thermal Storage System Failure

Catastrophic failure of thermal storage heat exchangers, piping and oil storage tanks could endanger human life on the plant site. Exposure to air and potential combustion of hydrocarbon oil (heat medium) poses the most severe safety threat. Even without combusting, these oils could reach a maximum temperature of 575°F during normal heat storage operation and would cause severe burns if contacted.

DOE's description of thermal storage media characteristics is as follows:

- 4990 tons of rock
- 139,000 gallons Caloria HT-43 (Exxon) heat transfer oil
- Maximum temperature during operation - 575°F
- Flammability - Flash temperature - 420°F
- Automatic - ignition temperature - 759°F

- Mitigation

Under normal operating conditions, heated oils will not be exposed to air and thus combustion should not occur. Special system maintenance will be considered to adequately control possible leaks of heated oil which could result in oil fires. In addition, proper handling and protective gear should prevent serious burns. Leak detection, fire suppression systems and inspection programs will be implemented. The oils being considered are not new, but rather have been in industrial use for quite some time. Thus, fire and burn safety and proper handling techniques are generally well understood and can be fairly easily employed at the Pilot Plant.

Fuel storage for the standby generator, if any, will present minor fire potential which can also be easily mitigated (i.e., undergrounding, etc.).

G. Aesthetic Resources

1. Current Status

The naturalness of the site area when viewed from a distance is disrupted by steel tower transmission lines, exotic tamarisk trees surrounding Coolwater Ranch alfalfa fields and the Coolwater Generating Station (primarily the two new emission stacks). The site itself still retains an open-space character, but the former loss of climax vegetation affects its general aesthetic value.

Exhibits XI-13, 15 and 17 are photographs of the site in its existing condition from varying angles.

2. Project Impact/Mitigation

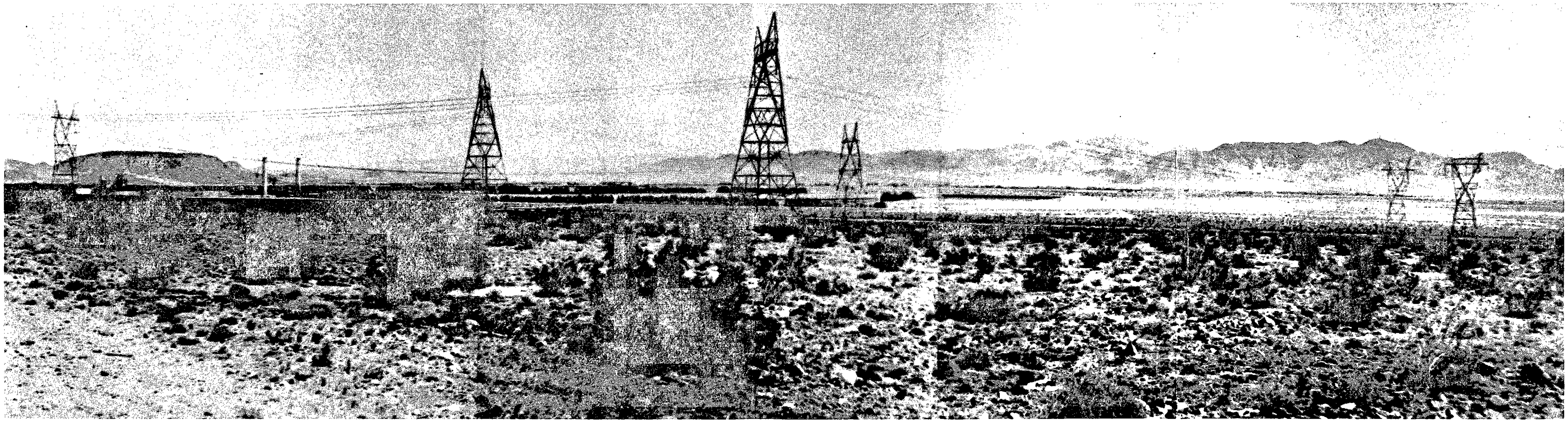
a. Plant Appearance

The photographs of the existing site are followed by artist's renderings of the Pilot Plant concept that will be representative of the resulting structures. (Exhibits-14-16-18) Some features may be altered, but the appearance would be similar.

The Pilot Plant will be visible to motorists on Interstate 15 and 40; local residents, and motorists in the Daggett and Yermo area; visitors approaching Calico Ghost town; and recreationists, graziers and miners on the south slope of the Calico Mountains and along the north slopes of the Ord (Camp Rock Road) and Newberry Mountains. Because of distance and topography, the Pilot Plant will be relatively unnoticeable from the Ghost town.

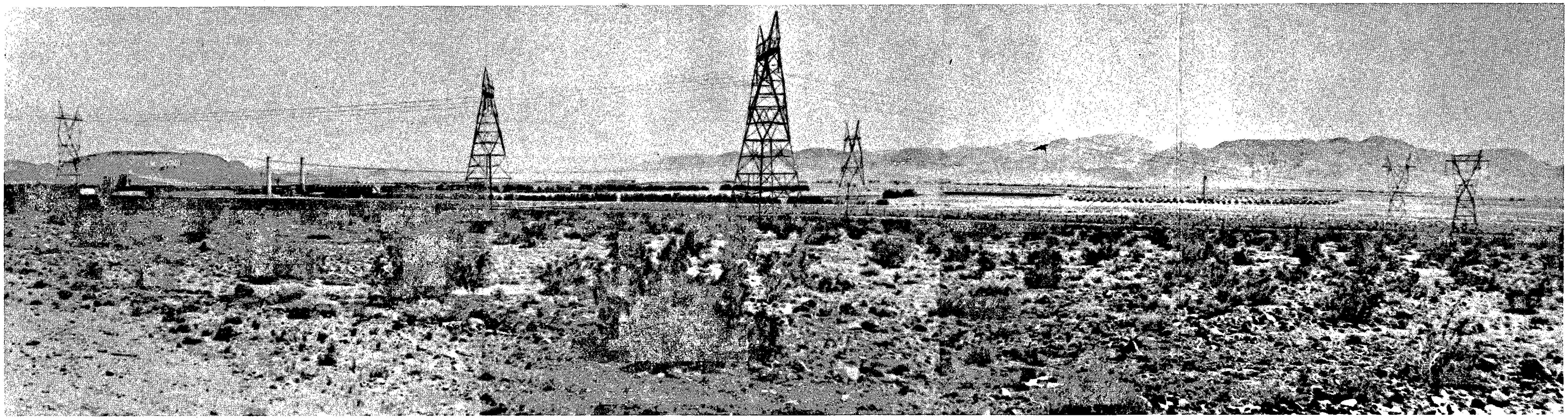
The 325-foot tall solar receiver tower will be the most prominent feature observed, and will influence the viewers initial, overall reaction to the Pilot Plant's appearance.

During periods of operation, the receiver surface at the top of the tower will appear as a bright glow to ground observers. (The retinal irradiance of the receiver will be one-thousandth of the irradiance of the sun-DOE.)



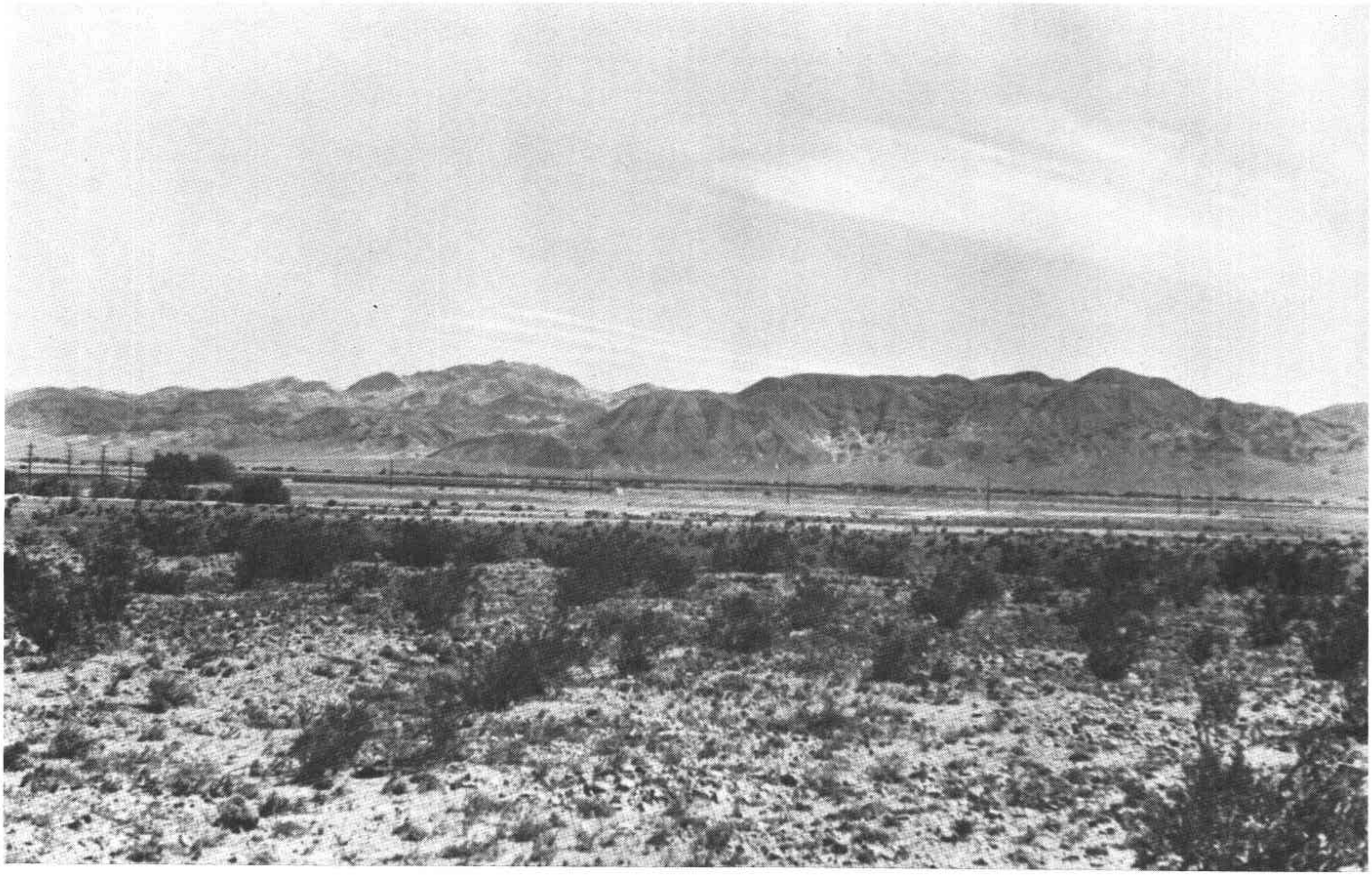
10 MWe SOLAR PILOT PLANT

PROPOSED SITE
LOOKING NORTHWEST
EXHIBIT XI-13



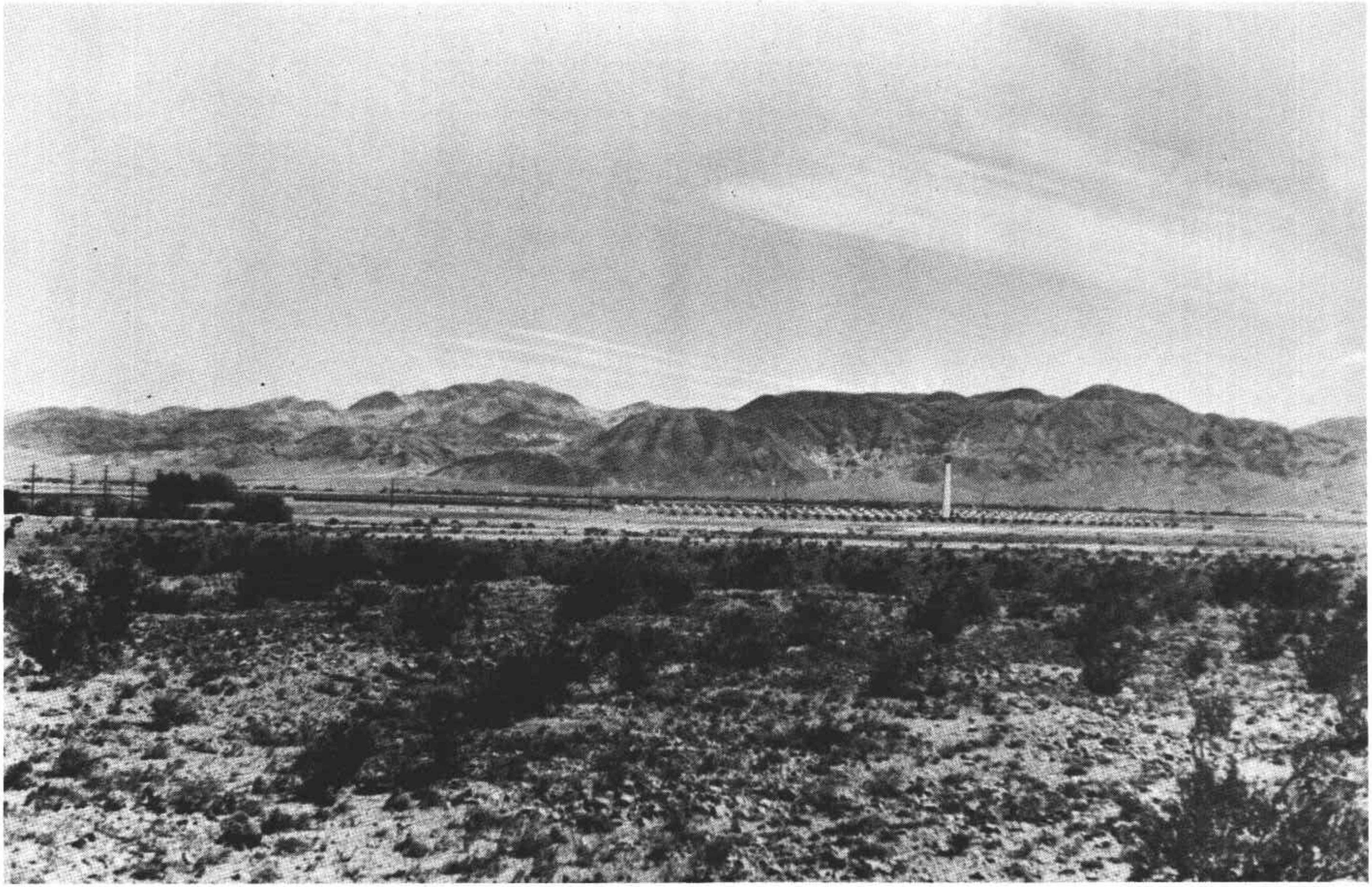
10 MWe SOLAR PILOT PLANT

ARTIST RENDERING
PROPOSED SITE
LOOKING NORTHWEST
EXHIBIT XI-14



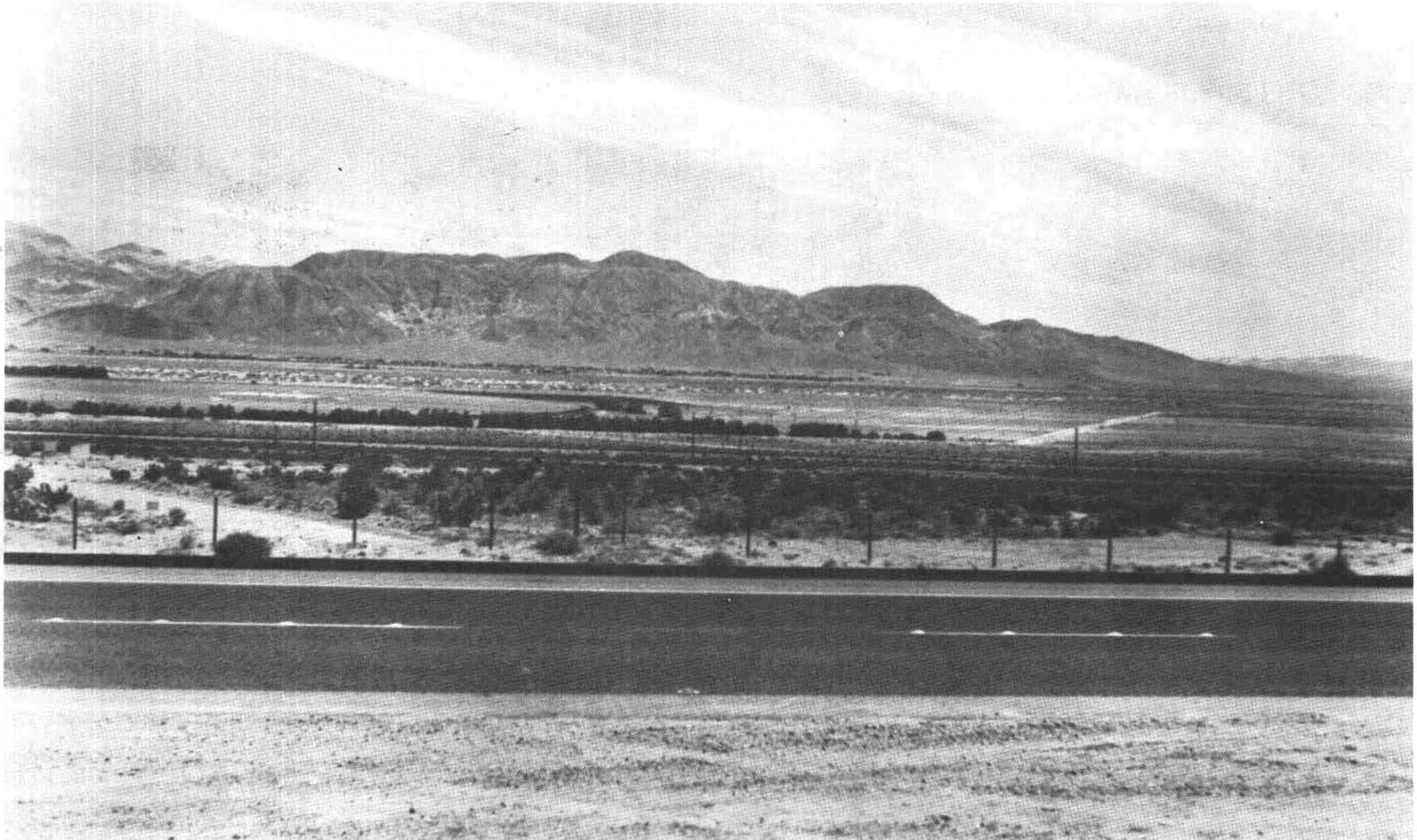
10 MWe SOLAR PILOT PLANT

PROPOSED SITE
LOOKING NORTH
EXHIBIT XI-15



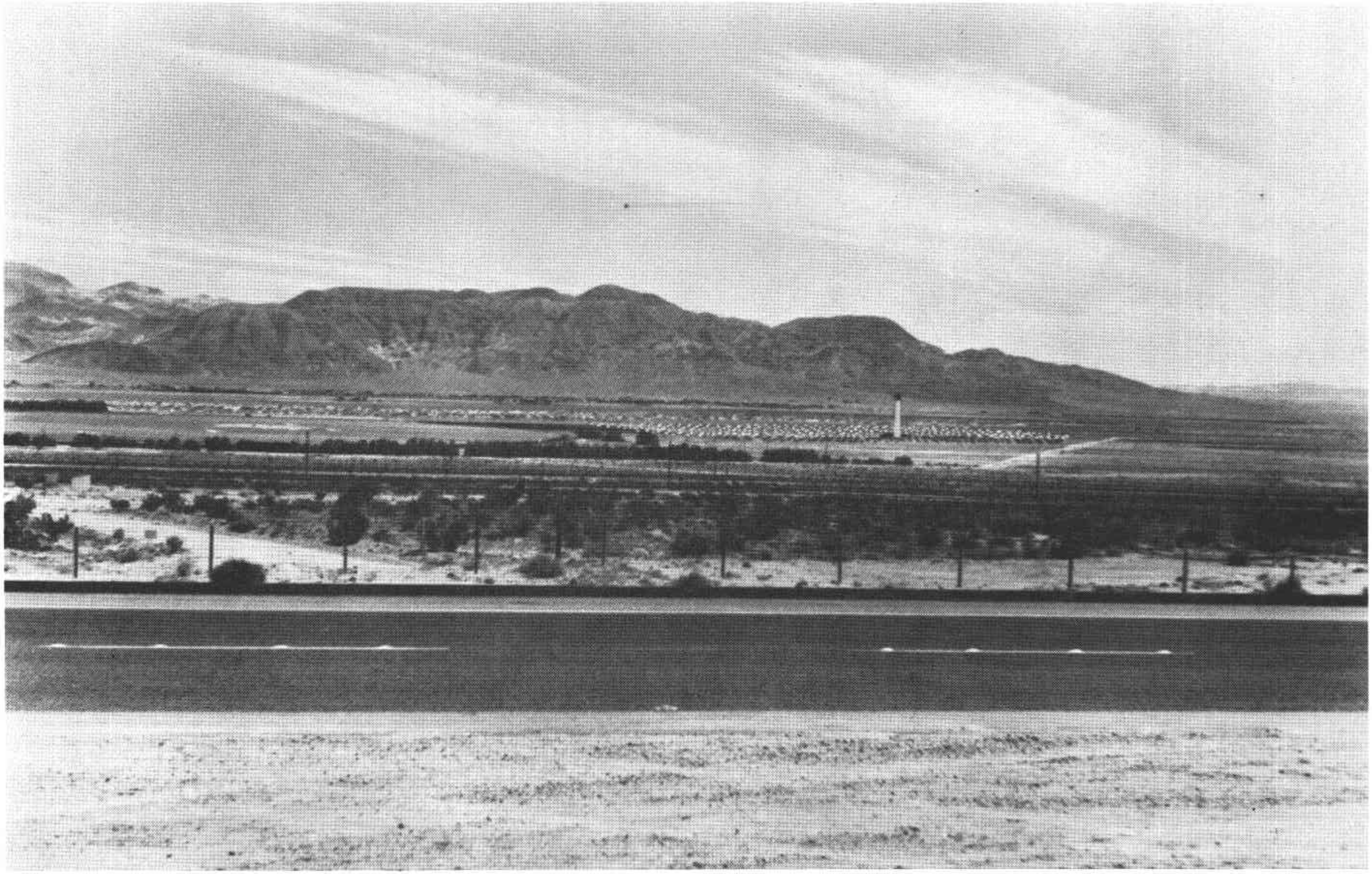
10 MWe SOLAR PILOT PLANT

ARTIST RENDERING
PROPOSED SITE
LOOKING NORTH
EXHIBIT XI-16



10 MWe SOLAR PILOT PLANT

PROPOSED SITE
LOOKING NORTHEAST
EXHIBIT XI-17



10 MWe SOLAR PILOT PLANT

ARTIST RENDERING
PROPOSED SITE
LOOKING NORTHEAST
EXHIBIT XI-18

The thermal storage tank will be another prominent feature. The cluster of Pilot Plant support buildings will be dwarfed by the tower located in its center.

