STATE OF CALIFORNIA

Energy Resources Conservation
And Development Commission

In the Matter of:

Application for Certification
For the Blythe Solar Power Project
Palo Verde Solar, LLC

Docket No. 09-AFC-6

Energy Commission Staff's Supplemental Staff Assessment Part 2

Please find attached the following outstanding items:

Air Quality – Supplemental Testimony and Declaration of Will Walters incorporating the Mojave Desert Air Quality Management District's Final Determination of Compliance.

Traffic and Transportation, Aviation Assessment – Testimony of Marie McLean, James Jewell, Clifford Ho, Mark Johnson, and Will Walters. Resumes of James Jewell, Clifford Ho and Mark Johnson.

Blythe Airport Risk Assessment, Supplemental Testimony of Dr. Alvin Greenberg.

DATED: July 12, 2010

Respectfully submitted,

/s/ Lisa M. DeCarlo

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AIR QUALITY

Supplemental Testimony of William Walters, P.E.

INTRODUCTION

This second Supplemental Staff Assessment (SSA) for air quality presents changes to the Mojave Desert Air Quality Management District (District) Conditions of Certification (CoCs) based on changes contained in the Districts Final Determination of Compliance (FDOC), but does not impact the staff's findings as presented in the Revised Staff Assessment. The revisions to the District conditions are shown below in underline/strikeout[1].

The District completed the FDOC for the project on July 8, 2010, which has addressed consistency issues with the conditions for the HTF piping system among other issues (MDAQMD 2010c). These revisions do not change the District's or staff's findings regarding compliance with Laws, Ordinances, Regulations and Standards (LORS).

REVISED PROPOSED CONDITIONS OF CERTIFICATION

The District CoCs with proposed revisions or that require renumbering are provided below, the other District conditions remain as provided in the Revised Staff Assessment.

DISTRICT CONDITIONS

District Final Determination of Compliance Conditions (MDAQMD 2010c)

Auxiliary Boiler Conditions

Equipment Description

Four - 35 MMBtu/hr Natural Gas Fired Auxiliary Boilers, Application Number/Permit Number: 0010748/B010913, 0010755/B010915, 0010762/B010916, and 0010769/B010917.

AQ-4 Emissions from this equipment shall not exceed the following hourly emission limits at any firing rate, verified by fuel use and compliance tests:

a. NOx as NO_2:

1. 0.389 lb/hr operating at 100% load (based on 9.0 ppmvd corrected to 3% O_2 and averaged over one hour)

2. 0.097 lb/hr operating at 25% load (based on 9.0 ppmvd corrected to 3% O_2 and averaged over one hour)

[1] The underline text within in Condition AQ-64 is not a revision to the condition; rather it is text that is underlined in the District condition. The only revision to AQ-64 is the condition number.

b. CO:

1. 1.322 lb/hr operating at 100% load (based on 50 ppmvd corrected to 3% O_2 and averaged over one hour)

2. 0.331 operating at 25% load (based on 50 ppmvd corrected to 3% O_2 and averaged over one hour)

c. VOC as CH_4:

1. 0.175 lb/hr operating at 100% load

2. 0.044 lb/hr operating at 25% load

d. SOx as SO_2:

1. 0.019~~0~~ lb/hr operating at 100% load

2. 0.005~~2~~ lb/hr operating at 25% load

e. PM10:

1. 0.035 lb/hr operating at 100% load

2. 0.088 lb/hr operating at 25% load

Verification: As part of the Annual Compliance Report, the project owner shall include information demonstrating compliance with boiler operating emission rates.

AQ-5 This equipment shall be operated only on PUC pipeline quality natural gas and shall be equipped with a non-resettable fuel meter. Fuel used shall not exceed:

a. 57,499,425 cubic feet of natural gas per rolling twelve months; and

b. 441,662 ~~524,995~~ cubic feet of natural gas per calendar day.

Verification: The project owner shall submit to the CPM the boiler fuel use data demonstrating compliance with this condition as part of the Annual Operation Report.

AQ-6 Operation of this equipment shall not exceed 17 total hours per day with no more than:

a. 15 hours per calendar day and 4500 hours per rolling twelve months at 25% load; and

b. 12 hours per calendar day and 600 hours per rolling twelve months at 100% load.

Verification: The project owner shall submit to the CPM the boiler fuel use data demonstrating compliance with this condition as part of the Annual Operation Report.

AQ-7 The project owner shall maintain an operations log for this equipment on-site and current for a minimum of five (5) years, and said log shall be provided to

District personnel on request. The operations log shall include the following information at a minimum:

a. Total operation time (hours/day, hours/month and cumulative hours/rolling twelve months);

b. Fuel use (daily, monthly and cumulative hours/rolling twelve months);

c. Maximum hourly, maximum daily, total quarterly, and total calendar year emissions of NOx, CO, PM10, VOC and SOx (including calculation protocol); and,

d. Any permanent changes made to the equipment that would affect air pollutant emissions, and indicate when changes were made.

Verification: The project owner shall make the site available for inspection of records and equipment by representatives of the District, ARB, and the Energy Commission.

Ullage System Conditions

Equipment Description

Four - HTF ullage expansion tanks, Application Number/Permit Number: 0010750/T010934, 0010757/T010935, 0010764/T010936, and 0010771/T010937.

~~**AQ-14** This equipment shall be operated and maintained in strict accord with the recommendations of its manufacturer or supplier and/or sound engineering principles.~~

~~**Verification:** The project owner shall make the site available for inspection of records by representatives of the District, ARB, and the Energy Commission.~~

AQ-14~~5~~ This system shall ~~only~~ store only HTF, specifically the condensable fraction of the vapors vented from the ullage system.

Verification: The project owner shall make the site available for inspection of HTF piping Inspection and Maintenance Program records (**AQ-17**) and HTF system equipment by representatives of the District, ARB, and the Energy Commission.

AQ-15~~6~~ This system shall be operated at all times with the carbon adsorption system under District permit [C010918, C010919, C010920, C010921~~To be Determined~~].

Verification: The project owner shall make the site available for inspection of records by representatives of the District, ARB, and the Energy Commission.

AQ-16 Vent release shall be monitored in accordance with a District approved Inspection, Monitoring and Maintenance plan.

Verification: The project owner shall make the site available for inspection of records by representatives of the District, ARB, and the Energy Commission.

AQ-17 The project owner shall establish an inspection and maintenance program to determine, repair, and log leaks in HTF piping network and expansion tanks.

Inspection and maintenance program and documentation shall be available to District staff upon request.

a. All pumps, compressors and pressure relief devices (pressure relief valves or rupture disks) shall be electronically, audio, or visually inspected once every operating day.

b. All accessible valves, fittings, pressure relief devices (PRDs), hatches, pumps, compressors, etc. shall be inspected quarterly using a leak detection device such as a Foxboro OVA 108 calibrated for methane.

c. Inspection frequency for accessible components, except pumps, compressors and pressure relief valves, may be changed from quarterly to annual when two percent or less of the components within a component type are found to leak during an inspection for five consecutive quarters.~~VOC leaks greater than 100-ppmv shall be tagged (with date and concentration) and repaired within seven calendar days of detection.~~

d. Inspection frequency for accessible components, except pumps, compressors and pressure relief valves, shall be increased to quarterly when more than two percent of the components within a component type are found to leak during any inspection or report.

e. If any evidence of a potential leak is found the indication of the potential leak shall be eliminated within 7 calendar days of detection.

f~~d~~. VOC leaks greater than 10,000-ppmv shall be ~~tagged and~~ repaired within 24-hours of detection.

~~g. Any detected leak exceeding 100-ppmv and not repaired in 7-days and 10,000-ppmv not repaired within 24-hours shall constitute a violation of this Authority to Construct (ATC)/Permit to Operate (PTO).~~

g. After a repair, the component shall be re-inspected for leaks as soon as practicable, but no later than 30 days after the date on which the component is repaired and placed in service.

~~h. The project owner shall place an adequate number of isolation valves in the Heat Transfer Fluid (HTF) pipe loops so as to be able to isolate a solar panel collector loop in the event of a leak of fluid. These valves shall be actuated automatically, manually, and remotely, or locally as determined during detailed engineering design. The detailed engineering design drawings showing the number, location, and type of isolation valves shall be provided to the District for review and approval prior to the commencement of the solar array construction.~~

h~~e~~. The project owner shall maintain a log of all VOC leaks exceeding 10,000-ppmv, including location, component type, ~~and repair made~~date of leak detection, emission level (ppmv), method of leak detection, date of repair, date and emission level of reinspection after leak is repaired.

i. The project owner shall maintain records of the total number of components inspected, and the total number and percentage of leaking components found, by component types made.

j~~f~~. The project owner shall maintain record of the amount of HTF replaced on a monthly basis for a period of 5 years.

Verification: The inspection and maintenance plan shall be submitted to the CPM for review and approval at least 30 days before taking delivery of the HTF. As part of the Annual Compliance Report, the project owner shall provide the quantity of used HTF fluid removed from the system and the amount of new HTF fluid added to the system each year. The project owner shall make the site available for inspection of HTF piping Inspection and Maintenance Program records and HTF system equipment by representatives of the District, ARB, and the Energy Commission.

AQ-18 The project owner shall submit to the District a compliance test protocol within sixty (60) days of start-up and shall conduct all required compliance/certification tests in accordance with a District-approved test plan. Thirty (30) days prior to the compliance/certification tests the project owner shall provide a written test plan for District review and approval. Written notice of the compliance/certification test shall be provided to the District ten (10) days prior to the tests so that an observer may be present. A written report with the results of such compliance/certification tests shall be submitted to the District within forty-five (45) days after testing.

Verification: The project owner shall provide a compliance test protocol to the District for approval and CPM for review at least no later than sixty (60) days after start-up and submit a test plan to the District for approval and CPM for review at least thirty (30) days prior to the compliance tests. The project owner shall notify the District and the CPM within ten (10) working days before the execution of the compliance tests required in **AQ-19** and **AQ-20**, and the test results shall be submitted to the District and to the CPM within forty-five (45) days after the tests are conducted.

AQ-19 The project owner shall perform the following initial compliance tests on this equipment in accordance with the MDAQMD Compliance Test Procedural Manual. The test report shall be submitted to the District within 180 days of initial start up. The following compliance tests are required:

a. VOC as CH_4 in ppmvd and lb/hr (measured per USEPA Reference Methods 25A and 18 or equivalent).

b. Benzene in ppmvd and lb/hr (measured per CARB method 410 or equivalent).

Verification: The project owner shall submit the test results to the District and to the CPM within 180 days after initial start up.

AQ-20 The project owner shall perform the following annual compliance tests on this equipment in accordance with the MDAQMD Compliance Test Procedural Manual. The test report shall be submitted to the District no later than six weeks prior to the expiration date of this permit. The following compliance tests are required:

a. VOC as CH_4 in ppmvd and lb/hr (measured per USEPA Reference Methods 25A and 18 or equivalent).

b. Benzene in ppmvd and lb/hr (measured per CARB method 410 or equivalent).

Additionally, records of all compliance tests shall be maintained on site for a period of five (5) years and presented to District personnel upon request.

Verification: As part of the Annual Compliance Report, the project owner shall include the test results demonstrating compliance with this condition and the project owner shall make the site available for inspection of records by representatives of the District, ARB, and the Energy Commission.

AQ-21 Emissions from this equipment may not exceed the following emission limits, based on a calendar day summary:

a. VOC as CH_4 – 1.5 lb/day, verified by compliance test.

b. Benzene – 0.75 lb/day, verified by compliance test.

Verification: As part of the Annual Compliance Report, the project owner shall include the test results demonstrating compliance with this condition and the project owner shall make the site available for inspection of records by representatives of the District, ARB, and the Energy Commission.

AQ-22~~18~~ If current non-criteria substances become regulated as toxic or hazardous substances and are used in this equipment, the project owner shall submit to the District a plan demonstrating how compliance will be achieved and maintained with such regulations.

Verification: The project owner shall a copy of the plan prepared to comply with this condition, if and when necessary, to the CPM for review within 30 days of submittal to the District.

Carbon Adsorption System Conditions

Equipment Description

Four - carbon adsorption systems, one serving each HTF ullage system, Application Number/Permit Number: 0010751/C010918, 0010758/C010919, 0010765/C010920, and 0010772/C010921.

AQ-23~~19~~ Operation of this equipment shall be conducted in accordance with all data and specifications submitted with the application under which this permit is issued unless otherwise noted below.

Verification: The project owner shall make the site available for inspection of records by representatives of the District, ARB, and the Energy Commission.

AQ-2420 This carbon adsorption system shall provide 98% control efficiency of VOC emissions vented from the HTF ullage system under District Permit [T010934, T010935, T010936, T010937to be determined].

Verification: The project owner shall provide the District and CPM carbon adsorption manufacturer guarantee data showing compliance with this condition at least 30 days prior to the installation of the carbon adsorption systems.

AQ-2521 The project owner shall prepare and submit a monitoring and change-out plan for the carbon adsorptions system which ensures that the system is operating at optimal control efficiency at all times for District approval prior to start up.

Verification: The project owner shall submit a monitoring and change-out plan for the carbon adsorptions system for District approval and CPM review prior to facility start-up.

AQ-2622 This equipment shall be properly maintained and kept in good operating condition at all times.

Verification: The project owner shall submit maintenance reports for carbon adsorption system to the CPM as part of Annual Compliance Report.

AQ-2723 This equipment must be in use and operating properly at all times the HTF ullage system is venting.

Verification: The project owner shall make the site available for inspection of records by representatives of the District, ARB, and the Energy Commission.

AQ-2824 Total emissions of VOC to the atmosphere shall not exceed 1.5 lbs/day and 300 lbs/year calculated based on the most recent monitoring results.

Verification: As part of the Annual Compliance Report the project owner shall include information on operating emission rates to demonstrate compliance with this condition.

AQ-2925 During operation, the project owner shall monitor VOC measured at an outlet from the carbon beds. Sampling is to be performed on a weekly basis. Samples shall be analyzed pursuant to USEPA Test Method 25 – Gaseous Non-methane Organic Emissions. Initial test shall be submitted to the District within 180 days after startup.

Verification: The project owner shall provide a summary of the carbon bed monitoring data as part of the Annual Compliance Report and shall submit tests to the District as required in this condition.

AQ-3026 FID shall be considered invalid if not calibrated on the day of required use.

Verification: The project owner shall make the site available for inspection of records and equipment by representatives of the District, ARB, and the Energy Commission.

AQ-3127 The project owner shall maintain current and on-site for the duration of the project a log of the weekly test results, which shall be provided to District personnel upon request, with date and time the monitoring was conducted.

Verification: The project owner shall make the site available for inspection of records and equipment by representatives of the District, ARB, and the Energy Commission.

AQ-32~~28~~ Prior to January 31 of each new year, the project owner of this unit shall submit to the District a summary report of all VOC emissions (as hexane).

Verification: The project owner shall provide a summary of the HTF vent system benzene and VOC emissions to the CPM as part of the Annual Compliance Report and to the District by January 31 each year.

Cooling Tower Conditions

Equipment Description

Four Cooling Towers, Application Number: 0010752, 0010759, 0010766 and 0010773.

AQ-33~~29~~ Operation of this equipment shall be conducted in compliance with all data and specifications submitted with the application under which this permit is issued unless otherwise noted below.

Verification: The project owner shall make the site available for inspection of records and equipment by representatives of the District, ARB, and the Energy Commission.

AQ-34~~30~~ This equipment shall be operated and maintained in strict accord with the recommendations of its manufacturer or supplier and/or sound engineering principles.

Verification: The project owner shall make the site available for inspection of records and equipment by representatives of the District, ARB, and the Energy Commission.

AQ-35~~31~~ The drift rate shall not exceed 0.0005 percent with a maximum circulation rate of 6,034 gallons per minute. The maximum hourly PM10 emission rate shall not exceed 0.061 pounds per hour, as calculated per the written District-approved protocol.

Verification: The manufacturer guarantee data for the drift eliminator, showing compliance with this condition, shall be provided to the CPM and the District 30 days prior to cooling tower operation. As part of the Annual Compliance Report the project owner shall include information on operating emission rates to demonstrate compliance with this condition.

AQ-36~~32~~ The project owner ~~operator~~ shall perform weekly tests of the blow-down water total dissolved solids (TDS). The TDS shall not exceed 2,000 ppmv based on an arithmetic average of all TDS measurements conducted each month. The operator shall maintain a log which contains the date and result of each blow-down water test in TDS ppm, and the resulting mass emission rate. This log shall be maintained on site for a minimum of five (5) years and shall be provided to District personnel on request.

Verification: The cooling tower recirculation water TDS content test results shall be provided to representatives of the District, ARB, and the Energy Commission upon request.

AQ-3733 The project owner operator shall conduct all required cooling tower water tests in accordance with a District-approved test and emissions calculation protocol. Thirty (30) days prior to the first such test the project owner operator shall provide a written test and emissions calculation protocol for District review and approval.

Verification: The project owner shall provide an emissions calculation and water sample testing protocol to the District for approval and CPM for review at least 30 days prior to the first cooling tower water test.

AQ-3834 A maintenance procedure shall be established that states how often and what procedures will be used to ensure the integrity of the drift eliminators. This procedure is to be kept onsite and available to District personnel on request.

Verification: The project owner shall make available at request the written drift eliminator maintenance procedures for inspection by representatives of the District, ARB, and the Energy Commission.

Emergency Generator Conditions

Equipment Description

Four – 2,922 hp emergency IC engine each driving a generator, Application Number/Permit Number: 0010753/E010926, 0010760/E010927, 0010767/E010928, and 0010774/E010929.

AQ-3935 This equipment shall be installed, operated and maintained in strict accord with those recommendations of the manufacturer/supplier and/or sound engineering principles which produce the minimum emissions of contaminants. Unless otherwise noted, this equipment shall also be operated in accordance with all data and specifications submitted with the application for this permit.

Verification: The project owner shall make the site available for inspection of equipment and records by representatives of the District, ARB, and the Energy Commission

AQ-4036 This unit shall only be fired on ultra-low sulfur diesel fuel, whose sulfur concentration is less than or equal to 0.0015% (15 ppm) on a weight per weight basis per CARB Diesel or equivalent requirements.

Verification: The project owner shall make the site available for inspection of equipment and fuel purchase records by representatives of the District, ARB, and the Energy Commission.

AQ-4137 A non-resettable hour meter with a minimum display capability of 9,999 hours shall be installed and maintained on this unit to indicate elapsed engine operating time. (Title 17 CCR §93115.10(e)(1)).

Verification: At least 30 days prior to the installation of the engine, the project owner shall provide the District and the CPM the specification of the hour timer.

AQ-42~~38~~ This unit shall be limited to use for emergency power, defined as in response to a fire or when commercially available power has been interrupted. In addition, this unit shall be operated no more than one hour in any twenty four hour period and 20 hours per year for testing and maintenance, excluding compliance source testing. Time required for source testing will not be counted toward the one hour daily or 20 hour per year limit.

Verification: The project owner shall make the site available for inspection of records and equipment by representatives of the District, ARB, and the Energy Commission.

AQ-43~~39~~ This facility shall not perform testing of more than one internal combustion engine at any one time and no more than two internal combustion engines in any twenty-four hour period.

Verification: The project owner shall make the site available for inspection of records and equipment by representatives of the District, ARB, and the Energy Commission.

AQ-44~~40~~ The project owner shall maintain a operations log for this unit current and on-site, either at the engine location or at a on-site location, for a minimum of five (5) years, and for another year where it can be made available to the District staff within 5 working days from the District's request, and this log shall be provided to District, State and Federal personnel upon request. The log shall include, at a minimum, the information specified below:

a. Date of each use and duration of each use (in hours);

b. Reason for use (testing & maintenance, emergency, required emission testing);

c. Calendar year operation in terms of fuel consumption (in gallons) and total hours; and,

d. Fuel sulfur concentration (the project owner may use the supplier's certification of sulfur content if it is maintained as part of this log).

Verification: The project owner shall submit records required by this condition that demonstrating compliance with the sulfur content and engine use limitations of conditions **AQ-40~~36~~, AQ-42~~38~~,** and **AQ-43~~39~~** in the Annual Compliance Report, including a photograph showing the annual reading of engine hours. The project owner shall make the site available for inspection of records by representatives of the District, ARB, and the Energy Commission.

AQ-45~~41~~ This unit is subject to the requirements of the Airborne Toxic Control Measure (ATCM) for Stationary Compression Ignition Engines (Title 17 CCR 93115). In the event of conflict between these conditions and the ATCM, the more stringent shall govern.

Verification: Not necessary.

AQ-46~~42~~ This unit is subject to the requirements of the Federal National Source Performance Standards (NSPS) for Stationary Compression Ignition Internal Combustion Engines (40 CFR Part 60 Subpart IIII).

Verification: The project owner shall submit the engine specifications at least 30 days prior to purchasing the engines for review and approval demonstrating that the engines meet NSPS and ARB ATCM emission limit requirements at the time of engine purchase.

Emergency Fire Suppression Water Pump Engine Conditions

Equipment Description

Four – 300 hp emergency IC engine each driving a fire suppression water pump, Application Number/Permit Number: 0010754/E010933, 0010761/E010930, 0010768/E010931, and 0010775/E010932.

AQ-47~~43~~ This equipment shall be installed, operated and maintained in strict accord with those recommendations of the manufacturer/supplier and/or sound engineering principles which produce the minimum emissions of contaminants. Unless otherwise noted, this equipment shall also be operated in accordance with all data and specifications submitted with the application for this permit.

Verification: The project owner shall make the site available for inspection of equipment and records by representatives of the District, ARB, and the Energy Commission

AQ-48~~44~~ This unit shall only be fired on ultra-low sulfur diesel fuel, whose sulfur concentration is less than or equal to 0.0015% (15 ppm) on a weight per weight basis per CARB Diesel or equivalent requirements.

Verification: The project owner shall make the site available for inspection of equipment and fuel purchase records by representatives of the District, ARB, and the Energy Commission.

AQ-49~~45~~ A non-resettable hour meter with a minimum display capability of 9,999 hours shall be installed and maintained on this unit to indicate elapsed engine operating time. (Title 17 CCR §93115.10(e)(1)).

Verification: At least 30 days prior to the installation of the engine, the project owner shall provide the District and the CPM the specification of the hour timer.

AQ-50~~46~~ This unit shall be limited to use for emergency power, defined as in response to a fire or due to low fire water pressure. In addition, this unit shall be operated no more than one hour in any twenty four hour period and 50 hours per year for testing and maintenance, excluding compliance source testing. Time required for source testing will not be counted toward the one hour daily limit or 50 ~~20~~ hour per year limit. The one hour daily and ~~or~~ 50 hour limit can be exceeded when the emergency fire pump assembly is driven directly by a stationary diesel fueled CI ~~IC~~ engine operated per and in accord with the National Fire Protection Association (NFPA) 25 - "Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems," 1998 edition. This requirement includes usage during emergencies. {Title 17 CCR 93115.3(n)}

Verification: The project owner shall make the site available for inspection of records and equipment by representatives of the District, ARB, and the Energy Commission.

AQ-51~~47~~ This facility shall not perform testing of more than one internal combustion engine at any one time and no more than two internal combustion engines in any twenty four hour period.

Verification: The project owner shall make the site available for inspection of records and equipment by representatives of the District, ARB, and the Energy Commission.

AQ-52~~48~~ The project owner shall maintain an operations log for this unit current and on-site, either at the engine location or at a on-site location, for a minimum of five (5) years, and for another year where it can be made available to the District staff within 5 working days from the District's request, and this log shall be provided to District, State and Federal personnel upon request. The log shall include, at a minimum, the information specified below:

a. Date of each use and duration of each use (in hours);

b. Reason for use (testing & maintenance, emergency, required emission testing);

c. Calendar year operation in terms of fuel consumption (in gallons) and total hours; and,

d. Fuel sulfur concentration (the project owner may use the supplier's certification of sulfur content if it is maintained as part of this log).

Verification: The project owner shall submit records required by this condition that demonstrating compliance with the sulfur content and engine use limitations of conditions **AQ-48~~44~~, AQ-50~~46~~,** and **AQ-51~~47~~** in the Annual Compliance Report, including a photograph showing the annual reading of engine hours. The project owner shall make the site available for inspection of records by representatives of the District, ARB, and the Energy Commission.

AQ-53~~49~~ This unit is subject to the requirements of the Airborne Toxic Control Measure (ATCM) for Stationary Compression Ignition Engines (Title 17 CCR 93115). In the event of conflict between these conditions and the ATCM, the more stringent shall govern.

Verification: Not necessary.

AQ-54~~50~~ This unit is subject to the requirements of the Federal National Source Performance Standards (NSPS) for Stationary Compression Ignition Internal Combustion Engines (40 CFR Part 60 Subpart IIII).

Verification: The project owner shall submit the engine specifications at least 30 days prior to purchasing the engines for review and approval demonstrating that the engines meet NSPS and ARB ATCM emission limit requirements at the time of engine purchase.

Non-Retail Gasoline Dispensing Facility Conditions

Equipment Description

One – above ground gasoline storage tank and fuel receiving and dispensing equipment, Application Number/Permit Number: ~~TBD~~0011391/N010938.

AQ-55~~51~~ The toll-free telephone number that must be posted is 1-800-635-4617.

Verification: The project owner shall make the site available for inspection of equipment and records by representatives of the District, ARB, and the Energy Commission

AQ-56~~52~~ The project owner shall maintain a log of all inspections, repairs, and maintenance on equipment subject to Rule 461. Such logs or records shall be maintained at the facility for at least two (2) years and available to the District upon request. Records of Maintenance, Tests, Inspections, and Test Failures shall be maintained and available to District personnel upon request; record form shall be similar to the Maintenance Record form indicated in EO VR-401-A, Figure 2N.

Verification: The project owner shall make the site available for inspection of equipment and fuel purchase records by representatives of the District, ARB, and the Energy Commission.

AQ-57~~53~~ Any modifications or changes to the piping or control fitting of the vapor recovery system require prior approval from the District.

Verification: The project owner shall make the site available for inspection of maintenance records by representatives of the District, ARB, and the Energy Commission.

AQ-58~~54~~ Pursuant to EO VR-401-A, vapor vent pipes are to be equipped with Husky 5885 pressure relief valves or as otherwise allowed by EO.

Verification: The project owner shall make the site available for inspection of equipment and records by representatives of the District, ARB, and the Energy Commission

AQ-59~~55~~ The project owner shall perform the following tests within 60 days of construction completion and annually thereafter in accord with the following test procedures:

a. Determination of Static Pressure Performance of Vapor Recovery Systems at Gasoline Dispensing Facilities with Aboveground Storage Tanks shall be conducted per EO VR-401-A Exhibit 4~~;~~, and

b. Phase I Adapters, Emergency Vents, Spill Container Drain Valve, Dedicated gauging port with drop tube and tank components, all connections, and fittings shall NOT have any detectable leaks; test methods shall be per EO VR-401-A Table 2-1, and

c. Liquid Removal Test (if applicable) per TP-201.6, and ~~Summary of Test Data shall be documented on a Form similar to EO VR-401-A Form 1.~~

Summary of Test Data shall be documented on a Form similar to EO VR-401-A Form 1.

The District shall be notified a minimum of 10 days prior to performing the required tests with the final results submitted to the District within 30 days of completion of the tests.

The District shall receive passing test reports no later than six (6) weeks prior to the expiration date of this permit.

Verification: The project owner shall make the site available for inspection of equipment and the results for the tests required by this condition by representatives of the District, ARB, and the Energy Commission.

AQ-60~~56~~ Pursuant to California Health and Safety Code sections 39600, 39601 and 41954, this aboveground tank shall be installed and maintained in accordance with Executive Order (EO) VR-401-A for EVR Phase I, and Standing Loss requirements.

http://www.arb.ca.gov/vapor/eos/eo-vr401/eo-vr401a/eo-401a.pdf

Additionally, Phase II Vapor Recovery System shall be installed and maintained per G-70-116-F with the exception that hanging hardware shall be EVR Balance Phase II type hanging hardware (VST or other CARB Approved EVR Phase II Hardware).

Verification: The project owner shall make the site available for inspection of equipment and records by representatives of the District, ARB, and the Energy Commission.

AQ-61~~57~~ Pursuant to EO VR-401-A; Maintenance and repair of system components, including removal and installation of such components in the course of any required tests, shall be performed by OPW Certified Technicians.

Verification: The project owner shall make the site available for inspection of equipment and records by representatives of the District, ARB, and the Energy Commission.

AQ-62~~58~~ Pursuant to EO VR-401-A, Maintenance Intervals for OPW; Tank Gauge Components; Dust Caps Emergency Vents; Phase I Product and Vapor Adapters, and Spill Container Drain Valve, shall be conducted by an OPW trained technician annually.

Verification: The project owner shall make the site available for inspection of equipment and records by representatives of the District, ARB, and the Energy Commission.

AQ-63~~59~~ The annual throughput of gasoline shall not exceed 600,000 gallons per year. Throughput Records shall be kept on site and available to District personnel upon request. Before this annual throughput can be increased the facility may be required to submit to the District a site specific Health Risk Assessment in accord with a District approved plan. In addition public notice and/or comment period may be required.

Verification: The project owner shall provide gasoline throughput records to demonstrate compliance with this condition in the Annual Compliance Report.

AQ-~~60~~64 The project owner shall; install, maintain, and operate EVR Phase I in compliance with CARB Executive Order VR-401-A, and Phase II vapor recovery in accordance with G-70-116-F. In the event of conflict between these permit conditions and/or the referenced EO's the more stringent requirements shall govern.

Verification: The project owner shall make the site available for inspection of equipment and records by representatives of the District, ARB, and the Energy Commission.

REFERENCES

MDAQMD 2010c. Mojave Desert Air Quality Management District. Final Determination of Compliance (FDOC). Blythe Solar Power Project. July 8, 2010.

DECLARATION OF
Testimony of William Walters, P.E.

I, **William Walters,** declare as follows:

1. I am presently employed by Aspen Environmental Group, a contractor to the California Energy Commission's Siting, Transmission and Environmental Protection Division, as a senior associate in engineering and physical sciences.

2. A copy of my professional qualifications and experience is attached hereto and incorporated by reference herein.

3. I prepared the staff testimony on **Air Quality** for the **Blythe Solar Power Project Supplemental Staff Assessment** based on my independent analysis of the Application for Certification and supplements hereto, data from reliable documents and sources, and my professional experience and knowledge.

4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue addressed therein.

5. I am personally familiar with the facts and conclusions related in the testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: July 9, 2010 Signed: ____________

At: Agoura Hills, California

TRAFFIC AND TRANSPORTATION

AVIATION ASSESSMENT

Supplemental Testimony of Marie McLean; Clifford Ho, PhD; Mark Johnson, AICP; James Jewell; and Will Walters, PE

SUMMARY OF CONCLUSIONS

While a solar thermal power plant is not a brand new technology, it is a rapidly evolving technology and not one frequently the subject of Energy Commission staff analysis. Nor is there a lot of information surrounding the potential for solar thermal power plants to impact airports and aviation safety. Therefore, staff had difficulty in identifying significance thresholds for the project's impacts on the Blythe Airport and reaching conclusions regarding whether those impacts, if significant, could be reduced to a level less than significant.

In this section staff provides its analysis, identifies mitigation measures that could reduce the severity of the potential impacts, and invites other agencies with expertise in this matter, such as California Department of Transportation, Division of Aeronautics; the Federal Aviation Association; the Riverside County Airport Land Use Commission, and the owner of the Blythe Airport, Riverside County, to attend the hearings and provide their input into this issue.

Staff has identified four main components of BSPP that could potentially impact the Blythe Airport and aviation: thermal plumes arising from the project's air cooled condensers, glint and glare reflected from the project's mirrors (solar arrays), the location of some of the project's transmission poles and the accompanying line in several of the Blythe Airports compatibility zones, and the potential for the project's evaporation ponds to encourage birds to flock near the airport. .

Staff concludes that the thermal plumes and glint and glare could result in a potentially significant impact to aviation safety and recommends the Commission adopt conditions of certification to reduce and mitigate these impacts to the extent possible. Staff concludes that the applicant's proposal to move the proposed transmission line outside airport compatibility zone B1 and off the extended centerline of runway 8-26 in response to comments made by the Airport Land Use Commission reduces the potential for the transmission line to impact aviation safety.

Staff, however, recommends additional marking of certain poles near the end of the runway to ensure they are sufficiently visible to pilots. Staff concludes that the potential for the evaporation ponds to attract flocks of birds is less than significant with implementation of Condition of Certification **BIO-25**, which requires netting of the ponds, monitoring, and implementation of addition measures, if necessary, to ensure that birds are not using the ponds.

Staff has also considered the potential for BSPP to cumulatively contribute to an impact to the airport. Staff has concluded that the BSPP in combination with the existing and proposed power plants on or near the Blythe Airport will contribute significantly to further constraining an already constrained airspace available for low-flying aircraft operating at Blythe Airport.

Staff is proposing mitigation to reduce and mitigate the impacts of the BSPP to the extent possible. However, staff cannot determine at this time if the effects of the proposed mitigation will reduce the cumulative impact to less than significant.

Finally, staff considered the BSPP's compliance with laws, ordinances, regulations, and standards (LORS).and concluded that the project complies except in the area of glint and glare. Consequently, staff is proposing mitigation to reduce and mitigate the impact of glint and glare to the extent possible. However, staff cannot determine whether mitigation will ensure compliance with LORS. Therefore, we invite the Riverside County Airport Land Use Commission as well as other local agencies to attend the hearings and provide comments.

INTRODUCTION

Solar Millennium and Chevron Energy Solutions have submitted a proposal to develop the Blythe Solar Power Project (BSPP), which would consist of four adjacent, independent, and identical solar fields, each with a nominal capacity of 250 megawatts (MW), for a total nominal capacity of 1,000 MW. The proposed location of the BSPP is approximately 8 miles west of the City of Blythe, 2 miles north of the Interstate-10 freeway in Riverside County, and 1 mile northwest of Blythe Airport (the Airport). The project is located on land management by the Bureau of Land Management.

In late 2009, the California Energy Commission (Energy Commission) received an Application for Certification (AFC) from Solar Millennium and Chevron Energy Solutions to construct and operate BSPP, at which time the Energy Commission began its analysis of the proposed project. Due to the proximity of the proposed project to the Airport, staff conducted this Aviation Assessment to analyze the compatibility of the BSPP with the provisions of the *Riverside County Airport Land Use Compatibility Plan* (ALUCP) that apply to Blythe Airport and to evaluate the potential for the BSPP to adversely impact aircraft operations in the vicinity of the Airport.

LAWS, ORDINANCES, REGULATIONS, AND STANDARDS

TRAFFIC AND TRANSPORTATION Table 1
Laws, Ordinances, Regulations, and Standards Pertaining to Aviation

Applicable Law	*Description*
Federal	

Code of Federal Regulations (CFR), Title 14, Aeronautics and Space; Part 77, Objects Affecting Navigable Airspace (14 CFR 77)	This regulation includes standards for determining physical obstructions to navigable airspace; information about requirements for notices, hearings, and requirements for aeronautical studies to determine the effect of physical obstructions to the safe and efficient use of airspace.
State	
California *Public Utilities Code*, Section 21670 to 21707, State Aeronautics Act	Pertains to orderly development of each public use airport and the area surrounding the airport to protect public health, safety, and welfare. Provides for the creation of airport land use commissions.
California Airport Land Use Planning Handbook	Supports and amplifies the State Aeronautics Act and provides guidance to agencies having control over airports and land use around airports. CEQA lead agencies are required by the *Public Utilities Code* to use the handbook to determine safety compatibility issues when assessing a project within an airport influence area.
Local	
Riverside County General Plan, Land Use	Pertains to public safety policies pertaining to county airports.
Riverside County Airport Land Use Compatibility Plan	Pertains to heights of projects as well as other restrictions in areas located near airports. All applicable policies and procedures in the Riverside plan are incorporated as part of the city of Blythe's policies. This plan also requires an avigation easement be secured through dedication for all uses permitted in any Airport Land Use Compatibility Safety Zone.
City of Blythe General Plan 2025, Chapter 7, Safety Element	Establishes policies pertaining to airport safety, including minimizing injury to aircraft occupants and preventing creation of hazards to flights. Guiding policies of this section include Blythe Airport Master Plan; Land Use Compatibility Plan; and Federal Aviation Regulations Part 77. Section also contains five guiding policies concerning safe use of airspace; visual disturbances involving light and glare; and electronic interference.
Palo Verde Valley Area Plan	Includes height and other restrictions pertaining to the Blythe Airport.

BLYTHE AIRPORT

Blythe Airport is a public-use general aviation airport located approximately 6 miles west of the City of Blythe in unincorporated Riverside County. Blythe Airport is one of the five best-equipped airports in terms of runway length and basic facilities within two to three hours of the City of Blythe and the only general aviation airport located in the Los Angeles/Desert Region to meet all minimum standards for community general aviation airports. The Airport is immediately east of the southern end of the McCoy Mountains.

The Airport comprises 3,904 acres. Much of the environs surrounding the Airport is unpopulated desert, although a neighborhood of approximately 300 homes lies less than a mile southwest of the Airport.[1] The Airport elevation is approximately 400 feet above mean sea level (MSL). The latest Blythe Airport Master Plan (the Airport Master Plan) was adopted in November 2001 and serves as a key source of information for this aviation assessment.

The remainder of this section provides an overview of the Blythe Airport, including a discussion of Airport ownership and compliance, existing and planned Airport facilities, a summary of historical and forecast Airport activity, as well as a description of the Airport's role in the surrounding area and the overall national airport system.

AIRPORT OWNERSHIP AND COMPLIANCE WITH AIRPORT IMPROVEMENT PROGRAM

Blythe Airport is owned by Riverside County and is under lease to the City of Blythe, which operates the Airport. Day-to-day operation of the Airport is overseen by the Airport Manager, who is an employee of the City of Blythe.

As the owner (sponsor) of the Airport, Riverside County is responsible for funding necessary improvements at the Airport. One of the main sources of funding for airport improvements is the federal Airport Improvement Program (AIP), which is administered by the Federal Aviation Administration. The AIP was initially authorized by the Airport and Airway Improvement Act of 1982 to assist airport sponsors in funding planning, development, and noise compatibility projects at public-use airports nationwide to accommodate projected civil aviation growth. Since 1983, the Airport has received AIP grants totaling nearly $4 million.[2] These AIP grants helped fund important airport development projects, such as runway and taxiway extensions, pavement rehabilitation, perimeter fencing, apron lighting, as well as a master plan study.

When an airport sponsor accepts an AIP grant, it is obligated to comply with various laws, regulations, and advisory circulars that are conditions of the grant. Known as Grant Assurances, these obligations require the grant recipients to maintain and operate their facilities safely and efficiently and in accordance with specified conditions. Although some of these conditions have a limited term (typically 20 years), others are perpetual.[3] Therefore, the requirements imposed by grant assurances are of considerable importance not only to airports and their sponsors, but also to their tenants and other users.

The AIP requires compliance with 39 grant assurances, which balance three competing public interests: the airport operator's needs; the FAA's objective that federal funds are effectively used to meet the need for public air transportation; and the federal government's goal to promote social objectives, such as providing opportunities to disadvantaged businesses and maintaining the rights of those with disabilities. Examples of grant assurances to which the Airport is obligated include compliance with

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1 Estimate derived from interpretation of Google Earth aerial photograph, dated November 30, 2004; Ricondo & Associates, Inc., June 2010.
2 Kimchi Hoang, Federal Aviation Administration, "Blythe inquiry," email to Marie McLean, California Energy Commission, June 8, 2010.
3 Federal Aviation Administration, *Airport Compliance Manual*, FAA Order 5190.6B, September 2009.

federal labor laws (e.g., Davis-Bacon Wage Determination, Sherman Anti-trust), legal provisions to ensure public access (e.g., nonexclusive rights, open access to the public, nondiscrimination), airport land use compatibility, airspace protection, and accounting and record-keeping provisions.

Two grant assurances with which Riverside County (as airport sponsor) must comply are relevant to the proposed BSPP:

- Grant Assurance #20 Hazard Removal and Mitigation – This grant assurance requires the sponsor to take actions necessary to protect the airspace around the Airport, including visual and instrument approach paths. This includes removing obstructions, securing land to prevent incompatible land use, properly marking and lighting obstructions, and preventing the establishment or creation of future hazards.
- Grant Assurance #21 Compatible Land Use – This grant assurance requires the sponsor to attempt to restrict the use of land adjacent to or in the immediate vicinity of the Airport to activities and purposes compatible with airport operations. Other issues such as noise abatement, environment, and safety issues derived from airport operations must be considered when establishing compatible land use.

Compliance with the *Airport Land Use Compatibility Plan* for Blythe Airport, described in Traffic and Transportation Aviation Report helps to ensure that Riverside County complies with these grant assurances.

Airport sponsors are obligated to adhere to the grant assurances, to correct any non-complying conditions as they arise, and to seek to correct any non-complying conditions that may have existed prior to the receipt of the first AIP grant. The FAA ensures compliance with grant assurances through its Airport Compliance Program, which oversees the airports to make sure they are safe, properly maintained, and operated in a manner that protects the public's interest and investment in a national airport system. If the FAA determines that the airport sponsor is not in compliance with one or more grant assurances, it can withhold current and future grant funding for the airport.

AIRPORT FACILITIES

Existing and planned facilities at the Airport are shown on **Figure 1**. Existing airport facilities include airfield (runways, taxiways, and aprons) and building/tenant facilities, as follows:

Runways – The Airport has two operating runways, each capable of accommodating a variety of aircraft up to the size of a small business jet. Runway 8-26 is oriented east-west and serves as the primary runway, with a length of 6,543 feet and a width of 150 feet.[4] The runway is equipped with medium intensity runway edge lights. A four-box Visual Approach Slope Indicator (VASI) light system is located on the Runway 26 end as a visual landing aid to help pilots maintain a 3-degree descent profile toward the runway during final approach. Runway 17-35 is oriented north-south with a length of

4 Runways are numbered based on their compass heading, rounded to the nearest 10 degrees. Because runways are used in both directions, they have two numbers. Runway 8-26 is oriented generally east-west. When used for landings and takeoffs to the east, it is referred to as Runway 8 (magnetic compass heading of approximately 80 degrees); when used for landings and takeoffs to the west, Runway 26 (heading of approximately 260 degrees).

5,800 feet and a width of 100 feet. The runway is equipped with medium intensity runway edge lights, with a four-box VASI available on both runway ends.[5]

Taxiways – A network of taxiways provides access between the two runways and the primary aircraft parking apron. Runway 8-26 is served by a full-length parallel taxiway south of the runway, and Runway 17-35 by a partial eastern parallel taxiway on the south end of the runway.

Aprons – The primary aircraft parking apron is located south of Runway 8-26 and east of Runway 17-35. Two abandoned aprons are located in the northwest quadrant of the Airport. A large restricted use apron is located in the northeast quadrant of the Airport, which has been abandoned, except for an area that is used by an agricultural aerial spraying operator.[6]

Building/tenant facilities – The primary building area is located in the southeast quadrant of the Airport. In 1993, Riverside County leased 8.3 acres of land and improvements in the southeast quadrant to Wolfe Enterprises, as the fixed base operator (FBO). The FBO provides services such as aircraft maintenance, fuel, flight instruction, and aircraft rental. The FBO facilities consist of a general aviation building containing 1,289 square feet, a main hangar containing 24,750 square feet, and two underground fuel tanks.[7] Other major buildings at the Airport include a National Weather Service facility, a Riverside County fire station, and other federal and county facilities. In addition to the FBO's conventional hangar, 11 individual hangars are at the Airport.[8]

According to the Airport Master Plan, future airfield improvements include the extension of Runway 8-26 and its parallel taxiway 3,450 feet west to an ultimate length of 10,012 feet, as well as the extension of the Runway 17-35 parallel taxiway to full length. Planned building/tenant facility improvements center on providing lease areas for private hangar development.[9]

AIRPORT ACTIVITY

This section summarizes the historical and forecast activity at the Airport, including aircraft operations (takeoffs and landings) and the number of aircraft based at the Airport. Aircraft operations are categorized as either itinerant or local. Itinerant operations are those that originate and terminate at different airports. Local operations include takeoffs and landings by aircraft operating in the traffic pattern or within sight of the airport, aircraft known to be operating in known practice areas, or aircraft practicing instrument approach procedures.

Historical Airport Activity

With no control tower to count operations, aircraft takeoffs and landings at the Airport have been estimated annually since 1980 by the airport operator, reported to the FAA,

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5 Federal Aviation Administration, *Airport Master Record*, FAA Form 5010, effective June 3, 2010.
6 Coffman Associates, Inc., *Blythe Airport Master Plan*, adopted November 2001.
7 2007-2008 Grand Jury Report for the Blythe Airport, identifying measures that the City of Blythe must take to mitigate aviation impacts associated with the Blythe Energy Plant, Phase I (BEP1), http://www.riverside.courts.ca.gov/grandjury/08blytheairport.pdf (accessed June 9, 2010).
8 Coffman Associates, Inc., *Blythe Airport Master Plan*, adopted November 2001.
9 Ibid.

recorded on the FAA Form 5010 *Airport Master Record*, and input into the FAA's Terminal Area Forecast (TAF) system. The most recent TAF, published in 2009, provides historical aircraft operations data from 1990 through 2008. **Table 1** summarizes annual aircraft operations and based aircraft for the Airport since 1990 and includes the most currently available fleet mix information.

Table 1
Historical Airport Activity

	1990	1995	2000	2005	2008 (2006 data) 1/
Based aircraft	50	27	17	11	10
Itinerant operations	15,000	18,000	12,400	12,650	12,650
Local operations	10,000	17,000	12,250	12,500	12,500
Total aircraft operations	25,000	35,000	24,650	25,150	25,150

Note:
1/ 2008 is the last year of reported historical data in the FAA's Terminal Area Forecast (TAF). Historical activity presented in the TAF is drawn from the FAA's *Airport Master Record* for the Airport. The most recent data entered into the *Blythe Airport Master Record* is for the 12-month period ending December 31, 2006. According to the *Airport Master Record*, of the 25,150 aircraft operations shown in the TAF for 2008 (based on 2006 data), approximately 50% were itinerant general aviation, 50% local general aviation, and less than 1% itinerant military.
Source: Federal Aviation Administration 2009-2030 Terminal Area Forecast system, http://aspm.faa.gov/main/taf.asp (accessed June 2, 2010).
Prepared by: Ricondo & Associates, Inc., June 2010.

Historical annual instrument approach data are not available from the FAA for the Airport. However, annual instrument approaches can be estimated based on trends experienced at similar airports. According to the Airport Master Plan, annual instrument approaches account for 1% of total itinerant operations. For 2008, this would equate to approximately 127 annual instrument approaches.

Forecast Airport Activity

The FAA's TAF system contains activity forecasts for the Airport for 2009-2030, which are updated annually by the FAA based on current trends. The 2009 TAF forecasts no change in based aircraft and operations levels for the Airport through the 21-year forecast period. The number of based aircraft is projected to remain at 10 and annual operations at 25,150. Annual operations are projected to be evenly distributed between itinerant and local operations. Itinerant military operations are projected to account for less than 1% of all operations.

A separate forecast summarized in **Table 2**, was developed for the Airport Master Plan. In addition to projecting aircraft operations through 2020, the Airport Master Plan estimated a theoretical ultimate activity level of 230,000 operations, including a large number of jet transport operations. To accommodate this activity, the Airport Master Plan proposed the 3,450-foot extension of Runway 8-26 to the west, as mentioned in Section 2.2.

Table 2
Forecast Airport Activity

	2010	2015	2020
Based aircraft	21	25	29

Operations			
Itinerant general aviation	21,100	27,400	34,700
Local general aviation	16,600	19,100	21,200
Total general aviation operations	37,700	46,500	55,900

Source: Coffman Associates, Inc., *Blythe Airport Master Plan*, adopted November 2001.
Prepared by: Ricondo & Associates, Inc., June 2010.

The Airport Master Plan projected future instrument approaches based on the assumption that annual instrument approaches account for 1% of total itinerant operations. For 2020, this would equate to 347 annual instrument approaches.

The *Airport Land Use Compatibility Plan* (ALUCP) prepared by the Riverside County Airport Land Use Commission for Blythe Airport is generally based on the activity forecasts in the Airport Master Plan, although one modification was made. The long-range forecast in the ALUCP (2020) includes 2,200 commercial airline operations, in addition to the 55,900 general aviation operations in the Master Plan forecasts, for a total of 58,100 annual operations.

AIRPORT ROLE AND AIR SERVICE

The Airport plays an important role not only within the Blythe area, but also within the national, state, and regional airport systems. This section describes these roles and the nature of the operations at the Airport.

Airport Role

Because airport planning is performed at national, state, regional, and local levels, the role and importance of the Airport at each of these levels is described in this section.

Blythe Airport in the National Setting

The National Plan of Integrated Airport Systems (NPIAS) is a 10-year plan that is continually updated and published by the FAA, which lists public-use airports and their development programs. The needs identified are considered to be in the national interest and eligible for federal financial planning and development assistance (e.g., AIP grants).

Blythe Airport is one of 2,564 airports in the country categorized in the latest NPIAS as a general aviation airport. To be included in the NPIAS, an airport must have at least 10 locally based aircraft and be located at least 20 miles from the nearest NPIAS airport. General aviation airports in the NPIAS account for 41% of the nation's general aviation fleet, are the closest source of air transportation for about 69% of the nation's population, and are particularly important to rural areas, providing access to emergency, business, and agricultural services.[10]

10 Federal Aviation Administration, *National Plan of Integrated Airport Systems (2009-2013)*, September 2008. This shift in aircraft activity has been occurring in Los Angeles County in recent years. As Bob Hope Airport and Van Nuys Airport have attracted increased high performance jet aircraft activity, the owners and operators of light, lower performance aircraft have been moving out of those airports. This transition has coincided with an increase in activity and the basing of light general aviation aircraft at nearby Whiteman Airport. See Jacobs Consultancy, *Supplemental Technical Report 1, Aviation Demand Forecasts, FAR Part 161 Application*, February 2009, pp. 44-52.

Blythe Airport in the State Setting

Blythe Airport is categorized as a Community General Aviation Airport in the California Aviation System Plan (CASP). The CASP defines Community Airports as those that provide access to other regions and states; are located near small communities or in remote locations; serve, but are not limited to, recreational flying, training, handling local emergencies; and providing basic or limited services for pilots or aircraft. These airports accommodate predominately single-engine aircraft under 12,500 pounds. Within the Los Angeles/Desert Region, there are 11 Community General Aviation Airports, of which Blythe Airport is the only one that meets all of this classification's minimum standards.[11]

Blythe Airport in the Regional Setting

In 2003, the Southern California Association of Governments (SCAG) updated its General Aviation System Plan (GASP) for the SCAG region, which includes the counties of Imperial, Los Angeles, Orange, Riverside, San Bernardino, and Ventura. Of the 57 public-use airports in the SCAG region, 44 are general aviation facilities, including Blythe Airport. The GASP explains that as the region becomes more urbanized, several larger general aviation airports are assuming the role of reliever for large commercial service airports and are handling greater amounts of corporate aviation activity (e.g., business jets). As these larger general aviation airports become more active with business aircraft and approach their physical capacity, lower performance aircraft tend to move to nearby airports if practical. This ripple effect can start with the primary hub airport and move throughout the regional aviation system, making smaller uncongested general aviation airports like Blythe Airport particularly important to the overall regional aviation system.[12]

Figure 2 depicts a region centered on the City of Blythe, which extends from Indio, California, on the west, Aguila, Arizona, on the east, Lake Havasu City, Arizona, on the north, and Yuma, Arizona, on the south. All points in the region are within a driving distance of approximately three hours from Blythe. This region spans two states and several counties. A comparison of Blythe Airport to other public use airports in this region is presented in **Table 3**.

Among general aviation airports in the region, Blythe Airport has the second longest primary runway, allowing the Airport to accommodate larger aircraft, such as multi-engine turboprops and business jets, than other general aviation airports in the region. Additionally, the Airport is one of only three airports in the region with published instrument approach procedures and multiple runways. Instrument approach procedures allow aircraft to land in weather conditions unsuitable for visual approaches. Having more than one runway increases the capacity of an airport and if oriented perpendicular to another runway (as at Blythe Airport), the crosswind coverage of the

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11 California Department of Transportation, *California Aviation System Plan*, December 2003.

12Southern California Association of Governments, *2003 General Aviation System Study for the SCAG Region*, 2003. This shift in aircraft activity has been occurring in Los Angeles County in recent years. As Bob Hope Airport and Van Nuys Airport have attracted increased high performance jet aircraft activity, the owners and operators of light, lower performance aircraft have been moving out of those airports. This transition has coincided with an increase in activity and the basing of light general aviation aircraft at nearby Whiteman Airport. See Jacobs Consultancy, *Supplemental Technical Report 1, Aviation Demand Forecasts, FAR Part 161 Application*, February 2009, pp. 44-52.

airport is increased. Taken together, these features make Blythe Airport one of the most accessible airports in the region from an aviation standpoint.

Based on travel time (by car) from the City of Blythe, Blythe Airport serves an area that would be otherwise relatively remote from a comparable general aviation airport. Aside from Blythe Airport, the nearest comparably equipped airport to the City of Blythe is Jacqueline Cochran Regional Airport near Coachella, California, which is 1.9 hours away. Avi Suquilla Airport near Parker, Arizona, is 1.2 hours away from Blythe, but its longest runway is shorter than the longest runway at Blythe and it does not have a second runway.

Table 3

Public Use Airports in the Region around Blythe, California

Airport Name [1/]	County	State	Airport Type [2/]	IAP [3/]	Longest Runway (feet)	Multiple Runways	Driving Distance to City of Blythe (hours)
Yuma MCAS / Yuma International Airport	Yuma	AZ	P	Yes	13,300	Yes	2.0
Jacqueline Cochran Regional Airport	Riverside	CA	GA	Yes	8,500	Yes	1.9
Lake Havasu City Airport	Mohave	AZ	CS	Yes	8,001	No	2.2
Blythe Airport	**Riverside**	**CA**	**GA**	**Yes**	**6,543**	**Yes**	**0.2**
Avi Suquilla Airport	La Paz	AZ	GA	Yes	6,250	No	1.2
Holtville Airport	Imperial	CA	GA	No	6,000	No	1.9
Twentynine Palms Airport	San Bernardino	CA	GA	Yes	5,531	Yes	2.0
Imperial County Airport	Imperial	CA	P	Yes	5,304	Yes	2.0
Bermuda Dunes Airport	Riverside	CA	GA	Yes	5,002	No	1.8
Salton Sea Airport	Imperial	CA	GA	No	5,000	No	2.3
Chemehuevi Valley Airport	San Bernardino	CA	GA	No	5,000	No	2.1
Calexico International Airport	Imperial	CA	GA	No	4,679	No	2.0
Chiriaco Summit Airport	Riverside	CA	GA	No	4,600	No	1.0
Bagdad Airport	Yavapai	AZ	GA	No	4,575	No	3.0
Brawley Municipal Airport	Imperial	CA	GA	Yes	4,402	No	1.7
Ocotillo Airport	San Diego	CA	GA	No	4,210	Yes	2.4
Desert Center Airport	Riverside	CA	GA	No	4,200	No	1.0
Cliff Hatfield Memorial Airport	Imperial	CA	GA	Yes	3,423	No	1.9
Rolle Airfield	Yuma	AZ	GA	No	2,800	No	2.4
Jacumba Airport	San Diego	CA	GA	No	2,508	No	2.7
Agua Caliente Airport	San Diego	CA	GA	No	2,500	No	3.1
Roy Williams Airport	San Bernardino	CA	GA	No	2,493	Yes	2.5

Notes:
1/ AAF = Army Airfield; EAF = Expeditionary Airfield; MCAS = Marine Corps Air Station; NAF = Naval Air Facility
2/ CS = commercial service; GA = general aviation; MIL = military; P = primary commercial service
3/ IAP = instrument approach procedures
Sources: Airnav, http://airnav.com/ (accessed June 4, 2010) (airport information); American Automobile Association (driving distances/times).
Prepared by: Ricondo & Associates, Inc., June 2010.

Blythe Airport in the Local Setting

A local service area defined for the Airport includes the cities and towns shown on **Table 4**. As shown, at least18,280 people live within the service area. The Airport represents the closest source of air transportation for these residents. For the communities located within this service area, the Airport provides an important function for residents and the local economy. The Airport provides direct employment for several people and indirectly supports and creates employment opportunities for others. The Airport contributes additional economic activity to local communities through the accommodation of emergency response aircraft, such as air ambulance operations, and as a base for the import and export of goods.

Table 4
Cities in the Blythe Airport Service Area

City/Town Name	County	State	Population
Cibola	La Paz	AZ	172
Ripley	Riverside	CA	Unknown
Poston	La Paz	AZ	389
East Blythe	Riverside	CA	3
Midland	Riverside	CA	Unknown
Palo Verde	Imperial	CA	236
Quartzsite	La Paz	AZ	3,354
Bouse	La Paz	AZ	615
Blythe	Riverside	CA	12,155
Ehrenberg	La Paz	AZ	1,357
Total			18,281

Source: U.S. Census Bureau, 2000 (population).
Prepared by: Ricondo & Associates, Inc., June 2010.

Nature of Air Service and Operations

Blythe Airport has not been served by scheduled air service since 1990. An airline, Air LA, operated at the Airport from 1989-1990, serving destinations such as Burbank, Grand Canyon, and Las Vegas using twin-engine turboprop aircraft. During this period, the Airport was included in the Federal Essential Air Service (EAS) program. The EAS program was put into place to guarantee—through Department of Transportation subsidies—that the small communities that were served by certificated air carriers before deregulation in 1978 continued to have a minimal level of scheduled air service. Due to program cuts, Blythe Airport lost EAS subsidy eligibility effective January 1, 1990.[13]

According to the latest Blythe Airport Master Record (effective June 3, 2010), the Airport is home to 10 based aircraft, including 9 single-engine aircraft and 1 multi-engine aircraft. A variety of aircraft types operate at the Airport annually, as documented in the Airport Master Plan, including single-engine aircraft (85%), twin-engine piston aircraft (11%), twin-engine turboprop aircraft (2%), business jets (2%), and helicopters, (1%).[14] This fleet mix is projected to remain unchanged through the master plan forecast period, with small increases in turboprop and business jet aircraft by 2020.

Most of the aircraft operations at the Airport are defined as general aviation, a term used to categorize a wide variety of aviation activity. General aviation is considered to be all aviation that is not commercial or military aviation. The majority of aircraft operational activity within the previously defined SCAG region and throughout the country is general aviation activity. The Airport serves as base, origination, or destination facility for nearly all facets of general aviation activity, including flight

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13 United States Department of Transportation, http://ostpxweb.dot.gov/aviation/X-50%20Role_files/easeliminated.htm (accessed June 9, 2010).
14 Coffman Associates, Inc., *Blythe Airport Master Plan*, adopted November 2001.

instruction, business travel, agricultural (crop dusting), police, air ambulance, charter, and personal/recreational flying.

RELATIONSHIP OF THE BSPP TO THE BLYTHE AIRPORT ALUCP

Part of the proposed BSPP site lies within the airport influence area for Blythe Airport, as established in the *Riverside County Airport Land Use Compatibility Plan* (ALUCP), and is subject to land use compatibility policies established in the ALUCP for Blythe Airport. At its closest point, the proposed BSPP site lies approximately 1.5 statute miles northwest of the nearest runway at the Airport – Runway 17-35. The BSPP site is immediately west of the extended centerline of Runway 17-35 and two statute miles north of the west end of Runway 8-26.

RIVERSIDE COUNTY AIRPORT LAND USE COMMISSION

The Riverside County Airport Land Use Commission (ALUC) exercises the duties and responsibilities stipulated in Section 21670 et seq. of the California Public Utilities Code (PUC). Those responsibilities are "to protect public health, safety, and welfare by ensuring the orderly expansion of airports and the adoption of land use measures that minimize the public's exposure to excessive noise and safety hazards within areas around public airports to the extent that these areas are not already devoted to incompatible uses."

The by-laws of the ALUC summarize the powers granted to the ALUC by state law:
To prepare and adopt an airport land use compatibility plan for each of the airports within the commission's jurisdiction.

To review the plans, regulations, and other actions of local agencies and airport operators pursuant to PUC Section 21676.

To assist local agencies in ensuring compatible land uses in the vicinity of all new airports and in the vicinity of existing airports to the extent that the land in the vicinity of those airports is not already devoted to incompatible uses.

To coordinate planning at the state, regional, and local levels so as to provide for the orderly development of air transportation, while at the same time protecting the public health, safety, and welfare.[15]

AIRPORT LAND USE COMPATIBILITY PLAN FOR BLYTHE AIRPORT

The current Riverside County *Airport Land Use Compatibility Plan* (ALUCP) was adopted in October 2004. It comprises three volumes: Volume 1 – Policy Document; Volume 2 – Background Data, West County Airports; and Volume 3 – Background Data, East County Airports. Chapter Two of Volume I, Policy Document, includes countywide policies that apply to all airports. Chapter Three includes the supplementary compatibility policies and the compatibility maps for Blythe Airport. [16]

15 Riverside Airport Land Use Commission, *Bylaws of the Riverside County Airport Land Use Commission*, July 2006 draft, http://www.rcaluc.org/filemanager/bylaws/RCO Bylaws.pdf, accessed June 7, 2010.

16 The Riverside County Airport Land Use Compatibility Plan requires an avigation easement for projects located in an airport zone of influence.

Table 5 presents the basic compatibility policies for the six compatibility zones specified in the Riverside County ALUCP. The compatibility policies stipulate the strictest limits on development in Zone A, which corresponds to the areas nearest the runways – within the Runway Protection Zone and building restriction line. As the distance of the zones from the runway ends increases, the policies become less restrictive. In all zones, however, hazards to flight are prohibited. Airspace review by the ALUC for structures of varying height is also required in all zones – for structures above 35 feet in Zones B1 and B2, above 70 feet in Zones C and D, and above 100 feet in Zone E. (In Zone A, structures are prohibited unless required for an aeronautical function..)

Chapter Three of the ALUCP includes the compatibility map for Blythe Airport, which is illustrated in **Figure 3**. The figure depicts the location of the proposed BSPP with respect to the Airport and the compatibility zones. The southeastern portion of the proposed BSPP facility lies within Zone E. A very small portion lies within Zone D. Parts of the proposed overhead power transmission line lie within these zones as well. The proposed transmission line also crosses the extended centerline of Runway 8-26 and into Zone C. However, after consultations with the Riverside County Airport Land Use Commission, the applicant agreed to shift the proposed transmission line and towers approximately one-quarter mile further west off the extended centerline of Runway 8-26. The relocation would shift the transmission line out of Zone B1.[17] (Figure 3 depicts the sponsor's latest proposed route for the transmission line.) The illustrations prepared by the applicant indicate that, along the extended runway centerline, the transmission lines would lie approximately 200 feet below the 3-degree glide slope to Runway 8 and approximately 50 feet below the FAR Part 77 horizontal surface.

The project sponsor is required to submit the revised plans to the FAA for an aeronautical study and obstruction/hazard.

ALUCP AIRSPACE PROTECTION POLICIES

Section 4.3 of the ALUCP describes the airspace protection policies for airports in Riverside County, including Blythe Airport. As a federal requirement, sponsors of proposed construction exceeding specified heights near airports must file a notice of proposed construction (Form 7460-1) with the FAA for an aeronautical study of the proposal. The FAA study will determine whether the proposed project would constitute an obstruction or create a hazard to air navigation.[18]

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17 Howard Balentine, Plots Depicting GenTie Clearance from 3 degree Approach Glide Slope and FAA Part 77 Horizontal Surface on Approach End of Runway 08 at the Blythe Airport, June 15, 2010.
18 The FAA requirements are described in 14 CFR Part 77, Subpart B.