The collector field will appear as a large conglomeration of relatively dark objects (heliostats). Only during stowing and unstowing (if then) will reflections of light off heliostats be visible to ground observers.

The existence of adjacent utility-related features (primarily transmission lines and the Coolwater stacks) will tend to diminish the Pilot Plant's net aesthetic disruption. Its short-term life span considerably reduces the magnitude of the effect. The real impact will be a function of each viewer's attitude.

- Mitigation

The surface finish and color of the tower, large plant support structures, and the heliostat bases and backing should blend with the typical sand/tan desert coloration in order to minimize stark contrasts. The project participants should determine what color shade will be compatible with the zinc and/or aluminum, weather-resistant primers used on exposed surfaces.

Although the receiver tower might be aesthetically displeasing to some observers, there are others who will perceive it as symbolic of the necessary, timely and environmentally efficient utilization of the desert's most prevalent natural resource (solar energy). The tower might therefore constitute less net aesthetic impact by virtue of its representation than do the adjacent Coolwater emission stacks.

H. Utilities and Public Services

1. Current Status

The site in its present form neither contains nor requires any of the following public utilities or government services. Two SCE-owned water wells exist on the south and east boundaries, but do not presently serve the site itself.

2. Project Impact/Mitigation

a. Electricity, Natural Gas, Telephone

All Pilot Plant and visitor center requirements will be served either by extension of existing facilities from SCE's Coolwater Generating Station, Pilot Plant capacity, or the electrical grid system. Power needs have been previously described (water pumping, heliostat focusing, lighting and general in plant uses). Natural gas will primarily be used for space heating control rooms, etc. Utility capacity will be adequate to handle increased demands.

- Mitigation

Stringent conservation measures should apply to energy use.

b. Water Supply System

The 220 acre-foot/year plant water requirement will be pumped from SCE-owned wells as a diversion from previous agricultural use. (See Chapter X-C). A public water conveyance or distribution system will not be required.

c. Wastewater Disposal (Operation Period)

Unevaporated wastewater from the cooling towers, filters, boiler and demineralizers will be routed to the existing, lined evaporation ponds, precluding percolation to groundwater (see Chapter X-C).

Domestic sewage will be collected in an on-site septic tank and percolated via leach lines. Public wastewater disposal facilities will not be required.

d. Solid Waste Disposal

(1) Construction

During the construction period, typically 40-50 cubic yards per week of construction scrap or debris would be expected. The solid waste produced will range from used shipping container materials; (e.g., wood crates, pallets) to excess construction materials; (e.g., metal scrap, concrete masonry scrap, scrap insulation, etc.).

Topsoil or overburden from construction will be redistributed on the site or used as containment around tankage areas.

Portable toilets will be used during construction. Approximately 90-100 gallons per week of sanitary sewage will be produced and removed from the site by a disposal contractor. Disposal trips to and from the Barstow dump site will generate an increase in vehicle miles traveled on I-40.

(2) Operation

Plant operation will generate less than a cubic yard daily of uncompacted solid waste. Waste is expected to be that attributable to either operation of the Pilot Plant; (e.g., paper, kitchen refuse, clothing, etc.) or Pilot Plant maintenance; (e.g., scrap metals, used material containers or crating materials, machine shop refuse, spent lubricants, etc.).

Pilot Plant research may generate more waste per megawatt of production than that normally attributable to a conventional power station.

- Mitigation

Construction techniques will typically utilize:

- Reuseable concrete form work.
- Reuseable portable scaffolds and portable erection equipment.
- Factory prefabricated equipment modules as practical.
- Portable construction facilities and buildings.

Wastes should be recycled whenever economically feasible. Direct recycling of solid waste is not anticipated; however, secondary recycling by refuse disposal contractors is most probable, particularly scrap metal recovery and recycling.

According to staff of the County Refuse Division, the County landfill dump south of Daggett is only 7 road miles from the plant site, but should not be used for Pilot Plant debris since it cannot accommodate significant amounts of material, has a short life expectancy, and does not have a daily cut and cover operation. It may be closed down in the near future.

The Yermo dump north of Daggett also is not suitable for construction debris. Disposal contractors will probably automatically utilize the Barstow landfill which is 12 miles west of the plant site, and construction contractors (if they remove construction waste) should be told to do the same. The Barstow site has a long-life expectancy, 600 acres available for cut and cover, and is manned with a full time crew and bulldozer.

Disposal trips should not be made with less than full loads in order to reduce fuel consumption.

e. Recreational and Cultural Facilities

- Calico Ghost Town, 6 miles north of the Pilot Plant is managed by the County Regional Parks Department (14 civil service employees) and draws over 300,000 annual visitors. In 1971-72 it produced $39,500 in revenue to the Parks Department and private concessionaires grossed over $502,000 in sales. Peak attendance occurs during May, August and October during "Calico Days" festivals. Pilot Plant visitation will beneficially complement park visitation, and vice versa.
- BLM National Resource Lands in the region will experience slight increases in use by construction and operation populations, primarily related to ORV recreation.
- Other cultural and recreational facilities in the study area will not be noticeably affected.

f. Schools

Project implications to study area schools are assessed in Section XI-B.

g. Law Enforcement

A description of on-site plant security provisions is included in Section XI-f. SCE security personnel will complement and assist County Sheriff's deputies in law enforcement on the Pilot Plant premises. There is no Sheriff sub-station in Daggett. Deputy response time to the site from the Barstow sub-station or from patrol location could range from 15 to 30 minutes.

- Mitigation

The existence of plant security personnel and site access restrictions will alleviate the need for on-site law enforcement by Sheriff deputies. (See Section XI-f.)

h. Fire Prevention and Control

Major site facilities susceptible to fire include:

- The Thermal Storage Tank will contain combustible oil as part of the heat storage media. Leaking oil (and also a potential fire perimeter) would be confined by earthen dikes or retaining walls, however, explosions could spread flames to adjacent structures.
- Diesel fuel may be stored for use in an emergency generator, if required.
- Reservoirs of turbine lubricants will contain approximately 1200 gallons of oil.

- Mitigation

SCE's existing wells and future water systems will be adequate for site water delivery. Sufficient water storage beyond the production capabilities of the three wells will be maintained within a suitably sized service/firewater tank and in the cooling tower basin (and circulating water lines).

Water pumping capability will be provided by:

- Redundant fire water pumps, or
- redundant service water pumps, or
- a gas driven water pump taking suction from either the firewater tank and/or the cooling tower basin.
- Redundant well pumps.

Water suppression of oil and electrical fires would generally be inadequate and possibly detrimental. SCE will provide non-water fire protection systems according to code and OSHA requirements.

Additionally, suitable fire detection system(s) will be provided to permit earliest awareness of the existence of fire, when mitigation countermeasures are most effective. Conventional engineering practices relative to fire prevention and mitigation will be utilized in the design of the plant (e.g., minimum use of flame supporting materials, the physical separation and isolation of fire prone areas, the use of extra integrity piping for flammable materials, etc.)

SCE's operating procedures include personnel training in fire prevention and fighting. SCE will have to absorb most of the responsibility for fire fighting.

The plant site is within the jurisdiction of the volunteer Daggett Communities Services Fire Department. Response time to the plant would be approximately 5-15 minutes. Back-up could be provided by the Marine Base if necessary. SCE should consider such an agreement.

i. Medical Emergency Services

The closest hospital to the site with emergency facilities and ambulance service is in Barstow approximately 10 miles to the west. Response time could range from 15 to 30 minutes. No paramedic rescue units are stationed in the Daggett community.

OSHA's requirement that certain on-site personnel be trained in general and advanced first aid will provide at least some form of quick response to the medical needs of construction and operation employees.

j. General Mitigation

Pilot Plant tax revenues (assuming at least the non-solar portion will be taxable) will more than compensate for the costs of the minor local governmental services the plant requires.

XII
FOOTNOTES

XII FOOTNOTES

1. The energy generated by the Pilot Plant will be delivered through the SCE transmission and distribution system which is interconnected with DWP and others. Electricity will be shared by SCE (80%) and by DWP (20%) in proportion to their financial participation.

2. Zone change and "site approval" will only be applicable to the final 130 acre plant site that will be selected out of the full 320 acres under consideration.

3. DOE (ERDA), "Program Opportunity Notice - Central Receiver Solar Power 10 - Megawatt Electric Pilot Plant Project Site Selection;" July 9, 1976, Washington D.C.

4. The higher water requirements of the Pilot Plant are due to lower carnot efficiencies because of lower operating temperatures (DOE).

5. Hovind, E. L. et al., An Evaluation of the Impact Upon the Air Quality from Present and Proposed New Power Generating Units at Coolwater Generating Station, Daggett, California, Prepared by Southern California Edison Company, Report No. 716-A, Goleta, California: North American Weather Consultants, (June, 1972).

6. Turner, B., "A Diffusion Model for an Urban Area," Journal of Applied Meteorology, (February, 1964).

7. Central Receiver Solar 10 - Megawatt Proposal of Partnership, Southern California Edison internal R&D Program, Co-proposal of Southern California Edison Company, Los Angeles Department of Water and Power, and the California Energy Resources Conservation and Development Commission, to the United States Energy Research and Development Administration, (September 15, 1976).

8. Solar Radiation Measurements in California, State of California Department of Water Resources, (January, 1974).

9. The level of drag will be greater when the mirrors are in a near vertical position during periods of tracking the sun low in the horizon. The effect will be at a minimum when the mirrors are stowed in a horizontal position during non-collection period. It is possible that small "eddy" (wind whirling) effects will result from heliostat obstructions, at least within the outer periphery of the field.

10. Hovind, E. L. et al., An Evaluation of the Impact Upon the Air Quality from Present and Proposed New Power Generating Units at Coolwater Generating Station, Daggett, California, Prepared by Southern California Edison Company, Report No. 716-A, Goleta, California: North American Weather Consultants, (June, 1972).

11. DOE (ERDA), Environment & Resource Assessment Branch, Division of Solar Energy, March 1977 - Solar Program Assessment - Environmental Factors - Solar Thermal Electric.

12. The study area has been defined as a linear region extending from the City of Barstow on the west along Interstates 15 and 40 to the communities of Yermo and Newberry on the east. Other communities within the study area boundary are Daggett, Lenwood and Minneola. The study area has been disaggregated into census tracts for discussion and data gathering purposes. The census tracts include: 90.02 (community of Yermo only), 93.00 through 95.00 (Barstow), 96.01 (Lenwood/ Daggett), 96.03 (Nebo Center, U.S. Marine Corps) and 103.00 (the communities of Minneola and Newberry only).

13. Economic Research Associates, Barstow Area Industrial Support Study, June 1976, p. III-74.

14. San Bernardino County Planning Department, "Preliminary 1977 Population and Housing Statistics;" and U.S. Bureau of the Census, "April, 1975 Special Census."

15. This assumes that project personnel would occupy 50% of the 32 vacant standard units reported for the City of Barstow by the Southern California Association of Governments as published in the Regional Housing Allocation Model, San Bernardino County, 1976.

16. In the 1975 San Bernardino County Special Census, household size for the county and the desert region was reported at 2.8.

17. The 1980 Barstow population forecast is based on the growth rate observed since the 1975 Special Census.

18. C. G. Engineering and Urban Futures, Inc., City of Barstow Market Analysis for Specific Redevelopment Plans, 1976, p. 21.

19. Of the 5,668 standard housing units in Barstow in 1976, 32 or 0.6 percent were vacant (SCAG, Regional Housing Allocation Model, 1976).

20. Of the 4,592 standard housing units in Victorville in 1976, 171 or 3.7 percent were vacant (SCAG, Regional Housing Allocation Model, 1976).

21. The amount of the additional local purchases is optimistic since it does not consider the present leakage of local retain expenditures to places outside the study area.

22. The City of Barstow estimates a current vacancy rate of 2.7% among all housing units, (includes both standard and substandard units). Among owner housing units, the vacancy rate is 2.0%. SCAG indicates that a healthy frictional vacancy rate for owner-occupied units should range between 2-3% (SCAG, Regional Housing Allocation Model, 1976).

23. The City of Barstow indicates an existing housing stock of 5,960 units, including both standard and substandard units.

24. It is estimated that the average household income will be approximately $20,000 based on 12 households where each has an Edison employee earning approximately $17,000 and 30 percent have a second wage earner receiving $10,500. Assuming that families will purchase homes at 2.5 times their gross annual income, the expected average market value for Edison employee homes will be approximately $50,000. Thus, the average assessed valuation would be $12,500 (therefore, the contribution of Barstow's total assessed valuation by the homes of Edison employees will be approximately $150,000). Given Barstow's current regular secured assessed valuation of approximately $32 million, Edison employees will increase the tax base of the city by about 0.5 percent.

25. Estimate based on 1.1 school-age children per family (Statistical Abstract of the United States, 1975) and an Average Daily Attendance, ADA, of approximately 97 percent (California Department of Education).

26. Estimate based on 0.15 community college students per family and an ADA of approximately 61 percent (California Department of Education).

XIII
BIBLIOGRAPHY

XIII. BIBLIOGRAPHY

1. Aerospace Report No. ATR-77(7523-20)-J, May 18, 1977, Atmospheric Attenuation of Solar Radiation, The Aerospace Corporation (Randall-Chemistry-Physics Laboratory.

2. Bowen, O.E., Jr., 1954, Geology and Mineral Deposits of the Barstow Quadrangle, San Bernardino County, California: Calif. Div. of Mines Bull 165

3. California Department of Water Resources, 1967, Mojave River Ground Water Basins Investigation: DWR Bulletin No. 84

4. Central Receiver Solar 10 - Megawatt Proposal of Partnership, Southern California Edison internal R&D Program, Co-proposal of Southern California Edison Company, Los Angeles Resources Conservation and Development Commission, to the United States Energy Research and Development Administration, (September 15, 1976).

5. Crandall and Associates, 1977, Ground Water Conditions During the Year 1976, Coolwater Generating Station, San Bernardino County, California, for the Southern California Edison Company's Consultant Report

6. Davidson, et al., Ecological Considerations of the Solar Alternatives, Lawrence Berneley Lab - (ERDA supported)

7. Davidson, et al., Assessment of the Socio-Economic and Environmental Aspects of the Central Receiver Power Plants, Energy and Environment Division - Lawrence Berneley Laboratory - (ERDA supported)

8. Dibble, T. W., Jr., 1963, Geology of the Willow Springs and Rosamond Quadrangles, California: U.S.G.S. Bulletin 1089-C

9. Dibble, T. W., Jr., 1970, Geologic Map of the Daggett Quadrangle, San Bernardino County, California: U.S.G.S. Misc. Geol. Invest. Map I-592.

10. EPRI Journal - Feb. 1976. Solar Realities - A Reprint

11. EPRI Journal - June 1976. STE Power P. 38-43

12. ERCDC, Inter-office Memo - May 16, 1977 - Alternative Implementation Division's Review of UCLA Power Generation and Siting Options Study.

13. ERDA-49, June 1975

14. ERDA-48 (1975) and ERDA 76-1 (1976)

15. ERDA - Central Receiver Solar Thermal Pilot Plant - Engineering Data, February 11, 1977.

16. ERDA, Environmental Development Plan (EDP) - Solar Thermal Power Systems - 1977

17. ERDA, Environmental Impact Data Sheets on MDAC System Concept

18. ERDA, Environment & Resource Assessment Branch, Division of Solar Energy, March 1977 - Solar Program Assessment - Environmental Factors - Solar Thermal Election

19. ERDA, (Arizona State University - Patten) - Solar Energy Conversion: An Analysis of Impacts on Desert Ecosystems - Progress Report - June - December, 1977. Issued September, 1977.

20. Geological Society of America, Report of The Committee on Environment and Public Policy. "Impacts and Management of Off-Road Vehicles." Wilshire St. 21 May 1977.

21. Federal Register, Vol. 43 #17, Jan. 26, 1977 U.S. ERDA - Part 711 - Guidelines for Environmental Review

22. Glenn A. Brown and Associates, 1974, Hydrogeologic Report Ground Water Quality Monitoring, Coolwater Generating Station, Daggett, San Bernardino County, California: Consultant Report.

23. Hovind, E. L. et al., An Evaluation of the Impact Upon the Air Quality from Present and Proposed New Power Generating Units at Coolwater Generating Station, Daggett, California, Prepared by Southern California Edison Company, Report No. 716-A, Goleta, California: North American Weather Consultants, (June, 1972).

24. Lahontan Regional Water Quality Control Board. Roy C. Hampson, Executive Officer Letter of Approval, April 19, 1976.

25. LeRoy Crandall and Associates. Ground Water Conditions during the Year 1976. Coolwater Generating Station, January 28, 1977.

26. Lucerne Valley Generating Station Project Draft Environmental Impact Report to the California Public Utilities Commission, Application No. 54148, (March 1976).

27. San Bernardino County Museum Association, Daggett Solar Power Generating Station Site, June 1, 1977.

28. SC APLD, 1975 Annual Report

29. Southern California Edison Company, 1972, Environmental Report for the Coolwater Combined-Cycle Project Units 3 and 4

30. SCE, LADWP, ERDA & CERCDC, July 1977, 10 MW Solar Power Pilot Plant — Applicant's Response to Preliminary Data Request for EIA/EIR.

31. State of California Department of Water Resources, Solar Radiation Measurements in California, January, 1974.

32. Thekaekara, M. A., Data on Incident Solar Energy

33. Turner, B., "A Diffusion Model for an Urban Area," Journal of Applied Meteorology, (February, 1964).

34. Water Quality Control Plan Report, South Lehontan Basin, May 15, 1975.

XIV
CONTACTS

XIV. PEOPLE AND ORGANIZATIONS CONTACTED

Barstow Chamber of Commerce

Barstow Motel Association

Barstow (City) - Paul J. Parham, Director, Community Development

Bureau of Land Management - John Hayward, Riverside District Office

Caltrans

- District #11, San Diego - William Baker
- District #8, San Bernardino - Maurice Loge

Daggett Community Services District

ERCDC - Scott Matthews

DOE - Joe Juetten

Federal Housing Administration - Santa Ana - Howard Richardson

Lahontan Regional Water Quality Control Board Staff - James Kuykendall

San Bernardino County

- Regional Parks Department - Paul Burden
- Public Works Agency
  - Refuse Division - Don Hilly
  - Flood Control - Ruben Montes
  - Traffic Division - staff
  - Transportation Division - staff
  - Airports Division - staff
- Environmental Improvement Agency
  - Planning Department - Robert Blank
  - Environmental Health Services - Ben Kaplan

Special Districts - Gary Miller

Environmental Analysis - Tom Rogers

Marion Ely

Energy Coordinator - Sara Hoffman

Museums Association - Gerald Smith

Robert Reynolds

Gene Cardiff

Southern California Air Quality Management District - Hugh Malone

Various staff

Southern California Edison Co.

District Management - Don Ferguson

Planning - DeAnn Lynch

Engineering - Joe La Rue

Various (See Chapter XVI)

Southern California Visitors Council - Lou Shaw

XV
APPENDICES

SOILS LOG OF TEST PIT EXCAVATIONS

Test Pit Number	Depth in Feet	Soil Type
1	0-2	A
	2-6.4	B
2	0-4	A
	4-6.2	B
3	0-2	A
	2-4	B
	4-6.4	C
4	0-5.7	D

Test Pit Number	Depth in Feet	Soil Type
5	0-3	A
	3-6.1	C
6	0-2	A
	2-6.1	C

SOIL TYPE	
A	Silty sand, tan, dry, compact, approximately 30% silt, 70% sand and fine sand, cohesive, stands straight.
B	Sandy gravel, light brown, dry, loose, contains approximately 40% rounded gravels, caves badly, hole will not stand vertical.
C	Sand, tan, dry, loose, well graded to fine, caves, slightly.
D	Gravelly sand, reddish brown, moist, compact, contains 20% rounded gravel up to 2", caves slightly.

Southern Calif. Edison
Coolwater Generating Station
Units 3 & 4

HOWARD PUMP, INC.