Table 5 (1 of 2)
Basic ALUCP Compatibility Policies

Zone	Locations	Maximum Densities / Intensities: Residential (d.u./ac) [1]	Other Uses (people/ac) [2]: Average [6]	Other Uses (people/ac) [2]: Single Acre [7]	Other Uses (people/ac) [2]: with Bonus [8]	Additional Criteria: Req'd Open Land [3]	Additional Criteria: Prohibited Uses [4]	Additional Criteria: Other Development Conditions [5]
A	Runway Protection Zone and within Building Restriction Line	0	0	0	0	All Remaining	› All structures except ones with location set by aeronautical function › Assemblages of people › Objects exceeding FAR Part 77 height limits › Storage of hazardous materials › Hazards to flight [9]	› Avigation easement dedication
B1	Inner Approach/ Departure Zone	0.05 (average parcel size ≥20.0 ac.)	25	50	65	30%	› Children's schools, day care centers, libraries › Hospitals, nursing homes › Places of worship › Bldgs with >2 aboveground habitable floors › Highly noise-sensitive outdoor nonresidential uses [10] › Aboveground bulk storage of hazardous materials [11] › Critical community infrastructure facilities [12] › Hazards to flight [9]	› Locate structures maximum distance from extended runway centerline › Minimum NLR of 25 dB in residences (including mobile homes) and office buildings [13] › Airspace review required for objects >35 feet tall [14] › Avigation easement dedication
B2	Adjacent to Runway	0.1 (average parcel size ≥10.0 ac.)	100	200	260	No Req't	Same as Zone B1	› Locate structures maximum distance from runway › Minimum NLR of 25 dB in residences (including mobile homes) and office buildings [13] › Airspace review required for objects >35 feet tall [14] › Avigation easement dedication
C	Extended Approach/ Departure Zone	0.2 (average parcel size ≥5.0 ac.)	75	150	195	20%	› Children's schools, day care centers, libraries › Hospitals, nursing homes › Bldgs with >3 aboveground habitable floors › Highly noise-sensitive outdoor nonresidential uses [10] › Hazards to flight [9]	› Minimum NLR of 20 dB in residences (including mobile homes) and office buildings [13] › Airspace review required for objects >70 feet tall [15] › Deed notice required
D	Primary Traffic Patterns and Runway Buffer Area	**(1)** ≤0.2 (average parcel size ≥5.0 ac.) *or* [16] **(2)** ≥5.0 (average parcel size ≤0.2 ac.)	100	300	390	10%	› Highly noise-sensitive outdoor nonresidential uses [10] › Hazards to flight [9]	› Airspace review required for objects >70 feet tall [15] › Children's schools, hospitals, nursing homes discouraged [17] › Deed notice required
E	Other Airport Environs	No Limit	No Limit [18]			No Req't	› Hazards to flight [9]	› Airspace review required for objects >100 feet tall [15] › Major spectator-oriented sports stadiums, amphitheaters, concert halls discouraged beneath principal flight tracks [18]
*	Height Review Overlay	Same as Underlying Compatibility Zone				Not Applicable	Same as Underlying Compatibility Zone	› Airspace review required for objects >35 feet tall [14] › Avigation easement dedication

Source: Riverside County Airport Land Use Commission, *Riverside County Airport Land Use Compatibility Plan Policy Document*, October 2004.
Prepared by: Riverside County Airport Land Use Commission.

Table 5 (2 of 2)
Basic ALUCP Compatibility Policies

1/ Residential development must not contain more than the indicated number of dwelling units (excluding secondary units) per gross acre. Clustering of units is encouraged. See Policy 4.2.5 for limitations. Gross acreage includes the property at issue plus a share of adjacent roads and any adjacent, permanently dedicated, open lands. Mixed-use development in which residential uses are proposed to be located in conjunction with nonresidential uses in the same or adjoining buildings on the same site shall be treated as nonresidential development. See Policy 3.1.3(d).

2/ Usage intensity calculations shall include all people (e.g., employees, customers/visitors, etc.) who may be on the property at a single point in time, whether indoors or outside.

3/ Open land requirements are intended to be applied with respect to an entire zone. This is typically accomplished as part of a community general plan or a specific plan, but may also apply to large (10 acres or more) development projects. See Policy 4.2.4 for definition of open land.

4/ The uses listed here are ones that are explicitly prohibited regardless of whether they meet the intensity criteria. In addition to these explicitly prohibited uses, other uses will normally not be permitted in the respective compatibility zones because they do not meet the usage intensity criteria.

5/ As part of certain real estate transactions involving residential property within any compatibility zone (that is, anywhere within an airport influence area), information regarding airport proximity and the existence of aircraft overflights must be disclosed. This requirement is set by state law. See Policy 4.4.2 for details. Easement dedication and deed notice requirements indicated for specific compatibility zones apply only to new development and to reuse if discretionary approval is required.

6/ The total number of people permitted on a project site at any time, except rare special events, must not exceed the indicated usage intensity times the gross acreage of the site. Rare special events are ones (such as an air show at the airport) for which a facility is not designed and normally not used and for which extra safety precautions can be taken as appropriate.

7/ Clustering of nonresidential development is permitted. However, no single acre of a project site shall exceed the indicated number of people per acre. See Policy 4.2.5 for details.

8/ An intensity bonus may be allowed if the building design includes features intended to reduce risks to occupants in the event of an aircraft collision with the building. See Policy 4.2.6 for details.

9/ Hazards to flight include physical (e.g., tall objects), visual, and electronic forms of interference with the safety of aircraft operations. Land use development that may cause the attraction of birds to increase is also prohibited. See Policy 4.3.7.

10/ Examples of highly noise-sensitive outdoor nonresidential uses that should be prohibited include amphitheaters and drive-in theaters. Caution should be exercised with respect to uses such as poultry farms and nature preserves.

11/ Storage of aviation fuel and other aviation-related flammable materials on the airport is exempted from this criterion. Storage of up to 6,000 gallons of nonaviation flammable materials is also exempted. See Policy 4.2.3(c) for details.

12/ Critical community facilities include power plants, electrical substations, and public communications facilities. See Policy 4.2.3(d) for details.

13/ NLR = Noise Level Reduction, the outside-to-inside sound level attenuation that the structure provides. See Policy 4.1.6.

14/ Objects up to 35 feet in height are permitted. However, the Federal Aviation Administration may require marking and lighting of certain objects. See Policy 4.3.6 for details.

15/ This height criterion is for general guidance. Shorter objects normally will not be airspace obstructions unless situated at a ground elevation well above that of the airport. Taller objects may be acceptable if determined not be obstructions. See Policies 4.3.3 and 4.3.4.

16/ Two options are provided for residential densities in *Compatibility Zone D*. Option (1) has a density limit of 0.2 dwelling units per acre (i.e., an average parcel size of at least 5.0 gross acres). Option (2) requires that the density be *greater than* 5.0 dwelling units per acre (i.e., an average parcel size *less than* 0.2 gross acres). The choice between these two options is at the discretion of the local land use jurisdiction. See Table 2B for explanation of rationale. All other criteria for *Zone D* apply to both options.

17/ Discouraged uses should generally not be permitted unless no feasible alternative is available.

18/ Although no explicit upper limit on usage intensity is defined for *Zone E*, land uses of the types listed—uses that attract very high concentrations of people in confined areas—are discouraged in locations below or near the principal arrival and departure flight tracks. This limitation notwithstanding, no use shall be prohibited in *Zone E* if its usage intensity is such that it would be permitted in *Zone D*.

Source: Riverside County Airport Land Use Commission, *Riverside County Airport Land Use Compatibility Plan Policy Document*, October 2004.
Prepared by: Riverside County Airport Land Use Commission.

ALUCP SAFETY POLICIES

As indicated in Table 5, the ALUCP safety policy that is directly relevant to the proposed BSPP is the prohibition of "hazards to flight." Footnote 9 in the table describes these hazards as physical, visual, and electronic forms of interference with the safety of aircraft operations. Policy 4.3.7 in the ALUCP provides this additional information on potential hazards:

> *Other Flight Hazards:* New land uses that may cause visual, electronic, or increased bird strike hazards to aircraft in flight shall not be permitted within any airport's influence area. Specific characteristics to be avoided include:
>
> (a) Glare or distracting lights which could be mistaken for airport lights;
>
> (b) Sources of dust, steam, or smoke which may impair pilot visibility;
>
> (c) Sources of electrical interference with aircraft communications or navigation; and
>
> (d) Any proposed use, especially landfills and certain agricultural uses, that creates an increased attraction for large flocks of birds. (Refer to FAA Order 5200.5A, *Waste Disposal Sites on or Near Airports* and Advisory Circular 150/5200-33A, *Hazardous Wildlife Attractants On or Near Airports.)*[19]

In addition to the power transmission lines and poles, the proposed BSPP project would have three attributes that may conceivably create hazards for air navigation – glare from the solar plant's mirror arrays, thermal plumes from the plant's air-cooled condensers, and the evaporation ponds (that could possibly attract birds). Another aspect of the proposed facility that merits discussion is the presence of relatively large quantities of hazardous materials, in the form of the plant's heat transfer fluid. Before assessing the potential impact of these attributes of the proposed project, the typical pattern of flight operations at the Airport is described.

Flight Routes and Procedures at Blythe Airport

Although Blythe Airport does not have an airport traffic control tower, operations at the Airport adhere to standard procedures in accordance with FAA regulations and published procedures.

Standard Flight Pattern

Figure 4 illustrates the elements of a standard traffic pattern. At an airport without an airport traffic control tower, a pilot approaching the airport to land must first determine the active runway, which may be accomplished by observing the flow of aircraft already in the traffic pattern, by overflying the airfield to note the wind direction indicators, or by radio communication with a Unicom facility. The pilot enters the downwind leg of the traffic pattern at a 45-degree angle abeam the midpoint of the active runway, referred to

19 Riverside County Airport Land Use Commission, *Riverside County Airport Land Use Compatibility Plan Policy Document*, October 2004, Policy 4.3.7, pp. 2-30.

in this report as the traffic pattern entry corridor. The downwind leg is typically established about one mile from the active runway, but the location varies depending on weather conditions and the number of aircraft in the pattern. (As the number of aircraft increases, the size of the traffic pattern increases.) The pilot begins turning to the base leg of the pattern at a point where the approach end of the runway is approximately 45 degrees behind the aircraft. On the base leg, the pilot descends and turns onto the final approach. If the pilot is executing touch-and-goes or multiple approaches, the pilot turns to the crosswind leg of the pattern after crossing the departure end of the runway and reaching an altitude of no less than 400 to 500 feet above the ground. Pilots departing the pattern typically exit by flying straight out or making a 45-degree left turn.

The procedures depicted on Figure 4 are customary standards, so in actual practice, there can be many variations. For example, FAA aeronautical publications may specify variations from the standards to ensure safe separation of aircraft from obstacles or to adhere to noise abatement routes. At uncontrolled airports with no traffic in the vicinity, pilots may exit the traffic pattern by immediately turning to their course headings, although they should always observe the practice of turning only after reaching the runway end and attaining a minimum safe turning altitude. In addition, variations in pilot technique and aircraft performance will result in many variations in the location of the traffic pattern over the ground.

Instrument Approaches at Blythe Airport

Figure 5 depicts the approximate flight tracks for each of the three published instrument approaches at Blythe Airport. All are nonprecision approaches, meaning that they provide lateral course guidance to specific runways or to the Airport but do not provide descent guidance to the landing threshold.

Through providing course and distance information, the VOR/DME-A approach directs aircraft from the southwest to the Airport.[20] When pilots have the Airport in sight, they will typically circle the Airport, enter the final approach to the active runway, and land. If they do not see the Airport at a point 2.1 nautical miles from the initial approach fix, they will execute a missed approach, climbing and generally following the track indicated on the figure, and either try again to land or divert to another airport.

Two approaches to Runway 26 are depicted – an RNAV[21] approach and a VOR/DME approach. Both direct aircraft to the runway from the east-northeast. The missed approaches are also designated. If the pilot is unable to see the runway at the designated missed approach points, he or she will follow the missed approach course. The missed approach for the RNAV procedure directs traffic to turn right, leading traffic over the site of the proposed BSPP. Based on standard rates of climb for typical aircraft

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20 A VOR is a ground-based Very high frequency Omni-directional Range station. A VOR radiates signals in all directions, which can be read as position lines radiating from the VOR station. By convention, 360 tracks or radials corresponding to each point of the compass are used. VOR instrument approaches specify that aircraft track to or from a VOR station on a specific radial, which leads the aircraft toward the airport or a runway end. VOR stations are commonly paired with distance measuring equipment (DME), which use radar principles to measure the slant distance (in nautical miles) from the ground station to a receiver in the aircraft. A ground station combining VOR and DME is called a VOR/DME. The VOR/DME station used for instrument approaches at Blythe Airport is called a VORTAC, which combines a VOR/DME with a tactical air navigation system (TACAN) used by military aircraft.
21 RNAV stands for area navigation, a technology that allows an aircraft to fly point to point on a direct course without reference to ground-based radio aids (such as a VORTAC). These "points" are called waypoints, which are predetermined geographical positions usually specified by latitude and longitude, or by radial and distance from a VORTAC, and used to define an RNAV route or instrument approach.

using the Airport, aircraft would be at altitudes of 3,200 to 5,400 feet MSL as they fly over the BSPP site, approximately 2,750 to 4,950 feet above the ground.

Obstacle Departures

Obstacle departure procedures (ODPs) are a type of instrument departure procedure designed to ensure safe aircraft separation from obstructions and obstacles after takeoff and until the aircraft reaches the en route environment. As instrument procedures, ODPs are used by aircraft operating under instrument flight rules (IFR). Pilots operating IFR in visual meteorological conditions, may not necessarily follow an ODP since they will have sufficient visibility to maintain separation from obstacles.

At Blythe Airport, ODPs are designated from all runways and are indicated on Figures 6 through 10. The ODPs for Runways 17, 35, and 8 all require right turns after takeoff (Figures 6, 7, and 8). The ODP for Runway 26 requires a left turn after takeoff (Figures 9 and 10).[22]

Flight Patterns at Blythe Airport

Figures 6 through **Figure 9** depict generalized traffic patterns for all four runway directions at Blythe Airport. The figures are generally self-explanatory, but several points deserve discussion.

Pattern Altitude – The airfield elevation is published as 397 to 399 feet MSL, and the traffic pattern altitude is established at 800 feet above airfield elevation (AFL), or approximately 1,200 feet MSL.[23]

Runway 26 and 35 Patterns – Wide traffic patterns are to be used for these runways to avoid low altitude overflights of the residential area immediately south of Interstate 10. (See Figure 7 and Figure 9.)

Departures, Runway 17 – Visual flight rules (VFR) departures from Runway 17 are to make climbing left turns.[24] (See Figure 6.)

Approaches, Runway 35 -- Aircraft landing on Runway 35 are to be established on the final approach 2 nautical miles from touchdown.[25] (See Figure 7.)

Victor Airways – Five low altitude, or Victor, airways are defined from the Blythe VORTAC, approximately 2 miles southwest of the Airport. Pilots approaching the Airport on these airways may decide to enter the traffic patterns at points other than the nominal pattern entry points, depending on the amount of traffic in the pattern. For example, aircraft headed to the Airport from Los Angeles on the V-460 airway may enter the Runway 17 pattern (Figure 6) by joining the crosswind leg rather than turning south and then back to the northwest to make a classic 45-degree entry to the downwind leg.

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22 FAA, Digital Terminal Procedures, Version 1006, effective June 3, 2010 to July 1, 2010.
23 FAA, *Airport/Facility Directory*, SW, 08 April 2010 to 03 June 2010, p. 73. FAA, Digital Terminal Procedures, Version 1006, effective June 3, 2010 to July 1, 2010.
24 FAA, *Airport/Facility Directory*, SW, 08 April 2010 to 03 June 2010, p. 73.
25 FAA, *Airport/Facility Directory*, SW, 08 April 2010 to 03 June 2010, p. 73.

On Figure 6, an extended straight-in arrival track to Runway 17 is indicated. Although this is not a standard approach to the runway, pilots may use a straight-in approach during low traffic conditions when they know that Runway 17 is active. The indicated approach track would bring aircraft directly along the eastern boundary of the proposed BSPP site and mirror arrays.

Figure 7 indicates that the nominal entry corridor for the Runway 35 traffic pattern would route aircraft over the western portion of the proposed BSPP site at altitudes ranging from 1,650 to 2,250 feet MSL, approximately 1,100 to 1,700 feet above the ground. The McCoy Mountains immediately southwest of the proposed BSPP site, with peak elevations of over 1,400 feet MSL, constrain the location of the pattern entry corridor.

Figure 10 depicts a right traffic pattern for Runway 26. The Energy Commission has recommended that prior to start of construction of Blythe Energy Project II (Blythe II -- the second phase of the natural gas-fired power station immediately east of Runway 8-26), the project owner shall petition FAA to change the traffic pattern for Runway 26 to a standard right pattern.[26] This would avoid direct overflights of the thermal plume from the Blythe II plant as aircraft transition from the base leg to the final approach. As indicated in Figure 10, a right traffic pattern would require that aircraft traversing the nominal traffic pattern entry corridor fly directly over the proposed BSPP at altitudes between 1,500 and 2,050 feet MSL, corresponding to heights of approximately 1,050 to 1,600 feet above the ground.

ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

This section includes information about the following:

1. Method for analyzing impacts
2. Direct/indirect/induced impacts and mitigation
3. Cumulative impacts and mitigation

METHOD FOR ANALYZING IMPACTS

To analyze BSPP's potential to result in direct, indirect, and cumulative adverse impacts on aviation, Energy Commission staff reviewed the project according to the following criteria:

1. Questions pertaining to airports in the "Guidelines for the Implementation of the *California Environmental Quality Act:* Appendix G, Environmental Checklist Form, Traffic and Transportation, to determine whether the project:
   a. Conflicts with an applicable plan, ordinance, or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation
   b. Results in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in a substantial safety risk
   c. Substantially increases hazards due to a design feature.

26 California Energy Commission, Blythe Energy Project II Impact Assessment, Traffic and Transportation, Summary of Findings and Conclusions, p. 187. The FAA has the sole authority to implement this recommended change.

2. Civil Aviation Safety Authority (CASA) of Australia guidelines for conducting plume rise assessments. Guidelines indicate that exhaust plumes with vertical gusts in excess of 4.3 meters per second may cause damage to airframes or upset aircraft flying at low altitudes.
3. No formally adopted methods and thresholds exist for determining the effects of glint and glare on aviation. However, staff worked with U.S. Department of Energy's Sandia National Laboratories, Energy Systems, to determine the potential of BSPP to result in glint and glare that could impact Blythe airport operations. The U.S. Department of Energy established Sandia National Laboratories' Energy Systems program as part of its mission of encouraging efficient and affordable renewable energy. Through that program, Sandia Laboratories has developed an extensive program of research and development in solar trough technology and operation.

DIRECT/INDIRECT IMPACTS AND MITIGATION

Information about the direct/indirect impacts on aviation of transmission lines; thermal plumes; glint and glare; evaporation ponds as bird attractants; the presence of large quantities of heat transfer fluid, and cumulative impacts follows. Mitigation is proposed where feasible.

Impact Assessment – Transmission Lines

The FAA is reviewing the applicant's plans for the power transmission lines and support poles. According to a report filed with the ALUC by the applicant, the proposed power transmission line that would traverse the ALUCP compatibility zones would have 39 power poles ranging in height from 90 to 145 feet above the ground.[27] The applicant has filed FAA Form 7460-1 with the FAA for the aeronautical review of these proposed poles. As of April 15, 2010, the FAA had issued determinations of no hazard for 25 of the poles, 2 of which are required to have red lights. The FAA has completed a preliminary review of the other 14 poles and has requested that the applicant provide detailed surveys before it can make an official determination. Staff checked the FAA website on July 9, 2009, and April 15 is the most recent data for FAA determinations. To date, staff has not received the complete determination from the FAA.

After consultations with the Riverside County Airport Land Use Commission, the applicant agreed to shift the proposed transmission line and towers approximately one-quarter mile further west off the extended centerline of Runway 8-26. The relocation would shift the transmission line out of Zone B1.[28] (Figure 3 depicts the sponsor's latest proposed route for the transmission line.) The illustrations prepared by the applicant indicate that, along the extended runway centerline, the transmission lines would lie approximately 200 feet below the 3-degree glide slope to Runway 8 and approximately 50 feet below the FAR Part 77 horizontal surface. The project sponsor is required to submit the revised plans to the FAA for an aeronautical study and obstruction/hazard determination. On May 28, 2010, the applicant provided a Notification of Revision

27 Blythe Solar Power Project (09-AFC-6), Response to ALUC Comments of March 22, 2010 on ALUC Application and Subsequent Correspondence by Email on April 13, 2010, Response Date: April 20, 2010, pp. 2, 13, 17.
28 Howard Balentine, Plots Depicting GenTie Clearance from 3 degree Approach Glide Slope and FAA Part 77 Horizontal Surface on Approach End of Runway 08 at the Blythe Airport, June 15, 2010.

Memorandum to the Energy Commission indicating that it has adjusted the gen-tie route further west per the request of the Riverside County Airport Land Use Commission.

Even with the applicant's change in the transmission line route, additional measures should be taken to ensure that these structures are visible to pilots. The lines and poles beneath runway approaches, typical pattern entry corridors, and typical departure routes should be marked and lighted, even if they are in conformance with FAA height requirements.[29] In addition, the applicant must submit a formal amendment to the Energy Commission before the transmission line and towers can be relocated.
The FAA recognizes that in certain cases, objects should be marked even if they may not constitute obstructions under the criteria in 14 CFR Part 77.

> Any temporary or permanent structure, including all appurtenances, that exceeds an overall height of 200 feet (61 m) above ground level (AGL) or exceeds any obstruction standard contained in 14 CFR Part 77, should normally be marked and/or lighted. However, an FAA aeronautical study may reveal that the absence of marking and/or lighting will not impair aviation safety. <u>Conversely, the object may present such an extraordinary hazard potential that higher standards may be recommended for increased conspicuity to ensure safety to air navigation.</u>[30]

In a safety study report published in 2006, the FAA noted the hazard that overhead wires can pose to aircraft.

> As with antenna towers, these high voltage/power lines or the supporting structures of these lines may not always be readily visible and the wires may be virtually impossible to see under certain conditions…. All pilots are cautioned to remain extremely vigilant for these power lines or their supporting structures when following natural flyways or during the approach landing phase.[31]

Therefore, staff recommends the Commission adopt Condition of Certification **TRANS-11** to ensure that the transmission line and poles closest to the runway are adequately marked for pilots' safety.
In addition to this measure, staff recommends that the applicant consider the feasibility of using an alternative route for the transmission line south of I-10, as indicated in **Figure 3**. Because a high proportion of operations at the Airport are for flight training and are likely to be by relatively inexperienced pilots, this modification in the location of the transmission line merits consideration.

Flight routes and traffic patterns at Blythe Airport are described below and depicted in a series of figures. The figures show that one instrument approach and five airways are defined by the Blythe VORTAC, an electronic navigational aid southwest of the Airport, depicted on Figure 3. The proposed location of the BSPP power transmission line lies

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29 This is indicated by the high proportion of local operations at the airport, estimated at 50% of all operations. Local operations are those that remain in the airport vicinity, including touch-and-goes, and are typically associated with flight training and proficiency exercises.
30 FAA Advisory Circular 70/7460-1K, *Obstruction Marking and Lighting*, February 1, 2007, p.3 (emphasis added).
31 FAA, Flight Procedure Standards Branch, AFS-420, *Safety Risk Analysis of Aircraft Overflight of Industrial Exhaust Plumes*, Safety Study Report DOT-FAA-AFS-420-06-1, January 2006, p. 4.

between the Blythe VORTAC and the Airport. The typical departure routes for takeoffs on Runway 26 (to the west) turn left, toward the point along Interstate 10 where the transmission lines are proposed to be routed east toward the Airport.

Impact Assessment – Thermal Plumes

As indicated in the information pertaining to flight routes and procedures, aircraft operating at Blythe Airport are most likely to fly over the proposed BSPP when executing missed approaches to Runway 26 when using the RNAV approach (Figure 5) and when entering the traffic pattern for Runway 35 (Figure 7). If the Runway 26 traffic pattern is changed from left to right before construction of the Blythe II plant, aircraft entering the Runway 26 pattern would also fly over the proposed BSPP site (Figure 10).

Characteristics of Thermal Plumes

The proposed BSPP includes four large air cooled condensers, each of which is 120 feet tall.[32] All are located outside the ALUCP compatibility zones.[33] The air-cooled condensers would produce thermal plumes, resulting in updrafts of varying velocities, depending on weather conditions and the level of load at the power plant. Updraft velocities would be highest when winds are calm and during full load operating conditions.[34] Because the air vented from the air-cooled condensers would contain negligible moisture and the ambient air is usually dry, water vapor would not routinely form in and around the plumes. Thus, they would usually be invisible to pilots.

The upward velocity of thermal plumes is a function of the momentum of the air as it exits the exhaust stack and the buoyancy of the air in the plume. Momentum, the initial stack exit velocity, is an important factor only for a short period. Buoyancy, created by the heat in the exhaust gases relative to the ambient air temperature, quickly becomes the dominant feature influencing plume velocity.[35]

The upward velocities of thermal plumes slow as they climb, because they entrain cooler ambient air, thus losing buoyancy. Upward velocities are greatest in calm conditions, and they become slower as winds increase, although the effect is nonlinear in two different ways. First, the effect of wind on the upward velocity decreases as the height of the plume above the exhaust stack increases. Second, the effect of wind decreases with each incremental increase in wind velocity.[36]

Table 6 presents plume velocities calculated for the proposed BSPP at various heights for worst-case conditions. Those conditions assume calm winds at the surface and upwards throughout the air column and an ambient temperature of 60 degrees Fahrenheit.

32 Solar Millennium (dba Palo Verde I, LLC), Response to request for supplemental data from Mr. Will Walters, Aspen Environmental Group, February 4, 2010.
33 The air-cooled condenser closest to the airport is approximately 135 feet outside the boundary of Zone E, according to the project applicant. See Blythe Solar Power Project (09-AFC-6), Response to ALUC Comments of March 22, 2010 on ALUC Application and Subsequent Correspondence by Email on April 13, 2010, Response Date: April 20, 2010, p. 1.
34 California Energy Commission staff report on proposed Blythe Solar Power Project, Section C.10, Traffic and Transportation, May 2010, p. C.10-44.
35 Riesman, U. and D. LeCureux, Potential for power plant stack exhaust to disrupt aircraft operations. Paper # 01-189, Greystone Environmental Consultants, Inc., Sacramento, CA, no date, p. 2.
36 Ibid, pp. 4-6.

While the effect of wind can be quite influential on plume velocities, ambient temperature has only a small effect. The average plume velocity is estimated across the plume cross-section. The air within the plume, however, would be moving at different velocities as the edges of the plume entrain ambient air. If the upward velocities are assumed to vary in the same way as a normal Gaussian distribution, the maximum velocity would be approximately two times the average velocity.[37]

Table 6
Worst-Case Predicted Plume Velocities

Height Above Ground (ft)	Average Plume Velocity (m/s)
1,000	5.22
1,100	5.03
1,200	4.86
1,300	4.72
1,400	4.59
1,500	4.48
1,600	4.37
1,700	4.28
1,800	4.19
1,900	4.11
2,000	4.03

Note: Calculations assume that the plant is operating at full load, exhaust plumes from the fans in each set of air-cooled condensers are merged, ambient temperature is 60 degrees (F), and winds are calm throughout the air column.

Source: Energy Commission staff calculations, presented in California Energy Commission staff report on proposed Blythe Solar Power Project, Section C.10, Traffic and Transportation, May 2010, p. C.10-45.Riverside County Airport Land Use Commission, *Riverside County Airport Land Use Compatibility Plan Policy Document*, October 2004.

Prepared by: Ricondo & Associates, Inc., June 2010.

Table 7 presents average hourly surface wind speeds at Blythe based on information provided by the project applicant and presented in the Revised Staff Assessment. Hourly average wind speeds are calm nearly 10% of the time and are very light (less than or equal to 1.5 meters per second, or 3.4 miles per hour) 18% of the time between 9:00 a.m. and 6:00 p.m. From an airport planning perspective, the calm and very light winds at Blythe Airport occur frequently enough to merit consideration in airport facility design and, by extension, in airport operating procedures.[38]

The observations reported in Table 7 are hourly averages. Obviously, wind speeds often vary continuously during the day, so hourly averages smooth this variable pattern. Data on wind speed variations in units of less than one hour are not available. It should be recognized, nevertheless, that brief periods of calm within an otherwise windy hour could result in thermal plumes with significant updraft velocities.

Table 7
Hourly Average Wind Speeds at Blythe from 9 a.m. to 6 p.m.

37 California Energy Commission staff report on proposed Blythe Solar Power Project, Section C.10, Traffic and Transportation, May 2010, p. C.10-44. The Gaussian, or normal, distribution is the bell-shaped curve that is presumed to represent the probability distribution of values for a given phenomenon across a wide-range of observations.

38 In planning for airport runway systems, for example, the FAA advises that the runways provide for safe aircraft operations in 95% of wind conditions. See FAA Advisory Circular 150/5300-13 CHG 6, Airport Design, Appendix 1, p. 87.

Wind Speed	Percent
Calm	9.9%
≤ 1.5 m/s (3.4 mph)	18.0%
≤ 2.1 m/s (4.7 mph)	27.2%
≤ 2.6 m/s (5.8 mph)	35.6%
>2.6 m/s (5.8 mph)	64.4%

Notes: m/s = meters per second.
Data presented in the table are for surface winds. Wind speeds can vary at different altitudes, and winds aloft influence the upward velocity of thermal plumes. Unfortunately, data for wind directions and speeds above the surface are not available for the Blythe area.
Source: California Energy Commission staff report on proposed Blythe Solar Power Project, Section C.10, Traffic and Transportation, May 2010, p. C.10-46. Based on data provided in AECOM Environment, Air Quality Modeling Files, August 28, 2009.
Prepared by: Ricondo & Associates, Inc., June 2010.

Effects of Thermal Plumes on Aircraft in Flight

In January 2006, the FAA published a safety study report on the risk to aircraft posed by industrial exhaust plumes.[39] The study included a comprehensive review of domestic accident data and found that no accidents were reported to have been caused by industrial exhaust plumes, although it appears that at least one accident attributable to exhaust plumes was inadvertently not considered in the study.[40] The study concluded that industrial exhaust plumes constituted an "acceptable risk" to aircraft in flight. The report advised, however, that given "the *potential* (however low) of aircraft upset at close proximity to high velocity plumes" flight over and around plume-generating facilities should be avoided.[41] The report recommended that the FAA continue to enhance awareness programs to inform pilots and air traffic control personnel of the potential problems associated with plumes and to offer avoidance strategies. One specific recommendation was that the *Aeronautical Information Manual* (*AIM*) should be revised to note that overflight of plume-generating industrial sites should be avoided at altitudes of less than 1,000 feet above the sites.[42]

The 2006 FAA study, as fully acknowledged in the report, was limited in scope. It did not include any data collection with respect to exhaust plume velocities, the proximity of power plants and other plume-generating industrial plants to airports, nor a review of pilot complaints with respect to industrial exhaust plumes. Neither did it systematically consider the potential for adverse effects in the vicinity of uncontrolled airports. One of the summary comments is illustrative:

> At airports where power plants could not be optimally avoided by current approach procedures or when weather resulted in plume footprints that could adversely affect airport operations, *ATC* [air traffic control] *past and present operational procedures* were deemed more than adequate to maintain established acceptable levels of risk.[43]

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39 FAA, Flight Procedure Standards Branch, AFS-420, *Safety Risk Analysis of Aircraft Overflight of Industrial Exhaust Plumes*, Safety Study Report DOT-FAA-AFS-420-06-1, January 2006.
40 In 1989, a helicopter flying over a cogeneration plant lost power and crashed after orbiting the power plant and passing over the exhaust plume. According to the accident report, a contributing factor to the accident was the "invisible nature of the exhaust gases which made detection of their presence unlikely." National Transportation Safety Board, LAX89LA270, File No. 2339.
41 Ibid., p. 16. Emphasis in original.
42 The notice has not been included in the most recent edition of the *AIM* (FAA, *Aeronautical Information Manual: Official Guide to Basic Flight Information and ATC Procedures*, February 11, 2010).
43 Ibid., p. 16. Emphasis added.

Despite this assurance, the FAA's Airport Obstructions Standards Committee (AOSC) is currently studying the effects of industrial exhaust plumes on aviation in its "Exhaust Plumes Initiative." The AOSC plans to coordinate its initial findings with other FAA organizations and stakeholders, to assess whether additional technical studies are necessary, and to determine whether any mitigation measures are required for facilities with exhaust plumes located near airports.[44]

The Civil Aviation Safety Authority (CASA) of Australia has published guidelines for conducting plume rise assessments.[45] CASA has determined that exhaust plumes with vertical gusts in excess of 4.3 meters per second may cause damage to airframes or upset aircraft flying at low altitudes. CASA notes that the stability of an aircraft is especially critical during periods of high pilot workload, as when an aircraft is being maneuvered at low altitude on approach or during the initial take-off climb segment. CASA requires that facilities producing thermal plumes with an average value exceeding 4.3 meters per second at a height of 110 meters (361 feet) above the ground be assessed for the potential hazard to aircraft operations.[46]

The air moving vertically within a thermal plume is not moving at uniform speed, nor will an aircraft necessarily enter an updraft plume squarely head-on. The air in the column is turbulent, with varying speeds across the column. If an aircraft hits the edge of a thermal plume, it is entirely possible that one wing will be pushed upward while the other is effectively depressed. At low altitudes, this can present the pilot with an extremely challenging condition, potentially leading to loss of control. The thermal updrafts from the air-cooled condensers at BSPP are of particular concern since they will be invisible to pilots.

To assess the potential impact of thermal plumes on aircraft overflights, staff has adopted CASA's vertical velocity criterion, an average of 4.3 meters per second, as a threshold of adverse impact.

The surface elevations at the sites of the air-cooled condensers range from 446 to 574 feet MSL, as indicated in Figures 5 through 10. Thus, average updraft velocities of 4.3 meters per second could reach altitudes of 2,120 to 2,245 feet MSL during calm wind conditions and peak power plant load levels. Figure 7 and Figure 10 indicate that aircraft entering the Runway 35 traffic pattern and the potential future Runway 26 right pattern would be at altitudes ranging from 1,500 to 2,250 feet MSL as they pass over the air-cooled condensers – at or below the altitudes at which average updraft velocities would exceed 4.3 meters per second.

As indicated in Figure 5, aircraft following the missed approach procedure for the Runway 26 RNAV approach will be at 3,200 to 5,400 feet MSL, corresponding to about 2,750 to 4,950 feet above the ground at the air-cooled condensers. Average plume velocities at these altitudes would be well below 4.3 meters per second.

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44 FAA, AOSC Exhaust Plume Initiative, PowerPoint presentation, February 23, 2010. In written testimony filed with California Energy Commission. See http://www.energy.ca.gov/sitingcases/mariposa/documents/others/2010-03-18_R_Pietrorazio_Industrial_Plume_Effect_on_Avaiation_TN_55980.pdf. Accessed June 13, 2010.
45 Australian Government Civil Aviation Safety Authority, Advisory Circular AC 139-05(0), June 2004.
46 Ibid, p. 2.

Aviation Safety Impact of Thermal Plumes

Thermal plumes from the air-cooled condensers at the proposed BSPP would potentially be hazardous to low-flying aircraft when winds are calm. Based on the analysis of flight patterns at the Airport, aircraft on arrival to the Airport that are flying over BSPP would be at altitudes low enough to experience turbulence from updrafts in excess of the critical average velocity of 4.3 meters per second. The risk of encountering turbulence would be heightened by the invisibility of the thermal plumes to pilots.

Low altitude overflights of the air-cooled condensers could occur if pilots are flying for extended distances to make classic 45-degree entries to the downwind leg of the Runway 35 traffic pattern (or a right pattern to Runway 26).

Staff concludes that thermal plumes present a possible significant adverse impact to pilots and recommends Condition of Certification **TRANS-7** to reduce this impact to the extent possible. This condition would require the applicant to ensure that measures are taken to inform pilots of the presence of these plumes through Aeronautical Charts, Airport/Facilities Directories (AFD) and Notice to Airmen (NOTAM

Before flying to a particular destination included in the National Airways System (NAS), pilots need to know information about specific airports, including changes in flight paths and hazards. Consequently, they consult the main references for changes in the NAS: Airport/Facilities Directories (AFD) and Aeronautical Charts. Those directories and charts are published by the Federal Aviation Administration (FAA).

Most changes to the NAS meeting NOTAM criteria are known sufficiently in advance to be carried in those publications. When those criteria are not known far enough in advance, changes are included in the Notices to Airmen publication (NTAP) or the Service A telecommunications system as a NOTAM D item or both. NOTAMS are published by the FAA every 28 days. NOTAM subscriptions are available from the FAA as well as from private vendors in e-mail format.

The latest two Notices to Airmen publications may be found on the FAA's website at the following address:
http://www.faa.gov/air_traffic/publications/notices/

Impact Assessment – Glint and Glare

With its large array of parabolic mirrors, BSPP is a potential source of glint and glare that may affect the vision of pilots operating aircraft at Blythe Airport. Glint, a momentary flash of light, and glare, a relatively continuous source of excessive brightness relative to ambient lighting, are conditions with which pilots must contend on any sunny day. Any number of objects can reflect sunlight into the sky, including windows on buildings and vehicles, lakes and ponds, polished stone surfaces, and white roofs and similar light-colored surfaces. Reflections off an aircraft itself can cause glint and glare for pilots.

Glint and glare do not necessarily pose equally serious hazards in all modes of flight. In cruise mode at relatively high altitude, pilots are more easily able to avert their eyes from the source of the glare and have time for their eyes to readjust than if they are executing low altitude maneuvers and maintaining separation from other aircraft as they prepare to land. The concern posed by the proposed BSPP is the adverse effects that glint and glare might present to pilots flying at low altitudes in and out of Blythe Airport.

Glint and glare are produced by either specular or diffuse reflection. Specular reflections occur off mirror-like surfaces, where the angle of reflection is identical to the angle of incidence from the light source. Diffuse reflections occur off rough or uneven surfaces, where the reflection angles are in all directions.[47]

The concern posed by the proposed BSPP is specular reflection off the parabolic troughs. (Diffuse reflection is not a concern at the proposed BSPP.) Glint and glare from specular reflection off the troughs could occur when the troughs are moving from a stow to a tracking position and from a tracking to a stow position. Glint and glare could also occur during the winter when the sun is low on the southern horizon and aligned with the trough, causing reflected light to spill from the north end of the troughs (referred to as end loss).[48] In the summer, when the sun rises and sets towards the north, spillage could also occur from the south end of the troughs in the early morning and early evening hours. Glint and glare can also occur at any time of day or time of year if the mirrors become misaligned with respect to the sun.

Metrics for Determining Adverse Impact

The study of the adverse effects of glare in outdoor environments is a relatively new field. As yet, neither the FAA nor the State of California has adopted standards defining thresholds beyond which glint or glare are to be considered problems. As noted above, the Riverside County ALUCP describes glare as a potential hazard to be avoided in all airport compatibility zones. The relevant policy of the ALUCP, however, does not provide guidance on the level of intensity at which glare is to be considered either especially serious or too minor to be of concern.

However, according to Policy 4.3.7 of the countywide policies of the 2004 Riverside County Land Use Compatibility Plan, the following use is prohibited:

- Any use which would cause sunlight to be reflected towards an aircraft engaged in an initial straight climb following take-off or towards an aircraft engaged in a straight final approach toward a landing at the airport.

Recently, scientists and engineers at the Solar Technologies Department at Sandia National Laboratories proposed safety metrics for assessing the effects of glint and glare, based on a review of medical research and other research undertaken by the

47 Ho, C.K., C.M. Ghanbari, and R.B. Diver. Methodology to assess potential glint and glare hazards from concentrating solar power plants: analytical models and experimental validation. In Proceedings of the 4th International Conference on Energy Sustainability, ES2010, Phoenix, AZ, May 17-22, 2010, p. 3.
48 Ho, C.K., C.M. Ghanbari, and R.B. Diver. Methodology to assess potential glint and glare hazards from concentrating solar power plants: analytical models and experimental validation. In Proceedings of the 4th International Conference on Energy Sustainability, ES2010, Phoenix, AZ, May 17-22, 2010, p. 3.

U.S. Air Force.[49] They noted that adverse effects of glint and glare are functions of the level of retinal irradiance and the subtended angle of the light source meeting the retina.[50] That is, as the intensity of light reaching the retina increases, and the subtended angle of the light source increases (becomes larger in the visual field of the observer), adverse effects on the eye increase.

The Sandia team has proposed two performance standards for describing the adverse impacts of glint and glare:

- Potential for permanent eye damage
- Potential for temporary after-image, also known as flash blindness

Both thresholds have been developed empirically and can be measured through equations accounting for the intensity of the light source and the subtended angle of the reflected image.

Permanent eye damage is caused by extremely high intensities of light that burn the retina. At substantially lower levels, the intensity of light can be great enough to cause temporary flash blindness, which is caused by bleaching the retinal pigments. Flash blindness is characterized by a temporary after-image in the visual field. Flash blindness can last for varying durations. An example of flash blindness is the effect after viewing a camera flash in a dim room.[51]

Figure 11 was developed for this study to provide criteria for assessing the potential impacts of glint and glare from the proposed BSPP facility on pilots operating at Blythe Airport. The figure presents maximum distances between the parabolic mirror and an observer at which flash blindness can occur as a function of mirror length available to reflect the sun. (Permanent eye damage is not a concern at the distances from the parabolic troughs at which aircraft will be operating.) The calculated distances assume specular reflection from a mirror with a reflectivity of 0.94, a subtended sun angle of 9.4 milliradians (mrad), and an RMS slope error of 5 mrad.[52] The focal length for the collector is assumed to be infinite, which would be true of a flat mirror. This validly represents the nature of the reflection off the long (linear) axis of the trough collector. The reflected sun image along this long axis, rather than the short parabolic axis, is the critical feature in assessing the potential for flash blindness. The reflected image of the sun along the long axis would maintain a constant subtended angle in the observer's visual field as the observer moves further from the mirror. This effect would continue until the observer is so far from the mirror that the entire image of the sun overfills the available mirror area, at which point the subtended angle of the reflected sunlight would decrease with increasing distance.

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49 Ho, C.K., C.M. Ghanbari, and R.B. Diver. Hazard analyses of glint and glare from concentrating solar power plants, SAND2009-4131C. In Proceedings of SolarPACES 2009, Berlin, Germany, September 15-18, 2009.
50 The subtended angle of the light source (or the reflected image) is a measure of the amount of the visual field that is occupied by the light source.
51 Ho, C.K., C.M. Ghanbari, and R.B. Diver. Methodology to assess potential glint and glare hazards from concentrating solar power plants: analytical models and experimental validation. In Proceedings of the 4th International Conference on Energy Sustainability, ES2010, Phoenix, AZ, May 17-22, 2010, p. 2.
52 Reflectivity is a measure of the degree to which a reflection accurately represents the light from the source. A value of 1.0 would represent perfect reflectivity. The subtended angle describes the size of the reflected image in the field of view. Mrad (milliradians) is a description of an angle subtended, or circumscribed, by a circular arc. RMS denotes root-mean-squared or the standard deviation associated with a range of distortions for slope errors along the mirror surface.

Figure 11 indicates that the maximum distance that can cause flash blindness depends on the length of the mirror available to reflect the sun (which dictates the subtended angle of the reflected sun image as a function of distance). The longer the mirror, the greater the distance capable of causing flash blindness. A flat mirror 5 meters in length would reflect sunlight intense enough to cause temporary flash blindness approximately 2,000 meters away. A flat mirror 20 meters in length would reflect sunlight that could cause temporary flash blindness a distance of 7,800 meters (approximately 4.8 miles).

Figure12 illustrates the situations during which specular reflections from the mirror arrays would extend off the BSPP plant property. The top panel is a schematic representation of end loss or spillage of the reflected solar image off the end of the parabolic mirror. This would occur when the sun is low on the horizon – during the middle of the winter, early on summer mornings, and late on summer evenings. At Blythe Airport, the sun is approximately 33 degrees above the horizon on noon of the winter solstice.[53] When the sun is 33 degrees above the horizon, and assuming that the heat collection element is 1.5 meters from the vertex of the parabolic mirror, approximately 2.3 meters at the northern edge of the mirrors would spill specular reflections of the sun off the north edge of the mirror array. Referring to Figure 11, a flat mirror 2.3 meters in length would reflect sunlight intense enough to cause flash blindness a distance of approximately 900 meters (2,950 feet).

The bottom panel on Figure 12 indicates how sunlight would be reflected if the mirror array was misaligned or moving to or from the stow position. In those situations, the entire length of the mirror would be available to create specular reflections. According to information provided by the applicant, each mirror unit is 63 feet (approximately 19 meters) long.[54] These units are arranged end-to-end in rows 1,200 to 1,300 feet (approximately 400 meters) long. If one of the mirror units was misaligned with the sun, it would reflect glare capable of causing temporary flash blindness at a distance of about 7,600 meters (approximately 4.7 statute miles). If an entire row of mirrors was misaligned, it could reflect blinding glare capable of causing temporary flash blindness considerably farther, potentially dozens of miles.[55]

Impact of Reflections from BSPP Parabolic Troughs on Aircraft in Flight

Flash blindness would be a potentially serious problem in the environs of an airport, especially an uncontrolled airport, because of the need for pilots to be able to see clearly in all directions to maintain safe separation from obstacles and other aircraft. In the immediate airport environs, aircraft are at relatively low altitudes and can be operating at low airspeeds, especially if they are on approach to land. Flash blindness, even for periods as brief as a few seconds, can impede a pilot's ability to see other traffic, to read cockpit instruments, and to react quickly and appropriately in the presence of conflicting traffic.

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www.srrb.noaa.gov/highlights/sunrise/azel.html
54 Blythe Solar Power Project, Section 2.0, Project Description, August 2009, p. 2-9.
55 The distance across which reflections would travel from a 400-meter long mirror would be so great that atmospheric attenuation typically would have to be accounted for in calculating the distance at which reflections would remain intense enough to cause flash blindness.

Figure 5 through **Figure 10** show the typical tracks flown at low altitudes by aircraft using Blythe Airport. The potential for pilots to be in the line of sight of specular reflections from the parabolic troughs is limited to only some flight tracks and aircraft operating configurations. The position of aircraft relative to the mirrors in the parabolic troughs is described below, and the potential for flash blindness is assessed.

Instrument Approaches

Figure 5 depicts the generalized flight tracks for the three instrument approaches at the Airport, including the missed approach courses. The instrument approach routes are all south of the proposed BSPP and are at relatively high angles of incidence to the north-south oriented parabolic troughs. Sunlight reflected to the southeast and southwest toward aircraft on approach to Blythe Airport is most likely to occur in the summer very early and very late in the day, when the sun is rising in the east-northeast and setting in the west-northwest.[56] Aircraft on the instrument approach routes would be at high angles of incidence to the mirrors (roughly 70 to 90 degrees) and would be at little risk of flash blindness from end loss reflections. End loss reflections of sufficient intensity to cause flash blindness would be unlikely to travel the distance to the nearest aircraft on the instrument approach routes (approximately 18,000 feet or 3.5 statute miles).

The risk of flash blindness caused by errant specular reflections would be greatest for pilots on the Runway 26 approaches early on summer mornings when the mirrors are rotating out of the nighttime stow position. Flashes of light of sufficient intensity to cause flash blindness could be reflected to the southeast for distances of several miles, based on the information provided in Figure 11. While each mirror array would reflect intense light toward the Runway 26 approach tracks for only a brief time, pilots may experience a sequence of blinding flashes as the whole set of mirror assemblies rotate out of storage.

Figure 5 also indicates the nominal missed approach tracks for each instrument approach. Only one missed approach track turns toward the proposed BSPP site. The missed approach track for the RNAV (GPS) approach to Runway 26 heads due north directly over the proposed BSPP site. Because aircraft will be climbing on the missed approach as they fly over BSPP, there is little risk of adverse impacts of glint and glare from specular reflections off the parabolic troughs. It is possible that at midday, the aircraft may catch reflected light from the parabolic troughs as they move directly over and then north of BSPP. Pilots may see some of this light as diffuse reflections off the body of the aircraft itself, but this is unlikely to be severe enough to cause flash blindness.

Runway 17 Traffic Pattern

Aircraft making a classic entry to the Runway 17 traffic pattern, depicted on **Figure 6**, would approach BSPP from the southeast at about a 45-degree angle to the parabolic troughs. On early summer mornings, when end loss reflections toward the southeast might occur, pilots entering the traffic pattern may be able to see the reflections. Because only a small portion of the mirror arrays will be the source of end loss

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56 On the day of the 2010 summer solstice (June 21) in Blythe, the sun rose at an azimuth of 61 degrees and set at 299 degrees. (National Oceanic and Atmospheric Administration, Earth System Research Laboratory, Solar Position Calculator. www.srrb.noaa.gov/highlights/sunrise/azel.html. Accessed June 28, 2010.)

reflections, blinding glare is unlikely to travel far enough to be a problem for pilots entering the Runway 17 traffic pattern. They would be no nearer than about 3.0 statute miles (approximately 16,000 feet) from the mirrors. Aircraft on other legs of the traffic pattern would not be in a position to receive direct end loss reflections from the parabolic troughs.

Pilots entering the Runway 17 traffic pattern from the southeast could be at risk of flash blindness early on summer mornings when the mirrors are being rotated out of nighttime stow positions. Because pilots normally would have the flexibility to alter their courses to avoid the blinding flashes of light at this point, the reflections would probably not cause serious problems. If several aircraft were in the traffic pattern, constraining the pilot's range of movement, the pilot may have to climb out of the pattern and go back around to try again.

Aircraft making extended straight-in approaches to Runway 17 would be flying just east of the BSPP mirror arrays. It is possible that during winter mornings, when the sun is relatively low on the southeastern horizon, specular reflections could be directed toward aircraft on these straight-in approaches. Based on the graph in **Figure 12,** aircraft would be close enough to the mirror arrays (from 1,600 to 2,000 feet or 500 to 600 meters) for pilots to be at risk of flash blindness in these situations.[57]

Runway 35 Traffic Pattern

Aircraft operating in the Runway 35 traffic pattern, depicted in **Figure 7**, would be unlikely to experience any adverse effects from end loss reflections off the parabolic troughs in the summer since they would tend to be either well south of the BSPP site (3 miles or more) or flying perpendicular to or away from the parabolic troughs. Departures to the north and northwest would be climbing as they fly over the mirror arrays, so pilots would not be exposed to direct specular reflections.

Aircraft approaching the Airport from the northwest to enter the downwind leg of the Runway 35 traffic pattern would be descending over the mirror arrays, but would be at angles ranging from approximately 20 to 60 degrees west of the north-south alignment of the parabolic troughs. It is possible that pilots could see specular reflections spilling to the northwest on winter afternoons when the sun is low on the southwest horizon. If necessary, pilots would have the flexibility on the pattern entry corridor to alter their headings to reduce the intensity of any glare to which they are exposed.

It is possible that some westbound pilots taking off on Runway 35 may choose to leave the Blythe vicinity via the Victor airways heading directly west from the Blythe VORTAC. In those cases, the most direct route to the airways would be to stay in the traffic pattern, exiting with a right turn from the downwind leg of the pattern to join the airway. In some cases, pilots may wish to fly an extended straight-out departure to gain altitude before making a climbing left turn to the crosswind leg of the pattern.

In those circumstances, pilots could be subject to reflections through the side window of the aircraft during the turn if the mirrors were out of alignment with the sun. Aircraft

57 The estimated distance is based on a 3-degree approach angle and distances of approximately 1,500 to 2,000 from the runway centerline to the nearest mirror array.

making this maneuver would be approximately 1,000 to 2,000 feet above the mirror arrays – close enough for flash blindness to be a possibility if pilots look to the left for other traffic below and to the south.

Runway 8 Traffic Pattern

Aircraft entering, operating in, and exiting the Runway 8 traffic pattern, depicted on Figure 8, would be unlikely to be exposed to significant reflection from the parabolic troughs, since they would not be flying directly toward areas where end loss reflections would most commonly be directed (to the north during the winter and to the south early and late in the day during the summer). It is possible that aircraft turning from the crosswind to the downwind leg of the pattern could receive direct end loss reflections early on summer mornings when the sun is in the northeast. This exposure would be fleeting as the aircraft executes its turn. At their closest, aircraft would be approximately 2 statute miles (approximately 10,500 feet or 3,200 meters) from the nearest parabolic trough. This would be too far for end loss reflections to be a problem, although it would be close enough to risk flash blindness caused by reflections from the parabolic troughs as they rotate out of the nighttime stow position.

Runway 26 Traffic Pattern

Aircraft in the Runway 26 traffic pattern, depicted on **Figure 9**, would be well south of the BSPP site and no closer than about 4 miles (approximately 21,000 feet) from the nearest parabolic trough when flying toward the BSPP site. At this location and distance, end loss reflections would be rare and lack sufficient intensity to cause flash blindness.

Before construction on the Blythe Energy Project II natural gas fired power plant may begin, the Energy Commission has directed the owner of that project to seek FAA action to change the Runway 26 traffic pattern to the opposite side of the Airport, as indicated in **Figure 10**. Aircraft on the crosswind leg of the right traffic pattern would be flying due north toward the parabolic mirrors before turning to the downwind leg at distances of approximately 4,000 to 7,000 feet (1,200 to 2,100 meters) from the nearest mirror array. Based on the graph in **Figure 11**, this is probably too far away for end loss reflections early on summer mornings or late on summer evenings to be intense enough to cause flash blindness.

Aircraft approaching the Airport from the northwest to enter the downwind leg of the Runway 26 right traffic pattern would be descending over the mirror arrays, but would be at angles ranging from approximately 20 to 60 degrees west of the north-south alignment of the parabolic troughs. As described for the Runway 35 pattern, it is possible that pilots could see reflections spilling to the northwest on winter afternoons when the sun is low on the southwest horizon.

In these situations, aircraft would be close enough to the mirror arrays (approximately 1,100 to 1,600 feet, or 340 to 490 meters, above the mirrors) for flash blindness to be a possibility based on the graph in **Figure 11**. Flash blindness could also be a problem for pilots flying over the parabolic mirrors if the mirrors were misaligned with the sun. If necessary, pilots in the pattern entry corridor would usually be able to alter their headings to reduce the intensity of any glare to which they are exposed.

Aviation Safety Impacts of Glint and Glare

With respect to the runways and traffic patterns at Blythe Airport, the mirror arrays at the proposed BSPP are oriented so that flash blindness would not be a problem to pilots in most circumstances. However, pilots could be exposed to flash blindness early in the morning as the mirrors are rotated out of nighttime stow positions and before sunset as they are rotated back to stow positions. In addition, flash blindness could be caused by incorrect alignments of the mirror arrays with the sun.

Specifically, flash blindness could occur in the following four operating configurations:

1. Runway 17, Straight-In Approaches – Aircraft making extended straight-in approaches could be exposed to end loss reflections from the mirror arrays on winter mornings at distances close enough to cause flash blindness.
2. Runway 35 Departures – Pilots making extended straight-out departures and climbing left turns over BSPP could be subject to reflections from the parabolic troughs through the side window of the aircraft during the turn, if the mirrors were misaligned with the sun, at distances close enough to cause flash blindness when the sun is high in the southern sky.
3. Entry to Runway 35 Pattern and Runway 26 Right Traffic Pattern – Pilots making classic entries to the traffic patterns would be flying over BSPP. They would be close enough to the mirror arrays to suffer flash blindness from reflections spilling to the northwest on winter afternoons when the sun is low on the southwest horizon and from misaligned mirrors. Pilots would have the flexibility to alter their headings on the pattern entry corridors, which could allow them to reduce the intensity of any glare to which they are exposed.

It is important to note that there have been no complaints of flash blindness or other adverse effects from pilots using Daggett airport, which is located next to the SEGS I and II solar facility. Nevertheless, staff believes that the BSPP solar troughs pose a potential significant adverse impact to pilots at the Blythe Airport and recommends conditions of certification **TRANS-7**, **TRANS-9, and TRANS-10** to reduce this impact to the extent feasible.

TRANS-7 requires the applicant to take all measures available to ensure that pilots are warned of the possible presence of glint or glare resulting from the project.

TRANS-9 requires the applicant to ensure that the project is built and operated to minimize the creation of glint and glare, including (1) attaching screening at the north end of collector assemblies to minimize the amount of light that spills off the ends; (2) ensuring that the solar arrays are properly aligned to reduce the incidences of glint and glare occurring from misalignment; and (3) bringing the arrays out of stowage before sunrise and returned to stow after sunset.

TRANS-10 requires the applicant to provide complaint forms to the airport to allow any pilots who may experience adverse glint or glare to contact the applicant. The applicant is required to contact the Energy Commission compliance project manager when it receives such a complaint, investigate whether the project was in fact responsible for the condition that triggered the complaint, and, if so, fix the source of the complaint.

Impact Assessment – Evaporation Ponds as Bird Attractants

The FAA maintains a database on wildlife strikes to aircraft. Among the 25 species considered the most hazardous to aircraft, 23 are birds.[58] The FAA reports that 92% of bird strikes occur when aircraft are at or below 3,000 feet above the ground.[59] For this reason, the FAA is particularly concerned to avoid the development of land use features that may attract wildlife hazardous to aircraft in the vicinity of airports, where aircraft are likely to be operating at low altitudes. Bodies of water near airports always raise concerns about the potential for attracting birds. This is an especially important concern in arid environments.

The FAA has published an advisory circular providing guidance to airport operators and land use planning jurisdictions for avoiding hazardous wildlife attractants near airports.[60] **Figure 13** illustrates the FAA's recommended criteria for the minimum distances separating hazardous wildlife attractants from airports and the air operations area (AOA).[61] Perimeters B and C, shown in the figure, are the relevant criteria at Blythe Airport, because the Airport serves turbine-powered aircraft. Although the evaporation ponds at the proposed BSPP are beyond the 10,000-foot distance of Perimeter B, they are within the 5 statute mile distance of Perimeter C. FAA specifically advises that hazardous wildlife attractants be avoided within Perimeter C "if the attractant could cause hazardous wildlife movement into or across the approach or departure airspace."[62]

As indicated in the aerial maps in this report, approach routes to the Airport from the north and northwest either lie directly over the proposed BSPP or between BSPP and the irrigated farmland and the Colorado River further east. Thus, birds living and roosting in the agricultural lands and river bottoms may be attracted to the BSPP evaporation ponds and fly through the airspace used by low-flying aircraft.
The FAA recognizes that it is not always possible to avoid water features near airports and AOAs. Thus, the FAA provides general guidance on mitigating the potential attractiveness of ponds and water features to wildlife.

> When it is not possible to drain a large detention pond completely, airport operators may use physical barriers, such as bird balls, wires grids, pillows, or netting, to deter birds and other hazardous wildlife. When physical barriers are used, airport operators must evaluate their use and ensure they will not adversely affect water rescue. Before installing any physical barriers over detention ponds on Part 139 airports, airport operators must get approval from the appropriate FAA Regional Airports Division Office.
>
> The FAA recommends that airport operators encourage off-airport storm water treatment facility operators to incorporate appropriate wildlife hazard

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58 FAA Advisory Circular 150/5200-33B, Hazardous Wildlife Attractants on or Near Airports, August 27, 2007, p. iii.
59 http://wildlife-mitigation.tc.faa.gov/wildlife/default.aspx. Accessed June 8, 2010.
60 FAA Advisory Circular 150/5200-33B, Hazardous Wildlife Attractants on or Near Airports, August 27, 2007.
61 In AC 150/5200-33B (p. 19), the FAA defines the AOA as, "[a]ny area of an airport used or intended to be used for landing, takeoff, or surface maneuvering of aircraft. An air operations area includes such paved areas or unpaved areas that are used or intended to be used for the unobstructed movement of aircraft in addition to its associated runway, taxiways, or apron."
62 FAA Advisory Circular 150/5200-33B, Hazardous Wildlife Attractants on or Near Airports, August 27, 2007, p. 1.

mitigation techniques into storm water treatment facility operating practices when their facility is located within the separation criteria specified in Sections 1-2 through 1-4 [as illustrated in Figure 11].[63]

Aviation Safety Impacts of Evaporation Ponds as Bird Attractants

The evaporation ponds at the proposed BSPP site have the potential to become feeding and resting areas for birds, which could pose hazards to low-flying aircraft near the Airport. However, Energy Commission staff has proposed Condition of Certification **BIO-25**, which requires (1) all ponds to be netted to exclude birds and other wildlife; and (2) additional visual bird deterrents and a rigorous monitoring program to verify that the netting is effective in excluding birds and other wildlife.

In addition, Condition of Certification **BIO-25** requires (1) monitoring of the ponds to continue for the life of the Project as well as (2) adaptive management and remedial action to discourage wildlife use if monitoring detects bird use at the ponds. Even if resident or migratory birds were initially attracted to the ponds, the netting would preclude use of the ponds for drinking, foraging, resting or nesting, and birds would be unlikely to linger in an area that provides no habitat or foraging opportunities. The lands in the immediate vicinity of the evaporation ponds would consist of solar fields that would be inhospitable to birds and other wildlife because they would be barren of vegetation that would otherwise provide cover and foraging habitat.

With implementation of Condition of Certification BIO-25, staff concludes that BSPP will not result in an increase in the number of birds in the vicinity of the Blythe Airport.

Impact Assessment – Hazardous Materials

Therminol VP1 is the heat transfer fluid that will flow through the pipes at the focal centers of the parabolic troughs and generate steam to run the electrical turbines. Therminol is a mixture of 73.5 % diphenyl ether and 26.5% biphenyl. It is solid at temperatures below 54 degrees Fahrenheit.

At the typical ambient temperatures in the Blythe area, with average annual highs of 88 degrees Fahrenheit and average annual lows of 55 degrees, Therminol should remain in a liquid state.[64] Therminol is highly flammable, and fires have occurred at other solar generating stations that use it.[65] An aircraft accident at the proposed BSPP would very likely result in an explosion and serious fire.

As indicated in Table 5, the safety compatibility policies of the Riverside County ALUCP prohibit the storage of hazardous materials in Zones A and B1.[66] No such policies apply in the other four compatibility zones. As discussed in the section on the Riverside County Airport Land Use Commission and as indicated in Figure 3, the portions of the proposed BSPP that lie within the compatibility zones are in Zones D and E. Thus, the policies of the ALUCP would not prohibit the storage and use of hazardous and flammable materials at the proposed BSPP site.

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63 FAA Advisory Circular 150/5200-33B, Hazardous Wildlife Attractants on or Near Airports, August 27, 2007, p. 6.
64 http://www.desertusa.net/Cities/ca/blythe.html. Accessed June 18, 2010.
65 The thermal solar plant near Daggett, California suffered an explosion and fire in 1999. (File information provided by the California Energy Commission staff, June 2010)
66 This policy would probably be interpreted as also prohibiting the use of hazardous material in above-ground industrial processes.

The policies of the Riverside County ALUCP related to hazardous materials are generally consistent with the guidance provided in the *California Airport Land Use Planning Handbook* (the *Handbook*).[67] The *Handbook* advises the prohibition or avoidance of hazardous materials in the zones nearest the runway ends and beneath low altitude departure turns. In zones more distant from the runways, including the traffic pattern zone, which roughly corresponds with Zone D at Blythe Airport (see Figure 3), the *Handbook* proposes no limits on hazardous materials.

The guidance in the Caltrans *Handbook* is based on an analysis of aircraft accident location data. According to the data in the *Handbook*, the pattern of aircraft accidents at 3 to 5 miles from an airport and away from frequently used approach and departure paths is widely dispersed.[68] While the *Handbook* does not provide accident probability data, per se, it does provide considerable information on the locational patterns of accidents near airports and with respect to the runway ends.

The analysis in the *Handbook* is based on the records of 873 accidents in the immediate environs of airports across the United States.[69] The data were compiled and plotted with respect to the ends of a nominal runway to reveal overall locational patterns.[70] Accidents most frequently occur very near the runway ends. As distance from the runway end and the extended runway centerline increases, the accident density pattern decreases markedly.

A series of diagrams showing accident distribution contours are presented in the *Handbook*.[71] The outermost contour shows the area within which 80% of all airport vicinity accidents occur. The diagrams for arrival accidents show a distinct clustering along the extended runway centerline, with the 80% contour extending approximately 12,500 feet off the arrival end of the runway, with a width no greater than approximately 3,000 feet.

Departure accidents tend to be more widely scattered off the runway ends. The 80% contour extends from 6,000 to 8,000 feet off the departure end of the runway and has a maximum width of approximately 6,000 feet. If the accident distribution contours were plotted for the runways at Blythe Airport, they would not extend into the proposed mirror arrays at the BSPP site.

Aviation Safety Impacts of Hazardous Materials

Neither the policies of the Riverside County ALUCP nor the guidance in the Caltrans *Handbook* would suggest that hazardous materials at the proposed BSPP site, given its location with respect to Blythe Airport, constitutes a substantial hazard to aircraft or to the public, based on the consequences of an aircraft accident.