PUMP TEST DATA
FIELD REPORT

Well Dia 20"
Well Depth 360'
Static Water Level 110'
Pump Setting 330'
Air Line 326.3'
12 hr. test

WELL NO. "A" TEST Production test SHEET 1 OF

DATE AND TIME 1/6/77	(PSI)	DISCHARGE RATE (GPM)	DEPTH TO WATER (FT)	REMARKS
6:00 AM	93.5	0	110'	Static at start of test
6:30	87	1500	125	Water is clean, no sand, no air
7:00	87	1500	125	Water is clean, no sand, no air
7:30	77	3000	148	Water is clean, no sand, no air
8:00	77	3000	148	Water is clean, no sand, no air
8:30	80	2750	141	Water is clean, no sand, no air
9:00	80	2750	141	Water is clean, no sand, no air
9:30	80.5	2500	140	Water is clean, no sand, no air
10:00	80.5	2500	140	Water is clean, no sand, no air
10:30	81	2250	139	Water is clean, no sand, no air
11:00	81	2250	139	Water is clean, no sand, no air
11:30	81	2250	139	Water is clean, no sand, no air
12:00 NOON	81	2250	139	Water is clean, no sand, no air
12:30 PM	84	2000	132	Water is clean, no sand, no air
1:00	84	2000	132	Water is clean, no sand, no air
1:30	84	2000	132	Water is clean, no sand, no air
2:00	84	2000	132	Water is clean, no sand, no air
2:30	84.5	1750	131	Water is clean, no sand, no air
3:00	84.5	1750	131	Water is clean, no sand, no air
3:30	87	1500	125	Water is clean, no sand, no air
4:00	87	1500	125	Water is clean, no sand, no air
4:30	88	1250	123	Water is clean, no sand, no air
5:00	88	1250	123	Water is clean, no sand, no air
5:30	89	1000	120	Water is clean, no sand, no air
6:00	89	1000	120	Water is clean, no sand, no air
6:15	77	3000	148	Ran sand test for 2 min, no sand
6:20	77	3000	148	Ran sand test for 2 min, no sand
6:30	93.5	0	110	End of test.

Southern Calif. Edison
Test Report
Coolwater Generating Station
Units 3 & 4

HOWARD PUMP, INC.

PUMP TEST DATA
FIELD REPORT

Well Diameter 20"
Well Depth 320'
Static Water Level 109'6"
Pump Setting 290'
Air Line 274'3"

WELL NO. #B TEST Production Test SHEET 1 OF

DATE AND TIME 1/24/77	(PSI)	DISCHARGE RATE (GPM)	DEPTH TO WATER (FT)	REMARKS
5:45 AM			109	Static of Well #A (read 1' below top of casing)
6:00	70		109	Static at start of test for well B
6:30	62.5	1500	129	Water is clean, no sand, no air
7:00	62.5	1500	129	Water is clean, no sand, no air
7:00			109	Static of Well A
** 7:10				Took sand test for 2 min. NO SAND
7:30	46	2900	168	Water is clean, no sand, no air
7:55			109	Static of Well A
8:00	46	2900	168	Water is clean, no sand, no air
8:30	48	2750	163	Water is clean, no sand, no air
9:00	48	2750	163	Water is clean, no sand, no air
9:10			109	Static of well A
9:30	53.5	2500	150	Water is clean, no sand, no air
9:55			110	Static of well A
10:00	53.5	2500	150	Water is clean, no sand, no air
10:30	56	2250	144'9	Water is clean, no sand, no air
10:55			110	Static of well A
11:00	56	2250	144'9	Water is clean, no sand, no air
11:30	56	2250	144'9	Water is clean, no sand, no air
11:55			110	Static of Well A
12:00 NOON	56	2250	144'9	Water is clean, no sand, no air
12:30	58.5	2000	139	Water is clean, no sand, no air
1:00			110'8	Static of Well A
1:00	58.5	2000	139	Water is clean, no sand, no air
1:10				Pump broke down
1:25	69.5	Recov.	113	
1:33			109	Total recovery
1:36			110	Static of Well A
3:30				$2\frac{1}{2}$ hr total down time
3:25			110	Static of Well A
4:00	58.5	2000	139	Water is clean, no sand, no air
4:25			110'1	Static of Well A, dropped 1"
4:30	58.5	2000	139	Water is clean, no sand, no air
5:00	61	1750	133	Water is clean, no sand, no air
5:25			110'4"	Static of Well A, Dropped 4"
5:30	61	1750	133	Water is clean, no sand, no air
6:00	62.5	1500	129	Water is clean, no sand, no air
6:25			110'8"	Static of Well A, dropped 8"

Southern Calif. Edison
Coolwater Generating Station
Units 3 & 4

HOWARD PUMP, INC.

PUMP TEST DATA
FIELD REPORT

WELL NO. #B TEST Production Test SHEET 2 OF

DATE AND TIME 1/24/77	(PSI)	DISCHARGE RATE (GPM)	DEPTH TO WATER (FT)	REMARKS
6:30 PM	62.5	1500	129	Water is clean, no sand, no air
7:00	64	1250	126	Water is clean, no sand, no air
7:25			110'6"	Static of well A, Came up 2"
7:30	64	1250	126	Water is clean, no sand, no air
8:00	64	1000	124	Water is clean, no sand, no air
8:25			110'2"	Static of Well A, Came up 4"
8:30	64	1000	124	Water is clean, no sand, no air
8:35	70	0	109	End of test on Well B
9:00			110	Static of Well A

Southern Calif. Edison
Coolwater Generating Station
Units 3 & 4
Well C

HOWARD PUMP, INC.

PUMP TEST DATA
FIELD REPORT

Well Diameter	20"
Well Depth	359'
Static Water Level	99'
Pump, setting	310'
Air Line	273'

WELL NO. WELL "C" TEST Production SHEET 1 OF 1

DATE AND TIME 3/29/77	(PSI)	DISCHARGE RATE (GPM)	DEPTH TO WATER (FT)	REMARKS
4:45 AM	75	0	99'	Static at start of test
5:00	71	1000	108'9"	Took water sample
5:15	60	3000	134'	Took sand test, no sand
5:30	60	3000	134	Water is clean, no sand, no air
6:00	60	3000	134	Water is clean, no sand, no air
6:30	62	2750	129	Water is clean, no sand, no air
7:00	62	2750	129	Water is clean, no sand, no air
7:30	64	2500	125	Water is clean, no sand, no air
8:00	64	2500	125	Water is clean, no sand, no air
8:30	65	2250	122	Water is clean, no sand, no air
9:00	65	2250	122	Water is clean, no sand, no air
9:30	65	2250	122	Water is clean, no sand, no air
10:00	65	2250	122	Water is clean, no sand, no air
10:30	65	2250	122	Water is clean, no sand, no air
11:00	65	2250	122	Water is clean, no sand, no air
11:30	66.5	2000	119	Water is clean, no sand, no air
12:00 NOON	66.5	2000	119	Water is clean, no sand, no air
12:30 PM	66.5	2000	119	Water is clean, no sand, no air
1:00	66.5	2000	119	Water is clean, no sand, no air
1:30	67.5	1750	117	Water is clean, no sand, no air
2:00	67.5	1750	117	Water is clean, no sand, no air
2:30	68	1500	115	Water is clean, no sand, no air
3:00	68	1500	115	Water is clean, no sand, no air
3:30	69.5	1250	112	Water is clean, no sand, no air
4:00	69.5	1250	112	Water is clean, no sand, no air
4:30	71	1000	108	Water is clean, no sand, no air
5:00	71	1000	108	Water is clean, no sand, no air
5:15	75	0	99	End of test

WELL LOG

Glenn A. Brown and Associates
Consulting Geologists

Owner: Southern California Edison Co. — Well No. 11
Drilled by: — USGS No. 9N/1E-14G1
Location: 2400 feet West and 2400 feet North of SE corner Section 14, East side of road.
Drilling method: Rotary — Date completed: 1957
Borehole depth: 578 — Borehole diameter:
Casing: 0-485', 16"; 475-578', 12"
Perforations: 148-166, 200-246, 253-384, 400-485'
Static water level: 89' (1960) — Drawdown: 16 ft. — Yield: 1603 gpm (1960)
Specific capacity: 100 gpm/ft — Electrical conductance: 1000 micromhos
Ground elevation: 1951 — Top of casing elevation: 1951.75

Depth	Description of materials
0 - 2 feet	Sand and Loam soil.
2 - 24	Sand and gravel 3/4".
24 - 26	Clay, yellow.
26 - 51	Sand and gravel.
51 - 54	Sand, gravel and clay.
54 - 69	Coarse sand, gravel (1/2")
69 - 87	Solid yellow clay & coarse sand with clay (tight)
87 - 107	Coarse sand, gravel, clay.
107 - 115	Coarse sand, large gravel.
115 - 120	Solid yellow clay, some gravel.
120 - 135	Large gravel, coarse sand.
135 - 148	Yellow clay.
148 - 166	Large gravel (3/4"-3"), coarse sand.
166 - 185	Sandy clay
185 - 196	Sandy clay, some small gravel
196 - 233	Large gravel, some coarse sand.
233 - 241	Clay, coarse sand and gravel.
241 - 275	Large gravel, coarse sand, boulders.
275 - 294	Clay and gravel, sandy.
294 - 337	Coarse sand and gravel.
337 - 374	Large gravel (tight) very hard.
374 - 384	Pea gravel.
384 - 430	Brown clay and gravel, hard.
430 - 486	Clay, gravel and boulders (tight)
486 - 508	Very hard clay (decomposed granite).
508 - 578	No log.

Remarks: Log condensed from detailed drilling log by Ebasco.
Yield 1775 gpm @ 129 ft. in 1970.

WELL LOG

Glenn A. Brown and Associates
Consulting Geologists

Owner: Southern California Edison Company — Well No. 12
Drilled by: Ephraim Harris — USGS No. 9N/1E-23E
Location: 1100 ft. East and 2000 ft. South of NW corner Section 23,
South side of Cooling Towers.
Drilling method: Cabel tool (?) — Date completed: October 14, 1961.
Borehole depth: 270 feet — Borehole diameter:
Casing: 12 inch double 10 gauge
Perforations: 140-260 ft; 2½ x 7/8" Mills knife
Static water level: 104 ft (1961) 118 ft — Drawdown: 14.6 — Yield: 831 gpm (1962)
Specific capacity: 57 gpm/ft (1974) — Electrical conductance: 1120 micromhos
Ground elevation: 1961 — Top of casing elevation: 1962.35

Depth	Description of materials
0 - 8 feet	Top soil.
8 - 47	Mohave River sand and gravel.
47 - 58	Hill silt, sand and gravel.
58 - 72	Hill clay.
72 - 73	Hill sand and gravel.
73 - 78	Clay
78 - 85	Mohave River sand and gravel.
85 - 91	Soft clay.
91 - 110	Mohave River sand and gravel.
110 - 118	Hill silt, sand and gravel.
118 - 125	Mohave River and hill sand and gravel.
125 - 158	Coarse sand and small gravel hill.
158 - 194	Same as above but more compact and stones to 6 inch.
194 - 201	More compact.
201 - 210	Very good sand and gravel to 3 inch.
210 - 229	Same but stones to 10 inch.
229 - 246	Hard tight clay.
246 - 250	Silt, sand and fine gravel.
250 - 263	Sticky clay.
263 - 265	Clay and gravel to 4".
265 - 266	Hard clay.
266 - 270	Fine sand and gravel to 3/4 inch. Bottom clay and cement.

Remarks: Log by Ephraim Harris. 64 tons gravel used, 1" maximum.

WELL LOG

Glenn A. Brown and Associates
Consulting Geologists

Owner: Southern California Edison Company — Well No. 13
Drilled by: Scoggins — USGS No. 9N/1E-23G
Location: 2100 ft West and 1400 ft. South of NE corner Sec. 23.

Drilling method: Rotary — Date completed: April 4, 1972
Borehole depth: 300 feet — Borehole diameter: 20 inch
Casing: 16" x 1/4"
Perforations: 200-300'; 6" x 1/4" torch cut.
Static water level: 115 ft. Jan. 1974 — Drawdown: — Yield:
Specific capacity: gpm/ft — Electrical conductance: 1150 micromhos
Ground elevation: 1960 — Top of casing elevation: 1961

Depth	Description of materials
0 - 24	Sand and gravel, gravel to 1/8".
24 - 60	Sand and gravel, gravel to 1/4"+.
60 - 80	Silty sand, some gravel.
80 - 90	Silty sand.
90 - 110	Clayey sand, brown, some gravel.
110 - 120	Clayey gravel.
120 - 130	Sand, brown, medium to fine.
130 - 140	Gravel and boulders.
140 - 150	Clayey gravel.
150 - 160	Silty sand, brown, some gravel.
160 - 220	Sand and gravel, gray, fine to coarse sand, gravel to 1/4 inch, some cobbles and boulders.
220 - 230	Clayey sand and gravel, some cobbles & boulders.
230 - 250	Sand and gravel, some fine sand, cobbles.
250 - 260	Sand and gravel, ½" gravel, some fine sand.
260 - 300	Sand and gravel, some clay.

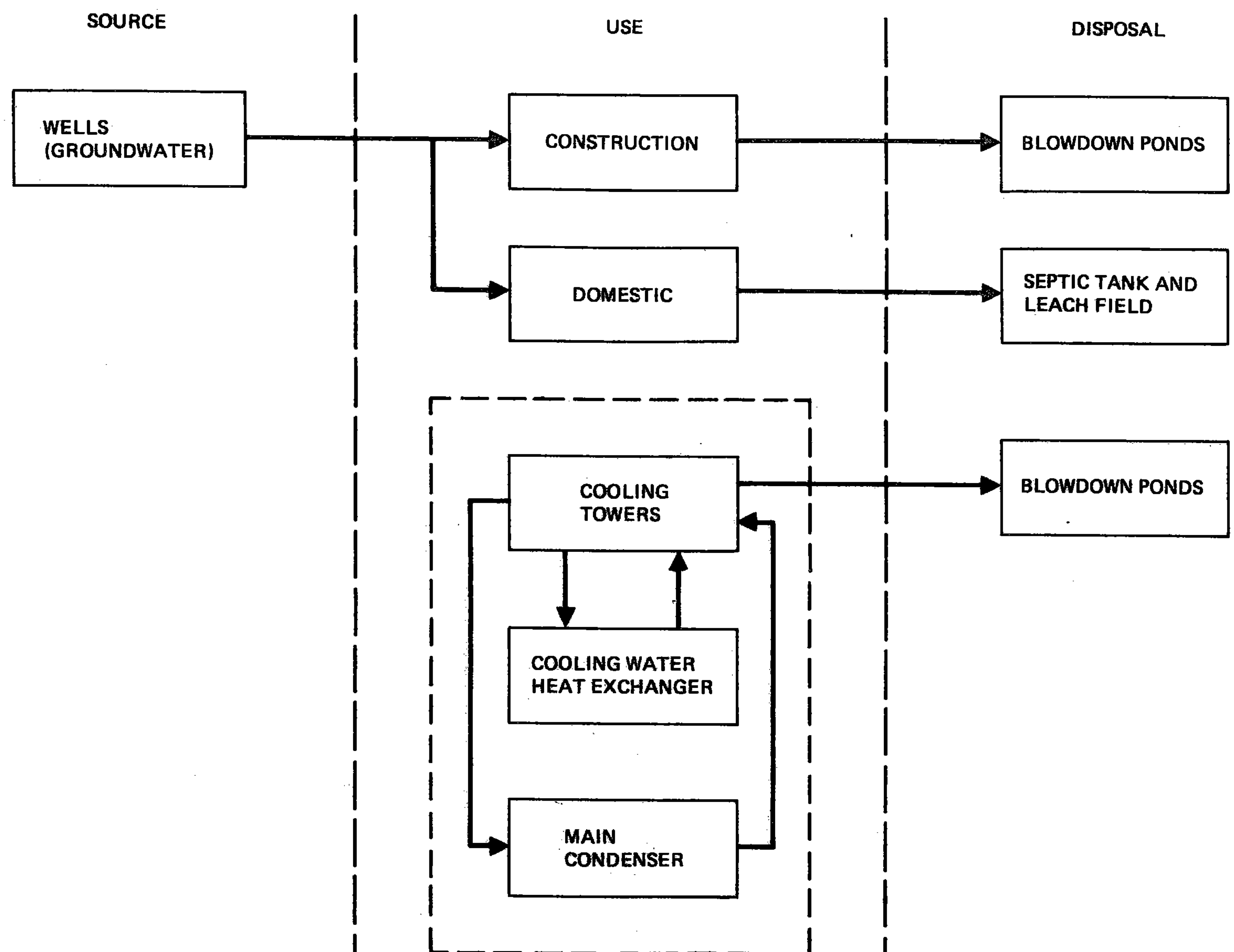
Remarks: Log constructed from cutting samples saved by driller.

Following is a description of the normal and potential sources, quality and disposition of plant wastewater:

- <u>Cooling System (See Exhibits C-1 and C-2)</u>

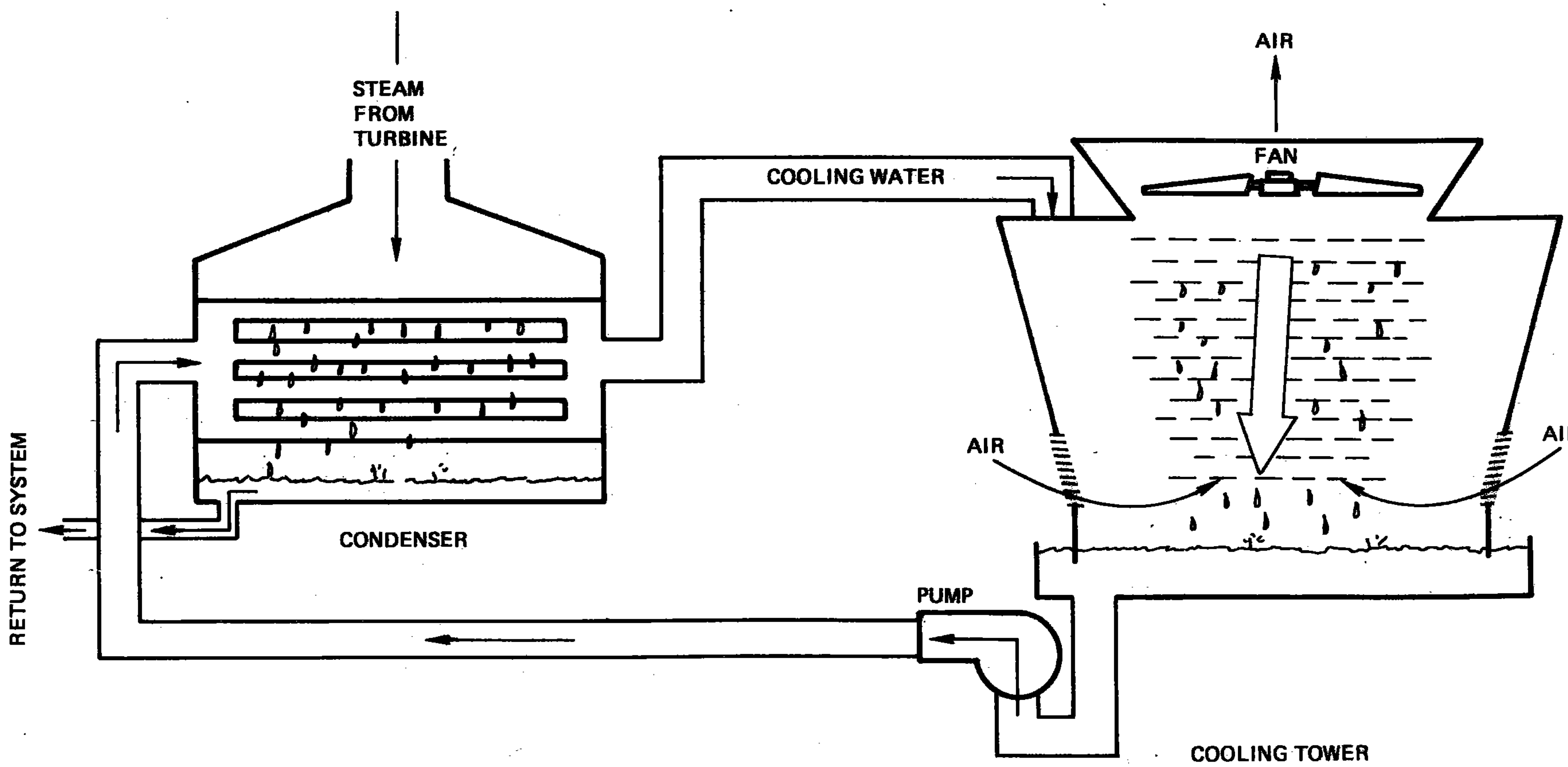
Water will be heated to steam in the conventional boiler. The steam exhausted from the turbine/generator will be cooled and condensed by a condenser. (Cooling water will flow through the tubes of the surface condenser, absorbing heat from the steam exhausted from the turbine/generator). The steam will cool and condense on the outside of the tube and fall as water to the bottom of the condensor, where it will be collected for reuse to the boiler. The cooling water which flows inside the condenser tubes will be pumped to the top of the cooling tower and pass through a series of slats and partitions to the bottom. Air will be drawn in through the sides of each tower cell by a fan located at the top of each cell. In flowing past the cooling water, the air will evaporate about 2% of the water in turn, cooling the remaining water. Cooling efficiency will be enhanced by orienting the tower to receive maximum advantage of the prevailing surface winds.

The circulating water discharged from the towers will be carried to the circulating water pump intake structure which will screen water-borne debris. Chemicals will be added to the circulating water system to control corrosion and algae growth in the water system piping. These chemicals, together with all other blowdown impurities (condensed solids, etc) will be channelled to the



10 MWe SOLAR PILOT PLANT

EXHIBIT C-1



10 MWe SOLAR PILOT PLANT

EXHIBIT C-2

blowdown (evaporation) pond for evaporation to the atmosphere. (See Exhibit C-3 for chemical analysis, of wastewater discharged to evaporation ponds).

- Boiler Blowdown

Normally boilers must be "blown down" to purge accumulated solids and contaminants from the system. The MDAC single pass to superheat receiver (boiler) does not employ blowdown. Effluent could be released to the environment only the use of emergency vent and relief valves. In that event, the quantity discharged would be variable but small, with the water quality at 20 to 50 parts per billion (ppb) dissolved solids, and the pH maintained at 9.5

- Condensate and Makeup Water Demineralization

Blowdown frequency (regeneration rate) for the condensate demineralizer is once every 7 days (5800 gallons) a makeup demineralizer regeneration rate is once a day (50 gallon). Solids composition of these wastes has not been determined since no adverse impact has been identified with disposal of demineralizer wastes to evaporation ponds. Any good quality wash water used for demineralizer flushing over and above regeneration wastes will be routed to cooling tower makeup water.

- Heat Exchanger Blowdown (Thermal Storage)

The heat exchanger for the thermal storage system transfers stored heat to the condensate to produce steam for the turbine during periods of low insolation or darkness. The exchanger must occasionally be blowndown to the evaporation pond. Quantity of effluent will approximate 50 pounds with a contaminant content of 2500 parts per million (ppm) dissolved solids.

EXHIBIT C-3

CHEMICAL ANALYSIS OF WASTE WATER

DISCHARGED TO EVAPORATION PONDS*

Specie	Concentration (mg/L)
Na (as $CaCO_3$)	10,600
Ca (as $CaCO_3$)	2,000
Mg (as $CaCO_3$)	600
Alkalinity (as $CaCO_3$)	100
SO_4 (as $CaCO_3$)	12,400
Cl (as $CaCO_3$)	1,000
SiO_2 (as is)	200
TDS	19,000
pH	4-9
Flow (gpm)	<50

*Average of all Pilot Plant liquid discharges to the evaporation pond

- <u>Heliostat Wash Effluent</u>

If the mirror cleaning solution selected contains chemical cleaning additives wash water will be collected, re-used and/or disposed of in the evaporation pond. The use of a non-chemical containing solution would enable use of the washwater as irrigation for vegetation ground cover on the collector field. The only impurities would be sand and dust from the mirrors. If used as such, approximately 80-90% would be evaporated from the mirror and soil surfaces and 10-20% would enter the soil deep enough to become soil moisture. It us unlikely that any wash water would ever percolate deep enough to mix with groundwater.

- <u>Septic Tank/Lead Line Systems</u>

Conventional disposal systems will handle the small amount of domestic wastes generated on the site.

- <u>Escape of Heat Transfer Fluids From Heat Storage Unit</u>

The plant will utilize a combination of rocks, and oil (heat transfer fluid) as heat transfer media in the thermal storage subsystem. This fluid could be released inadvertently during infrequent system flushing and/or accidental leakage. (Periodic system flushing is required before both replacement of degraded fluids and general maintenance.). A main tank failure could result in oil spillage of approximately 250,000 gallons.

a. Photo Chemical Oxidant (Ozone)

Southern California smog is a pungent, colorless, toxic gas produced by a photochemical reaction involving oxides of nitrogen, reactive hydrocarbons and other organic gases. It primarily stems from mobile sources. Manifestations are eye irritation, respiratory impairment, vegetation damage, cracking of rubber products, etc. Ozone does not generally interfere with insolation, however it is an indication that elements that could scatter light exist in the atmosphere. In 1976, the Federal oxidant standard of .08 ppm was exceeded during 203 hours in Victorville and during 18 hours in Barstow. No data exists for the Daggett area.

b. Particulate Matter (Suspended)

Atmospheric particulates consist of solids or liquids such as iron oxides, soot, dust, aerosols, fumes and mist. Normally 90% of known particles are less than 5 microns in diamameter (1 micron - 1 millionth of a meter). Particulate matter primarily stems from soil or mineral dust, industrial fumes, internal combustion, etc. Particulates contribute to atmospheric photochemical reactions and act alone or in conjunction with gases affecting respiration and intensifying corrosion of metals. Particles of aerosol size (less than 1 micron) can both scatter and absorb sunlight, reducing the amount of solar energy reaching the earth's surface and resulting in haze and its attendant reduction in visibility. High particulate concentrations and water vapor (cloud cover) produce the most significant interferences to optimum solar insolation and Pilot Plant efficiency.

The 24 hour average state standard for particulate matter is 100 micrograms/cubic meter (ug/m^3). In 1975 this standard was exceeded 34.5% of the sample days in Victorville and 53.8% of the sample days in Barstow. On extremely windy days Barstow's high volume particulate sampler has recorded concentrations of 450 ug/m^3 and greater.

The state annual geometric mean standard is 60 ug/m^3. The 1975 annual mean for suspended particulates was 90.4 ug/m^3 in Victorville and 110.6 ug/m^3 in Barstow. The Barstow mean approached 116 ug/m^3 in 1976. Barstow's concentrations have exceeded the annual geometric mean standard by 50-60 ug/m^3 over the past years. The AQMD has documented an uptrend in ambient particulate levels in the lower Mojave River Valley probably due to increased soil disturbance and urbanization.

c. Carbon Monoxide (CO)

CO is a colorless, odorless, toxic gas produced by imcomplete combustion of carbon-containing substances. CO concentrations are usually greater in the winter when meteorological conditions augment the build-up of directly emitted contaminants. In the desert portion of the County, over 90% of CO is contributed by mobile sources.

CO is a very toxic primary pollutant to humans and animals and is only slowly oxidized in the atmosphere to carbon dioxide (CO_2). It is not known to effect vegetation, corrosion, or sunlight diffusion.

Barstow's maximum hourly CO concentration was 7 ppm in 1975, well under the state standard of 40 ppm.

d. Oxides of Nitrogen (NO_x)

The two important forms are nitric oxide (NO) and nitrogen dioxide (NO_2). NO is a colorless, odorless gas formed from atmospheric nitrogen and oxygen when combustion occurs at high temperatures and pressures. Most of the NO is air oxidized to NO_2 within 5 minutes of emission, creating the reddish brown "cloud" of irritating gas often seen lingering over coastal basin and desert areas of Southern California.

Primary sources of NO_x are both mobile and industrial internal combustion systems. Major sources in the region are motor vehicles, various cement plants and the Coolwater Generating Station.

The sunlight scattering or absorption properties of the colored NO_2 gas have not been quantified.

The maximum hourly average concentrations of NO_2 for 1975 was 0.30 ppm in Victorville and 0.25 ppm in Barstow. The state hourly standard is 0.25 ppm. The Barstow station's recording of NO_2 concentrations equal to the state standard indicate high levels in the area due to relatively local sources. Ambient NO_2 levels over the Daggett region have not been measured.

e. Sulfur Dioxide (SO_2)

SO_2 is a colorless, pungent, irritating gas formed primarily by combusting sulfur-containing fossil fuels such as oil and coal.

SO_2 reacts with water vapor and ozone in the atmosphere to form sulfur trioxide (SO_3) and sulfuric acid mist. This acid in turn reacts with dust and other materials to produce sulfate particulates.

Cement plants and the Coolwater Generating Station are the major potential sources of SO_2 in the region. The presence of ambient SO_2 is a factor of the type of fossil fuel burned, and stack clean up efficiency. SO_2 may increase in the future if power and cement plants are required to combust heavy oil and coal respectively because of dwindling natural gas supplies, and if SO_2 scrubbers are not installed.

Low concentrations of SO_2 combined with small particulate matter (sulfates) appear to harm lung tissue. At higher concentrations, SO_2 irritates the upper respiratory tract. Sulfur oxides combined with moisture and oxygen (forming acid mists) are known to destroy vegetation, dissolve or corrode materials, and as an aerosol (suspended in atmosphere) can limit visibility and reduce sunlight penetration.

Neither the Victorville nor Barstow monitoring stations include SO_2 monitoring devices. The ambient level at the plant site will primarily be a factor of the Coolwater Generating Station emissions, other local sources and the quality of the air transported from the South Coast Air Basin.

f. Hydrocarbons

Hydrocarbons are gaseous compounds containing hydrogen and carbon in various combinations, mostly found in fossil fuels. They constitute a vast family of organic compounds. Those that are classified as aromatics and olefins are highly reactive and combine with NO_x to produce photochemical oxidants. Most reactive ambient hydrocarbons are produced by gasoline storage and marketing (evaporation of gas to atmosphere) and by incomplete combustion in motor vehicle engines. The relative efficiency of fuel combustion at a stationary source such as the Coolwater plant does not result in the emission of significant amounts of hydrocarbons.

Some effects of hydrocarbon pollution are unkown. Certain hydrocarbons inhibit plant growth and cause leaf damage. Present levels are not known to cause direct health effects in humans. The primary impact is their significant contribution to oxidant formation.

Hydrocarbons are not monitored in Barstow and state or federal standards have not yet been established. Ambient levels at the plant site are probably relatively light.

SAN BERNARDINO COUNTY
MUSEUM
ASSOCIATION

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June 6, 1977

RECEIVED
JUN 8 1977
EIA/ENVIRONMENTAL
ANALYSIS
DIVISION

Mr. Charles H. Bell
Associate Environmental Analyst
Environmental Improvement Agency
1111 E. Mill Street, Bldg. #1
San Bernardino, Ca. 92415

Re: Archaeological-Historical-Paleontological-Biological Resources Assessment of West 1/2 of Section 13 (Township 9 North, Range 1 East) Southern California Edison Daggett Solar Power Generating System

Attached is the result of study of the impact which the proposed Southern California Daggett Solar Power Generating Station would have on the archaeological-historical-paleontological-biological resources of the selected site.

The biological study was conducted by Oscar Clark of UCR; Robert Sanders of San Bernardino County Museum Association; Eugene Cardiff of the San Bernardino County Museum; and Dr. Charles Howell of the University of Redlands. The paleontological study was completed by Robert Reynolds of the San Bernardino County Museum, and the archaeological-historical study was done by Ruth D. Simpson, Dr. Gerald A. Smith, and La Verna Arnold Brown of UCR.

The methods used in gathering data included literature review, site file checks and field surveys.

Oscar Clark states that there are no rare or endangered species of vascular plants found to exist at the proposed site for the SCE Daggett Solar Power Generating Station. Eugene Cardiff, Robert Sanders, and Dr. Charles Howell state that there will be no significant impact that will require mitigation in respect to the biological resources, if the proposed station is constructed as planned. It is recommended that an interpretative center be completed as part of the project.

Robert Reynolds states that no fossils were found on the surface of the land proposed for use for this project, but recommends a crew trained in paleontology be present during the initial stages of grading for construction.

Ruth D. Simpson, Gerald Smith, and Lee Brown note the presence of limited cultural resources along the northern portion of the proposed site and recommend that this portion not be utilized for construction, or that a further study be made to recover the noted surface artifacts and ascertain if there are sub-surface cultural resources which should be further evaluated.

Mr. Charles Bell
June 6, 1977
Page 2

It is the opinion of the San Bernardino County Musuem Association that this project, if approved, will have no significant detrimental effect on the biological, paleontological, or cultural resources of San Bernardino County providing the following mitigation is accomplished as recommended.

1) Plan the construction to avoid the northern portion of the property along the bluff overlooking the Mojave River Drainage.

2) Avoid disturbance of the Mojave River Drainage area.

3) Have a paleontological observer present during initial grading for construction.

4) Recover all surface artifacts and develop interpretative center (Museum) at the Daggett site of the same quality as the one at San Onofre.

Sincerely,

Joseph E. Hearn

Dr. Joseph E. Hearn
President, San Bernardino County
Museum Association

JEH:sm

Attach: as noted

SITE PLANT LIST

SCE and S.B. County
Museum Surveys

Key: Occurrence

I Infrequent
O Occasional
C Common
D Dominant

Plant Type

A Annual
P Perennial
S Shrub
T Tree
W Weed (Non-Native)
C Cultivated

OCCURRENCE	PLANT TYPE	SCIENTIFIC NAME	COMMON NAME
		ASTERACEAE	SUNFLOWER FAMILY
I	A	Ambrosia acanthicarpa	Annual Bur Ragweed
O	S	A. dumosa	Burrobush
I	P	A. psilostachya	Western Ragweed
O	A	Baileya pleniradiata	Wolly Marigold
I	A	Anisocoma acaulis	Scalebud
I	A	Chaenactis carphoclinia	Pebble Pinchshion
O	A	C. fremontii	Fremont Pincushion
O	A	Dicoria canescens	-
O	A	Eriophyllum wallacei	-
C	A	Geraea canescens	Desert Sunflower
O	S	Hymenoclean salsola	Cheese Bush
I	S	Lepidospartum squamatum	Scale Broom
C	A	Malacothryx glabrata	Desert-Dandelion
I	A	Monoptilon bellioides	Mohave Desert Star
O	A	Palafoxia linearis	Spanish Needles
I	A	Psathyrotes ramosissima	-

SITE PLANT LIST

SCE and S.B. County
Museum Surveys

Key: Occurrence

- I Infrequent
- O Occasional
- C Common
- D Dominant

Plant Type

- A Annual
- P Perennial
- S Shrub
- T Tree
- W Weed (Non-Native)
- C Cultivated

OCCURRENCE	PLANT TYPE	SCIENTIFIC NAME	COMMON NAME
O	P	Stephanomeria pauciflora	-
		BIGNONIACEAE	CATALPA FAMILY
I	T	Chilopsis linearis	Desert Catalpa
		BORAGINACEAE	BORAGE FAMILY
O	A	Amsinckia tessellata	Fiddleneck
O	P	Coldenia plicata	-
D	A	Crypthantha angustifolia	Popcorn Flower
O	A	C. micrantha	Popcorn Flower
O	A	C. pterocarya	Popcorn Flower
		BRASSICACEAE	MUSTARD FAMILY
O	AW	Brassica geniculata	Short Padded Mustard
O	A	Descurainia pinnata	Tansy-Mustard
I	A	Dithyraea californica	Spectacle-Pod
C	AW	Sisymbrium irio	London Rocket
O	A	Streptanthella longirostris	-

SITE PLANT LIST

SCE and S.B. County
Museum Surveys

Key: Occurrence

I	Infrequent
O	Occasional
C	Common
D	Dominant

Plant Type

A	Annual
P	Perennial
S	Shrub
T	Tree
W	Weed (Non-Native)
C	Cultivated

OCCURRENCE	PLANT TYPE	SCIENTIFIC NAME	COMMON NAME
		CARYOPHYLLACEAE	PINK FAMILY
C	A	Achyronychia cooperi	Frost-Mat
		CHENOPODIACEAE	GOOSE-FOOT FAMILY
O	S	Atriplex polycarpa	Saltbush
I	PW	A. semibaccata	Australian Saltbush
C	AW	Salsola iberica	Tumbleweed
C	AW	S. paulseni	Barbed-Wire Tumbleweed
I	S	Suaeda fruticosa	Iodine Bush
		CUCURBITACEAE	GOURD FAMILY
O	P	Cucurbita palmata	Gourd
		EUPHORBIACEAE	SPURGE FAMILY
I	A	Stillingia spinulosa	Broad-Leaved Stillingia
		FABACEAE	PEA FAMILY
O	A	Astragalus didymocarpus	Locoweed
		GERANIACEAE	GERANIUM FAMILY
C	AW	Eriodium cicutarium	Red-Steemed Filaree

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- C Cultivated

OCCURRENCE	PLANT TYPE	SCIENTIFIC NAME	COMMON NAME
		HYDROPHYLLACEAE	WATERLEAF FAMILY
O	A	Nama demissum	Purple Mat
I	A	Nama depressum	-
C	A	Phacelia crenulata	Notch-Leaved Phacelia
		LILIACEAE	
O	A	Hesperocallis undulata	Desert - Lily
		LOASACEAE	LOASA FAMILY
O	A	Mentzelia albicaulis	Blazing Star
		MALVACEAE	MALLOW FAMILY
I	A	Eremalche rotundifolia	Desert Five-Spot
O	A	E. exilis	White Mallon
		NYCTAGINACEAE	
C	A	Abronia sp	Sand-Verbena
		ONAGRACEAE	
O	A	Camissonia boothi	-
O	A	C. claviformis	Brown-Eyed Primrose
I	A	Oenothera primiveris	-

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OCCURRENCE	PLANT TYPE	SCIENTIFIC NAME	COMMON NAME
		POACEA	GRASS VALLEY
I	AW	Cenchrus incertus	Sanbur
I	P	Panicum urvillei	-
D	AW	Schismus barbathus	ABU Mashi
		PAPAVERACEAE	POPPY FAMILY
I	A	Eschscholzia glyptosperma	-
		PLANTAGINACEAE	PLANTAIN FAMILY
C	A	Plantago insularis	Desert Plantain
		POLEMONIACEAE	PHLOX FAMILY
O	A	Gilia latiflora	Gilia
O	A	Langloisia punctata	Spotted Gilia
		Langloisia matthewsii	Desert Calico
		POLYGONACEAE	BUCKWHEAT FAMILY
O	A	Eriogonum angulosum	-
I	A	E. thomasii	-
I	A	E. pusillum	-
I	PW	Rumex crispus	Curley Dock

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C Cultivated

OCCURRENCE	PLANT TYPE	SCIENTIFIC NAME	COMMON NAME
		RESEDACEAE	MIGNONETTE FAMILY
O	A	Oligomeria linifolia	-
		SOLANACEAE	NIGHTSHADE FAMILY
I	P	Datura meteloides	Jimson Weed
I	P	Physalis crassifolius	Ground Cherry
		TAMARICACEAE	TAMARISK FAMILY
I	TW	Tamarix ramosissima	Salt Cedar
		ZYGOPHYLLACEAE	CALTROPS FAMILY
C	S	Larrea tridentata	Cresosote Bush

REGIONAL WILDLIFE LIST

(Prepared for EIR on SCE Coolwater Units 3 & 4)

VERTEBRATES NORMALLY FOUND IN THE CREOSOTE BUSH SCRUB AND ALKALI SINK COMMUNITIES OF THE MOJAVE DESERT NEAR BARSTOW, CALIFORNIA

Scientific Name	Common Name
BIRDS	
Toxostoma lecontei	Le Conte's thrasher
Oreoscoptes montanus	Sage thrasher
Phalanoptilus nuttallii	Poor-will
Lanius ludovicianus	Loggerhead shrike
Amphispiza bilineata	Black-throated sparrow
Bubo virginianus	Great horned owl
Corvus corax	Raven
Cathartes aura	Turkey vulture
Buteo jamaicensis	Red-tailed hawk
Flaco mexicanus	Prairie falcon
Lophortyx gambelii	Gambel's quail
Zenaidura macroura	Mourning dove
Geococcyx californianus	Roadrunner
MAMMALS	
Tadarida brasiliensis	Brazilian free-tailed bat
Macrotus californicus	California leaf-nosed bat

REGIONAL WILDLIFE LIST (Continued)

Scientific Name	Common Name
Daspyterus ega	Western yellow bat
Corynorthinus rafinesquei	Long-eared bat
Pipistrellus hesperus	Western pipstrelle
Myotis yumanensis	Yuma myotis
Sylvilagus auduboni	Desert cottontail
Lepus californicus	Black-tailed jackrabbit
Ammospermophilus leucurus	White-tailed antelope squirrel
Spermophilus beecheyi	California ground squirrel
Thomomys bottae	Botta's pocket gopher
Perognathus longimembris	Little pocket mouse
Perognathus formosus	Long-tailed pocket mouse
Perognathus penicillatus	Desert pocket mouse
Dipodomys microps	Chisel-toothed kangaroo rat
Dipodymys merriami	Merriam' kangaroo rat
Dipodomys deserti	Desert kangaroo rat
Reithrodontomys megalotis	Western harvest mouse
Peromyscus crinitus	Canyon mouse
Peromyscus maniculatus	Deer mouse
Onychomys torridus	Southern grasshopper mouse
Neotoma lepida	Desert wood rat
Canis latrans	Coyote
Taxidea taxus	Badget
Vulpes macrotis	Kit fox

REGIONAL WILDLIFE LIST (Continued)

Scientific Name	Common Name
Urocyon cinereoargenteus	Gray fox
Lynx rufus	Bobcat
REPTILES	
Gopherus agassizi	Desert Tortoise
Coleonyx variegatus	Western banded gecko
Xantusia vigilis	Desert night lizard
Dipsosaurus dorsalis	Desert iguana
Callisaurus draconoides	Zebra-tailed lizard
Crotophytus collaris	Collared lizard
Crotophytus wizlizeni	Leopard lizard
Uta stansburiana	Side-blotched lizard
Cnemidophorus tigris	Western whiptail lizard
Lichanura trivirgata	California boa
Chionactis occipitalis	Western shovel-nosed snake
Hypsiglena torquata	Night snake
Lampropeltus getulus	Common kingsnake
Pituophis melanoleucus	Gopher snake
Crotalus cerastes	Sidewinder
Crotalus mitchelli	Speckled rattlesnake
Crotalus scutulatus	Mojave rattlesnake

INSECT LIST

(S.D. County Museum Association - 1977)

The specific list of insects observed by the investigators included the following:

ORTHOPTERA

Gyrillidae: *Nemobius mexicana*, common cricker

Acrididae: *Anconia integra*, the ghostly grasshopper
Boot etix argentatus, the creosote bush grasshopper
Schistocerca americana, common grasshopper

COLEOPTERA

Tenebrionidae: *Phloeodes pustulosus*, the ironclad beetle
Eleodes sp. the stink beetle

Meloidae: *Cysteodemus armatus*, the inflated beetle
Epicauta sp.
Lytta sp.