As discussed in the previous sections, however, the proposed BSPP project has the potential to introduce hazards to air traffic in the form of thermal plumes and glare of sufficient strength to possibly result in flash blindness in certain circumstances. Staff

67 Caltrans Division of Aeronautics, *California Airport Land Use Planning Handbook*, January 2002, Table 9B, p. 9-44.
68 Caltrans Division of Aeronautics, *California Airport Land Use Planning Handbook*, January 2002, pp. 9-23 to 9-34.
69 Caltrans Division of Aeronautics, *California Airport Land Use Planning Handbook*, January 2002, p. 8-15.
70 Ibid., pp. 8-21 – 8-23, 9-26 – 9-33.
71 Ibid., pp. 9-26 – 9-23.

cannot quantify the probability that this increase in potential hazards would or could result in a plane crash. If such a crash were to happen, however, and a plane crashed into the facility, the presence of large amounts of HTF would likely ensure that such a crash would be fatal to the pilot and any other occupants of the plane.

Impact Assessment - Cumulative Impacts

Several solar thermal, solar photovoltaic, and natural gas power plants are proposed or are currently operating in the vicinity of the Blythe Airport. These include:

1. Blythe I, already operating
2. Blythe II, licensed for construction
3. At least seven proposed power plants on or in the vicinity of the Blythe Airport, including two proposed solar tower plants proposed north of the BSPP.

The two proposed solar tower plants—FPL Energy McCoy and enXco McCoy—will use solar towers. Those towers will result in glint and glare for pilots flying from Blythe Airport. In addition, three proposed and one existing power plant would be located in the Blythe Airport Land Use Compatibility Plan (ALUCP). Those plants would constrain the airspace available for low-flying aircraft operating at Blythe Airport.

These constraints are further heightened by the presence of the McCoy Mountains directly west of the Airport, which already constrains the use of low altitude airspace in that area.

Additional information about those plants follows.

Operational and Proposed Plants Around BSPP

Figure 14 depicts operational power plants, proposed power plants, and areas within which solar power plant applications have been either filed or approved in the vicinity of Blythe Airport. In addition to BSPP, two other proposed power plant projects are inside the ALUCP compatibility boundaries – the Blythe Airport Solar 1 project and the First Solar-Quartzite site. One existing plant, Phase I of the Blythe Energy Project (Blythe I), a natural gas-fired power plant (Blythe I), and one approved but unbuilt plant, Phase II of the Blythe Energy Project (Blythe II), also are inside the compatibility boundaries.

Photovoltaic

As a photovoltaic (PV) project, the Blythe Airport Solar 1 project poses substantially fewer potential problems for aviation than other kinds of power plants, including concentrating solar plants. The PV cells are specifically designed to absorb sunlight, rather than reflecting it, so glare should not be a significant issue. In addition, the plant would have no sources of thermal updrafts. Several airports are known to have installed PV plants without ill effect on airport operations.[72]

The proposed First Solar-Quartzite project would also be a photovoltaic power plant. As with the proposed Blythe Airport Solar 1 plant, no significant impacts on Blythe Airport should be expected.

72 Examples include Denver International Airport, Fresno-Yosemite International Airport, and Mineta San Jose International Airport.

Two other photovoltaic power plants are proposed in the Blythe Airport area – the Desert Lightsource Renewable Mule Mountain II and the Altera Mule Mountain facilities. Both would be photovoltaic projects that would be unlikely to cause significant impacts for flights to and from Blythe Airport.

Table 8
Potential Effects on Aviation of Existing and Proposed Power Plants Near Blythe Airport

Project Name	Project Type	Status	Effect on Aviation
Altera Mule Mountain	Photovoltaic (PV)	Under review with BLM	Potential for glint and glare effects, but likely minor, since PV cells are not highly reflective and site is 6 miles from Airport.
Blythe Airport Solar 1	Photovoltaic	Approved, construction planned	Potential for glint and glare effects, but likely minor because PV cells are not highly reflective.
Blythe Energy Project, Phase I (Blythe I)	Natural gas-fired	Built and operating	Updrafts cause turbulence on Runway 26 approach.
Blythe Energy Project, Phase II (Blythe II)	Natural gas-fired	Approved, not built	Updrafts may add to turbulence on Runway 26 approach; may affect Runway 8 departures and Runway 17 pattern traffic; would require shift in Runway 26 pattern from left to right.
Blythe Solar Power Project (BSPP)	Concentrating solar, trough mirror system	Proposed, application under review	Updrafts for Runway 35 pattern entry and right pattern entry for Runway 26. Glare would be an intermittent problem, with the potential for flash blindness in certain configurations at certain times of the day and year.
Desert Lightsource Renewables - Mule Mountain II	Photovoltaic	Under review with BLM	Potential for glint and glare effects, but likely minor, because PV cells are not highly reflective. and site is 9 miles from Airport.
enXco-McCoy	Concentrating solar, power tower	Under review with BLM	Potential for glint and glare with reflections cast upward to the collecting tower. Could affect aircraft approaching the Airport from the north on V-135 airway. Possible turbulence effects for low-lying aircraft caused by cooling condenser thermal plumes for cooling condensers.
FPL Energy-McCoy	Concentrating solar, power tower	Under review with BLM	Potential for glint and glare with reflections cast upward to the collecting tower. Could affect aircraft approaching the Airport from the north on V-135 airway. Possible turbulence effects for low-lying aircraft caused by cooling condenser thermal plumes for cooling condensers.
First Solar – Desert Quartzite	Photovoltaic	Under review with BLM	Potential for glint and glare effects, but likely minor because PV cells are not highly reflective.
Ridgeline Energy LLC – Gypsum Solar	Information not available	Information not available	Cannot determine given lack of information. Location 7 miles from Airport and away from typical approach and departure corridors, thus, impacts would probably be minimal.

Source: Information on power plants from California Energy Commission, June 2010. Assessment of potential aviation impacts by Ricondo & Associates.
Prepared by: Ricondo & Associates, Inc., June 2010.

Concentrating Solar Plants

Two projects proposed north of BSPP would be concentrating solar plants using power towers. This plant design features a central tower that collects sunlight reflected from an array of mirrors on the ground. This design presents a risk of glint and glare being cast upward into the airspace if the mirrors are occasionally misaligned with respect to the sun and the collector towers.

Glint and glare from these plants would most likely affect pilots of aircraft arriving from the north on the V-135 airway and descending as they approach the Blythe Airport vicinity. (The airways in the Airport vicinity are depicted on Figures 6 through 10.) These plants would also produce thermal plumes from the cooling condenser systems. The plumes could affect low-flying aircraft, although fewer low-flying aircraft should be over those plants than over the proposed BSPP because they are further from the Airport.

Gas-Fired Power Plants--Blythe I and Blythe II

The primary effects of the Blythe I and II plants, which are natural gas-fired generating plants, are thermal updrafts from the cooling towers and the generator exhaust stacks.[73] Given their location immediately off the approach end of Runway 26, the primary runway, they potentially create an adverse condition for aircraft on approach to land on the runway, causing turbulence during an especially critical phase of flight. Staff is not currently aware of any complaints received as a result of BEPI's thermal plume. As discussed in above, before construction of Blythe II, the project owner must seek approval from the FAA to change the traffic pattern for Runway 26 from a left to a right pattern.

In addition, the Energy Commission directed the applicant for the Blythe II power plant to obtain FAA approval for the designation of a runway other than Runway 26 as the calm wind runway.[74] A third mitigation measure adopted by the Energy Commission as a condition of approval of the Blythe II plant was that a remark be recorded for broadcast on the Automated Surface Observation System, or equivalent broadcast, advising pilots to avoid low altitude overflights of the power plant.[75]

None of the recommended conditions would alter the character of the thermal plumes associated with Blythe II. Thus, these conditions would only be effective in reducing the potential hazard to low-flying aircraft if aircraft avoid the use of Runway 26 for landings.

The paragraphs below include information concerning potential increased risks the proposed BSPP project would present to aircraft operating at Blythe Airport if the changes to the traffic pattern and calm wind runway proposed for the Blythe II project were implemented.

Changing Right Pattern on Runway 26

Figures 9 and 10 illustrate the differences in the traffic pattern and flight corridors that would result from changing the Runway 26 traffic pattern from left to right. Figure 9, identifies the location of the Victor airways with respect to the downwind leg of the traffic pattern. Four of the five airways defined from the Blythe VORTAC are oriented such that aircraft flying to Blythe on these airways would be able to transition readily from the

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73 The Energy Commission has received complaints from pilots experiencing serious turbulence on approach to Runway 26 over the Blythe I plant. California Energy Commission, Final Staff Assessment, Blythe Energy Project Phase II, Application for Certification (02-AFC-1), April 2005, pp. 4.10-17 and 4.10-36.
74 Ibid., p. 187. The "calm wind runway" is the runway designated as the primary runway when winds are light or calm.
75 California Energy Commission, Commission Decision, Blythe Energy Project Phase II, Application for Certification (02-AFC-1), December 2005, p. 190.

airway to the downwind leg of the traffic pattern. Aircraft arriving from the east on the fifth airway would be able to easily turn southeast of the Airport and then back to the northeast to enter the downwind leg of the pattern along the nominal traffic pattern entry corridor.

Figure 10 indicates that only one of the airways is well positioned for easy entry to a right pattern for Runway 26 – V-135 from the north. Aircraft on this airway could readily transition to the nominal pattern entry corridor to enter the downwind leg of the traffic pattern. However, they would fly directly over the BSPP site and be exposed to the risk of thermal plumes and, during winter afternoons, glare from the mirror arrays. Aircraft on the other airways would be required to circle the Airport to be positioned for safe entry to the traffic pattern.

Changing the Calm Wind Runway

It is customary for the longest runway most directly aligned with the prevailing winds to be designated as the calm wind runway. At Blythe, where the prevailing winds are from the southwest, Runway 26 is the best calm wind runway.[76] In addition to its alignment with respect to the prevailing winds, it is the longest and widest runway, has the greatest pavement strength rating, and has two of the three published instrument approaches.

Runway 17 is probably the best alternative calm wind runway, given the high proportion of southerly and southwesterly winds. From an aeronautical and airport operations perspective, however, Runway 17 is distinctly inferior to Runway 26. Runway 17 is approximately 740 feet shorter, has a lower pavement strength rating,[77] and lacks a full parallel taxiway. The absence of a full parallel taxiway negatively affects the efficient use of the runway and presents safety concerns, especially at an uncontrolled airport.

Without a full parallel taxiway, aircraft taking off on Runway 17 must taxi on the runway itself, in the opposite direction of landings and takeoffs, to reach the departure end of the runway. Clearly, the risk of conflicts caused by aircraft moving in opposite directions on an active runway is highly undesirable at an uncontrolled airport and itself poses an unmitigable impact.

The problems with changing the calm wind runway are sufficiently great that the FAA is unlikely to make a change without the runway pavement being strengthened and the taxiway system being improved. Even with substantial improvements to Runway 17, the lack of instrument approaches to the runway may be sufficient for the FAA to refuse to designate it as the calm wind runway.

If Runway 17 should ever be designated the calm wind runway, and BSPP is in operation, the risk of adverse impacts of glare would be heightened because of the increased likelihood of straight-in approaches to Runway 17.

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76 Coffman Associates, Blythe Airport, Airport Data Sheet, November 2001.
77 Federal Aviation Administration, *Airport Master Record*, FAA Form 5010, effective June 3, 2010; Federal Aviation Administration, *Airport/Facility Directory*, SW, 08 April 2010 to 03 June 2010, p. 73.

Summary of Cumulative Impact Analysis

Staff has also considered the potential for BSPP to cumulatively contribute to an impact to the airport. Staff has concluded that the BSPP in combination with the existing and proposed power plants on or near the Blythe Airport will contribute significantly to constraining the airspace available for low-flying aircraft operating at Blythe Airport.

The BSPP introduces into the airspace thermal plumes and glint and glare. This airspace, already compromised by the presence of Blythe I and the approved construction of Blythe II, will be compromised further by the proposed construction of two proposed and one existing power plant in the Blythe Airport Land Use Compatibility zones as well as two proposed solar tower plants—FPL Energy McCoy and enXco McCoy located north of the BSPP. Those existing and proposed plants introduce the risk of thermal updrafts and glint and glare into the airspace.

In addition, those constraints are further heightened by the presence of the McCoy Mountains directly west of the Airport, which already constrains the use of low altitude airspace in that area.

Staff is proposing mitigation to reduce and mitigate the impacts of the BSPP to the extent possible. However, staff cannot determine at this time if the effects of the proposed mitigation will reduce the cumulative impact to less than significant.

COMPLIANCE WITH LAWS, ORDINANCES, REGULATIONS AND STANDARDS

TRAFFIC AND TRANSPORTATION Table 2
Proposed Project's Consistency with
Laws, Ordinances, Regulations, and Standards Pertaining to Aviation

Applicable Law	*Description*
Federal	
Code of Federal Regulations (CFR), Title 14, Aeronautics and Space; Part 77, Objects Affecting Navigable Airspace (14 CFR 77)	This regulation includes standards for determining physical obstructions to navigable airspace; information about requirements for notices, hearings, and requirements for aeronautical studies to determine the effect of physical obstructions to the safe and efficient use of airspace. **Consistent with requirements contained in FAA Regulation, Part 77, Objects Affecting Navigable Airspace.**
State	
California *Public Utilities Code*, Section 21670 to 21707, State Aeronautics Act	The Aeronautics Act is intended to provide for the orderly development of each public use airport in California and to, among other things to minimize the public's exposure to excessive noise and safety hazards within areas around public airports. Act administered by California Department of

	Transportation, Division of Aeronautics. **Consistent. California Energy Commission staff worked with the Division of Aeronautics to help ensure project's compliance with state and federal safety regulations.**
California Airport Land Use Planning Handbook	Supports and amplifies the State Aeronautics Act and provides guidance to agencies having control over airports and land use around airports. CEQA lead agencies are required by the *Public Utilities Code* to use the handbook as a guide to determining safety compatibility issues when assessing a project within an airport influence area. **Consistent. No part of the BSPP is within any airport safety zone identified in the Caltrans Handbook or the Riverside County Airport Land Use Compatibility Plan that prohibit hazardous materials.**
Local	
Riverside County General Plan, Land Use	Pertains to public safety policies pertaining to county airports. Not consistent with Land Use 14.7, which is designed to "ensure that no structures or activities encroach upon or adversely affect the use of navigable airspace." **Undetermined. Staff has found two elements of the BSPP that could result in a significant adverse impact to the navigable airspace: thermal plumes and glint and glare from solar troughs. Consequently, staff is proposing mitigation to reduce and mitigate those impacts to the extent possible.** However, staff cannot determine whether mitigation will ensure compliance with LORS.
Riverside County Airport Land Use Compatibility Plan, 2004, Chapter 2, Countywide Policies, Policy 4.3.7	Purpose of the plan is to articulate procedures and criteria according to the California State Aeronautics Act. All applicable policies and procedures in the Riverside plan are incorporated as part of the city of Blythe's policies. This plan includes four uses that are prohibited in within any airport influence area. Two of those uses are pertinent to this project, glint and glare and plumes, although only one prohibited use is located in an airport zone of influence. "Other Flight Hazards: New land uses that may cause visual, electronic, or increased bird strike hazards to aircraft in flight shall not be permitted within any airport's influence area. Specific characteristics to be avoided include: (a) Glare or distracting lights which could be mistaken for airport lights; (b) Sources of dust, steam, or smoke which may impair pilot visibility; (c) Sources of electrical interference with aircraft communications or navigation; and (d) Any proposed use, especially landfills and certain agricultural uses, that creates an

	increased attraction for large flocks of birds. (Refer to FAA Order 5200.5A, Waste Disposal Sites on or Near Airports and Advisory Circular 150/5200-33A, Hazardous Wildlife Attractants On or Near Airports.)" **Glint and Glare**. **Undetermined.** The BSPP could result in a significant adverse impact to navigable airspace because of glint and glare from solar troughs located in an airport compatibility zone. Consequently, staff is proposing mitigation to reduce and mitigate those impacts to the extent possible. However, staff cannot determine whether mitigation will ensure compliance with LORS. **Plumes. Complies.** The BSPP consists of four, 120 feet air-cooled condensers (ACCs), one of which is 135 feet outside an airport zone of influence. It is, however, part of a unit that is located in an airport zone of influence. Those ACCs can result in plumes of approximately 4.3 meters per second at altitudes of 2,100 to 2,245 feet MSL during calm wind conditions and peak load levels. Aircraft entering the Runway 35 traffic pattern and the potential future Runway 26 right pattern would be at altitudes ranging from 1,500 to 2,500 feet MSL as they pass over the air-cooled condensers—at or below the altitudes at which average updraft velocities would exceed 4.3 meters per second. **Evaporation Ponds. Complies.** Staff concludes that the potential for the evaporation ponds to attract flocks of birds is less than significant with implementation of Condition of Certification **BIO-25**, which requires netting of the ponds, monitoring, and implementation of addition measures, if necessary, to ensure that birds are not using the ponds. **Avigation Easement. Complies.** Riverside County requires an avigation easement for BSPP. Condition of Certification TRANS-8 requires the applicant to work with the Bureau of Land Management to provide this easement to Riverside County.
City of Blythe General Plan 2025, Chapter 7, Safety Element Incorporates by reference the 2025 Blythe Airport Master Plan and the 2004 Riverside County Airport Land Use Compatibility Plan.	Establishes policies pertaining to airport safety, including minimizing injury to aircraft occupants and preventing creation of hazards to flights. Guiding policies of this section include Blythe Airport Master Plan; Land Use Compatibility Plan; and Federal Aviation Regulations Part 77. Section also contains five guiding policies concerning hazards to airspace; visual disturbances involving light and glare; and electronic devices. **"Guiding Policies: Airport/Airport Influence Area Hazards Reduction** 24. Policy: Minimize the risks associated with an off-airport accident or emergency landing.

	25. Policy: Ensure that hazardous obstructions to the navigable airspace do not occur. 26. Policy: Minimize and/or avoid land uses which can attract wildlife into the flight path. 27. Policy: Minimize the risks associated with visual hazards including distracting lights, glare, and sources of smoke. 28. Policy: Minimize the risk of electronic hazards which interfere with aircraft instruments or radio communications. **Implementation Policies: Airport/Airport Influence Area Hazards Reduction** Implementation: Development within the airport influence area shall comply with the safety and airspace protection policies contained in the Airport Land Use Compatibility Plan. Implementation: Development within the airport influence area shall comply with the height limits established in accordance with Part 77 of the Federal Aviation Regulations." **Policy 24. Complies.** Proposed BSPP mitigations are designed to reduce and mitigate risks associated with off-airport accidents or emergency landings. **Policy 25. Complies.** Project complies with all FAA requirements designed to eliminate airspace hazards. **Policy 26. Complies.** Staff concludes that the potential for the evaporation ponds to attract flocks of birds is less than significant with implementation of Condition of Certification **BIO-25**, which requires netting of the ponds, monitoring, and implementation of addition measures, if necessary, to ensure that birds are not using the ponds. **Policy 27. Complies with mitigation for glare.** The BSPP could result in a significant adverse impact to navigable airspace because of glint and glare from solar troughs located in an airport compatibility zone. Consequently, staff is proposing mitigation to reduce and mitigate those impacts to the extent possible. **Policy 27. Complies for sources of smoke.** The BSPP consists of four, 120 feet air-cooled condensers (ACCs), one of which is 135 feet outside an airport zone of influence. It is, however, part of a unit that is located in an airport zone of influence. Those ACCs can result in plumes of approximately 4.3 meters per second at altitudes of 2,100 to 2,245 feet MLS during calm wind conditions and peak load levels. Aircraft entering the Runway 35 traffic pattern and the potential future Runway 26 right pattern would be at altitudes ranging from 1,500 to 2,500 feet MSL as they pass over the air-cooled condensers—at or below the altitudes at which average updraft velocities would

	exceed 4.3 meters per second. **Policy 28. Complies.** Project design incorporates measures to ensure no electronic interference with aircraft instruments or radio communications.
Palo Verde Valley Area Plan	Incorporates Riverside County Airport Land Use Compatibility Plan, 2004, Countywide Policies. This plan includes four uses that are prohibited in within any airport influence area. Three of those uses are pertinent to this project, glint and glare, plumes, and large concentration of birds although only two prohibited uses are located in an airport zone of influence: A. The following uses shall be prohibited in all airport safety zones: (1) Any use which would direct a steady light or flashing light or red, white, green, or amber colors associated with airport operations toward an aircraft engaged in an initial straight climb following takeoff or toward an aircraft engaged in a straight final approach toward a landing at an airport, other than an FAA approved navigational signal light or visual approach slope indicator. (2) Any use which would cause sunlight to be reflected toward an aircraft engaged in an initial straight climb following takeoff or toward an aircraft engaged in a straight final approach toward a landing at an airport. (3) Any use which would generate smoke or water vapor or which would attract large concentrations or birds, or which may otherwise affect safe air navigation within the area. (4) Any use which would generate electrical interference that may be detrimental to the operation of aircraft and/or aircraft instrumentation. **Glint and Glare**. **Undetermined.** The BSPP could result in a significant adverse impact to navigable airspace because of glint and glare from solar troughs located in an airport compatibility zone. Consequently, staff is proposing mitigation to reduce and mitigate those impacts to the extent possible. However, staff cannot determine whether mitigation will ensure compliance with LORS. **Plumes. Complies.** The BSPP consists of four, 120 feet air-cooled condensers (ACCs), one of which is 135 feet outside an airport zone of influence. It is, however, part of a unit that is located in an airport zone of influence. Those ACCs can result in plumes of approximately 4.3 meters per second at altitudes of 2,100 to 2,245 feet MLS during calm wind conditions and peak load levels. Aircraft entering the Runway 35 traffic pattern and the potential future Runway 26 right pattern would be at altitudes ranging from 1,500 to

	2,500 feet MSL as they pass over the air-cooled condensers—at or below the altitudes at which average updraft velocities would exceed 4.3 meters per second. **Evaporation Ponds. Complies.** Staff concludes that the potential for the evaporation ponds to attract flocks of birds is less than significant with implementation of Condition of Certification **BIO-25**, which requires netting of the ponds, monitoring, and implementation of addition measures, if necessary, to ensure that birds are not using the ponds. **Avigation Easement. Complies.** Riverside County requires an avigation easement for BSPP. Condition of Certification TRAN-8 requires the applicant to work with the Bureau of Land Management to provide this easement to Riverside County.

CONCLUSION

As discussed above, BSPP has the potential to result in adverse impacts to the Blythe airport and pilots using the airport. Staff recommends the conditions of certification below to reduce these impacts to the extent feasible.

PROPOSED CONDITIONS OF CERTIFICATION

TRANS-7 Prior to the start of operation, the project owner shall seek and obtain FAA approval to insert comments or notations in the appropriate Aeronautical Charts, Airport/Facilities Directories, and Notice to Airmen (NOTAM) publication, to ensure that pilots are properly notified of the location of BSPP and the possible existence of thermal plumes and glint or glare from the solar arrays.

Verification: At least 30 days prior to the start of operation of any phase of the project, the project owner shall provide documentation that the AFD, NOTAM publication has been modified accordingly.

TRANS-8 Prior to the start of operation of any phase of the project, the project owner shall prepare an Avigation Easement in accordance with Appendix D of the *California Airport Land Use Planning Handbook* and have it signed by the Bureau of Land Management.

Verification: At least 60 days prior to the start of construction, the project owner shall submit a BLM-signed avigation easement to the CPM for review and approval. Once approved by the CPM, applicant shall send the Avigation Easement to the Riverside County Land Use Commission staff for review and recording purposes. Once recorded, applicant shall send a copy of the recorded document to the CPM.

TRANS-9 Prior to the start of construction, the project owner shall provide a plan to the CPM which includes the measures to be taken to reduce glint and glare to the maximum extent possible. The plan shall include the following measures designed to:

- Block end-loss reflections from reaching the sky where aircraft are operating by installing walls or screens at the north end of the parabolic trough collectors or by extending the heat collection elements beyond the north end of the collectors far enough to capture reflections when the sun is in the southern horizon, thus reducing the risk of end loss reflections.
- Ensure the mirrors are (1) brought out of stowage before sunrise and are aligned to catch the first rays of the morning sun; and (2) returned to stow position after sunset.
- Ensure mirrors are continuously monitored for malfunctions and to ensure that they remain properly aligned with the sun. Acquire appropriate equipment and establish procedures to cover inoperative or malfunctioning mirrors immediately after malfunctions are discovered to prevent the escape of errant reflections.
- Establish procedures to avoid glare while intentionally moving individual collectors off-axis to “dump” power incident on the heat collection elements during periods of high insolation. For example, if the plant operator needs to dump power and rotate several modules off-axis, the operator should start with the modules at the north-most and west-most parts of the collector field, which is furthest from the Blythe Airport to the southeast. For each module that is rotated off-axis, the operator should consider the nearest flight pattern; if it is to the east, then the module should be rotated to the west, and vice-versa. This rotating shall be done in a manner that minimizes the impact of glare on aircraft (for example, rotating modules furthest from the airport in a direction that is away from flight patterns).
- Establish procedures to avoid glare when rotating mirrors into a wind-stow position. Plant operators shall check for aircraft in the vicinity before moving the collectors into a wind-stow position.

Verification: Within 30 days prior to the start of construction, the project owner shall submit the required plan for CPM review and approval. The project owner shall also notify the CPM when the required modifications have been made and are available for inspection.

In addition, the project owner shall compile data concerning the date and time of any malfunctions, the remedies taken to correct the malfunctions, and the success of the remedies. That information shall be included in the monthly compliance reports during construction and semi-annual compliance report during operation.

TRANS-10 Throughout the construction and operation of the project, the project owner shall document, investigate, evaluate, and attempt to resolve all project-related glare complaints. The project owner or authorized agent shall:

- Use the Complaint Resolution Form (below), or functionally equivalent procedure acceptable to the CPM, to document and respond to each complaint.
- Attempt to contact the person or persons making the complaint within 24 hours. If not contacted within 24 hours, attempt to contact the person or persons for a reasonable time period, to be determined by the CPM.
- Conduct an investigation to determine the source of glare related to the complaint.
- If the glare is project related, take all feasible measures to reduce the glare at its source.
- As soon as the complaint has been resolved to the complainant's satisfaction, submit to the CPM a report in which the complaint as well as the actions taken to resolve the complaint are documented. The report shall include (1) a complaint summary, including the name and address of the complainant; (2) final results of glare reduction efforts; and (3) a signed statement by the complainant, if obtainable, in which complainant states that the glare problem is resolved to his or her satisfaction.

Verification: Within five business days of receiving a glare complaint, the project owner shall file with the City of Blythe Development Services Department, the Riverside County Planning Department, and the CPM a copy of the Glare Complaint Resolution Form, documenting the resolution of the complaint. If mitigation is required to resolve a complaint and the complaint is not resolved within three business days, the project owner shall submit an updated Glare Complaint Resolution Form when the mitigation is implemented.

TRANS-11: prior to the start of construction of the transmission line, the project owner shall submit a plan identifying measures to be taken to mark and light the lines and poles beneath runway approaches, typical pattern entry corridors, and typical departure routes pursuant to criteria included in FAAC 70/7460-1K. The plan shall identify the number and location of poles that are subject to the criteria and the exact measures to be taken to properly mark and light the poles in conformance with FAAC 70/7460.

Verification: At least 30 days prior to the start of transmission line mobilization, the project owner shall provide a construction plan for review and approval. Once the plan has been approved and implemented, the project owner shall provide documentation showing completion of the transmission line, including the required marking and lighting measures.

Form 1 - GLARE COMPLAINT RESOLUTION FORM

Blythe Solar Power Project
(09-AFC-6)

COMPLAINT LOG NUMBER ______________________

Complainant's name and address:

Phone number: ______________________

Date complaint received: ______________________
Time complaint received: ______________________

Nature of complaint:

Definition of problem after investigation by plant personnel:

Date complainant first contacted: ______________________

Description of corrective measures taken:

Complainant's signature: ______________________ Date: ___________

Approximate installed cost of corrective measures: $ ___________
Date installation completed: ___________
Date first letter sent to complainant: ___________ (copy attached)
Date final letter sent to complainant: ___________ (copy attached)

This information is certified to be correct:

Plant Manager's Signature: ______________________

(Attach additional pages and supporting documentation, as required).

REFERENCES

14 CFR Part 77, Objects Affecting Navigable Airspace, Subpart B, Notice of Construction or Alteration.

2007-2008 Grand Jury Report for the Blythe Airport, *Identifying Measures that the City of Blythe Must Take to Mitigate Aviation Impacts Associated with the Blythe Energy Plant, Phase I (BEP1)*, http://www.riverside.courts.ca.gov/grandjury/08blytheairport.pdf (accessed June 9, 2010).

Australian Government Civil Aviation Safety Authority. *Advisory Circular AC 139-05(0)*, June 2004.

Balentine, Howard. "Plots Depicting GenTie Clearance from 3 degree Approach Glide Slope and FAA Part 77 Horizontal Surface on Approach End of Runway 08 at the Blythe Airport." Memorandum to File: Solar Millennium 60139695 Task 6300, June 15, 2010.

Blythe Solar Power Project (09-AFC-6), *Response to ALUC Comments of March 22, 2010 on ALUC Application and Subsequent Correspondence by Email on April 13, 2010*, Response Date: April 20, 2010.

Blythe Solar Power Project, *Section 2.0, Project Description*, August 2009.

California Department of Transportation. *California Aviation System Plan*, December 2003.

California Department of Transportation. Division of Aeronautics. *California Airport Land Use Planning Handbook*, January 2002.

California Energy Commission. Staff report on proposed Blythe Solar Power Project, *Section C.10, Traffic and Transportation*, May 2010.

California Energy Commission. *Blythe Energy Project II Impact Assessment, Traffic and Transportation, Summary of Findings and Conclusions*, no date.

California Energy Commission. *Commission Decision, Blythe Energy Project Phase II, Application for Certification (02-AFC-1)*, December 2005.

California Energy Commission. *Final Staff Assessment, Blythe Energy Project Phase II, Application for Certification (02-AFC-1)*, April 2005.

California Energy Commission. *Staff report on proposed Blythe Solar Power Project, Section C.10, Traffic and Transportation*, May 2010.

Coffman Associates, Inc. *Airport Layout Plan*, November 16, 2001.

Coffman Associates, Inc. *Blythe Airport Master Plan*, adopted November 2001.

Coffman Associates, Inc. *Blythe Airport, Airport Data Sheet*, November 2001.

Environmental Systems Research Institute (ESRI). Data CD for Blythe, California vicinity, accessed May 2010.

County of Riverside Airport Land Use Commission Application for Major Land Use Action Review; Blythe Solar Power Project, Docket No. 09-AFC-6; Solar Millennium LLC; March 3, 2010.

County of Riverside Airport Land Use Commission. *Bylaws of the Riverside County Airport Land Use Commission*, July 2006 draft, http://www.rcaluc.org/filemanager/bylaws/RCO Bylaws.pdf (accessed June 7, 2010).

County of Riverside County Airport Land Use Commission. *Riverside County Airport Land Use Compatibility Plan Policy Document*, October 2004.

County of Riverside Airport Land Use Commission Staff Report, Case Number ZAP19996BL10-Palo Verde Solar I, LLC, May 13, 2010.

Federal Aviation Administration. Advisory Circular 70/7460-1K, *Obstruction Marking and Lighting*, February 1, 2007.

Federal Aviation Administration. Advisory Circular 150/5300-13 CHG 6, *Airport Design,* Appendix 1.

Federal Aviation Administration. Advisory Circular 150/5200-33B, *Hazardous Wildlife Attractants on or Near Airports*, August 27, 2007.

Federal Aviation Administration. *2009-2030 Terminal Area Forecast System*, http://aspm.faa.gov/main/taf.asp (accessed June 2, 2010).

Federal Aviation Administration, *Aeronautical Information Manual: Official Guide to Basic Flight Information and ATC Procedures*, February 14, 2008.

Federal Aviation Administration. *Aeronautical Information Manual: Official Guide to Basic Flight Information and ATC Procedures*, February 11, 2010.

Federal Aviation Administration. *Airport/Facility Directory*, SW, 08 April 2010 to 03 June 2010.

Federal Aviation Administration. *Airport Master Record*, FAA Form 5010, effective June 3, 2010.

Federal Aviation Administration. *AOSC Exhaust Plume Initiative, PowerPoint presentation*, February 23, 2010.