Cuculionidae: Several minute species

Coccinelidae: Ladybird beetles (possibly of two genera) were among the more common insects. Possibly *Coccinella* and *Adalia*.

HYMENOPTERA

Wasps were visibly scarce.

A small pompilid was seen.

Sphecinae were seen.

HEMIPTERA

Miridae: Many tiny mirids were seen.
Plant hoppers: Were seen and not identified as to exact family.
Scale insects: Tachardiinae were in some evidence.

INSECT LIST

(S.B. County Museum Association - 1977)

DIPTERA

A number of families of lifes were seen, including:

Asillidae - probably Rapionidas xanthus.
Stratiomyidae
Bombylidae
Syrphidae
Muscidae

LEPIDOPTERA

Gemoetridae: Larvae were common on plants of Larrea.
Papilionidae: Rare. One spotted.
Lycaenidae: One was seen.
Pieridae: Most common, but still not common.

Pyrgus albescens: western checkerspot.
Pieris protodice: common white.

Hesperidae: Also common with the pierids riding the flyway.

Heliopetes ericetorum: The large white skipper.

COOLWATER GENERATING STATION BIRD LIST
(Observation by SCE Employee)
1973 - 1977

Common Leon
Eared Grebe
Western Grebe
Pied-billed Grebe
White Pelican
Great Blue Heron
Snowy Egret
Cattle Egret
Canada Goose
White Fronted Goose
Snow Goose
Ross' Goose
Mallard
Gadwall
Pintail
Green-Winged Teal
Cinammon Teal
American Widgeon
Shoveler
Redhead
Ring Necked Duck
Canvasback
Greater Scaup
Lesser Scaup
Greater Yellowlegs
Lesser Yellowlegs
Least Sandpiper
Dunlin
Long-billed Dowitcher
Western Sandpiper
Marbled Godwit
Hudsonian Godwit - 1 sighting
American Avocet*
Black-necked Stilt*
Wilson's Phalarope
Northern Phalarope
Ring-billed Gull
Bonaparte's Gull
Forster's Tern
Black Tern
Rock Dove*
Mourning Dove*
Roadrunner*
Barn Owl*
Bufflehead
Ruddy Duck
Common Merganser
Turkey Vulture
Sharp-Shinned Hawk
Coppers Hawk
Red Tailed Hawk*
Rough Legged Hawk
Ferruginous Hawk
Golden Eagle*
Marsh Hawk
Prarie Falcon*
American Kestrel*
Chukar
Gambel's Quail
Sora
American Coot
Semipalmated Plover
Snowy Plover
Killdeer*
Common Snipe
Whimbrel
Spotted Sandpiper
Willet
Anna's Hummingbird
Black-Chinned Hummingbird
Rufous Hummingbird
Common Flicker
Hairy Woodpecker
Downey Woodpecker
Nuttall's Woodpecker
Western Kingbird*
Black Phoebe
Say's Phoebe*
Western flycatcher
Western Wood Pewee
Horned Lark*
Violet-green Swallow
Tree Swallow
Bank Swallow
Rough-winged Swallow
Barn Swallow
Common Raven*
Pinon Jay

COOLWATER GENERATING STATION BIRD LIST

(Observation by SCE Employee)

1973 - 1977

Great Horned Owl*
Common Nighthawk
Lesser Nighthawk
Black Swift
Vaux's Swift
White-throated Swift
Western Bluebird
Mountain Bluebird
Ruby-cowned Kinglet
Water Pipit
Cedar Waxwing
Phainopepla
Loggerhead Shrike
Starling*
Yellow Warbler
Black-throated Gray Warbler
Myrtle Warbler
Yellow-rumped Warbler
Townsend's Warbler
Yellowthroat
Wilson's Warbler
House Sparrow*
Western Meadowlark
Yellow-headed Blackbird*
Red-winged Blackbird*
Northern Oriole
Brewer's Blackbird*
Brown-headed Cowbird
Western Tanager*
Black-headed Grosbeak
Blue-Grosbeak
Lazuli Bunting
White-breasted Nuthatch
Red-breasted Nuthatch
Brown Creeper
Long-billed Marsh Wren
Mockingbird
Robin
Evening Grosbeak
House Finch*
American Goldfinch
Lesser Goldfinch
Lawrence's Goldfinch
Rufous-sided Towhee (west)
Savannah Sparrow
Lark Sparrow
Oregon Junco
Chipping Sparrow
White-Corwned Sparrow
Golden Crowned Sparrow
Fox Sparrow
Lincoln's Sparrow
Song Sparrow
Lapland Longspur

*Birds that nest locally are marked with an asterisk.

EXCERPT FROM SCE VISITOR - USE STUDY

In 1981, the projected number of annual visitors at the Pilot Plant Information Center would be approximately 49 thousand. This assumes that traffic along Interstates 15 and 40 near the Pilot Plant continues to increase at its 1970-76 average annual rate. The 1981 county population is based on the San Bernardino County Planning Department's population forecast for 1980 and the projected annual growth rate for 1980-85. Corporate sponsored tour attendance has been provided by SCE. The projected number of visitors is distributed as follows:

Local Attendance	7.9 thousand
Transient Attendance	39.9 thousand
Tour Attendance	1.1 thousand
Total	48.9 thousand

Based on the seasonal distribution of attendance at the Calico Ghost Town, the seasonal attendance pattern at the Pilot Plant Information Center would be as follows:

Month	Total (in 000s)	Percent
January	2.5	5.1
February	3.5	7.1
March	4.0	8.1
April	4.7	9.6
May	5.6	11.5
June	3.9	7.9
July	4.7	9.6
August	5.1	10.4
September	2.9	6.0
October	5.6	11.5
November	3.8	7.7
December	2.6	5.3
Total	48.9	100.0

It is difficult to determine how the projected annual attendance of 49 thousand would vary over time. During the 1966 to 1972 period at the San Onofre Nuclear Generating Station when the visitor center was located in permanent facilities, annual attendance totals exhibited no discernible growth pattern. The novelty of the Pilot Plant should serve to boost information center attendance during the initial years of plant operation. On the other hand, energy policies curbing gasoline consumption would likely reduce the long term transient highway population.

XVI. PREPARATION

San Bernardino County is lead agency for the preparation of this combination EIA/EIR. Charles H. Bell, Associate Environmental Specialist with the Environmental Analysis Division of the County Environmental Improvement Agency prepared this report for the County.

Southern California Edison Co., in response to the County's request for project data and technical input, prepared the document entitled "Applicant's Response to the County's Preliminary Data Request" — on behalf of the utility consortium and government sponsors. It was the primary source of material for EIA/EIR preparation. G. DeAnn Lynch, Associate Environmental Specialist with SCE, coordinated the preparation of the response. Contributors to the SCE report include:

<u>Southern California Edison</u>

T. James DuBois, Senior Engineer

L. J. Brunton, Associate Engineer

David R. Poole, Associate Urban Regional Planner

Patrick Hamilton, Engineering Geologist

Lee E. Brothers, Senior Engineer

Joe LaRue, Engineer - Water Quality

Carmen P. Winarski, Generation Project Engineer

Steve A. Wiegman, Environmental Planning Engineer

(Supervised preparation of SCE's report)

Williams-Kuebelbeck & Associates, Socio/Economic data

(under contract)

San Bernardino County Museums Association (under contract)

Gerald A. Smith, Director

Ruth Dee Simpson, Archaeologist

Robert E. Reynolds, Geologist-Paleontologist

Eugene Cardiff, Ornithologist

Oscar Clark, Biologist-Botanist

Sandia Laboratories

Bill Moore - Mechanical Engineer (solar concepts)

U.S. Department of Energy (Federal)

Joe Juetten, Coordinator (solar-related data)

California Energy Commission

Scott Matthews, Coordinator (Commission staff)

XVII
ADDENDUM

DATE: June 1, 1978

TO: Interested Parties

FROM: San Bernardino County
Environmental Improvement Agency
1111 East Mill Street, Bldg.1
San Bernardino, CA 92415

RE: ADDENDUM - Final Environmental Impact Report
10 Megawatt Solar Power Pilot Plant
Daggett, California

I. Introduction

The information and documents in this addendum, when combined with the project's draft Environmental Impact Report (EIR) dated December 16, 1977, constitute the Final EIR pursuant to the County's guidelines implementing the California Environmental Quality Act (CEQA). San Bernardino County, as lead agency for the project's environmental review, will not reprint the draft EIA/EIR in a final form; therefore, this addendum has been sent to all parties on our mailing list. However, the Department of Energy may decide to print copies of the Final EIA/EIR for use as future reference material.

II. San Bernardino County Findings on Project and EIR

A. On December 13, 1977, the County Environmental Review Board (ERB) determined that the draft EIA/EIR was an adequate document (with amendments) and that the project would not have a significant adverse effect on the environment . (Addendum #1)

During the above hearing, the ERB requested that the following changes be made in the Final EIA/EIR:

VII-2 (Top paragraph)
Change to read:

"The County planning process will provide an important tool for use by local residents to insure a long term beneficial land use in this area."

XI-30 (2)
Change to read:

(2) Joint Utilities Management Plan (JUMP) Element

JUMP was adopted as an energy element of the San Bernardino County General Plan on May 17, 1976. One purpose of the Joint Utilities Management Plan (JUMP) is to better define

San Bernardino County's policy on the future location of all major energy facilities. The study identifies, on a countywide scale, critical constraints to be considered in facility siting. Another is to encourage the development of alternative sources of power which use renewable resources. The proposed pilot plant is located near the site of an existing power plant, which is currently being expanded, and is designed to investigate the feasibility of STE, an alternative energy source. As such, it is consistent with JUMP policies on siting and alternative fuel source development.

In reviewing a project such as the proposed pilot plant, it should be assessed in relation to its consistency with the General Plan and its elements, including JUMP and the Land Use Element. The pilot plant is not in a manufacturing land use category in the Land Use Element of the General Plan. The pilot plant is, however, consistent with the goals, policies, and programs of JUMP, and is located at a site identified in the siting analysis maps for fossil fuel plants as "moderate potential for adverse impact." The entire SCE Coolwater property is identified on the JUMP Proposed Facilities Map as the site for the expansion of the Coolwater Fossil Fuel Plant as of January, 1976. JUMP does not identify these sites as approved but only as potential sites. Specifically, it is consistent with the Goal No. 3, "Encourage the development of alternative energy sources which have a minimum adverse impact on the environment." And siting Policy No. 1, "The County will consider the location of energy facilities in areas of minimal environmental and community impact." It is also consistent with identified programs, including a directive to solicit participation in experimental development proposals involving solar energy and to support federal, state, and public utility programs which employ the development of ultimate energy systems that are both mixed and diverse.

In cases where there are inconsistencies between General Plan Elements, the Element most recently enacted takes precedent. Although the map of the Land Use Element designates an agricultural zone; the goals, policies, and programs contained in JUMP provide the necessary consistency with the General Plan to allow the proposed zone change to M-2-T

ADDENDUM #1

[illegible] IMPROVEMENT AGENCY

[illegible] ANALYSIS DIVISION
[illegible] Street, Bldg. 1 · San Bernardino, CA 92415 · (714) 383-2395

December 16, 1977

TO AGENCIES AND INTERESTED INDIVUDUALS:

RE: ENVIRONMENTAL REVIEW BOARD DETERMINATION FOR 10 MEGAWATT SOLAR POWER PILOT PLANT EIR/EIA

On Tuesday, December 13, 1977, the San Bernardino County Environmental Review Board (ERB) determined that the Draft Environmental Impact Report (EIR)/Environmental Impact Assessment (EIA) for the above-referenced project was an adequate environmental document relative to County guidelines implementing the California Environmental Quality Act. The ERB further determined that implementation of the zone change and location and development plan will not have a significant adverse effect on the environment.

If you wish to appeal the ERB decision, you may file an appeal in writing with the Clerk of the Board of Supervisors, 175 West Fifth Street, Second Floor, San Bernardino, California, within fourteen (14) days of the ERB determination. The taking of an appeal stays proceedings in the matter appealed until the determination on said appeal has been made.

The completed Draft EIR/EIA is now ready to be considered at a public hearing to be scheduled before the San Bernardino County Planning Commission and Board of Supervisors. The Draft EIR portion of the document will be certified by both the Planning Commission and the Board of Supervisors.

Should you have any questions regarding these procedures, you may contact me by telephoning (714) 383-2395, or by writing to the Environmental Improvement Agency, ENVIRONMENTAL ANALYSIS DIVISION, 1111 East Mill Street, San Bernardino, California 92415.

Lewis J. Walker

Lewis J. Walker
Environmental Review Officer

LJW:jkb

B. San Bernardino County Planning Commission Decision

On May 4, 1978 the County Planning Commission:

1. Recommended that the Board of Supervisors approve the M-2-T zone classification and adopt the "non-significant finding" and instruct the clerk to file a Notice of Determination for the proposal.

2. Approved the Location and Development Plan and recommended that the Board of Supervisors certify the EIR as adequate.

3. Approved some of the mitigation measures listed in the EIR as conditions of the project approval. (Addendum #2)

ADDENDUM #2

Item 5.

Applicant:	Southern California Edison Co.	P. C. Hearing
Address:		Date: May 4, 1978
		Index: D377-345N
		Panel:

Proposal: 1) Zone change from DL to M-2.
2) Location and Development Plan to establish a Solar Electric Generating Plant with a 325' high solar tower.

Location: 2-34 miles east of Daggett/Yermo Road, north of Santa Fe Street, 1/2 mile east of the town of Daggett, Daggett area.

Staff makes presentation which includes analysis, finding, Environmental finding and a recommendation to approve the M-2-T district classification.

Mr. Ferguson states he does not have anything to add to staff's report.

The Chairman calls for opposing testimony, none is given, he closes the hearing.

The Environmental Impact Report is presented addressing the impact of the use on the site. Staff states the impact will be minimal.

Commissioner McDonald moves to recommend that the Board of Supervisors APPROVE the M-2-T zone classification and ADOPT the Negative Declaration and instruct the clerk to file a Notice of Determination for the proposal; finding that the proposed zone change is consistent with the policies of the Joint Utilities Management Plan which is known as the Energy Element of the County General Plan; the site is suitable for the uses permitted in the M-2-T zone because of the relatively flat topography, adequate access from Santa Fe Road, and compatible surrounding uses; subject to the following "T" standards:

1. The uses of the district shall be limited to energy production, transmission and research related to solar energy production.

2. Any non-solar related activities shall be subject to a Location and Development Plan review and approval.

Commissioner Bristow seconds; the motion CARRIES unopposed.

Staff makes the presentation for the Location and Development Plan which includes analysis, findings, Environmental Impact Report and a recommendation to approve with conditions.

The Environmental Impact Report is presented addressing impacts and mitigating measures.

The Chairman calls upon the applicant for input.

Mr. Ferguson introduces the staff from Southern California Edison Company.

Staff in presenting the EIR states there may be some developers who may wish to capitalize on the novelty of this proposal, so he warns the Commissioners to be aware of this when applications come through for approval in the area. He states the proposal is only to be in the area for five years.

Commissioner Harrison asks the applicant how will the site be restored after the five years.

Mr. Schweinberg, Department of Energy, states there is an agreement with the utility Company and his company that either one or the other buy the other out or tear the facility down.

The Planning Director asks Mr. Schweinberg about realignment of the heliostats if they should get out of alignment.

Mr. Schweinberg states there is a facility in New Mexico where this use has been studies and the heliostats will be controlled by computers, so the possiblity of them getting out of alignment is almost nil.

The Planning Director asks about the chance of the heliostats interferring with air traffic.

Mr. Schweinberg states he had flown around the plant in New Mexico and found that you would only pick up the glow from one of the heliostats at a time and then it would only be in comparison to an unfrosted "40" watt bulb.

The Chairman calls for additional testimony.

John Shone, representing the Road Department, states his department is requiring road improvements but it has not been reflected in the conditions of approval, so he would them incorporated.

Mr. Ferguson states he would agree to a meeting to discuss the requirement, but condition number six will resolve the requirement.

The Planning Director states it should be pointed out that the Transportation Department's requirement will be resolved at the Board of Supervisors hearing. He states he would suggest that during the two week appeal period all of the conditions be resolved.

Mr. Ferguson states he would like to keep condition number six worded as it stands at this time.

The Commissioners discuss the requirements.

The Chairman closes the hearing to further discussion.

Commissioner McDonald moves to APPROVE the Location and Development Plan and recommend that the Board of Supervisors CERTIFY the Environmental Impact Report as adequate; finding that the site is adequate in area to accommodate the proposed use based upon the size and shape of the lot in relation to the intensity of the use; access to the site is adequate from Santa Fe Road; the proposed use will not have an adverse effect on abutting properties because of the existing electrical generating facility and low density agricultural lands surrounding the site; the proposed use is consistent with the policies of the Joint Utilities Management Plan element of the the General Plan; the lawful conditions stated in the approval are deemed necessary to protect the public health, safety and general welfare; subject to the following conditions:

1. The facility shall be constructed in accordance to Seismic Standards set forth by Department of Energy, County Department of Building and Safety and any other regulatory agencies.

2. Dust control measures shall be in accordance with the San Bernardino County Desert Air Pollution Control District.

3. Should Heliostat washing fluids contain chemical substances harmful to soil and/or vegetation mitigation measures shall be reviewed and approved by the Lahontan Regional Water Quality Control Board.
4. Measures shall be initiated subject to Planning Director review and approval, to prevent any possible oil spills from the heat storage unit to penetrate the ground surface.

5. Prior to grading and trenching, Southern California Edison shall contact County Museum Association to determine the best methods to salvage any possible subsurface artifacts and fossils. Said extraction methods shall be utilized unless waived by the County Planning Director.

6. The applicant shall comply with the requirements of the County Board of Supervisors regarding any necessary road improvements.

7. The parking area and driveways shall be dustproofed. The number of parking spaces and driveways shall comply with the County Parking Standards.

8. A chain link fence, not to exceed eight feet in height shall enclose the site.

9. Visitor control methods shall be provided subject to Planning Director review and approval.

10. The applicant shall take every precaution to prevent misdirected solar reflections due to misaligned heliostats.

11. This approval includes a helistop subject to Board of Supervisors final resolution. Final precise location shall be subject to Planning Director review and approval.

12. The applicant shall ascertain and comply with the requirements of all Federal, State and County agencies and/or departments as are applicable, including but not limited to Environmental Health Services, Lahontan Regional Water Quality Control Board and County Fire Warden.

13. Any modifications of the site approval to accommodate general operations, testing and compliance with conditions shall be subject to Planning Director review and approval.

14. This approval shall not be effective until the Zone Change is approved and the Environmental Impact Report is adopted by the Board of Supervisors.

Commissioner Bristow seconds; the motion CARRIES unopposed.

The meeting is recessed at 12:45 P.M.; reconvenes at 2:10 P.M.

(County Counsel is noted absent.)

III. County Responses to Public and Agency Comments on Draft EIR

A. Letter (12/27/77) from Los Angeles Department of Water and Power (DWP) (Addendum #3)

Response:

DWP's comments on our first rough draft EIR were incorporated into the draft EIR issued for public review.

B. Letter (1/6/78) from the Marine Corps Logistics Support Base (Addendum #4)

Response:

We have received no additional comments from the Marine Corps. No response is required.

ADDENDUM #3

Department of Water and Power the City of Los Angeles

December 27, 1977

Environmental Improvement Agency
Environmental Analysis Division
1111 East Mill Street, Building 1
San Bernardino, California 92415

Attention Mr. Lewis J. Walker
Environmental Review Officer

Gentlemen:

10-MW Solar Power Plant

Thank you for your letter dated December 2, 1977, submitting for our review the combined Draft Environmental Impact Assessment/Environmental Impact Report for the 10-MW Solar Pilot Plant proposed to be constructed near Daggett, California.

We understand that the San Bernardino Environmental Review Board has approved the adequacy of this report at their December 13, 1977, meeting.

We have transmitted our comments on your first rough draft to Southern California Edison Company with our letter dated October 17, 1977. We have no further comments.

Very truly yours,

ROBERT E. BRADLEY
Engineer of
Mechanical Design

SK:js

cc: 1 Attached

111 North Hope Street, Los Angeles, California ☐ *Mailing address:* Box 111, Los Angeles 90051
Telephone: (213) 481-4211 *Cable address:* DEWAPOLA

ADDENDUM #4

UNITED STATES MARINE CORPS
MARINE CORPS LOGISTICS SUPPORT BASE, PACIFIC
BARSTOW, CALIFORNIA 92311

IN REPLY REFER TO:
B520:DTS:lrb
11370
6 JAN 1978

Mr. L. J. Walker, Environmental Review Officer
Environmental Analysis Division
Environmental Improvement Agency
1111 East Mill Street, Building #1
San Bernardino, California 92415

Dear Mr. Walker:

Thank you for including the Marine Corps Logistics Support Base, Pacific, Barstow, on the list of agencies reviewing the Environmental Impact Assessment for the new Solar Power Pilot Plant at Daggett.

The subject report has been reviewed by the Base Public Works Office and was found to contain no controversial issues requiring immediate comment from the Marine Base. However, as the Marine Corps Logistics Support Base, Pacific receives much of its environmental guidance from the Western Division, Naval Facilities Engineering Command Environmental Protection Branch in San Diego, we have forwarded the Draft report to that agency for possible comments to you prior to 15 January 1978.

Sincerely,

R. D. DEPOALF
Lieutenant Colonel, U. S. Marine Corps
Director, Facilities and Services Division
By direction of the Commanding General

RECEIVED
JAN 12 1978
EIA/ENVIRONMENTAL
ANALYSIS
DIVISION

MCLSBF 5216/ REV. 4-76

State of California
GOVERNOR'S OFFICE
OFFICE OF PLANNING AND RESEARCH
1400 TENTH STREET
SACRAMENTO 95814
(916) 445-0613

EDMUND G. BROWN JR

ADDENDUM #5

January 24, 1978

Lewis J. Walker
San Bernardino Co. Envir. Improvement Agency
1111 East Mill Street
San Bernardino, CA 92415

SUBJECT: SCH# 77121280 - 10 MEGAWATT SOLAR POWER PILOT PLANT

Dear Mr. Walker:

This is to certify that State review of your environmental document is complete.

The results of the State review are attached. You should respond to the comments as required by the California Environemntal Quality Act. You should address your responses to the commenting agency with a copy to the Clearinghouse.

Sincerely,

Deni Greene

Deni Greene
Director
State Clearinghouse

DG/ddt
Attachment
cc: Ken Fellows, DWR
Mary Schell, Library
Thomas E. Bailey, SWRCB
James A. Walker, Energy Commission

RECEIVED JAN 1978

C. <u>State Clearinghouse Memo/Memo from Lahontan Regional Water Quality Control Board (Addendum #6 & 7)</u>
(The following responses correspond to the numbered comments.)

<u>Response</u>:

1. The section on heliostat washing specifically dealt with the problem of not knowing the particular chemical (if any) to be used. The section does contain a general assessment of the impacts of using chemicals in the washwater. The primary mitigation measure involves the use of distilled water without incorporation of chemicals in order that wash runoff could double as irrigation for vegetation in the heliostat field. Any use of such chemicals will require approval by Lahontan and possibly Department of Energy and, therefore, is not a subject requiring further analysis in the EIR.

2. Section F-(1) contains an assessment of the project's environmental health effects related to failures of the receiver, boilers, turbins, and the thermal storage system. Use of other hazardous substances will be covered by the Occupational Safety and Health Act which can more effectively provide for mitigation than this EIR per se.

State of California

Memorandum

ADDENDUM #6

THE RESOURCES AGENCY

To : 1. Mr. L. Frank Goodson
Projects Coordinator
The Resources Agency
Resources Building, 13th Floor

2. San Bernardino County - Environmental Improvement
1111 E. Mill Street
San Bernardino, CA 92415

Date: JAN 10 1978

In Reply Refer
To: 420: mkh

From : **STATE WATER RESOURCES CONTROL BOARD**
DIVISION OF PLANNING AND RESEARCH

Subject: REVIEW OF NOTICE OF INTENT: SCH 77121280
10 Megawatt Solar Power Pilot Plant

The attached comments from the California Regional Water Quality Control Board constitute the comments of the State Water Resources Control Board.

T E Bailey

Thomas E. Bailey
Assistant Division Chief

Attachment

REGIONAL WATER QUALITY CONTROL BOARD

INTERNAL MEMO **ADDENDUM #7**

TO: Peter A. Rogers, Chief
Division of Planning & Research

FROM: ROY C. HAMPSON, EXECUTIVE OFFICER
Lahontan Region

DATE: December 20, 1977

SIGNATURE: by D. Ducli

SUBJECT: 10 MEGAWATT SOLAR POWER PILOT PLANT - SCH #77121280

Introduction

We have reviewed the Environmental Impact Assessment (EIA)/Environmental Impact Report (EIR) for the 10 Megawatt Solar Power Pilot Plant, State Clearinghouse (SCH) #77121280 and have the following comments:

Specific Comments

The discussion of heliostat washing procedures does not describe the chemicals that may be used nor does it address the environmental consequences that would result should such chemicals enter the environment due to improper handling or other problems.

The EIA/EIR does not include a list of hazardous substances that will be present during construction or operation of the plant nor does it include safety measures concerning storage or use of such substances.

If you have any questions concerning the above comments please contact William Winchester or David Evans in our Victorville office at (714) 245-6585.

RCH:dtfa

D. State Clearinghouse Memo/Memo (1/12/78) from the Energy Resources Conservation and Development Commission (Addendum #8)

Responses:

1. This philosophical question seems to answer itself and will be a major consideration during the Pilot Plant's testing period.

2. The "220 AFY/10MW" figure used in the EIR was Edison's estimate. The EIA/EIR states that water consumption in a solar plant will be greater per unit of electricity produced than in a conventional plant; however, consider the report corrected relative to these comments. Although no net increase in groundwater pumping will occur on SCE-owned property because pumping for agriculture will be reduced by an amount equivalent to the increase required for plant cooling, there will be a net increase in total water consumption. (Some irrigation water percolates to groundwater whereas power plant cooling water is totally evaporated to ambient air.)

3. The proprietory nature of the mirror cleaning solvent(s) was not totally acceptable to the EIA/EIR author either. That is why the preferred mitigation measure involved the use of distilled water only so that soils and vegetation in the heliostat field would not be harmed. DOE and the Lahontan Water Quality Control Board will have some jurisdiction over the type of solvent used and the County will remain involved with this issue. No further analysis in the EIA/EIR is required.

4. Footnote: DOE - Solar Program Assessment (See Bibliography and X-64(b).

5. Agree.

6. Agree.

7. Agree.

8. Windblown dust is considered in the section on air quality. Pilot plant monitoring should include wind/dust/radiation loss relationships.

9. The number of days with temperatures below 32°F could approach 30-40 during a cold winter; however, frost formation would primarily occur during humid periods or after a ground soaking rain. Vapor from the Coolwater towers could possibly augment frost formation on the mirrors; however, the effect will

be minimal when heliostats are in a stowed position. Early morning sun will quickly melt any frost.

10. The importance of temperature fluctuations should be assessed as part of project monitoring.

11. Correct.

12. Agree.

13. Correct.

14. Agree.

15. Reference to snow should be retained since it is a periodic occurrence on the site and could be applicable to other sites chosen for future STE development.

16. Agree.

17. Agree.

18. Agree.

19. Agree.

20. <u>Add</u> statement with reference instead of <u>replace</u>.

21. Agree.

22. Agree.

23. See top of X-80.

24. Agree.

25. The statement is correct and should be considered part of the text.

26. The statement is correct and should be considered part of the text.

27. Agree.

28. Intensity of use of the site by foraging or burrowing tortoises is not quantified but will vary from year to year. (See X-101 (2a) Biological inventorying is still in progress.

29. First sentence should be included as part of the text.

30. The County will attempt to implement the first part of this recommendation. The second part has been incorporated into conditions of approval.

STATE OF CALIFORNIA—THE RESOURCES AGENCY

EDMUND G. BROWN JR., Governor

ENERGY RESOURCES CONSERVATION
AND DEVELOPMENT COMMISSION
1111 HOWE AVENUE
SACRAMENTO, CALIFORNIA 95825
(916) 322-3452

January 12, 1978

Mr. Chuck Bell
San Bernardino County
Environmental Improvement Agency
1111 East Mill Street, Bldg. 1
San Bernardino, CA 92415

Dear Chuck:

Here are the Energy Commission's comments on the Draft EIA/EIR for the 10 Megawatt Solar Power Pilot Plant. As you know, the Commission is responsible for information dissemination, possible funding of environmental related research projects and development of expertise for evaluating future projects. The specific comments on the Draft EIR address themselves to making the document adequate for those purposes.

I was quite pleased with the report and enjoyed participating in its preparation and review. Overall, the EIR is excellent in terms of both the level of coverage and quality of analysis.

Please call me at (916) 322-3452 if you have any further questions.

Sincerely,

SCOTT W. MATTHEWS
Energy Assessment Division

SWM:nwb

Enclosure

cc: Mr. J. L. Rasband
SCE
Rosemead, CA

State of California

The Resources Agency of California

ADDENDUM #8 (Continued)

Memorandum

To : Lewis J. Walker
Environmental Review Officer
San Bernardino County

Frank Goodson
Project Coordinator
The Resources Agency

Date : January 12, 1978

From : **Energy Resources Conservation and Development Commission** - James A. Walker JW
1111 Howe Avenue
Sacramento, 95825

Subject: COMMENTS ON THE 10 MEGAWATT SOLAR POWER PILOT PLANT EIA/EIR

Introduction

The project is the construction of a 10 Megawatt, Solar Thermal Electric (STE) Pilot Plant in the Mojave Desert of California. Its purpose is to research, over a five year period, the technologic, economic and environmental feasibility of future STE utility application. The Pilot Plant will consist of a field of 2,300 collector mirrors (heliostats) that will focus solar radiation on a boiler at the top of a 325 foot tower for the purpose of producing steam to drive a conventional turbine generator. The plant will require approximately 100 acres of a 130 acre site owned by Southern California Ediston (SCE). It will be located one mile east of SCE's existing Coolwater Generating Station, 10 miles east of Barstow (120 air miles northeast of Los Angeles).

Project participants are the U.S. Department of Energy (DOE), SCE, the Los Angeles Department of Water and Power (LADWP), and the California Energy Resources Conservation and Development Commission (the Commission). The combined Environmental Impact Assessment/Environmental Impact Report was prepared by San Bernardino County with assistance from the project participants as requested for the purpose of fulfilling DOE's and the County's environmental review responsibilities.

The Commission is not a responsible agency in this project. The Commission's total contribution of $800,000 over the life of the project will be used for services rather than a capital commitment. The Commission will provide: information dissemination/technology transfer services; funding of some small environmentally related research activities to be identified during the course of the project; and development of expertise for evaluating future sites.

The EIR, besides being adequate from a CEQA standpoint, represents a good starting point for further discussion of the potential impacts of large scale solar thermal development.

Lewis J. Walker
Frank Goodson
January 12, 1978
Page 2

Specific Questions and Comments

Page	Comment
II-10	What are the economies of scale at 100 Mw that are not present at 10 Mw? It would seem that the principal investment is in the heliostats, and that these would increase in number arithmetically with increased output. Labor costs appear to be relatively minor.
X-37	The water requirements comparison is inaccurate. SCE's Combined Cycle (CC) Notice of Intent (NOI) shows a 12,000 acre feet per year (AFY) requirement for 1,290 megawatts at about a 75% capacity factor (CF) or about 9 AFY/MF. The Commission staff's AB 1852 study shows that a 475 Mw CC uses 3,700 AFY at a 70% CF or about 8 AFY/Mw.

The estimate in the EIR is 220 AFY/10 Mw; projected CF for the facility is 55%. If you adjusted water usage to a 75% CF the plant would use about 300 AFY or about 30 AFY/Mw.

The Commission's California Model for Computing Residuals and Water Consumption for Electric Power Plants indicates cooling water use of 467 AFY for a 10 Mw solar plant at 75% CF. Including the 70 AFY of non-cooling water usage the total water use by the solar plant would be 537 AFY at a 75% CF or over 50 AFY/Mw. Therefore:

a) Water requirement reported in EIR is low (even at 55% CF) - apparently closer to half what it might actually be.

b) Compared with a combined cycle plant the solar plant would use roughly five times as much water (for equivalent generation) rather than less than twice as much (as the EIR reports).

c) A more logical water use comparison (since combined cycles are such low water users) would be between solar and nuclear plants; water use for solar appears to be only 2.5 - 3 times that for a nuclear plant.

d) Part of the problem may be related to thermal efficiencies used; the EIR (pg. X-73) states that "STE plants can be expected to operate at efficiencies of about 24%"; SCE's updated supply plan reports a heat rate for their planned solar projects of 24,000 btu/kwh (about a 14% efficiency) - this figure is used in the Commission's water consumption model.

Lewis J. Walker
Frank Goodson
January 12, 1978
Page 3

Specific Questions and Comments (continued)

Page	Comment
X-44	The statement that "as long as the solvent's contents remain proprietary, it is difficult to assess its net impacts and the best re-use and disposal methods" does not seem an acceptable resolution of the issue for EIR purposes.
X-47	Footnotes for references need to be provided. For example: the quote on page X-74 - "A preliminary study of the impacts of cooling towers associated with nuclear power plants suggests that waste heat rejection from plants with capacities as high as 1000 Mwe is not likely to have a significant large-scale effect on the local climate." - needs a footnote.
X-50 Para. 1	"The results...conditions." The statement is true only if the assumption is made that conditions at the two locations remain comparable in other seasons. Verification of this is possible only through a year-round measurement program.
X-50 Para. 2	"The basic...features." Suggest inserting after features: "(e.g., the Pacific high, westerlies, etc.) and migrating pressure systems."
X-50 Para. 2	Last line: 74% should be 68%. The percentage increases to 87% if only winds greater than 10 mph are considered.
X-53 Para. 2	It would be helpful to include the actual differences between the wind speeds since windier locations tend to have less incoming radiation due to dust, etc.
X-55 Para. 3	The frequency of days with temperatures of 32^{o}F or below should be included (if available). This could have an effect on frost formation on mirrors.
X-56	Extreme maximum and minimum temperatures for each month should be included in the table if readily available. (They are certainly more crucial in affecting heliostats, etc., than average temperatures.)
X-58 Para. 2	December 1968 should read December 1967.
X-59 Para. 1	Last line: suggest replacing "especially" with "and" since the present wording insinuates that frontal activity occurs in summer.
X-59 Para. 2	Last line: should read "monthly and seasonal." Seventh line from bottom: "soundings".

Lewis J. Walker
Frank Goodson
January 12, 1978
Page 4

Specific Questions and Comments (continued)

Page	Comment
X-63 Para. 3	Suggest adding: "If proper control of exposed areas is not exercised, the eddies created from increasing surface roughness in the heliostat field could result in increased dust levels."
X-64 Para. 2	Suggest the reference to snow be dropped due to its negligible effect.
X-65 Para. 2 Line 7	Suggest adding "on an annual average" after diffuse.
X-67 Para. 3	Suggest adding "However, at low sun angles total incoming radiation is quite low."
X-68 Para. 3 Line 1	Suggest adding "directly" after reflect.
X-70 Para. 1 Last Line	Suggest adding "typical desert" before "land outside of the plant."
X-70	Last two sentences (i.e., "Shading of. . . ."). Suggest replacing with: "There could be a slight warming under the heliostats on calm, clear winter nights although the total effect appears minimal (ref. Waco, D.E., "Frost Pockets in the Santa Monica Mountains of Southern California," Weather, Vol. 23, No. 11, Nov. 1968.)
X-76 Para. 1 Last Line	Suggest changing to "ambient relative humidity of at the most 0.2% in the immediate area."
X-77 Para. 4	Suggest changing to "A negligible increase in evaporation, etc." since some increase would occur if the temperature of the added water was higher than the existing water.
X-78 Para. 1	Suggest adding a sentence or two on possible effects due to sharp-edged cloud shadows causing rapid changes in incoming radiation. This may also suggest information on frequency of cumulus-type clouds.
X-78 Para. 3	Suggest replacing "$20^{o}F$ and $70^{o}F$" with "can range up to $50^{o}F$" since the range (or change) in temperature appears to be more important than absolute values.

Lewis J. Walker
Frank Goodson
January 12, 1978
Page 5

Specific Questions and Comments (continued)

Page	Comment
X-83 Para. 1	If local sources in Barstow contribute to the ambient air quality of the surrounding region, then the maximum concentration of photochemical pollutants (e.g., O_3) could very well be downwind (in the Daggett area). Also, Barstow exceeded the California NO_2 standard on July 19, 1976 and exceeded the O_3 standard on 22 hours during the July-September 1976 period. The NO_2 standard was exceeded only four times during July in the entire South Coast Air Basin.
X-86 Para. 3	Particle size is important but total suspended particle (concentration) may be as important in the Barstow-Daggett area. M.S. Reid of Jet Propulsion Laboratory has found that incoming solar radiation on cloud-less days may vary ± 15% from the mean at the Goldstone site due to both aerosols from the L.A. Basin and particulate matter from local (or desert) dust storms. The fine dust particles can be suspended to several thousand feet in the atmosphere. The smog aerosols are correlated with wind direction (west wind brings high concentrations). Dust particles may occur with any directional flow.
X-90 Para. 2 3rd Line	Suggest you leave out "relatively constant" since "depending on climatic conditions" suggests it is not constant.
X-101	The report should indicate if the desert tortoise is known to use the property or what the probability is of their being present?
XI-23	Although utility facilities and properties are taxed at the 25% rate the actual assessed valuation reallocated to the county may be less than that. It is not clear from the discussion of tax revenues on Pages XI-23 through 25 that this is the case.
XI-46-55	It is strongly recommended that San Bernardino County contact the State Historic Preservation Office and the California Native American Heritage Commission for further analysis of the cultural resources impacts. Further, it is recommended that the proposed mitigation for cultural resources be strengthened to require early consultations by the construction work force with the paleontologist, historian, and archeologist prior to construction. Early consultation with the construction work force will maximize the protection and possible discovery of cultural resources.

JAMES A. WALKER
Deputy Executive Director
(322-4774)

SWM:nwb

E. State Clearinghouse Letter/Memo (2/23/78) from the Air Resources Board (Addendum #9)

Responses:

A general response is made to following even though it is not required by the State Clearinghouse. (See cover letter to Addendum #9).

1. The only air pollution rules and regulations possibly applicable to the Pilot Plant would be those pertaining to cooling tower particulates (salts) and fugitive dust from stockpiled earth or other materials. The plant will not contain major stationary sources of pollutants.

2. SCE estimates that the Pilot Plant cooling tower will emit approximately 54 lbs. of salt drift/average production day. The tower will be placed downwind of the heliostat field. The particulates could affect downwind vegetation to some degree and could incrementally add to the potential for corrosion in the heliostat field. Relative to the salt drift from the Coolwater units approximately 3/4 mile upwind, the Pilot Plant's emissions will be minimal, primarily affecting Edison-owned property. However, it should be noted that salt drift fall-out rates have not yet been fully quantified.

3. Existing air quality is fully described in Appendix D of the Draft EIA/EIR. The Pilot Plant's net effect on air quality in the site area is minor. The major impact may be that from radiation diffusion from existing air pollution adversely affecting plant efficiency. The more the plant efficiency is reduced, the use of resources for plant construction and generation becomes less productive.

State of California
GOVERNOR'S OFFICE
OFFICE OF PLANNING AND RESEARCH
1400 TENTH STREET
SACRAMENTO 95814
(916) 445-0613

EDMUND G. BROWN JR.
GOVERNOR

ADDENDUM #9

March 2, 1978

Lewis J. Walker
San Bernardino Co. Envir. Improvement Agency
1111 East Mill Street
San Bernardino, CA 92415

SUBJECT: SCH# 77121 280 - 10 MEGAWATT SOLAR POWER PILOT PLANT

Dear Mr. Walker:

In a letter to you dated January 24, 1978, the State Clearinghouse verified your compliance with the review procedures contained in the State Guidelines for Implementation of the California Environmental Quality Act. The attached comment was sent to the Clearinghouse at a later date. You are not required to respond to it.

Sincerely,

Deni Greene

Deni Greene
Director
State Clearinghouse

DG/ddt
Attachment

State of California

Memorandum

ADDENDUM #9 (Con't.)

To : L. Frank Goodson
Resources Agency

San Bernardino County
Environmental Improvement Agency
1111 E. Mill Street
San Bernardino, CA 92415
Attn: Lewis J. Walker

Date : February 23, 1978

Subject: DEIA/DEIR for 10 MW Solar Thermal Electric Pilot Plant, San Bernardino Cou[nty]
SCH # 77121280

From : **Air Resources Board**
Harmon Wong-Woo, Chief
Stationary Source Control Division

Introduction

Southern California Edison (SCE), the Los Angeles Department of Water and Power (LADWP), the California Energy Resources Conservation and Development Commission (CERCDC), and the Federal Department of Energy (DOE) are cosponsors of a proposed 10 MW Solar Thermal Electric (STE) pilot power plant near Daggett, San Bernardino County (Southeast Desert Air Basin), about 12 miles southeast of Barstow. The pilot plant, construction of which will start soon, is expected to be in operation by late 1980, and is expected to operate at overall sunlight-to-electricity conversion efficiency of about 21%, with a capacity factor of approximately 55%. Its purpose is to research, over a five year period, the technological, economic, and environmental feasibility of future STE utility application. The pilot plant will consist of a field of 2,300 sun-tracking mirrors (heliostats) that will focus solar radiation on a boiler at the top of a 325-foot tower for the purpose of producing steam to drive a conventional turbine generator. In addition, a thermal storage system, consisting of a heat storage tank filled with oil and rock, will be utilized to store thermal energy generated in excess of that required for normal plant operation. The system will supply this stored energy to generate electricity when sunlight is not available. The storage system is estimated to be capable of generating up to seven megawatts for up to five hours when fully charged. The plant will require approximately 100 acres of a site owned by SCE. The solar portion of the plant is estimated to cost $100 million, and the total non-solar costs are $19.6 million.