Federal Aviation Administration. *Digital Terminal Procedures,* Version 1006, effective June 3, 2010 to July 1, 2010.

Federal Aviation Administration, Flight Procedure Standards Branch, AFS-420. *Safety Risk Analysis of Aircraft Overflight of Industrial Exhaust Plumes*, Safety Study Report DOT-FAA-AFS-420-06-1, January 2006.

Federal Aviation Administration. *National Plan of Integrated Airport Systems (2009-2013)*, September 2008.

Federal Aviation Administration. Order 5190.6B, *Airport Compliance Manual*, September 2009.

Google Earth aerial photograph, Blythe Airport vicinity, dated November 30, 2004.

Ho, C.K., C.M. Ghanbari, and R.B. Diver. "Hazard Analyses of Glint and Glare from Concentrating Solar Power Plants," SAND2009-4131C. In *Proceedings of SolarPACES 2009*, Berlin, Germany, September 15-18, 2009.

Ho, C.K., C.M. Ghanbari, and R.B. Diver. "Methodology to Assess Potential Glint and Glare Hazards from Concentrating Solar Power Plants: Analytical Models and Experimental Validation." In *Proceedings of the 4th International Conference on Energy Sustainability, ES2010*, Phoenix, AZ, May 17-22, 2010.

http://airnav.com/ (accessed June 4, 2010) (Blythe Airport information).

http://ostpxweb.dot.gov/aviation/X-50%20Role_files/easeliminated.htm (accessed June 9, 2010).

http://wildlife-mitigation.tc.faa.gov/wildlife/default.aspx (accessed June 8, 2010).

http://www.desertusa.net/Cities/ca/blythe.html (accessed June 18, 2010).

http://www.energy.ca.gov/sitingcases/mariposa/documents/others/2010-03-18_R_Pietrorazio_Industrial_Plume_Effect_on_Avaiation_TN_55980.pdf (accessed June 13, 2010).

Jacobs Consultancy. *Supplemental Technical Report 1, Aviation Demand Forecasts, FAR Part 161 Application, Bob Hope Airport,* pp. 44-52, February 2009.

Kiewit, AECOM. "Blythe Solar Power Project, Figure 2, General Arrangement Site Plan," May 2010 (site plan).

Kimchi Hoang, Federal Aviation Administration. "Blythe inquiry," email to Marie McLean, California Energy Commission, June 8, 2010.

National Oceanic and Atmospheric Administration, Earth System Research Laboratory, Solar Position Calculator. www.srrb.noaa.gov/highlights/sunrise/azel.html (accessed June 28, 2010).

National Transportation Safety Board. LAX89LA270, File No. 2339.

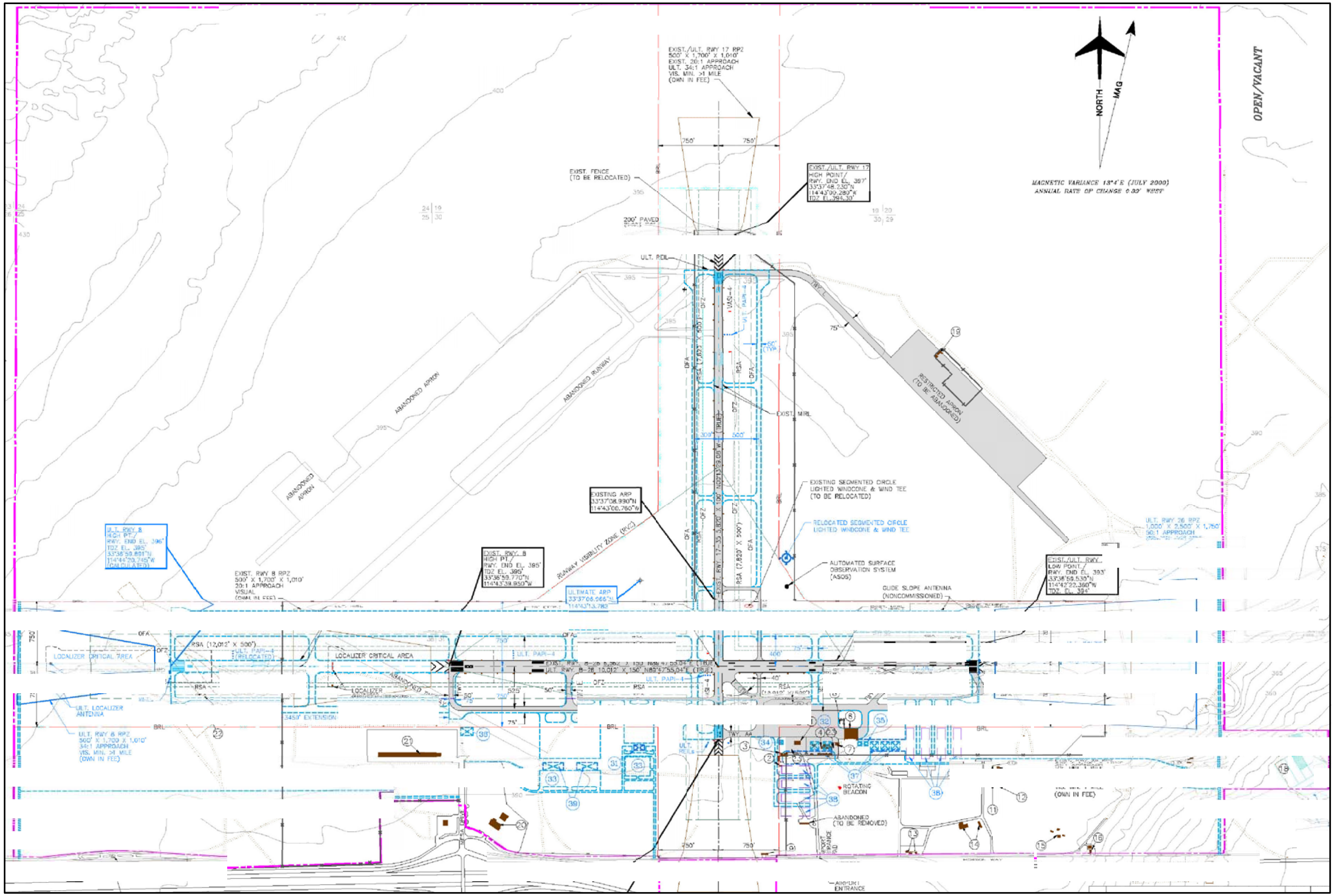
Riesman, U. and D. LeCureux. *Potential for Power Plant Stack Exhaust to Disrupt Aircraft Operations. Paper # 01-189*, Greystone Environmental Consultants, Inc., Sacramento, CA, no date.

Solar Millennium (dba Palo Verde I, LLC). "Response to Request for Supplemental Data from Mr. Will Walters, Aspen Environmental Group," February 4, 2010.

Southern California Association of Governments. *2003 General Aviation System Study for the SCAG Region*, 2003.

U.S. Census Bureau. 2000 Census of Population, Riverside County, California.

U.S. Geological Survey. National Map Seamless Server, accessed May 2010 (cities, census 2000 population data).



BUILDINGS/FACILITIES

EXISTING	ULTIMATE	DESCRIPTION
1	31	COMMERCIAL SERVICE PASSENGER TERMINAL
2		POWER VAULT
3		NATIONAL WEATHER STATION (TO BE RELOCATED)
4		PORTABLE T-HANGARS (TO BE RELOCATED)
5		TIEDOWN APRON
6		AIRCRAFT MAINTENANCE/STORAGE HANGAR
7	32	GENERAL AVIATION TERMINAL
8		ABOVE GROUND FUEL STORAGE
9		RIVERSIDE COUNTY FIRE STATION
10		HYDROPNEUMATIC TANK
11		PUMP HOUSE WELL #6
12		210,000 GALLON WATER TANK
13		U.S. BORDER PATROL
14		AIRPORT MAINTENANCE
15		BLYTHE SKEET AND TRAP CLUB
16		RIVERSIDE COUNTY ANIMAL SHELTER
17		SHOOTING RANGE
18		OXIDATION PONDS
19		AGRICULTURAL AERIAL SYSTEM
20		SOUTHWEST EXPRESS TRAVEL PLAZA
21		CON-WAY TRANSPORTATION SERVICES
22		BLYTHE DRAG RACING SANDTRACK
23	33	AUTO PARKING
	34	AIR TRAFFIC CONTROL TOWER (ATCT)
	35	AIRCRAFT WASH/MAINTENANCE FACILITY
	36	AIRCRAFT RESCUE and FIREFIGHTING (ARFF)
	37	COMMERCIAL HANGARS
	38	T-HANGAR OR CORPORATE HANGAR PARCELS
	39	AIR CARGO

LEGEND

EXISTING	ULTIMATE	DESCRIPTION
		AIRPORT PROPERTY LINE
		AIRPORT REFERENCE POINT (ARP)
		AIRPORT ROTATING BEACON
		BUILDING CONSTRUCTION
BRL	BRL	BUILDING RESTRICTION LINE (BRL)
	SAME	DIRT ROAD
		FACILITY CONSTRUCTION
		FENCING
VASI-4	PAPI-4	NAVIGATIONAL AID INSTALLATION
		RUNWAY END IDENTIFICATION LIGHTS (REIL)
		RUNWAY THRESHOLD LIGHTS
		RUNWAY EDGE LIGHTING – MIRL/HIRL
		SECTION CORNER
		SEGMENTED CIRCLE/WIND INDICATOR
1080	SAME	TOPOGRAPHIC CONTOURS

Source: Coffman Associates, November 16, 2001 (airport layout plan).
Prepared by: Ricondo & Associates, Inc., June 2010.

Figure 1

0 NTS

north

Existing and Planned Airport Facilities

LEGEND

- Highways
- Major Routes
- Railroads
- Rivers
- Lakes
- County Boundary
- State Boundary

Airports

- Runway < 5,000 ft.
- Runway >= 5,000 ft.

Cities (by population)

- Unincorporated Places
- 1 - 10,000
- 10,000 - 50,000
- 50,000 - 250,000

Note: AAF = Army Airfield
EAF = Expeditionary Airfield
MCAS = Marine Corps Air Station
NAF = Naval Air Facility

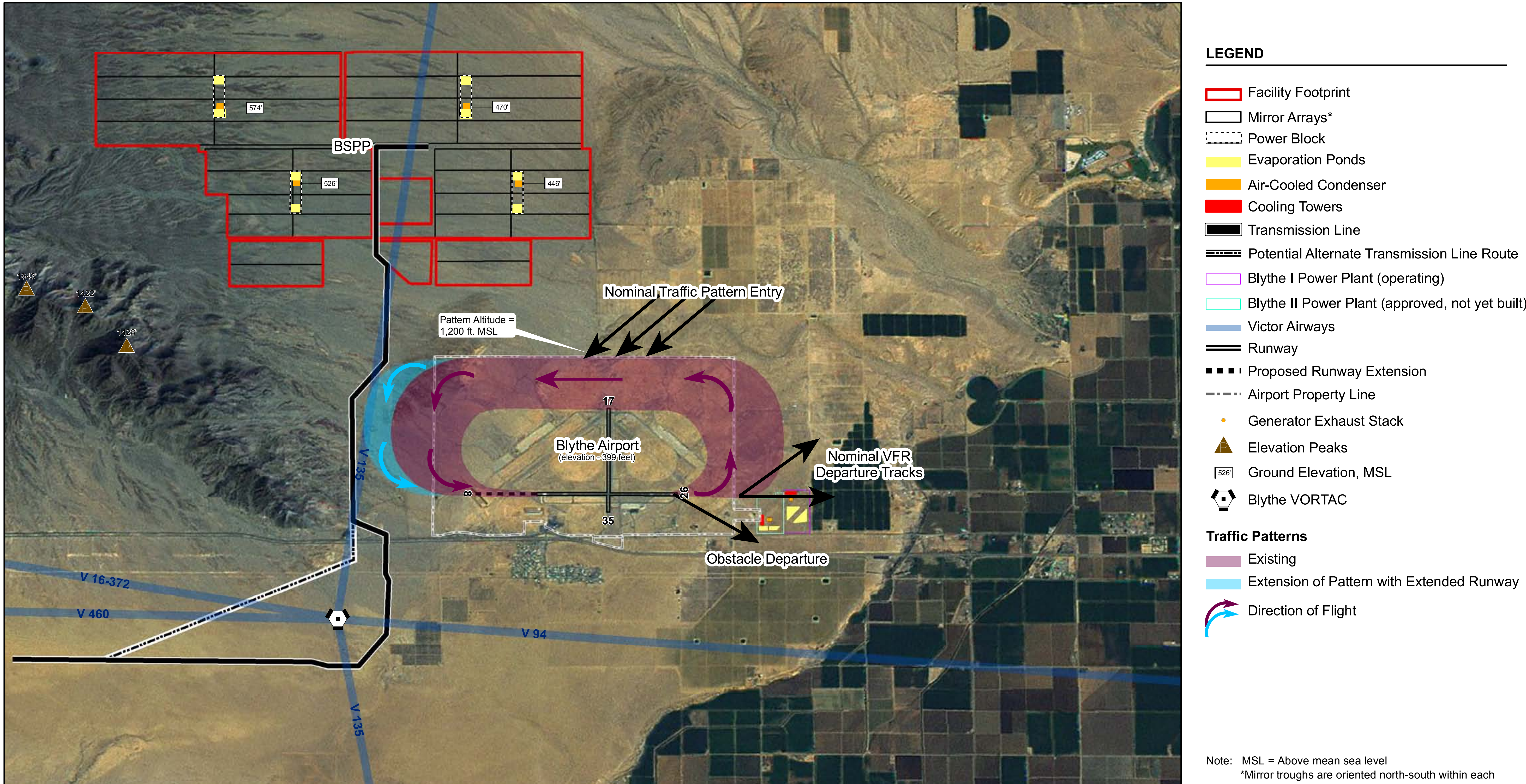
Source: U.S. Geological Survey, National Map Seamless Server, accessed May 2010 (cities, census 2000 population data); Environmental Systems Research Institute Data CD, accessed May 2010 (highways, major routes, railroads, landmarks, lakes, rivers, state boundaries, county boundaries); Bureau of Transportation Statistics, 2009 (airports).
Prepared by: Ricondo & Associates, Inc., June 2010.

Figure 2

0 20 miles

north

Blythe Airport in the Regional Setting



Note: MSL = Above mean sea level
*Mirror troughs are oriented north-south within each mirror array cell.

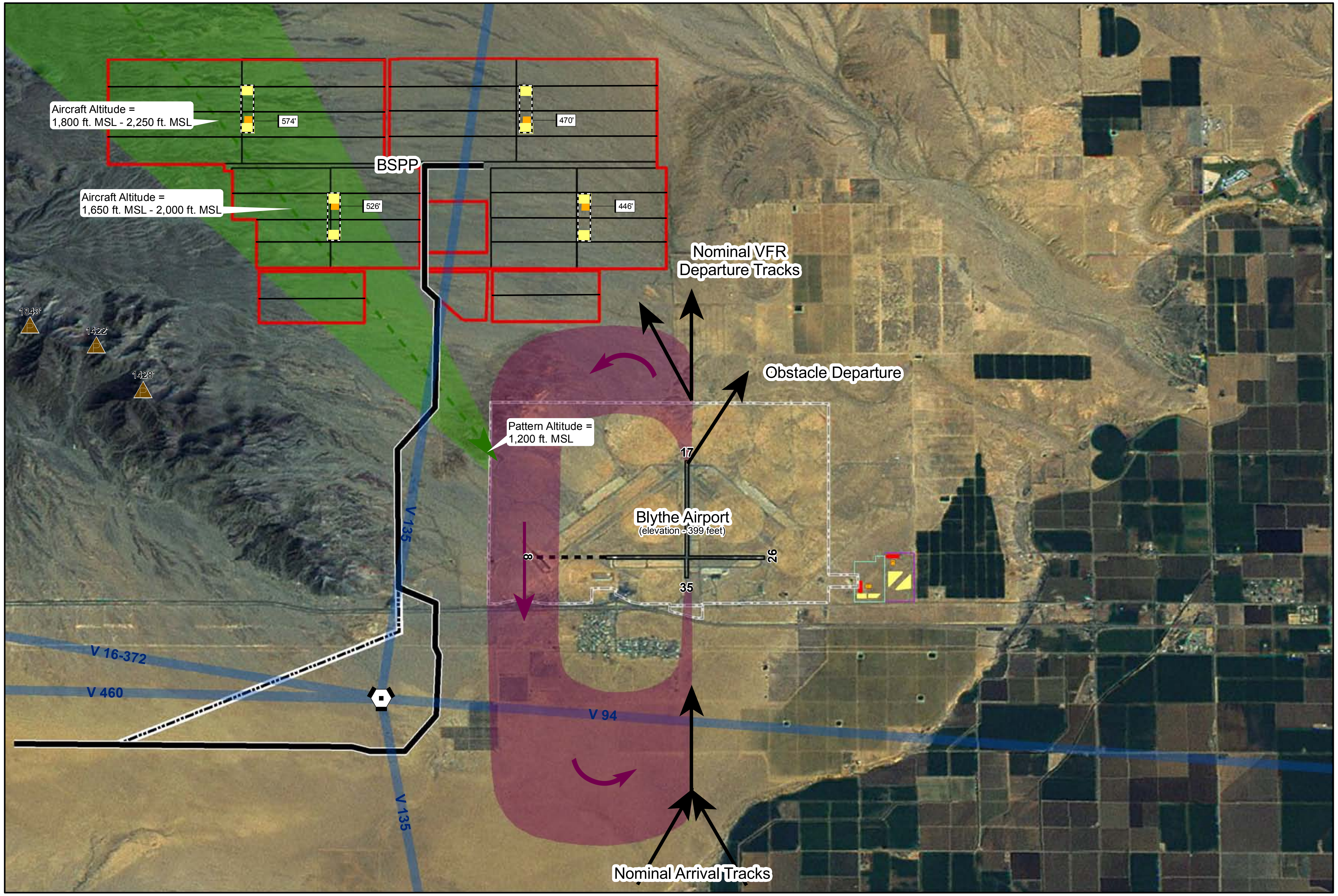
Source: Federal Aviation Administration, Airport/Facility Directory, SW, 08 APR 2010 to 03 JUN 2010, p. 73; California Energy Commission, 2010 (facility footprint, air-cooled condenser, power block, transmission line); Coffman Associates, 2001 (airport property line); Kiewit, AECOM, 2010 (mirror arrays, evaporation ponds).
Prepared by: Ricondo & Associates, Inc., June 2010.

Figure 8

0 6,000 ft

north

Generalized Traffic Pattern Runway 8



LEGEND

- Facility Footprint
- Mirror Arrays*
- Power Block
- Evaporation Ponds
- Air-Cooled Condenser
- Cooling Towers
- Transmission Line
- Potential Alternate Transmission Line Route
- Blythe I Power Plant (operating)
- Blythe II Power Plant (approved, not yet built)
- Victor Airways
- Runway
- Proposed Runway Extension
- Airport Property Line
- Generator Exhaust Stack
- Elevation Peaks
- 526' Ground Elevation, MSL
- Blythe VORTAC
- Nominal Traffic Pattern Entry
- Traffic Pattern
- Direction of Flight

Note: MSL = Above mean sea level
*Mirror troughs are oriented north-south within each mirror array cell.

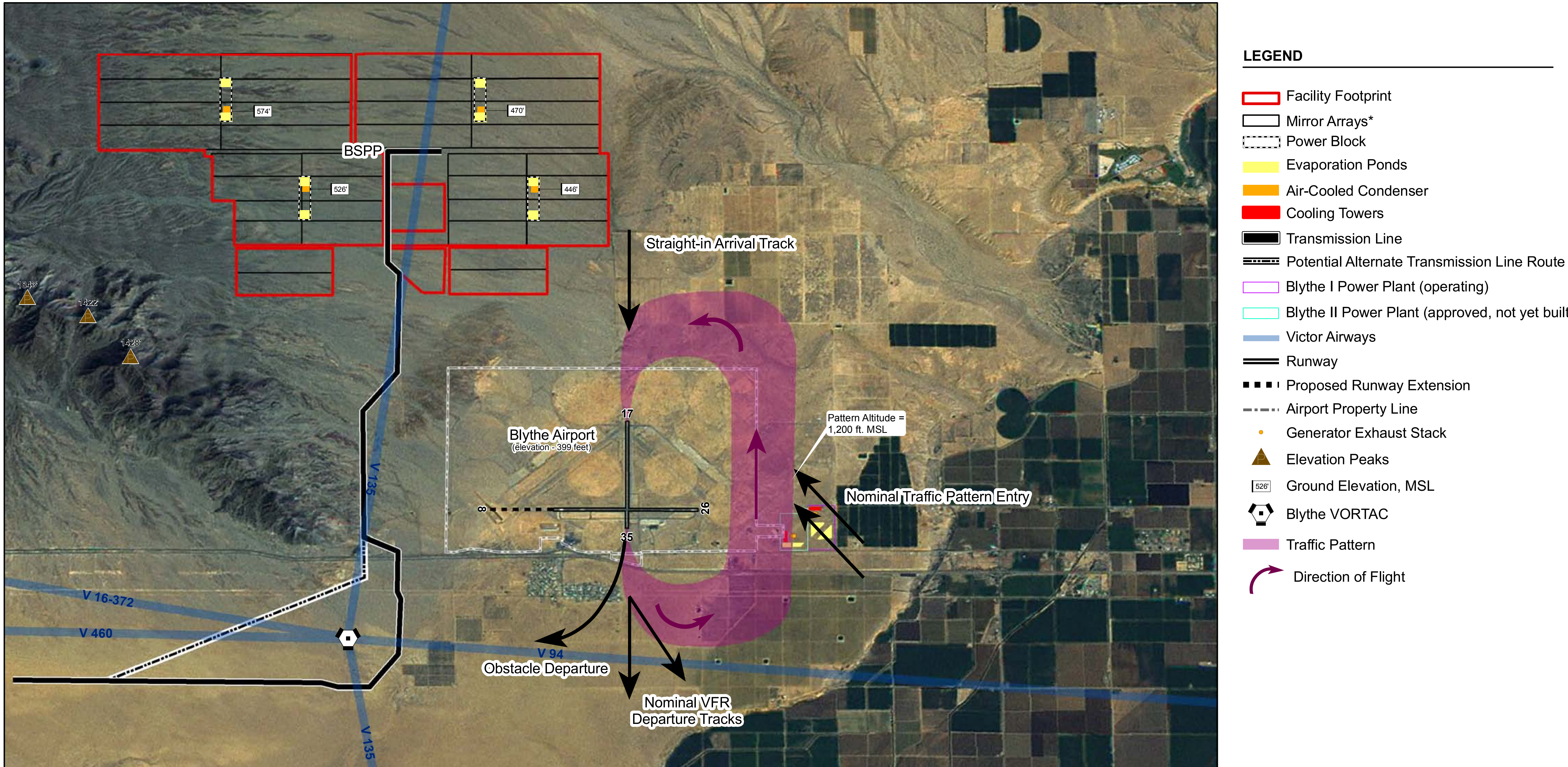
Source: Federal Aviation Administration, Airport/Facility Directory, SW, 08 APR 2010 to 03 JUN 2010, p. 73; Riverside County Airport Land Use Commission, Riverside County Airport Land Use Compatibility Plan, October 14, 2004 (Exhibit BL-7); California Energy Commission, 2010 (facility footprint, air-cooled condenser, power block, transmission line); Coffman Associates, 2001 (airport property line); Kiewit, AECOM, 2010 (mirror arrays, evaporation ponds).
Prepared by: Ricondo & Associates, Inc., June 2010.

Figure 7

0 6,000 ft

north

Generalized Traffic Pattern Runway 35

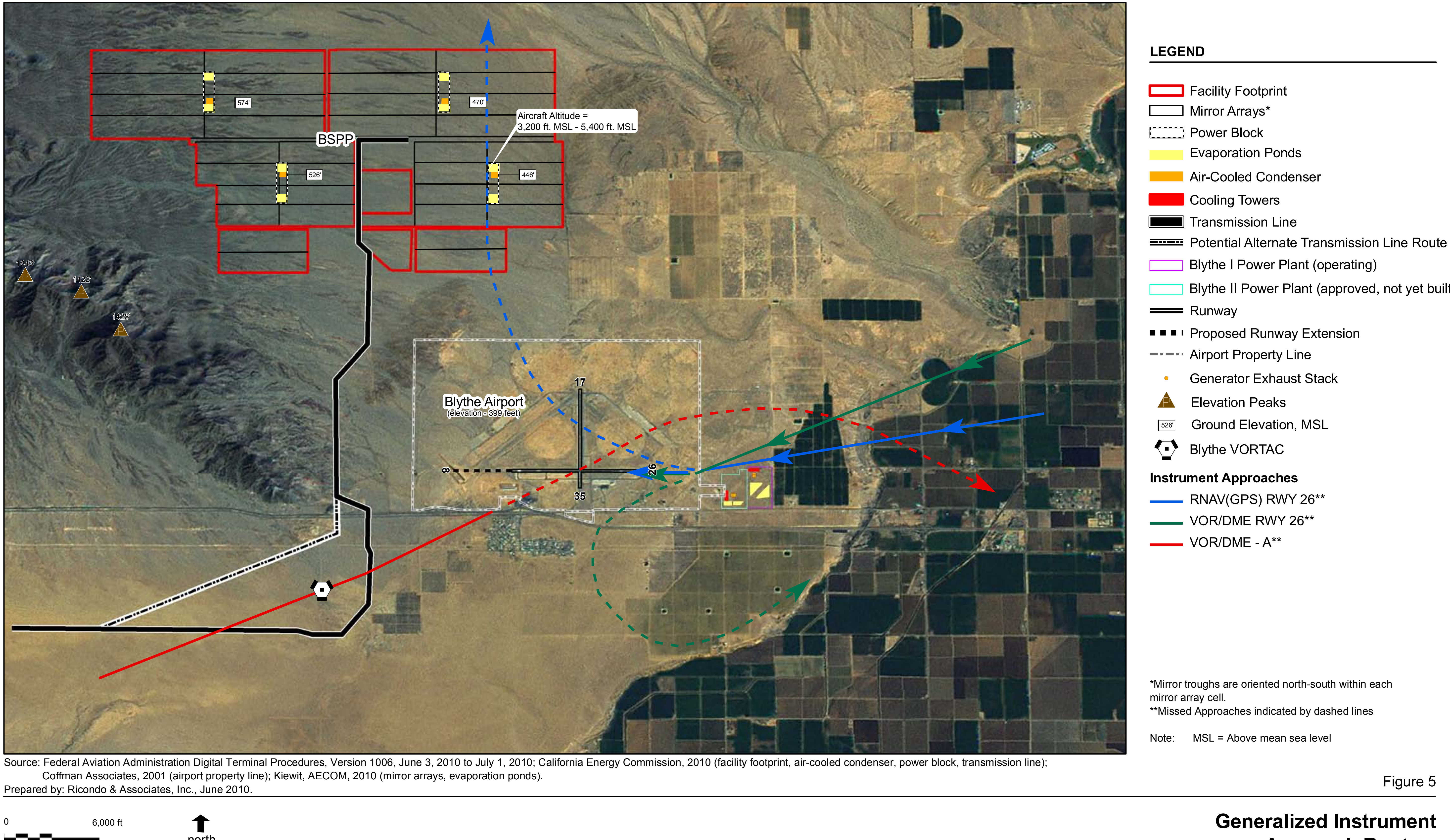


Note: MSL = Above mean sea level
*Mirror troughs are oriented north-south within each mirror array cell.

Source: Federal Aviation Administration, Airport/Facility Directory, SW, 08 APR 2010 to 03 JUN 2010, p. 73; Riverside County Airport Land Use Commission, Riverside County Airport Land Use Compatibility Plan, October 14, 2004 (Exhibit BL-7); California Energy Commission, 2010 (facility footprint, air-cooled condenser, power block, transmission line); Coffman Associates, 2001 (airport property line); Kiewit, AECOM, 2010 (mirror arrays, evaporation ponds).
Prepared by: Ricondo & Associates, Inc., June 2010.

Figure 6

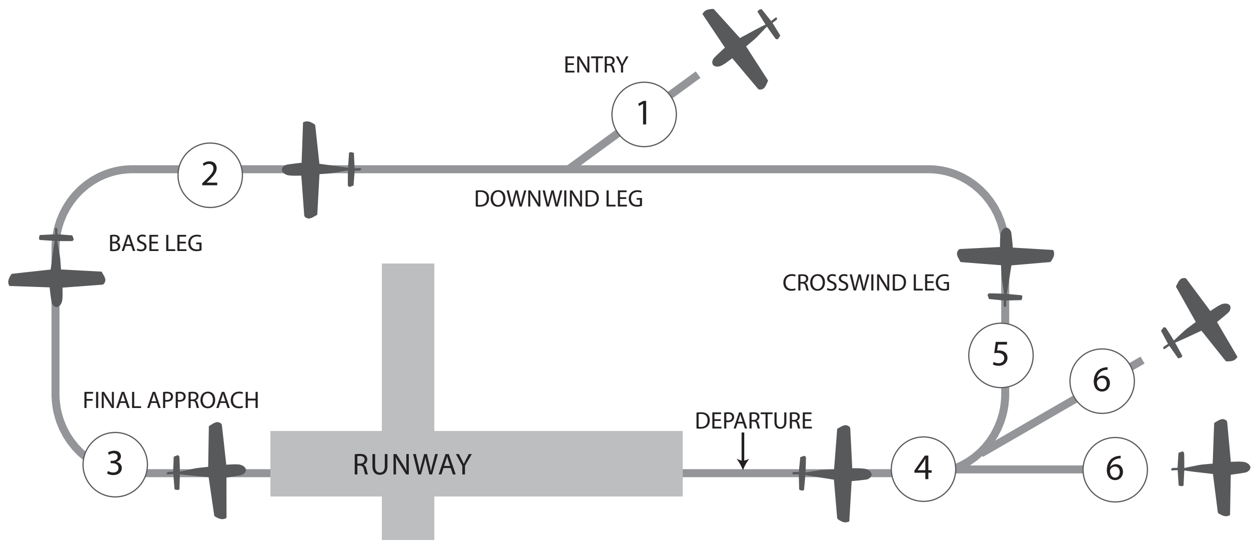
Generalized Traffic Pattern
Runway 17



Source: Federal Aviation Administration Digital Terminal Procedures, Version 1006, June 3, 2010 to July 1, 2010; California Energy Commission, 2010 (facility footprint, air-cooled condenser, power block, transmission line); Coffman Associates, 2001 (airport property line); Kiewit, AECOM, 2010 (mirror arrays, evaporation ponds).
Prepared by: Ricondo & Associates, Inc., June 2010.