The pilot plant will require approximately 220 acre-feet per year of water for plant cooling, steam supply make-up, heliostat washing, domestic uses, etc. This water will be supplied by one to three wells recently drilled on and adjacent to the site. The water used for cooling and the boiler exhaust condensate will be evaporated directly to the atmosphere through cooling towers. The remaining blowdown effluent will be too high in total dissolved solids (TDS) for percolation to ground water, and will be conveyed to the nearby Coolwater power plant evaporation ponds where it will evaporate to the atmosphere.

L. Frank Goodson

ADDENDUM #9 (Con't.)

San Bernardino County
Environmental Improvement Agency

We support the development of clean alternatives to the use of high polluting fossil fuels for power generation. We have reviewed the DEIA/DEIR for this project, and offer our comments and recommendations concerning the document's air quality analysis.

Comments and Recommendations

1. The EIA/EIR should list all applicable air pollution rules and regulations. The document must state how the proposed power plant could comply with each requirement.

   Under Rules 213, 213.1, and 213.2 of the San Bernardino County Air Pollution Control District, the applicants must obtain permits for construction and operation of the facility. These requirements should be listed on page II-7 of the EIA/EIR in the "additional permits required" section.

2. The document does not provide any estimates of particulate matter emissions from the pilot plant's cooling towers. These data must be provided in the EIR. The document should list these emission estimates in the Summary of Environmental Impacts section (page IV-8), and should estimate their subsequent impact on air quality in the area. The document should provide more detailed information on available mitigating measures for particulate matter emission from the cooling towers. This should include data on pretreatment of the supply water for reduction of suspended solids. On page X-94, the document addresses dry cooling as a possible mitigating measure to reduce evaporative emissions that could affect incoming solar radiation and reduce the plant's efficiency. The document does not consider this or other alternatives, e.g., once-through cooling or wet-dry cooling, in terms of mitigating the cooling tower emission impact on air quality. The document should also compare the economic and design parameters associated with each alternative mitigating measure.

3. The document does not adequately describe existing air quality in the area. The State ambient air quality standards for particulate matter (24-hour and annual geometric mean), oxidant, and NO_2 have been exceeded at the Barstow and Victorville monitoring stations in 1976 (ARB data). Since there is a documented existing air quality problem in the area upwind of the proposed STE pilot plant site (Barstow), the EIR must include this information in detail, and must assess the pilot plant's effect on the area's air quality. The document does not do this; instead, all existing and future air quality conditions are discussed mainly in terms of their effects on the efficiency of the solar power plant. For example: On page X-95 the document describes the possible synergistic effects of the water vapor from the cooling towers and evaporation ponds acting in combination with local and ambient concentrations of SO_2 and dust. This discussion considers the potential formation of sulfuric acid mist and sulfates in view of the possible diffusion of radiation and corrosion of the heliostats. SCE's analysis of this potential sulfate aerosol formation states that the chances for its occurrence are minimal due to the differences in emission heights of the emission sources (principally the pilot plant

cooling towers and the Coolwater Generating Station), but could theoretically occur during unstable meteorological conditions. We suggest that this section and all others dealing with air quality in the EIR should also discuss the pilot plant's impact on regional air quality and air quality standards.

Conclusions

The State and Federal ambient air quality standards for particulate matter, oxidant, and NO_2 are periodically violated in the vicinity of the proposed STE pilot power plant. The DEIA/DEIR states that the pilot plant's cooling towers will emit particulate matter into the atmosphere of the area. In view of the particulate matter problem in the region, the EIA/EIR should provide detailed information concerning the pilot plant's particulate matter emissions, mitigating measures to reduce these emissions, and should consider the impact of the project on the area's air quality. We support the search for clean energy alternatives, but we feel that this document has not provided an adequate appraisal of the STE pilot plant's air quality impact.

If you have any questions, please call Mr. Ray Tuvell, of my staff, at (916) 322-6037.

F. Letter (1/16/78) from U.S. Department of Energy (Addendum #10)

Response:

General

1. Some mitigation measures have been adopted by the San Bernardino County Planning Commission as conditions of approval. Others listed in the EIA/EIR are more suitably under the jurisdiction of DOE and should be considered accordingly prior to project construction.

2. Discussions of the existing natural and man-made environments are important in order to determine the extent of potential impacts to and from the Pilot Plant. California and County environmental guidelines require sufficient detail in an EIR in order that the reader may be able to fully understand the relationship between the project and the existing environment so as to determine any effects possibly not assessed in the document.

3. Although DOE interprets NEPA as not requiring an assessment of the effects of the existing environment on a project, it is a requirement of the California Environmental Quality Act (CEQA). Since this is a combined NEPA and CEQA document, this element was included. If certain characteristics of a local environment could adversely affect the viability and productivity of a project, then the resources used and consumed by the project may not constitute their best use; therefore, in turn creating an adverse impact.

Specific

1. See #3 above.

2. Readers of environmental documents are usually interested in a summary of all the parameters of a project being assessed.

3. Agree.

4. The electricity from the STE Pilot Plant will be distributed to SCE's grid and therefore will be partially used for operation of traditional cooling and heating systems. Such efficiency should be quantitatively compared with that of direct, locally applied solar conversion heating and cooling systems in order to determine the net best use of resources required to build and sustain the two systems.

5. CEQA documents require a description of the regional environment in order to set the stage for any discussion of potential land-use conflicts. Land uses in the California desert are not always localized and effects are often far ranging.

6. Agree - consider the text so amended.

7. Agree - consider the text so amended.

8. OK - the project specifications were often altered throughout the period the EIA/EIR was being drafted.

9. Agree.

10. Agree. The County assumes DOE will estimate resource requirements.

11. Agree. Would it be worthwhile for DOE to provide a formula to quantify the extent of land and resource uses for a number of given electricity producing situations?

12. 1½ pages of regional geologic setting may not be too long for a reader who wants to assess any further regional issues not specified in the document.

13. Agree. Consider the text so amended.

14. SCE and DOE are best able to make this determination before the heliostat field layout and revegetation plans (if any) are finalized.

15. Agree. Consider the text so amended.

16. See #2 of "General" above. The purpose of this document was to provide a tool for the determination of environmental impact. What is known now about the project's net effect was not known during the early stages of the document's formation, therefore, it was not possible to include only those issues obviously related to an environmental impact.

17. The section on air mass dispersion characteristics was included in order to provide a tool for determining the effect of Coolwater's existing air pollution plumes on diffusion of solar radiation (as a factor of Pilot Plant efficiency).

18. Agree. Consider the text so amended.

19. Agree. Determination of incidence of valley fever bacteria in topsoils should be determined by the consortium and DOE prior to construction (as discussed at the May 11-12 STE siting workshop in Arizona).

20. Mitigation of heliostat glare is a County permit condition (See Addendum #2). It also was discussed during the May 11-12 workshop in Arizona as a requirement best imposed by DOE and the utility consortium.

ADDENDUM #10

Department of Energy
San Francisco Operations Office
1333 Broadway
Oakland, California 94612

January 16, 1978

Mr. Charles H. Bell
Environmental Improvement Agency
Environmental Analysis Division
1111 East Mill Street
Building 1, 2nd Floor
San Bernadino, CA 92415

Subject: DRAFT EIR/EIA, 10 MWe SOLAR POWER PLANT, BARSTOW, CA.

Dear Mr. Bell:

Enclosed are partial DOE comments on the subject EIR. As noted in the last paragraph of Page 2 of the enclosure, our review is incomplete. However, we are sending you these so that they can be considered as early as possible in your review process. We will forward any additional substantive comments as soon as received, but do not anticipate anything further of a significant nature. Also, if any additional comments are made too late to be considered in your CEQA process, we will address them as part of our NEPA process.

I hope these comments are helpful to you. If we can be of further assistance, please feel free to contact me at any time.

Sincerely,

Joe Juetten

Joseph P. Juetten
Environment and Safety Division

Enclosure:
As stated

ADDENDUM #10 (Continued) January 13, 1978

TO: Joe Jutten
Environment and Safety Division
DOE San Francisco Operations Office

FROM: Gene Frankel, for the
Environmental and Resource Assessments Branch
DOE Division of Solar Technology

SUBJECT: DRAFT EIA/EIR 10 MWe SOLAR POWER PLANT, BARSTOW CA.

We have reviewed the draft EIA/EIR and find it sufficiently detailed to comply with ERDA/DOE guidelines for environmental impact assessments. The EIA/EIR describes and analyzes the proposed facility; the existing environment; potential environmental impacts during construction, operation, and site restoration; compatibility with Federal, State, and local plans; and alternatives to the solar facility. Furthermore, it appears that the EIA could easily be upgraded to an EIS with the addition of a section on "unavoidable adverse environmental effects" and further discussion of the environmental implications of alternatives.

GENERAL
1

Most of our comments are of a minor nature and are discussed at length below. Our primary concern is the manner in which mitigation strategies are discussed. Many strategies are proposed to reduce or obviate adverse effects, yet there is no indication whether these strategies will in fact be adopted. Admittedly some of these strategies require operational data from the facility before they can be implemented, however, this point is never made clear. Additionally, there is no indication of whether or not the System Safety Design Criteria will be utilized.

We feel that a discussion clarifying the status of mitigation strategies should be included (possibly in Section IV). This discussion should point out that while some strategies have been decided upon, others will await further data from R&D efforts. Also, it should be made clear that one function of this facility is to test and develop control strategies.

A second major area of concern is that certain aspects of the existing environment are discussed in great detail, but then turn out to be impacted in only a minor way by the proposed power plant. The most significant example of this is section X.D(p.X49 ff.), "Climate/Meteorology" in which 13 pages are devoted to describing the "current status" but then it is concluded on p. X-63 that plant construction and operation will have only a minor effect. A similar criticism can be raised about pp. XI-27 to XI-37 in which the land surrounding the plant site, which will not be affected to any significant degree, is described in great detail. This questionable detail makes the report longer than it need to be and may discourage the general public, for whom the EIA/EIR is supposed to be written, from reading it.

A third major concern is the considerable space devoted in the report to "effects of the environment on the plant." By no interpretation of NEPA that we know of can such factors be considered relevant to an EIA or EIS which is supposed to be about the effects of a proposed action <u>on the environment</u>. Therefore the discussion on pp. X-85 to X-88 on the effects of particulates and air pollution on plant efficiency, for example, is unnecessary. Certainly #3 in the list of major adverse impacts (effects of dust and air pollutants on plant efficiency) on p. I-3 should be eliminated for this reason, as should #2 (seismic activity) unless seismic activity is likely to present a worker safety problem at the plant site.

Specific criticisms of the report are listed on the following pages. It should be noted that we have not yet received comments back from the Assistant Secretary for the Environment or the Office of the General Counsel, so we cannot state unequivocally at this time that the report is acceptable as an EIA.

ADDENDUM #10 (Continued)

January 13, 1978

TO: Joe Jutten

FROM: Gene Frankel

SUBJECT: SPECIFIC COMMENTS ON DRAFT EIA/EIR FOR BARSTOW.

Specific

1. pp. I-2 and I-3. Impact #3 is not an impact on the environment and therefore should be deleted. Impact #2 is also not an impact on the environment and should also be deleted unless seismic activity could produce structural failures which might cause injuries to plant personnel.

2. pp. II-3 and 4. What is the relevance of the information on these pages to the EIA/EIR?

3. p. II-9. "Division of Solar Energy" should read "Division of Solar Technology".

4. p. II-12. Sentence beginning, "The viability..." is wrong since solar thermal electric systems have different end use functions than direct solar heating and cooling systems. This sentence should be deleted.

5. p. II-21. The sentences from "In addition,..." to "...Training Center (DOD)." discuss land which is not affected by the proposed plant. This section should be omitted.

6. p. II-26. Sentence from "The Pilot Plant..." to "...activity, etc)." should read: "The Pilot Plant is expected to have an average capacity factor of approximately 55% (45% equivalent downtime out of an average 24 hour day due to lack of solar radiation, research and development activity, etc). Underlined words are additions or substitutions requested by DST.

7. p. II-31. Substitute for the first paragraph the following: "In the conceptual design stage, Pilot Plant sizing has been based on an insolation level of 0.950 kilowatts per square meter (kw/m^2), which is a typical insolation value used for desert areas. The component and subsystem parameters identified in the description were drawn from the conceptual design with final sizing of the plant to be based upon insolation data collected by SCE near the actual Pilot Plant site. (See Section X-E-c Solar Radiation.) The final design is not expected to differ significantly from the conceptual design described herein."

8. p. II-32. Number of heliostats is 2400-2600, not 2300.

9. p. II-39. Next to last paragraph. "dedicated" should be replaced by "designed".

10. p. VI-1. Last paragraph. Estimates of resource requirements should be made, especially for plant materials. See the ERDA "Program Assessment: Environmental Factors, Solar Thermal Electric," pp. 19-22 for details.

11.p. IX-1. Last paragraph. It is not certain that solar thermal power plants will require "significantly more land area" than strip mining for coal for the same amount of electric generation. This should be quantified.

12. p. X-1. Regional Geologic Setting. This section seems too long for the given impact.

13. p. X-11. Mitigation. Should include a statement to the effect that the pilot plant is so small that mining effects will be minimal.

14. p. X-25. First paragraph. "A study should be made..." We need a statement as to whether this will actually be done as a result of the recommendation in the EIA/EIR.

15. p. X-33. Next to last paragraph, last sentence , last clause. Should read "...so while the 220 acre-feet of water will be an ~~x~~increase over SCE's present pumping as of 1977, it will not constitute a net increase in SCE's historic groundwater withdrawal." Current phrasing conveys the wrong emphasis.

16. p. X-49. "Current Status" section should be condensed for reasons explained above in general comments.(i.e., no significant impact).

17. p. X-58. "Air-Mass Dispersion Characteristics" seem irrelevant to STPS since there are no emissions. Suggest they be ommitted.

18. X-95. Synergistic Effects. High temperatures at the receiver could lead to production of NO_x in atmosphere and photochemical reactions with pollutants in the air. This possibility should be mentioned.

19. p. XI-60. "Valley Fever. Current Status." Incidence of valley fever in top soils should be determined as there has been an increased incidence of this disease in California.

20. p. XI-68. "Mitigation(of heliostat glare impacts)", first paragraph. Will the measures suggested here actually be carried out? When will this be decided? ~~XXXXXXXXXXX~~

G. Memo (4-11-78) from San Bernardino County Aviation Division, Public Works Agency (Addendum #11)

Response:

The FAA permit would be the best vehicle to implement the mitigation measures suggested in the memo (See XI-68 & 69). DOE could also require such testing as a condition prior to start up.

H. Memo (4-7-78) from San Bernardino County Transportation Department, Public Works Agency (Addendum #12)

Response:

SCE, the Transporation Department and the Board of Supervisors are in the process of resolving these issues (See XI-43).

INTER-OFFICE MEMO

DATE April 11, 1978 ADDENDUM #11

FROM Dewey E. Richardson PHONE 2237
Chief, Aviation Division

TO Charles Bell
Associate Environmental Analyst

SUBJECT Environmental Impact Assessment
10 Megawatt Solar Power Pilot Plant

We have reviewed the Draft Environmental Impact Report concerning the 10 Megawatt Solar Power Pilot Plan near Barstow, California from the standpoint of effects on the County Airports and airspace near the site.

As the report implies, the 325-foot solar tower, plus two 250-foot high emission stacks could be detrimental to private aircraft operating near the site.

A permit for the tower and emission stacks should be received from the Federal Aviation Administration (FAA). The tower and stacks should be lighted in accordance with FAA specifications. Information concerning the location and heights of the objects should be entered into the flight publications, such as navigation charts, instrument approach charts, etc.

Of greater significance is the potentially serious problem associated with reflective glare from misaligned or even properly-aligned heliostats. The fact that the solar site is located only three miles from the Barstow-Daggett Airport presents potential hazardous glare conditions for aircraft landing and departing the Airport as well as aircraft overflights.

Unfortunately, there is very little experience to draw from concerning the glare effects on pilots and aircraft flying near a solar site. The report indicates that in the technology's infancy, accidents of a serious nature can and will occur. This admission should not be treated lightly.

A series of tests should be run prior to start-up to determine the impact on aircraft landing and departing Barstow-Daggett Airport. Additionally, overflight tests should be run to determine the glare and thermal effects on general aviation aircraft.

The FAA should consider establishing a "restricted area" around the site. The height of the towers and emission stacks, coupled with the potential glare problems, identifies the Solar Power project site as a definite hazard to air navigation and should be avoided.

Dewey E. Richardson

DER:kk

12-1367-000 Rev.

INTER-OFFICE MEMO

ADDENDUM # 12

DATE April 7, 1978

FROM JOHN R. SHONE
Director of Transportation

PHONE 1203

TO MARVIN W. KRIEGER, SENIOR PLANNER
Planning Department - Desert Division

SUBJECT SOUTHERN CALIFORNIA EDISON SOLAR POWER PLANT - DAGGETT
SITE DEVELOPMENT PLAN INDEX NO. D377-345N

We have reviewed the subject proposal from the standpoint of effects on the County Road System and have the following comments.

The proposed site of this $100 million development can only be reached via a very substandard County Road known as Santa Fe Street from either "A" Street in Daggett or Hidden Springs Road. The 5 miles of County Maintained Road between these limits serves practically no traffic other than that generated by the Edison facilities. We feel that the construction activity necessary to build this plant and the considerable visitor traffic that this unique facility will generate makes it imperative that Santa Fe Street be improved by Edison in conjunction with the construction of this plant. The specific improvements needed are:

1. REALIGNMENT OF UP RR X-ING

The very poor vertical and horizontal alignment at this location and lack of automatic gates at the railroad crossing makes this a hazardous location. The realignment will also require the construction of a major culvert to handle drainage in the flood control channel adjacent to the east side of the railroad because the existing dip would have to be removed. While the road in its present condition would probably be adequate to handle the very small volume of local traffic generated by the few residents, the greatly increased traffic that is being generated by the plants now under construction and which will be generated by the new facility makes improvement of this location necessary. These improvements have already been requested of the County by employees at the Edison plant. A rough cost estimate of this work is:

Acquisition of Right of Way (4.5 Ac)	$10,000
Construct Reinforced Concrete Box Culvert	28,000
Realign Roadway	37,000
Install Gate at RR X-Ing	35,000*
Total	$110,000

*Assumes RR will contribute 50% of total of $70,000

12-1367-000 Rev. 1/77

Marvin W. Krieger, Senior Planner
Planning Department--Desert Division
April 7, 1978
Page 2

2. <u>MINOR WIDENING AND RESURFACING OF SANTA FE STREET</u>

Santa Fe Street between "A" Street and Hidden Springs Road should be paved with 0.2' of asphalt concrete to provide a standard 26' County roadway with an improved surface and greater structural strength to carry the traffic generated. The resurfacing cost estimate for the 5 miles of resurfacing is $200,000.

There are no County Road Funds available for this work. Since the need for these improvements is being generated solely by the activities of the Couthern California Edison Company, we request that they be made condition of approval of this project.

JOHN R. SHONE
DIRECTOR OF TRANSPORTATION

JAS:az
cc: Supervisor Mayfield
John Bernard
Joe Colley
EIA-Attn: Chuck Bell

A G E N D A

ENVIRONMENTAL REVIEW BOARD

Tuesday, December 13, 1977

MEMBERS	REPRESENTING
Gabriel Epstein, Chairman	Public Member, Redlands
Richard L. Roberts, Vice Chairman	Environmental Health Services
Thomas Irwin	Public Member, Apple Valley
Dr. Gerald Smith	Museums
Gene Ehe	PWA/County Surveyor's Office
Kenneth C. Topping	Planning Department
Attn: Dianne Guzman	

COUNTY COUNSEL

Clark Alsop

STAFF TO THE BOARD

Environmental Improvement Agency
ENVIRONMENTAL ANALYSIS DIVISION

PLACE OF HEARING

Environmental Improvement Agency Hearing Chambers
1111 East Mill Street, Bldg. 1
San Bernardino, CA 92415
(714) 383-2395

TIME 9:30 a.m.

1. Reclamation Plan - Rocklite Chino Mine
   EAD Log No. 77M-0003
   Chino
   Lightweight Processing Company ______________________

2. Reclamation Plan - Victorite Mine
   EAD Log No. 77M-0004A
   Northeast of Victorville
   Interpace Corporation ______________________

(OVER)

3. Reclamation Plan - P. S. Hart Mine
EAD Log No. 77M-0004B
Castle Mountains
Interpace Corporation ______________________

4. Solar Power Plant EIR
EAD Log No. 77E-0375
Daggett
Southern California Edison Co. et al ______________________

***** LUNCH BREAK *****

RESUME 1:30 p.m.

5. Specific Plan & Tentative Tract 9648
Index No. (109-78) (cons. EIR)
EAD Log No. 76E-0611
Cucamonga
Western Properties/Lewis Homes ______________________

Building and Safety

ENVIRONMENTAL IMPROVEMENT AGENCY

County of San Bernardino

ENVIRONMENTAL ANALYSIS DIVISION
1111 East Mill Street, Bldg. 1 · San Bernardino, CA 92415 · (714) 383-2395

Lewis J. Walker
Environmental Review Officer

December 2, 1977

Land Use - [M2] Xlow Agricultural
TI-26
Never been accepted for Energy Technology

TO AGENCIES AND INTERESTED INDIVIDUALS:

RE: ENVIRONMENTAL REVIEW - 10 MEGAWATT SOLAR POWER PILOT PLANT

Enclosed for your review is a copy of the combined Draft Environmental Impact Assessment/Environmental Impact Report on the Solar Pilot Plant proposed to be constructed near Daggett, California. This document was prepared by the San Bernardino County Environmental Improvement Agency in accordance with the Department of Energy's and the County's respective Federal and State environmental review guidelines.

The Department of Energy will utilize the Draft Report as an Environmental Impact Assessment to determine the project's level of significance and whether or not a Federal Environmental Impact Statement will be required.

The San Bernardino County Environmental Review Board will review the "Draft Environmental Impact Report" for the above-referenced project on December 13, 1977, at 9:30 a.m. in the Hearing Chambers of the Environmental Improvement Agency, 1111 East Mill Street, Building 1, First Floor, San Bernardino, California.

The Environmental Review Board has several options to take in respect to the report:

1. It may approve the adequacy of the "Draft Environmental Impact Report" as prepared and post it for a fourteen (14) day public appeal/input period.

2. It may refer the "Draft Environmental Impact Report" back to Staff for further research.

3. It may request or require additional information to be submitted by the participants.

If additional information is requested, the "Draft Environmental Impact Report" could be referred back to the Environmental Review Board for final approval. Upon completion of the posting period following the determination of an adequate report, the Planning Commission may then act upon the requested entitlement.

Please submit any comments on this Draft EIA/EIR before January 15, 1978 (the end of the County and State review periods). Additions and corrections will be incorporated into the final report.

Should you have any questions relating to these procedures, you may contact me by telephoning (714) 383-2395, or by writing to the Environmental Improvement Agency, ENVIRONMENTAL ANALYSIS DIVISION, at the above address.

Lewis J. Walker/mlm

Lewis J. Walker
Environmental Review Officer

LJW:CHB:mlm

Enclosure: agenda

DRAFT

ENVIRONMENTAL IMPACT ASSESSMENT/ ENVIRONMENTAL IMPACT REPORT

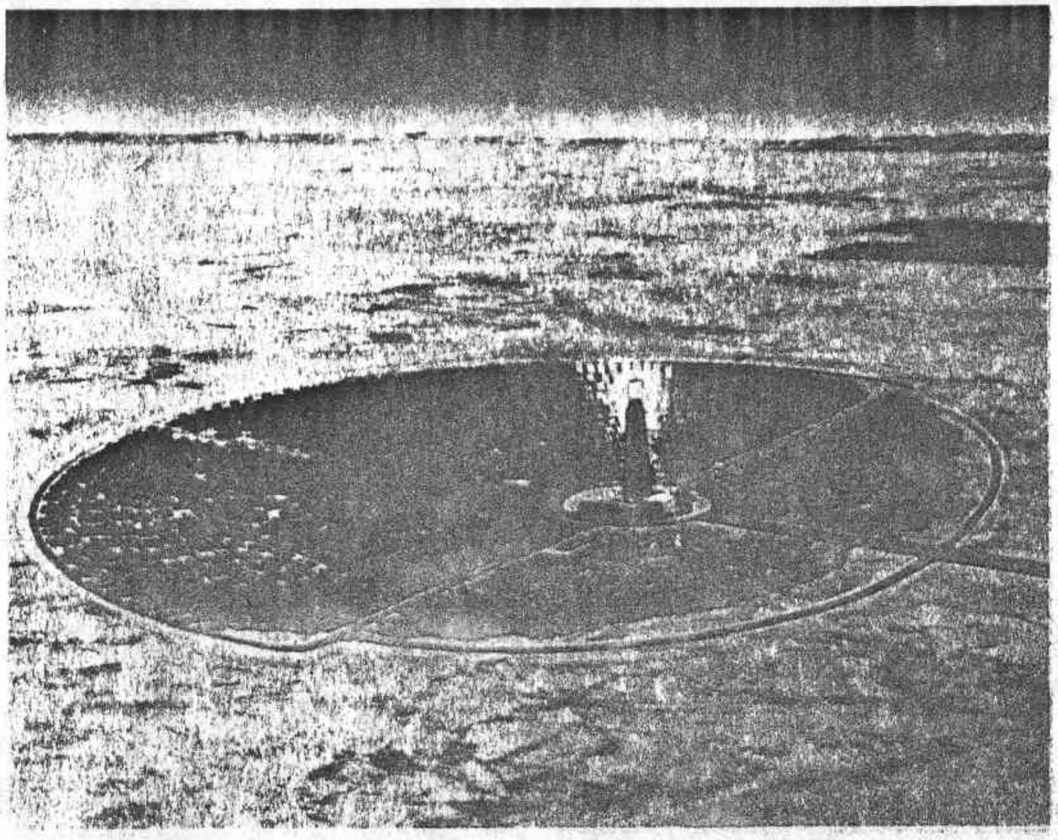
10 MEGAWATT SOLAR POWER PILOT PLANT

December, 1977

Prepared by:
Environmental Improvement Agency of
San Bernardino County, California

ENVIRONMENTAL IMPACT ASSESSMENT/ENVIRONMENTAL IMPACT REPORT

10 MEGAWATT SOLAR POWER PILOT PLANT



December, 1977

Participants:
United States Department of Energy
Southern California Edison Company
Los Angeles Department of Water and Power
California Energy Resources Conservation and Development Commission

Department of Energy
San Francisco Operations Office
1333 Broadway
Oakland, California 94612

Reply to:

DOE Site Office
Post Office Box 366
Daggett, CA 94612

(619) 254-2672

Mr. William D. Matheny
Chief, Control Branch
Document Control & Evaluation Division
DOE Technical Information Center
Post Office Box 62
Oak Ridge, TN 37830

JAN 09 1984

Submission of 10-MWe Pilot Plant ("Solar One") Project Documentation under Co-operative Agreement DE-FC03-77SF10501, for TIC/NTIS Archiving and Announcement

Dear Mr. Matheny:

Enclosed is another shipment of Solar One project documents, including:

	Document No.	Secondary No.	Title	Date
1.	DOE/SF/10501-137	STMPO-737	Solar One Visitor Center Report	July 1983
2.	DOE/SF/10501-138	STMPO-738	Solar One Visitor Center Report	Aug. 1983
3.	DOE/SF/10501-139	STMPO-739	Solar One Visitor Center Report	Sep. 1983
4.	DOE/SF/10501-140	STMPO-740	Solar One Visitor Center Report	Oct. 1983
5.	DOE/SF/10501-141	STMPO-741	Solar One Visitor Center Report	Nov. 1983
6.	DOE/SF/10501-142	STMPO-742	Solar One Visitor Center Report	Dec. 1983
7.	DOE/SF/10501-304	STMPO-604	"Solar One" Leaflet	Nov. 1980
8.	DOE/SF/10501-305	STMPO-605	NONE (Color Brochure)	Jan. 1984
9.	DOE/SF/10501-003	STMPO-063	Final Impact Assessment & Report	June 1978

Nos. 7 and 9 are old documents that never got into the system; the restare current ones. Nos. 7 and 8 are distributed through the Visitors Center operated for us by Southern California Edison. Again, any feedback on this process you wish to provide will be gratefully received.

Sincerely yours,

S. D. Elliott, Jr., Director,
DOE Project Office, Barstow

cc: R. Gaither, SAN/OPC
D. Holz, SAN/ISEA
R. Hughey, SAN/FGS
C. Lopez, SCE R&D

DOE Form RA-426
(10/80)

U.S. DEPARTMENT OF ENERGY

OMB NO. 038-R0190

DOE AND MAJOR CONTRACTOR RECOMMENDATIONS FOR ANNOUNCEMENT AND DISTRIBUTION OF DOCUMENTS

See Instructions on Reverse Side

1. DOE Report No.	2. Contract No.	3. Subject Category No.
DOE/SF/10501-003 (STMPO-063)	DE-FC03-77SF10501	UC-62

4. Title
"FINAL IMPACT ASSESSMENT/ENVIRONMENTAL IMPACT REPORT, 10 MWe Solar Power Pilot Plant"

5. Type of Document ("x" one)
- ☐ a. Scientific and technical report
- ☐ b. Conference paper: Title of conference ________

________ Date of conference ________

Exact location of conference ________ Sponsoring organization ________

- ☒ c. Other (specify planning, educational, impact, market, social, economic, thesis, translations, journal article manuscript, etc.) ENV.

6. Copies Transmitted ("x" one or more)
- ☐ a. Copies being transmitted for standard distribution by DOE–TIC.
- ☐ b. Copies being transmitted for special distribution per attached complete address list.
- ☒ c. Two completely legible, reproducible copies being transmitted to DOE–TIC. (Classified documents, see instructions)
- ☐ d. Twenty-seven copies being transmitted to DOE–TIC for TIC processing and NTIS sales.

7. Recommended Distribution ("x" one)
- ☐ a. Normal handling (after patent clearance): no restraints on distribution except as may be required by the security classification.

Make available only ☐ b. To U.S. Government agencies and their contractors. ☐ c. within DOE and to DOE contractors.
☐ d. within DOE. ☐ e. to those listed in item 13 below.

- ☒ f. Other (Specify) Archive/issue on request; Proj. Ofc. has made initial distribution

8. Recommended Announcement ("x" one)
- ☒ a. Normal procedure may be followed. ☐ b. Recommend the following announcement limitations:

9. Reason for Restrictions Recommended in 7 or 8 above.
☐ a. Preliminary information. ☐ b. Prepared primarily for internal use. ☐ c. Other (Explain)

10. Patent, Copyright and Proprietary Information
Does this information product disclose any new equipment, process or material? ☒ No ☐ Yes If so, identify page nos. ________
Has an invention disclosure been submitted to DOE covering any aspect of this information product? ☒ No ☐ Yes
If so, identify the DOE (or other) disclosure number and to whom the disclosure was submitted.
Are there any patent-related objections to the release of this information product? ☒ No ☐ Yes If so, state these objections.
Does this information product contain copyrighted material? ☒ No ☐ Yes
If so, identify the page number ________ and attach the license or other authority for the government to reproduce.
Does this information product contain proprietary information? ☒ No ☐ Yes If so, identify the page numbers ________.
("x" one ☐ a. DOE patent clearance has been granted by responsible DOE patent group.
☒ b. Document has been sent to responsible DOE patent group for clearance.

11. National Security Information (For classified document only; "x" one)
Document ☐ a. does ☐ b. does not contain national security information

12. Copy Reproduction and Distribution
Total number of copies reproduced 25 Number of copies distributed outside originating organization 20

13. Additional Information or Remarks (Continue on separate sheet, if necessary)

14. Submitted by (Name and Position) (Please print or type)
S. D. Elliott, Jr., Director, DOE Project Office, Barstow

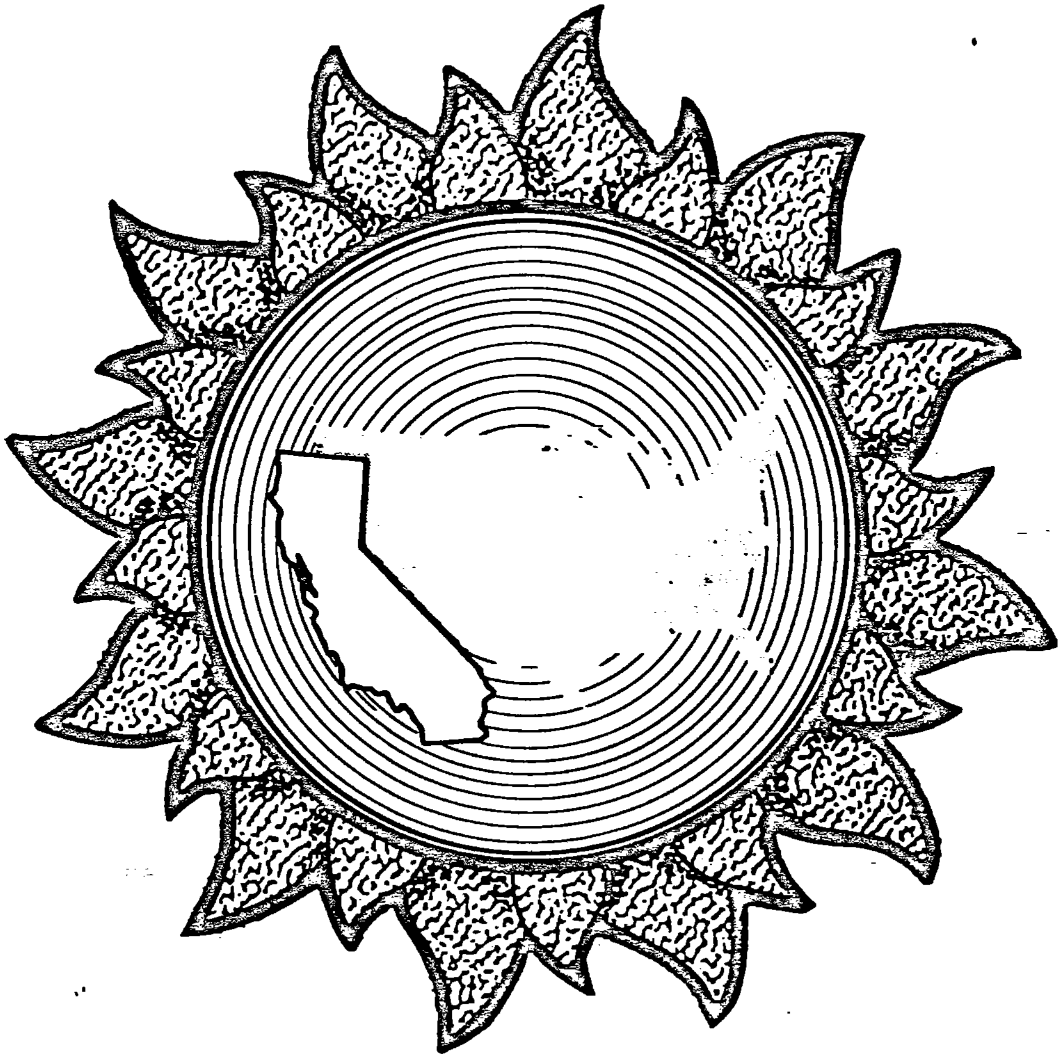
Organization
Post Office Box 366, Daggett, CA 92327 (619) 254-2672

Signature S D Elliott Date JAN 09 1984

DOE/SF/10501-003
STMPO-063

FINAL IMPACT ASSESSMENT/ENVIRONMENTAL IMPACT REPO

10 MEGAWATT SOLAR POWER PILOT PLANT



June, 1978

Prepared by:
Environmental Improvement Agency of
San Bernardino County, California

DOE F 1325.8
(7-79)

U.S. DEPARTMENT OF ENERGY

memorandum

DATE JAN 0 9 1984

REPLY TO ATTN OF Doug Elliott, DOE Project Office, Barstow

SUBJECT Submission of 10-MWe Pilot Plant ("Solar One") Documents under Cooperative Agreement DE-FC03-77SF10501 for Patent Clearance

TO Roger Gaither, OPC

Enclosed are nine documents, with accompanying SAN Form 70's signed by the SCE R&D Site Manager, for clearance by the SAN Office of Patent Counsel:

Primary Doc. No.	Secondary No.	Title
DOE/SF/10501-137	STMPO-737	Solar One Visitor Center, July 1983
DOE/SF/10501-138	STMPO-738	Solar One Visitor Center, Aug. 1983
DOE/SF/10501-139	STMPO-739	Solar One Visitor Center, Sep. 1983
DOE/SF/10501-140	STMPO-740	Solar One Visitor Center, Oct. 1983
DOE/SF/10501-141	STMPO-741	Solar One Visitor Center, Nov. 1983
DOE/SF/10501-142	STMPO-743	Solar One Visitor Center, Dec. 1983
(all of the above on a single Form 70)		
DOE/SF/10501-304	STMPO-604	"Solar One" Leaflet (Nov. 1980)
DOE/SF/10501-305	STMPO-605	NONE (Solar One Brochure, Jan. 1984)
DOE/SF/10501-003	STMPO-063	Final Impact Assessment/Report, June 1978

Two additional copies of each of these reports are being forwarded directly to the DOE Technical Information Center for archiving, microfiching and distribution on request by TIC and NTIS. Please review these reports to insure that no patentable material is included, and advise TIC as appropriate. The feedback copy of the SAN Form 70 should be sent to me at the Project Office; I will forward it to SCE.

When review is completed, please transmit your copies to Bob Hughey, SAN/FGS; M+R copies have already been supplied. (FGS has received a request for the EIA/EIR, and this will avoid our having to make an additional copy of this bulky item.)

Doug Elliott

S. D. Elliott, Jr., Director,
DOE Project Office, Barstow

cc: Bob Hughey, DOE/SAN (FGS)
Don Holz, DOE/SAN (ISEA)
W. D. Matheny, DOE/TIC
C. W. Lopez, SCE R&D

DEPARTMENT OF ENERGY
SAN FRANCISCO OPERATIONS OFFICE

CONTRACTOR REQUEST FOR PATENT CLEARANCE
FOR RELEASE OF UNCLASSIFIED DOCUMENT

Prime Contract No. DE-FC03-77SF10501
Subcontract No. N/A
Report No. DOE/SF/10501-003 (STMPO-063)
Date of Report June, 1978
Name & Phone No. of DOE Technical Representative S. D. Elliott, Jr. (619) 254-2672

TO: Roger S. Gaither, Asst. Chief for Prosecution
Office of Patent Counsel/Livermore Office
P.O. Box 808, L-376
Livermore, California 94550

FROM: DOE Project Office, Barstow
Post Office Box 366
Daggett, CA 92327

1. Document Title:
FINAL IMPACT ASSESSMENT/ENVIRONMENATAL IMPACT REPORT (10-MWe Solar Pilot Plant)

2. Type of Document: KX Technical Report, ☐ Conference Paper, ☐ Journal Article, ☐ Abstract or Summary, ☐ Copy of Oral Presentation, ☐ Other (please specify): ______

3. In order to meet a publication schedule or submission deadline, patent clearance by ______ would be desired.

SENDER IS TO CHECK BOX #4 OR #5 BELOW.

KX 4. I have reviewed (or have had reviewed by technically knowledgeable personnel) this document for possible inventive subject matter (Subject Inventions) and that no inventions or discoveries (Subject Inventions) are deemed to be disclosed in this document except as stated below:

a. Attention should be directed to pages ______ of this document.

b. This document describes matter relating to an invention:

i. Contractor Invention Docket No. ______.
ii. A disclosure of the invention was submitted to DOE on ______ (date)
iii. A disclosure of the invention will be submitted shortly ______ (approximate date)
iv. A waiver of DOE's patent rights to the contractor:
☐ has been granted, ☐ has been applied for; or ☐ will be applied for ______ (date)

☐ 5. This document is being submitted, but no review has been made of this document for possible inventive subject matter.

6. Remarks:

Reviewing/Submitting Official: Name (Print/Type) Charles W. Lopez
Title SCE R&D Site Manager
Signature Charles W. Lopez Date Jun 6, 1983

TO: INITIATOR OF REQUEST

FROM: ASSISTANT CHIEF FOR PROSECUTION
Office of Patent Counsel/Livermore Office

☐ No patent objection to above-identified release.

☐ Please defer release until advised by this office.

Signed ______ Date Mailed ______

DOE OFFICE OF PATENT COUNSEL (OPC)

DEPARTMENT OF ENERGY
SAN FRANCISCO OPERATIONS OFFICE

CONTRACTOR REQUEST FOR PATENT CLEARANCE
FOR RELEASE OF UNCLASSIFIED DOCUMENT

Prime Contract No.	DE-FC03-77SF10501
Subcontract No.	N/A
Report No.	DOE/SF/10501-003 (STMPO-063)
Date of Report	June, 1978
Name & Phone No. of DOE Technical Representative	S. D. Elliott, Jr. (619) 254-2672

TO: Roger S. Gaither, Asst. Chief for Prosecution
Office of Patent Counsel/Livermore Office
P.O. Box 808, L-376
Livermore, California 94550

FROM: DOE Project Office, Barstow
Post Office Box 366
Daggett, CA 92327

1. Document Title:
FINAL IMPACT ASSESSMENT/ENVIRONMENATAL IMPACT REPORT (10-MWe Solar Pilot Plant)

2. Type of Document: XX Technical Report, ☐ Conference Paper, ☐ Journal Article, ☐ Abstract or Summary, ☐ Copy of Oral Presentation, ☐ Other (please specify): ______

3. In order to meet a publication schedule or submission deadline, patent clearance by ______ would be desired.

SENDER IS TO CHECK BOX #4 OR #5 BELOW.

XX 4. I have reviewed (or have had reviewed by technically knowledgeable personnel) this document for possible inventive subject matter (Subject Inventions) and that no inventions or discoveries (Subject Inventions) are deemed to be disclosed in this document except as stated below:

a. Attention should be directed to pages ______ of this document.

b. This document describes matter relating to an invention:

i. Contractor Invention Docket No. ______.
ii. A disclosure of the invention was submitted to DOE on ______ (date)
iii. A disclosure of the invention will be submitted shortly ______ (approximate date)
iv. A waiver of DOE's patent rights to the contractor:
☐ has been granted, ☐ has been applied for; or ☐ will be applied for ______ (date)

☐ 5. This document is being submitted, but no review has been made of this document for possible inventive subject matter.

6. Remarks:

Reviewing/Submitting Official: Name (Print/Type) Charles W. Lopez
Title SCE R&D Site Manager
Signature Charles W. Lopez Date Jan 6, 1983

TO: INITIATOR OF REQUEST

FROM: ASSISTANT CHIEF FOR PROSECUTION
Office of Patent Counsel/Livermore Office

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☐ Please defer release until advised by this office.

Signed Harold M. Dixon Date Mailed 1/13/84

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