Figure 5

Generalized Instrument Approach Routes



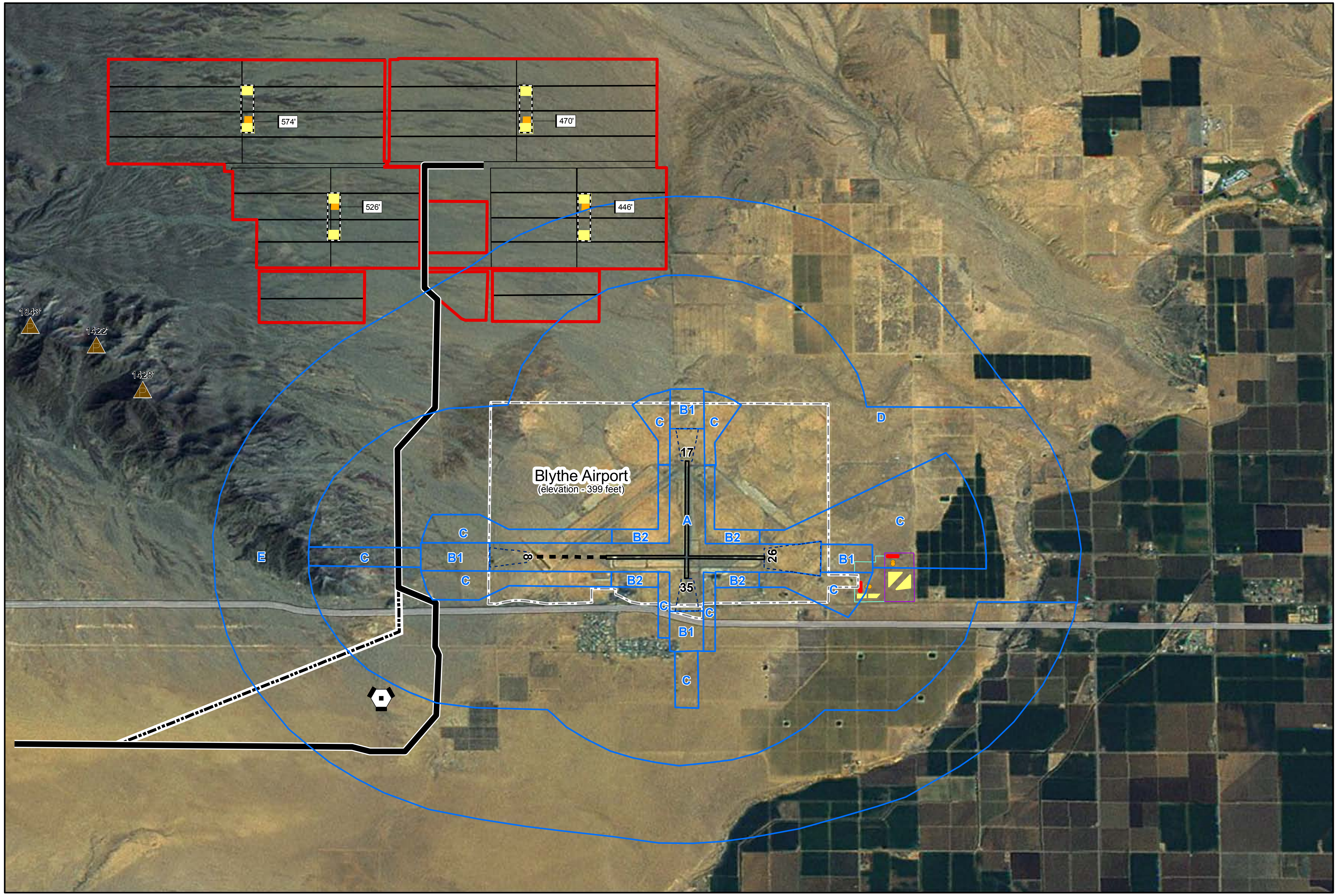
Depiction of Standard Left Traffic Pattern (Standard Right Traffic Pattern would be the Opposite)

1. Enter pattern in level flight, abeam the midpoint of the runway, at pattern altitude. (1,000' AGL is recommended pattern altitude unless established otherwise.)
2. Maintain pattern altitude until abeam approach end of the landing runway on downwind leg.
3. Complete turn to final at least 1/4 mile from the runway.
4. Continue straight ahead until beyond departure end of runway.
5. If remaining in the traffic pattern, commence turn to crosswind leg beyond the departure end of the runway within 300 feet of pattern altitude.
6. If departing the traffic pattern, continue straight out or exit with a 45 degree turn (to the left when in a left-hand traffic pattern to the right when in a right-hand traffic pattern) beyond the departure end of the runway, after reaching pattern altitude.

Source: USDOT, Federal Aviation Administration, Aeronautical Information Manual: Official Guide to Basic Flight Information and ATC Procedures, February 14, 2008.
Prepared by: Ricondo & Associates, Inc, June 2010.

Figure 4

Traffic Pattern Operations



LEGEND

- Facility Footprint
- Mirror Arrays*
- Power Block
- Evaporation Ponds
- Air-Cooled Condenser
- Cooling Towers
- Transmission Line
- Potential Alternate Transmission Line Route
- Blythe I Power Plant (operating)
- Blythe II Power Plant (approved, not yet built)
- Runway
- Proposed Runway Extension
- Airport Property Line
- Highways
- Major Routes
- Blythe Airport Compatibility Zone
- Runway Protection Zone (RPZ)
- Generator Exhaust Stack
- Elevation Peaks
- 526' Ground Elevation, MSL
- Blythe VORTAC

Note: MSL = Above mean sea level
*Mirror troughs are oriented north-south within each mirror array cell.

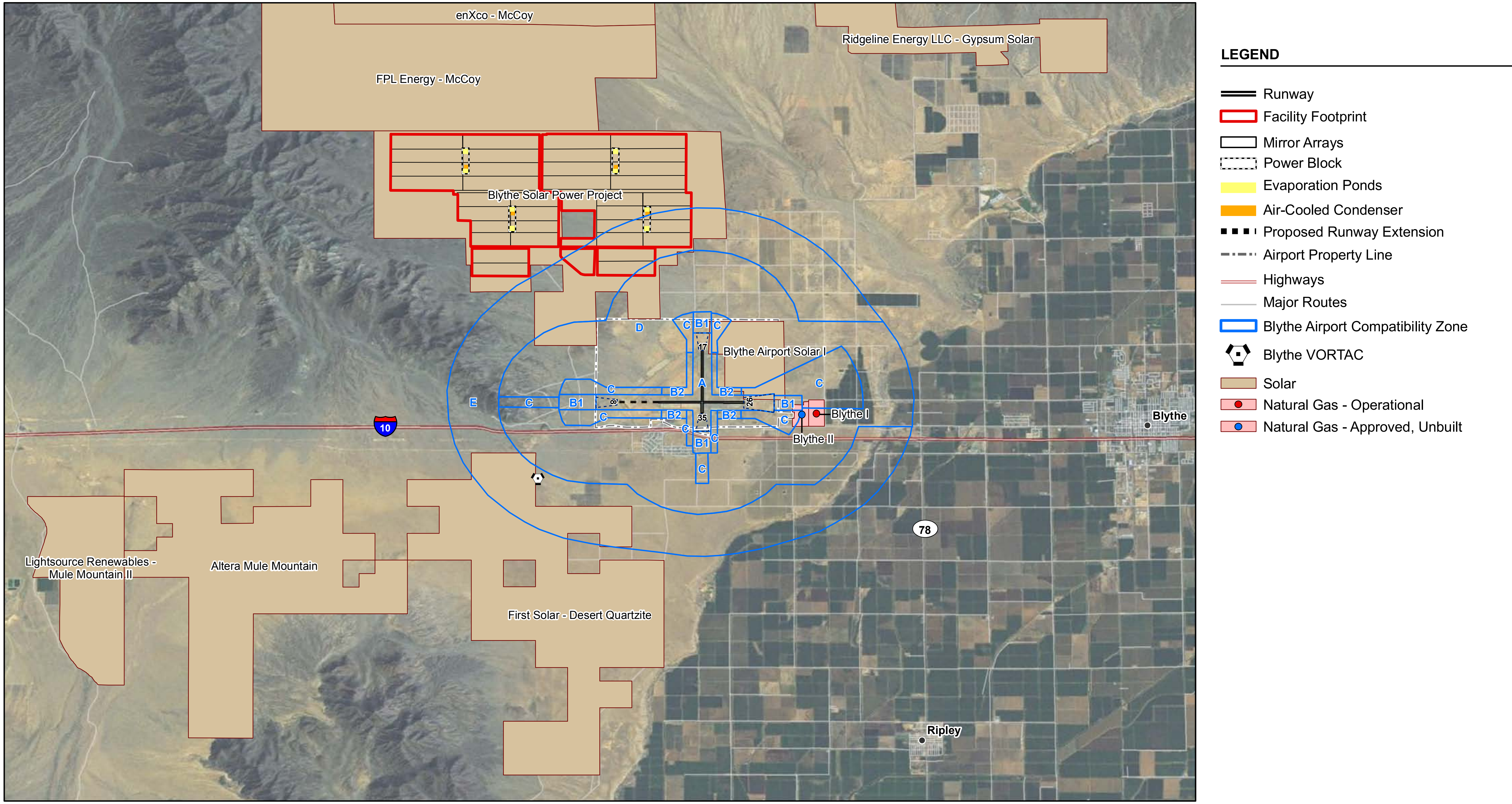
Source: Environmental Systems Research Institute Data CD, accessed May 2010 (highways, major routes), California Energy Commission (air-cooled condenser, power block, transmission line, compatibility zones, facility footprint), accessed May 2010; Coffman Associates, 2001 (airport property line); Kiewit, AECOM, 2010 (mirror arrays, evaporation ponds).
Prepared by: Ricondo & Associates, Inc., June 2010.

0 6,000 ft.

north

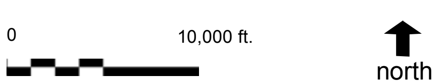
Figure 3

BSPP in Relation to ALUCP Compatibility Zones

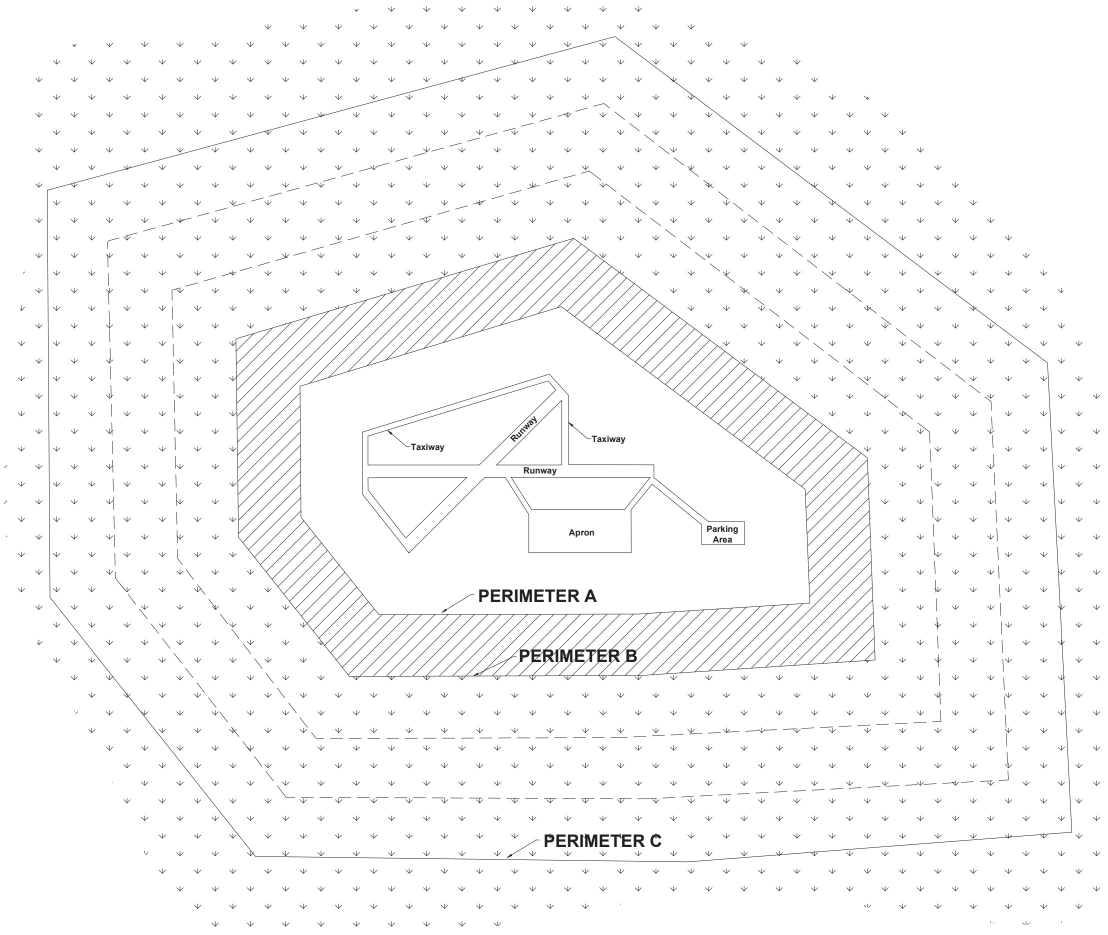


Source: Environmental Systems Research Institute Data CD, accessed May 2010 (highways, major routes), California Energy Commission (compatibility zones, major roads, air-cooled condenser, power block, facility footprint, renewable energy right of way), accessed May 2010; Coffman Associates, 2001 (airport property line).
Prepared by: Ricondo & Associates, Inc., June 2010.

Figure 14



Existing and Proposed Power Plants in Eastern Riverside County



PERIMETER A: For airports serving piston-powered aircraft, hazardous wildlife attractants must be 5,000 feet from the nearest air operations area.

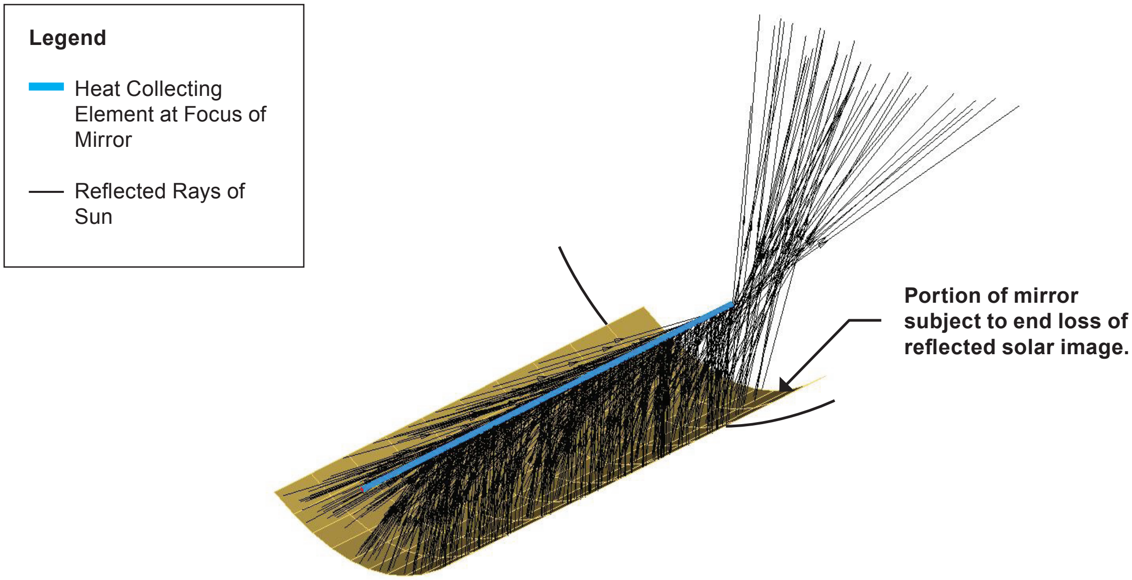
PERIMETER B: For airports serving turbine-powered aircraft, hazardous wildlife attractants must be 10,000 feet from the nearest air operations area.

PERIMETER C: 5-mile range to protect approach, departure and circling airspace.

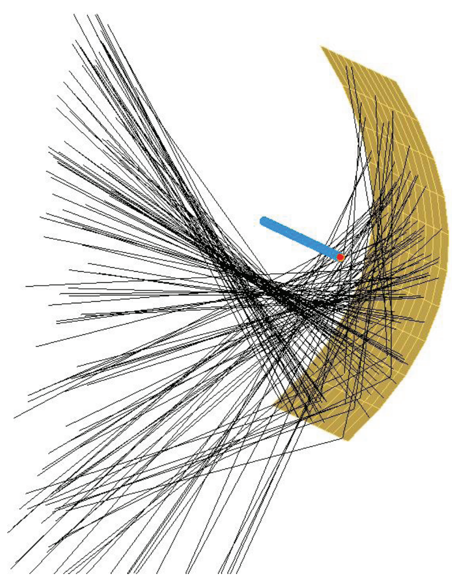
Source: FAA Advisory Circular 150/5200-33B, Hazardous Wildlife Attractants on or Near Airports, August 27, 2007.
Prepared by: Ricondo & Associates, Inc., June 2010.

Figure 13

Separation Distances for Hazardous Wildlife Attractants



Potential for end loss when sun is low on the horizon to the northeast, south, or northwest of the mirror array.

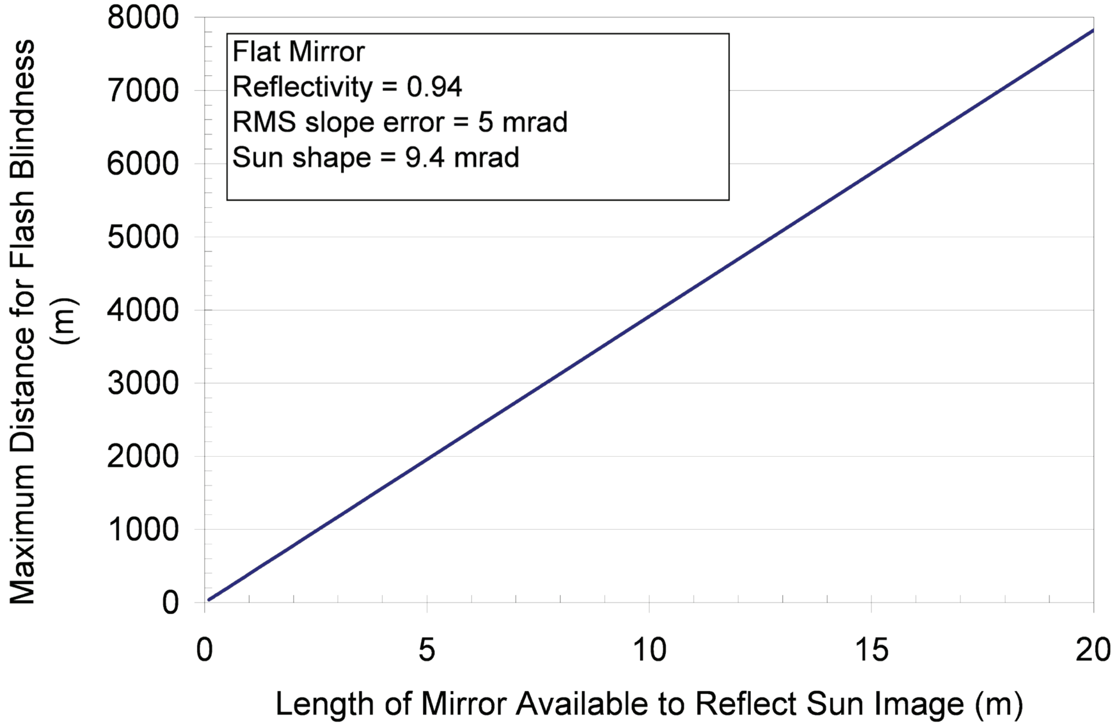


Potential for reflection along length of mirror array when misaligned with sun or when moving to or from stow position.

Source: Clifford K. Ho, June 2010.
Prepared by: Ricondo & Associates, Inc., June 2010.

Figure 12

Examples of Specular Reflection from Parabolic Trough Solar Collectors



NOTES:

mrad (milliradians)
One-thousandth of a radian. The radian is a description of an angle subtended by a circular arc. It is computed as the ratio of the length of the arc to the radius of the arc.

RMS (root mean square)
The standard deviation of multiple measurements, in milliradians, of the slope error of the mirror surface.

Slope Error
The relative angular deviation in milliradians of the mirror surface from a perfect parabolic shape.

Subtended Angle
An angle subtended by (or lying within) a circular arc. In this analysis, the subtended angle describes the relative size of a reflected image, with the circular arc representing the field of view of a person with normal vision.

Sun Shape
The relative size of the sun in the visual field of a person with normal vision. (The total size of the visual field is 1 radian.)

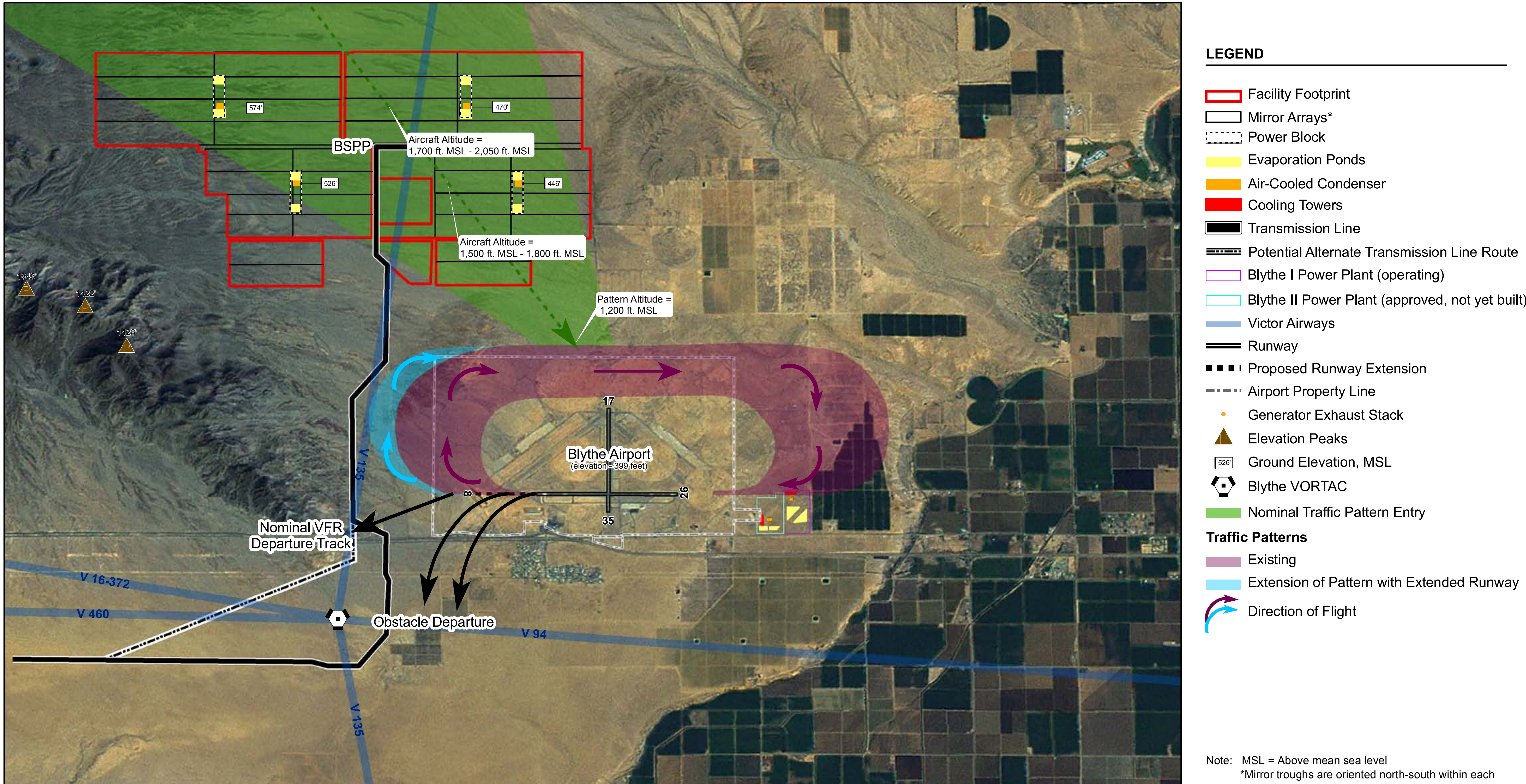
1/ The calculation of maximum distances for flash blindness assumes that the collector is flat and focal length is infinite, which is true along the long-axis of the linear collector. The calculation is derived from Ho et al., Methodology to assess potential glint and glare hazards from concentrating solar power plants: analytical models and experimental validation. In Proceedings of the 4th International Conference on Energy Sustainability, ES2010, Phoenix, AZ, May 17-22, 2010, p. 2.

2/ Typical RMS slope errors of current parabolic trough collectors are approximately 5 to 6 mrad (personal communication, Tim Moss, Sandia National Laboratories, 6/16/2010).

Source: Clifford K. Ho, June 2010.
Prepared by: Ricondo & Associates, Inc., June 2010.

Figure 11

Maximum Distances at Which Flash Blindness May Occur from Specular Reflections at BSPP*



Note: MSL = Above mean sea level
*Mirror troughs are oriented north-south within each mirror array cell.

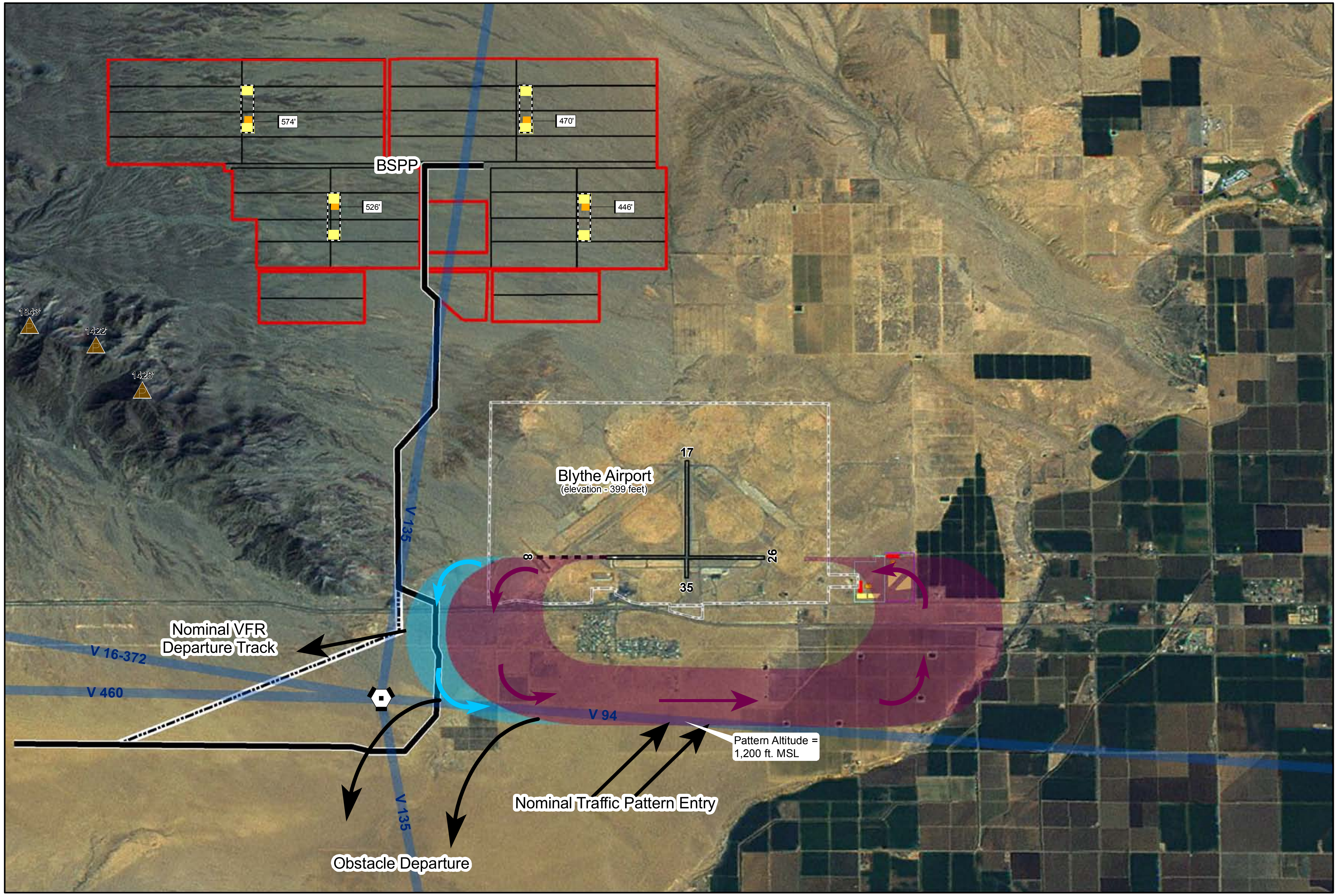
Source: Size of pattern based on standard left pattern presented in: Riverside County Airport Land Use Commission, Riverside County Airport Land Use Compatibility Plan, October 14, 2004 (Exhibit BL-7);
California Energy Commission, 2010 (facility footprint, air-cooled condenser, power block, transmission line; Coffman Associates, 2001 (airport property line); Kiewit, AECOM 2010 (mirror arrays, evaporation ponds).
Prepared by: Ricondo & Associates, Inc., June 2010.

Figure 10

0 6,000 ft

north

Potential Future Runway 26
Right Traffic Pattern



LEGEND

- Facility Footprint
- Mirror Arrays*
- Power Block
- Evaporation Ponds
- Air-Cooled Condenser
- Cooling Towers
- Transmission Line
- Potential Alternate Transmission Line Route
- Blythe I Power Plant (operating)
- Blythe II Power Plant (approved, not yet built)
- Victor Airways
- Runway
- Proposed Runway Extension
- Airport Property Line
- Generator Exhaust Stack
- Elevation Peaks
- 526' Ground Elevation, MSL
- Blythe VORTAC

Traffic Patterns

- Existing
- Extension of Pattern with Extended Runway
- Direction of Flight

Note: MSL = Above mean sea level
*Mirror troughs are oriented north-south within each mirror array cell.

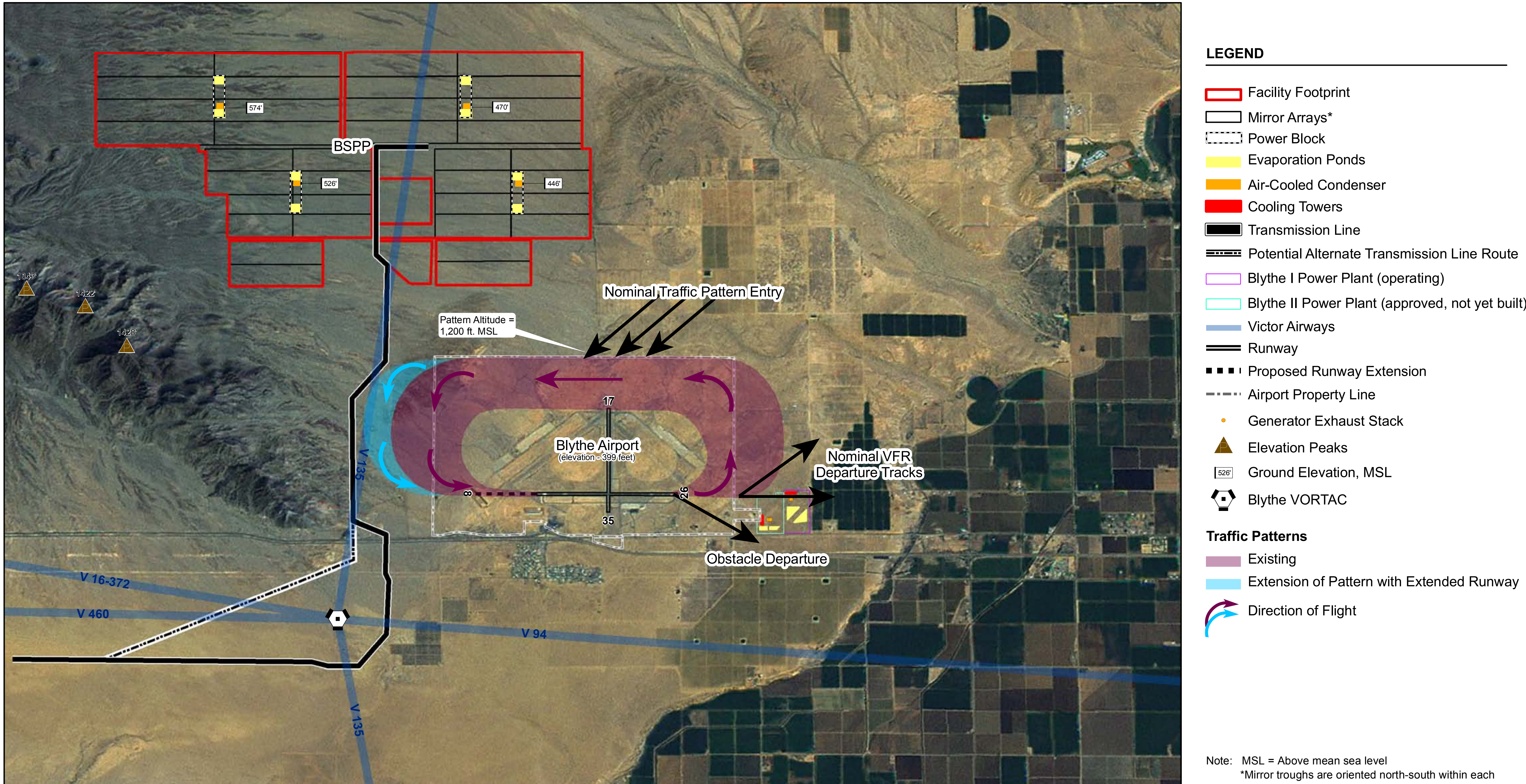
Source: Federal Aviation Administration, Airport/Facility Directory, SW, 08 APR 2010 to 03 JUN 2010, p. 73; Riverside County Airport Land Use Commission, Riverside County Airport Land Use Compatibility Plan, October 14, 2004 (Exhibit BL-7); California Energy Commission, 2010 (facility footprint, air-cooled condenser, power block, transmission line); Coffman Associates, 2001 (airport property line); Kiewit, AECOM, 2010 (mirror arrays, evaporation ponds).
Prepared by: Ricondo & Associates, Inc., June 2010.

0 6,000 ft

north

Figure 9

Generalized Traffic Pattern
Runway 26



Note: MSL = Above mean sea level
*Mirror troughs are oriented north-south within each mirror array cell.

Source: Federal Aviation Administration, Airport/Facility Directory, SW, 08 APR 2010 to 03 JUN 2010, p. 73; California Energy Commission, 2010 (facility footprint, air-cooled condenser, power block, transmission line); Coffman Associates, 2001 (airport property line); Kiewit, AECOM, 2010 (mirror arrays, evaporation ponds).
Prepared by: Ricondo & Associates, Inc., June 2010.

Figure 8

0 6,000 ft

north

Generalized Traffic Pattern
Runway 8

JAMES EARL JEWELL, LC, ATF, IES, CIES (Hon), SAH

EDUCATION:

BA, College of the Pacific
MFA, School of Drama, Yale University

EMPLOYMENT:

1957-67, Engineering Division, Holzmueller Corporation
1967-69, Theatre Consulting Service, Bolt, Beranek & Newman
1969-87, Lighting Services Administrator, Pacific Gas & Electric Company
1987- present, Consultant in Lighting
Since 1993 in association with Alan Lindsley, AIA, IES

PROFESSIONAL ACTIVITIES:

Illuminating Engineering Society
President – 1984-85
Vice President – 1983-84
Director – 1979-86
Office Lighting Committee – 1976 - present, Chairman, 1978-80
Roadway Lighting Committee – 1974 – present, Chairman, 1990-92
Regional Energy Committee Chairman – 1974-76, 1978-84
Energy Advisory Committee – 1973-75
Technical Missions – China – 1984, 1987, 1988

European Lighting Congress: Strasbourg, 1969; Florence, 1977; Granada, 1981; Lausanne, 1985; Budapest, 1989; Edinburgh, 1993; Berlin, 2001

Pacific Basin Lighting Congress: Chairman, Shanghai, 1989; Bangkok, 1993; Nagoya, 1997; Organizing Committee, Delhi, 2002; Cairns, 2005; Bangkok, 2009

Edison Electric Institute: Street Lighting Committee – 1971-87, Chairman 1979-81

International Commission on Illumination:
Board of Administration – 1983-87, 1987-91
Division Four (Lighting for Transport)
Technical Committee 4.34 -- 1980-95
Technical Committee 4.25 -- 1992-99

Professional Light Designers Convention: London, 2007; Berlin, 2009

Expert Witness – Admitted as an expert witness in the Superior Courts of Amador, Contra Costa, and San Francisco Counties.

AWARDS AND HONOURS:

IES Regional Technical Award – 1985
IES Distinguished Service Award – 1986
College of Fellows of the American Theatre --1988
Honourary Member, China IES – 1989
CIE Distinguished Service Award – 1991
IES Louis B. Marks Award – 1993

CERTIFICATION:

LC – Granted in 1990 by the National Council on the Qualification of Lighting Professionals

RELEVENT WORK EXPEREIENCE:

With PG&E appeared before CEC Committee and Staff on lighting issues with respect to the siting and licensing of Geysers steam power plants.

On behalf of PG&E and the IES appeared before the Simonson Committee to consult on the development of the lighting portions of Title 24.

On behalf of PG&E and the IES appeared before the CEC on numerous occasions to support the development of fluorescent lamp promotional programs and to assist in developing rigorous lighting ballast standards for California and on other lighting energy management issues.

While at PG&E supported and oversaw funding for projects on daylight following and electronic ballasts. Projects supported by both the DOE and CEC.

In practice as a lighting consultant worked with private clients and jurisdictions on matters concerned with light trespass and “intrusive” lighting.

JEJewell
19 February, 2010

Clifford K. Ho

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(505) 844-2384; ckho@sandia.gov

Citizenship: United States

EDUCATION

UNIVERSITY OF CALIFORNIA AT BERKELEY

Ph.D. Mechanical Engineering, May, 1993
Major: Heat and mass transfer
Minor: Fluid dynamics and engineering analysis (numerical methods and applied math)

M.S. Mechanical Engineering, December, 1990

UNIVERSITY OF WISCONSIN—MADISON

B.S. Mechanical Engineering, May, 1989

RESEARCH EXPERIENCE

SANDIA NATIONAL LABORATORIES - Albuquerque, New Mexico (1993 – Present)

Senior Member of Technical Staff (1993-1997)
Principal Member of Technical Staff (1997-2003)
Distinguished Member of Technical Staff (2003-Present)

- Develop models, analyses, and tests for concentrating solar power processes and systems (www.sandia.gov/csp)
- Performed computational fluid dynamic simulations of heat and mass transfer for applications including membrane separation processes (desalination), mixing in water-distribution systems, and UV disinfection (www.sandia.gov/cfd-water)
- Developed models of chemical transport through skin for transdermal drug delivery and exposure assessments (www.sandia.gov/geobio)
- Analyzed sensors and methods for detecting trace explosives for DOE and Homeland Security
- Developed microchemical sensor systems and characterization methods for real-time, continuous, in-situ sensing of volatile organic compounds in air, soil, and water (www.sandia.gov/sensor; 4 patents)
- Performed numerical simulations and total-system performance assessments of heat- and mass-transfer problems related to environmental restoration and nuclear waste management (www.sandia.gov/caps)
- Managed and served as technical lead for the Natural Systems Performance Assessment Department during the Yucca Mountain Viability Assessment and Site Recommendation. Responsible for $3-5M per year of budget, and up to thirty technical staff in multiple labs, companies, and federal agencies.

UNIVERSITY OF NEW MEXICO - Albuquerque, NM (1996 – 2003)

- Taught undergraduate courses as an Adjunct Professor in Thermodynamics, Heat Transfer, Dynamics, and Engineering Analysis in the Department of Mechanical Engineering. (1996 - 1999)
- Taught Hydrogeology (E&PS 462/562) to undergraduate and graduate students as an Adjunct Professor in the Department of Earth and Planetary Sciences. (2003)
- Received "Outstanding Professor" award in 1997.

BERKELEY ENVIRONMENTAL RESTORATION CENTER (BERC) - UNIVERSITY OF CALIFORNIA AT BERKELEY 8/89-5/93

- *Research Assistant:* Investigated the recovery of volatile hydrocarbons from porous media during a soil decontamination process known as soil vapor extraction. Incorporated theoretical modeling and experimentation in the analysis of liquid and gas phase transport mechanisms. Developed exact and numerical solutions to multi-component, multi-phase transport models. Designed one and two-dimensional flow visualization experiments for qualitative and quantitative validation of models.

McDonnell Douglas Corporation - St. Louis, MO (5/88 – 8/88)

- Created FORTRAN programs, ran software, and wrote instructional reports pertaining to fatigue analysis of F/A-18 Hornet and Blue Angel aircraft

General Motors Corporation - GM Technical Center, Warren, MI (5/87 – 8/87)

- Derived theoretical models and developed finite element models of three-legged joints in automobile frames using MSC/NASTRAN. Performed tests and compared results to model predictions.

Leadership and Community Outreach

Professional Conference Session Chair/Organizer - ASME, AICHE, ASCE, AGU, ANS
Session Chair/Organizer: Chaired and organized numerous professional conference sessions on multiphase, non-isothermal flow and contaminant transport in porous media. Served as a lead technical organizer for the High-Level Radioactive Waste Management Conference (2001, 2003, 2006, 2008).

Board of Directors – Shandiin Child Development Center, Albuquerque, NM
Vice-President: Responsible for the fiscal and operational welfare of Shandiin Child Development Center, which served nearly 100 families annually. Provided incentives and professional development opportunities for teachers and staff.. (2005 – 2009)

Georgia O'Keeffe Elementary School Green Team, Albuquerque, NM
Conceived the Green Team for Georgia O'Keeffe Elementary School and led activities to teach students, teachers, and staff about sustainable practices for energy, water, and materials (recycling), including an annual school-wide Earth Day celebration with hands-on demonstrations and activities. Donated $5,000 award for winning Discover Magazine's "Future of Energy in 2 Minutes or Less" video contest to the school to help launch the Green Team.

Current President of Antelope Run Neighborhood Association - Albuquerque, NM
Oversee and initiate neighborhood and community activities for 139 homes including social events (ice cream socials, block parties, holiday parties, personal interest groups), general maintenance contracts, volunteer committees, Make a Difference Day, Board meetings, emergency management, and enforcement of covenants. Create newsletters and communications for entire neighborhood.

Toastmasters International - Albuquerque, NM
President: Organized, managed, and led weekly meetings for a club whose mission is to maintain and improve its members' public speaking skills through speeches, contests, and workshops. Assisted in organizing district conferences held in Albuquerque. 7/94-12/95
VP Education: Monitored educational progress of members and organize weekly schedules and events. 1/95-7/96
Awards: 1st Place in Humorous Speech Contest (10/95)–District 23 (New Mexico and El Paso); 3rd Place in Humorous Speech Contest (6/96)–Region III (8 states)

Other

- Mentored over a dozen students (summer and year-round high-school, undergraduate, and graduate students) and staff at Sandia and served as a thesis advisor for graduate student at NM Tech
- Served as Mentor for the Department of Homeland Security Science and Technology Scholarship and Fellowship Program, Summer, 2004
- Served as principal investigator of four SNL Small Business Assistance projects, providing engineering services and expertise to small businesses in NM
- Active participant in Sandia's Science and Technology Outreach program
- Volunteer regularly for Sandia's Habitat for Humanity
- Served regularly as a judge for the UNM Science Fair

- Volunteer guide and exhibit demonstrator for the Albuquerque Explora Science Center (1994-1999)
- Volunteer for the Asian Leadership Outreach Committee at Sandia

SKILLS

- Proficient in 3-D modeling and computational analyses for heat and mass transfer, computational fluid dynamics, and stress analysis (SolidWorks, FLUENT, CosmosWorks, Cosmos FloWorks, CFdesign, TOUGH2, FEHM)
- Programming languages: FORTRAN, HTML, Mathcad, Matlab, some knowledge in C++ and Visual Basic
- Proficient in probabilistic modeling, uncertainty analyses, and sensitivity analyses
- Experienced in data acquisition (Campbell Scientific, Agilent), testing, and data analysis (Statistica, Minitab)

PROFESSIONAL SOCIETIES

- New Mexico Solar Energy Association
- American Solar Energy Society
- American Society of Mechanical Engineers
- American Geophysical Union

EDITORIAL BOARDS

- SENSORS Journal (Chemical Sensors Editorial Board; www.mdpi.com/journal/sensors)
- Electronic Journal of Mathematical and Physical Sciences (www.emis.de/journals/EJMAPS/)

AWARDS

- Featured on the cover of *Innovation Magazine*, America's Journal of Technology Commercialization, "The Best and the Brightest Innovators in the Energy Labs," April/May 2010, p. 31.
- Recipient of the 2010 Asian American Engineer of the Year Award (www.cie-usa.org) for significant, lasting, and global contributions to the nation. Past winners include DOE Secretary of Energy Stephen Chu and five other Nobel Laureates (February, 2010).
- *Discover Magazine's* 1st place winner, "Future of Energy in Two Minutes or Less Video Contest," 2008, http://discovermagazine.com/contests/vote-for-the-future-of-energy-in-2-minutes-or-less/
- *Toastmasters International:* 1st Place in Humorous Speech Contest (10/95)–District 23 (New Mexico and El Paso); 3rd Place in Humorous Speech Contest (6/96)–Region III (8 states)
- Sandia Employee Recognition Awards:
  - 2009 (Team Award for Concentrating Solar Power)
  - 2004 (Team Award and representative for Performance Testing of Trace Explosives Detectors for Vehicle Screening)
  - 2002 (Team Award and representative for In-Situ Chemiresistor Sensor)
  - 2001 (Team Award for Yucca Mountain Site Recommendation)
  - 2000 (Individual Leadership Award)
  - 1999 (Team Award for Yucca Mountain Viability Assessment)

- Outstanding Professor Award, University of New Mexico, 1997.

PUBLICATIONS AND PATENTS

Author of 4 patents, nearly a dozen technical advances, over 100 peer-reviewed journal articles and conference papers, author/editor of the books "Gas Transport in Porous Media (Springer)" and "Yucca Mountain Project (Elsevier)," and author of several other book chapters (see below).

Intellectual Property

U.S. Patent No. US 7,229,593, Ho, C.K., "Portable Vapor Diffusion Coefficient Meter," SD-7307, Issued June 12, 2007.

U.S. Patent No. US 7,189,360, Ho, C.K., "Circular Chemiresistors for Microchemical Sensors," SD-7095, Issued March 13, 2007.

U.S. Patent No. US 7,179,421, Ho, C.K., "Multi-Pin Chemiresistors for Microchemical Sensors," SD-7373, Issued February 20, 2007.

U.S. Patent No. US 7,003,405, Ho, C.K., "Characterization Methods for Real-Time In-Situ Sensing of Volatile Contaminants," SD-6894, Issued Feb. 21, 2006.

Rodacy, P.J., M. Bassili, C.K. Ho, D.W. Hannum, D.A. Jones, Controlled Force Manual Sampling Apparatus, Sandia National Laboratories Technical Advance SD-10601, 2/12/2007.

SD-10493, Ho, C.K. and W.L. Bradford, Sacrificial Spacers for Feed Channels in Spiral-Wound Membrane Modules, Sandia National Laboratories Technical Advance SD-10493, 10/17/2006.

SD-10441, Ho, C.K., P. Clem, C.J. Cornelius, S.J. Altman, Micro-Mixers and Coatings to Reduce Fouling on Membrane Surfaces, Sandia National Laboratories Technical Advance SD-10441, 9/8/2006.

SD-7850, Wang, Y., H. Gao, and C.K. Ho, Techniques for Improvement of Sensing Polymer Films, Sandia National Laboratories Technical Advance, 9/30/05.

SD-7830, Ho, C.K. and K.A. Peterson, Smart LTCC Channels with Integrated Chemical, Temperature, and Flow Sensors, Sandia National Laboratories Technical Advance, 9/29/04.

SD-7542, Kooser, A.S., C.K. Ho, and L.K. McGrath, Molecular-imprinted chemiresistor sensors for chemical and biological detection, Sandia National Laboratories Technical Advance filed 8/19/03.

SD-7372, Ho, C.K., Confined cavity chemiresistors for microchemical sensors, Sandia National Laboratories Patent Application filed 1/23/03.

SD-6976, Ho, C.K., M.W. Jenkins, R.C. Hughes, Waterproof microsensor for in-situ monitoring of volatile compounds, Sandia National Laboratories Patent Application filed 5/2002.

SD-7097, Ho, C.K., Automated monitoring and remediation system for volatile subsurface contaminants using in-situ sensors, Sandia National Laboratories Patent Application filed 10/24/02.

Cooperative Research and Development Agreement (#1669.0) between Sandia National Labs and Lighthouse Worldwide Solutions, Development of Chemiresistor Sensor Technology for Real-Time Monitoring of Volatile Organic Compounds During Hazardous Waste Site Remediation, Project Accomplishments Summary, 12/03.

Ho, C.K., Intellectual Property Management for Projects with Commercially Viable Products, white paper posted on web fileshare (https://wfsprod01.sandia.gov/groups/srn-uscitizens/documents/other/wfs048113.pdf), 1/02.

Publications

Solar Technologies

Ho, C.K., S.S. Khalsa, and G.J. Kolb, Methods for Probabilistic Modeling of Concentrating Solar Power Plants, *Solar Energy*, in press.

Ho, C.K., T.R. Mancini, G.J. Kolb, N.P. Siegel, B.D. Iverson, and J. Gary, Development of a Power-Tower Technology Roadmap for DOE, in proceedings of SolarPACES 2010, Perpignan, France, Sep. 21-24, 2010.

Ho, C.K. and A.P. Dobos, Stochastic Modeling of Concentrating Solar Power Plants using the Solar Advisor Model (SAM), in proceedings of SolarPACES 2010, Perpignan, France, Sep. 21-24, 2010.

Ho, C.K. and S.S. Khalsa, Hazard Analysis and Web-Based Tool for Evaluating Glint and Glare from Solar Collector Systems, in proceedings of SolarPACES 2010, Perpignan, France, Sep. 21-24, 2010.

Roger, M., S.S. Khalsa, C.K. Ho, L. Amsbeck, B. Gobereit, R. Buck, N. Siegel, and G. Kolb, Performance Analysis of Alternative Designs for High-Temperature Solid Particle Receivers, in proceedings of SolarPACES 2010, Perpignan, France, Sep. 21-24, 2010.

Benitez, D., M. Eck, T. Hirsch, Ho, C.K. and M. Wagner, The First Steps Towards a Standardized Methodology for CSP Electricity Yield Calculations, in proceedings of SolarPACES 2010, Perpignan, France, Sep. 21-24, 2010.

Khalsa, S.S., and C.K. Ho, Development of Rigorous Boundary Conditions to Simulate Receiver Irradiance from Heliostat-Fields and Dish Concentrators, in proceedings of SolarPACES 2010, Perpignan, France, Sep. 21-24, 2010.

Turchi, C., M. Mehos, C.K. Ho, and G. Kolb, Current and Future Costs for Parabolic Trough and Power Tower Systems in the US Market, in proceedings of SolarPACES 2010, Perpignan, France, Sep. 21-24, 2010.

Siegel, N.P., C.K. Ho, S.S. Khalsa, and G.J. Kolb, Development and Evaluation of a Prototype Solid Particle Receiver: On-Sun Testing and Model Validation, *J. Solar Energy Engr.*, 132(2), 021008-1 – 021008-8.

Ho, C.K., and G.J. Kolb, 2010, Incorporating Uncertainty into Probabilistic Performance Models of Concentrating Solar Power Plants, *J. Solar Energy Engr*., 132, in press.

Christian, J.M., and C.K. Ho, 2010, Finite Element Modeling of Concentrating Solar Collectors for Evaluation of Gravity Loads, Bending, and Optical Characterization, ES2010-90050, in proceedings of the ASME 2010 4th International Conference on Energy Sustainability, Phoenix, AZ, May 17-22, 2010.

Khalsa, S.S., and C.K. Ho, 2010, Development of a "Solar Patch" Calculator to Evaluate Heliostat-Field Irradiance as a Boundary Condition in CFD Models, ES2010-90051, in proceedings of the ASME 2010 4th International Conference on Energy Sustainability, Phoenix, AZ, May 17-22, 2010.

C.K. Ho, C.M. Ghanbari, and R.B. Diver, 2010, Methodology to Assess Potential Glare Hazards from Concentrating Solar Power Plants: Analytical Models and Experimental Validation, ES2010-90053, in proceedings of the ASME 2010 4th International Conference on Energy Sustainability, Phoenix, AZ, May 17-22, 2010.

C.K. Ho, S.S. Khalsa, and N.P. Siegel 2010, Analytical Methods to Evaluate Flux Distributions from Point-Focus Collectors for Solar Furnace and Dish Engine Applications, ES2010-90054, in proceedings of the ASME 2010 4th International Conference on Energy Sustainability, Phoenix, AZ, May 17-22, 2010.

Kolb, G.J., C.K. Ho, B. Iverson, T. Moss, and N. Siegel, 2010, Freeze-Thaw Tests of Trough Receivers Employing a Molten Salt Working Fluid, ES2010-90040, in proceedings of the ASME 2010 4th International Conference on Energy Sustainability, Phoenix, AZ, May 17-22, 2010.

Yellowhair, J., and C.K. Ho, 2010, Heliostat Alignment Methods: An Overview and Comparison, ES2010-90356, in proceedings of the ASME 2010 4th International Conference on Energy Sustainability, Phoenix, AZ, May 17-22, 2010.

Ho, C.K., C.M. Ghanbari, and R.B. Diver, 2010, Methodology to Assess Potential Glint and Glare Hazards from Concentrating Solar Power Plants: Analytical Models and Experimental Validation, SAND2010-2581C, in proceedings of the 4th International Conference on Energy Sustainability, ES2010-90053, Phoenix, AZ, May 17-22, 2010.

Ho, C.K., M. Roeger, S.S. Khalsa, L. Amsbeck, R. Buck, N. Siegel, and G. Kolb, 2009, Experimental Validation of Different Modeling Approaches for Solid Particle Receivers, SAND2009-4140C, in proceedings of SolarPACES 2009, Berlin, Germany, September 15-18, 2009.

Ho, C.K., S.S. Khalsa, and G.J. Kolb, 2009, Tools for Probabilistic Modeling of Concentrating Solar Power Plants, SAND2009-4141C, in proceedings of SolarPACES 2009, Berlin, Germany, September 15-18, 2009.

Ho, C.K., C.M. Ghanbari, and R.B. Diver, 2009, Hazard Analyses of Glint and Glare from Concentrating Solar Power Plants, SAND2009-4131C, in proceedings of SolarPACES 2009, Berlin, Germany, September 15-18, 2009.

Ho, C.K., and G.J. Kolb, 2009, Incorporating Uncertainty into Probabilistic Performance Models of Concentrating Solar Power Plants, SAND2009-3003C, in proceedings of the 2009 ASME 3rd International Conference on Energy Sustainability, San Francisco, CA, July 19-23, 2009.

Ho, C.K., S.S. Khalsa, and N.P. Siegel, 2009, Modeling On-Sun Tests of a Prototype Solid Particle Receiver for Concentrating Solar Power Processes and Storage, ES2009-90035, 2009 ASME 3rd International Conference on Energy Sustainability, SAND2009-2740C, San Francisco, CA, July 19-23, 2009.

Ho, C.K., 2008, Software and Codes for Analysis of Concentrating Solar Power Technologies, SAND2008-8053, Sandia National Laboratories, Albuquerque, NM.

Water Safety and Security

Wright, H.B., E. Wicklein, and C.K. Ho, 2009, Reactor Wall Reflections Impact Dose Delivery And Regulatory Compliance With UV Disinfection, SAND2009-5507C, in proceedings of the American Water Works Association Water Quality Technology Conference, Seattle, WA, November 15-19, 2009.

Ho, C.K., 2009, Evaluation of Reflection and Refraction in Simulations of Ultraviolet Disinfection Using the Discrete Ordinates Radiation Model, SAND2009-2529J, *Water Science and Technology*, 59(12), 2421-2428.

Ho, C.K. and L. O'Rear, Jr., 2009, Evaluation of Solute Mixing in Water Distribution Pipe Junctions, *J. American Water Works Association*, SAND2009-2502J, 101(9), 116-127.

Ho, C.K., S.S. Khalsa, E. Wicklein, and H.B. Wright, 2009, Modeling UV Disinfection using Integrated Computational Fluid Dynamics and Discrete Ordinates Radiation Models, in proceedings of Disinfection 2009, SAND2008-7956C, Atlanta, GA, Feb. 28 – Mar. 3, 2009.

Ho, C.K., S.S. Khalsa, E. Wicklein, and H.B. Wright, 2008, Important Factors for Computational Modeling of UV Disinfection Systems, in proceedings of the American Water Works Association Water Quality Technology Conference, SAND2008-4993C, Cincinnati, OH, November 16-20, 2008.

E. Wicklein, H.B. Wright, and C.K. Ho, 2008, Computational Fluid Dynamics Modeling of UV Reactor Validation Tests, in proceedings of the American Water Works Association Water Quality Technology Conference, SAND2008-6021C, Cincinnati, OH, November 16-20, 2008.

Romero-Gomez, P., C.K. Ho, and C.Y. Choi, 2008, Mixing at Cross Junctions in Water Distribution Systems. 1: Numerical Study, *J. Water Resources, Planning, and Management*, May/June, 134(3), 285-294.

Khalsa, S.S. and C.K. Ho, 2008, Design Optimization of Anti-Fouling Micromixers for Reverse Osmosis Membranes, in Proceedings of the 23rd Annual WateReuse Symposium, Dallas, TX, September 7-10, 2008, SAND2008-2757C.

Ho, C.K., and S.S. Khalsa, 2008, EPANET-BAM: Water Quality Modeling with Incomplete Mixing in Pipe Junctions, in Proceedings of the 2008 Water Distribution System Analysis Conference, Kruger National Park, South Africa, August 17-20, 2008. (SAND2008-3065C)

Ho, C.K., 2008, Solute Mixing Models for Water Distribution Pipe Networks, *J. Hydraulic Engineering*, SAND2008-0166J, 134(9), 1236-1244.

Ho, C.K., S.J. Altman, H.D.T. Jones, S.S. Khalsa, L.K. McGrath, and P.G. Clem, 2008, Analysis of Micromixers to Reduce Biofouling on Reverse-Osmosis Membranes, *Environmental Progress*, SAND2008-1239J, in press.

Ho, C.K. and S.S. Khalsa, 2008, Improved Contaminant Mixing Models for Water Quality Modeling in Water Distribution Networks, in proceedings of the Singapore International Water Week Convention, Singapore, June 23-27, 2008. (SAND2008-2432C)

Ho, C.K., C.Y. Choi, S.A. McKenna, 2007, Evaluation of Complete and Incomplete Mixing Models in Water Distribution Pipe Network Simulations, in Proceedings of the 2007 World Environmental and Water Resources Congress, May 15-19, 2007, Tampa, FL.

Ho, C.K., S.S. Khalsa, P. Clem, M. Niehaus, S. Brown, and W. Hart, 2007, Analysis of Micro-Mixers to Reduce Fouling on Membrane Surfaces, 2007 North American Membrane Society Conference, May 12-16, 2007, Orlando, FL.

Jones, H., S. Altman, C.K. Ho, et al., 2007, Fluorescent Hyperspectral Imaging of Biofilms on Water Treatment Membranes, 58th Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, February 25-March 2, 2007, Chicago, IL.

Ho, C.K., L. Orear, Jr., J.L. Wright, and S.A. McKenna, 2006, Contaminant Mixing at Pipe Joints: Comparison Between Laboratory Flow Experiments and Computational Fluid Dynamics Models, in Proceedings of the 2006 Water Distribution System Analysis Symposium, Cincinnati, OH, August 27-30, 2006.

Ho, C.K., 2005, Energy-Water Central Region Needs-Assessment Workshop Summary Report, SAND2005-7710, Sandia National Laboratories, Albuquerque, NM.

Hydrologic Flow and Contaminant Transport

Ho, C.K., B.W. Arnold, and S.J. Altman, 2009, Dual-Permeability Modeling of Capillary Diversion and Drift Shadow Effects in Unsaturated Fractured Rock, *J. Heat Transfer* (special issue on "Recent Advanced in Porous Media Transport"), SAND2009-4137J, Vol. 131, Paper 101012, 1-6.

Ho, C.K., B.W. Arnold, and S.J. Altman, Dual-Permeability Modeling and Evaluation of Drift-Shadow Experiments, in Proceedings of the 2008 International High-Level Radioactive Waste Management Conference, Las Vegas, NV, September 7-10, 2008. (SAND2008-3070C)

Altman, S.J., A. Forsberg, W. Peplinski, and C.K. Ho, Experimental Observation of the Drift-Shadow Effect using X-Ray Absorption Imaging, *J. Hydrology*, 348(3-4), 341-349 (SAND2007-2673J).

Ho, C.K., and Z.P. Walton, 2007, Modeling Water Penetration through Cracks in Waste Packages with Impinging Droplets, in Proceedings of the Waste Management 2007 Conference, Tucson, AZ, February 25-March 1, 2007.

Walton, Z.P., C.K. Ho, and M.D. Schuhen, Testing of Flow Through Stress Corrosion Cracks, in Proceedings of the 2006 International High-Level Radioactive Waste Management Conference, Las Vegas, NV, April 30-May 3, 2006.

Altman, S.J., A. Forsberg, W. Peplinski, and C.K. Ho, Testing the Concept of Drift Shadow with X-Ray Absorption Imaging, in Proceedings of the 2006 International High-Level Radioactive Waste Management Conference, Las Vegas, NV, April 30-May 3, 2006.

Sleep, B.E., C.D. Shackelford, J.C. Parker, C.K. Ho, et al., 2006, "Chapter 2 Modeling of Fluid Transport through Barriers," in *Barrier Systems for Environmental Contaminant, Containment, and Treatment*, edited by C.C. Chien, et al., pp. 71-132, CRC Press, Taylor & Francis, Boca Raton.

Ho, C.K., 2004, Asperity-Induced Episodic Percolation in Channels and Fractures, *J. Porous Media*, 7(3), 155-164.

Ho, C.K., L.K. McGrath, and J.L. Wright, 2003, Survey of Subsurface Treatment Technologies for Environmental Restoration Sites at Sandia National Laboratories, New Mexico, SAND2003-2880, Sandia National Laboratories, Albuquerque, NM.

Ho, C.K., 2001, A semianalytical solution for steady infiltration in unsaturated fractured rock, *Water Resources Research*, 37(8), 2285-2289.

Ho, C.K., 2001, "Dual Porosity vs. Dual Permeability Models of Matrix Diffusion in Fractured Rock," SAND 2000-2336C, in Proceedings of the 9th International High-Level Radioactive Waste Management Conference, Las Vegas, NV, April 29-May 2, 2001.

Ho, C.K., 2000, "Modeling Fast Flow Paths in Unsaturated Fractured Rock," *Vadose Zone Science and Technology Solutions*, B.B. Looney and R.W. Falta eds, Battelle Press, Columbus, OH, pp. 785-791.

Ho, C.K. and S.W. Webb, 1998, Capillary Barrier Performance in Heterogeneous Porous Media, *Water Resources Research*, vol. 34, no. 4, pp. 603-609.

McCurley, R., C.K. Ho, and M.L. Wilson "Analysis of Infiltration Uncertainty," SAND2000-2688C, in Proceedings of the 9th International High-Level Radioactive Waste Management Conference, Las Vegas, NV, April 29-May 2, 2001.

Wilson, M.L. and C.K. Ho, "Abstraction of Seepage Into Drifts," SAND2000-2389C, in Proceedings of the 9th International High-Level Radioactive Waste Management Conference, Las Vegas, NV, April 29-May 2, 2001.

Ho, C.K. and M.L. Wilson, Calculation of Discrete Fracture Flow Paths in Dual Continuum Models, in *Proceedings of the International Symposium on Dynamics of Fluids in Fractured Rocks*: Concepts and Recent Advances, *LBNL-42718*, Berkeley, CA, 2/99.

Ho, C.K. and M.L. Wilson, Calculation of Discrete Fracture Flow Paths Using Dual-Continuum Models, SAND97-2709C, *Proceedings of the International High-Level Radioactive Waste Management Conference*, 5/98.

Ho, C.K. and S.W. Webb, The Effects of Heterogeneities and Wavy Interfaces on Capillary Barrier Performance, SAND98-0859A, in *Proceedings of the TOUGH98 Workshop*, 5/98.

Ho, C.K., S.J. Altman, S.A. McKenna, B.W. Arnold, 1996 Unsaturated Zone Flow Modeling for GWTT-95, SAND95-2497C.

Altman, S.J., B.W. Arnold, R.W. Barnard, G.E. Barr, C.K. Ho, S.A. McKenna, R.R. Eaton, 1996, Flow Calculations for Yucca Mountain Groundwater Travel Time (GWTT-95), SAND96-0819.

Altman, S.J., B.W. Arnold, C.K. Ho, and S.A. McKenna, 1996, Sensitivity Studies of Unsaturated Groundwater Flow Modeling for Groundwater Travel Time Calculations at Yucca Mountain, NV, SAND95-2541C.

Ho, C.K., S.J. Altman, B.W. Arnold, 1995, Alternative Conceptual Models and Codes for Unsaturated Flow in Fractured Tuff: Preliminary Assessments for GWTT-95, SAND95-1546.

Eaton, R.R., C.K. Ho, R.J. Glass, M.J. Nicholl, and B. W. Arnold, 1996, Three-Dimensional Modeling of Flow through Fractured Tuff at Fran Ridge, SAND95-1896.

Ho, C.K., "Assessing Alternative Conceptual Models of Fracture Flow", SAND95-0324C, in proceedings of the TOUGH2 Workshop '95, Lawrence Berkeley Laboratory, March 20-22, 1995.

Ho, C.K. and M.L. Wilson, "Assessing Alternative Conceptual Models of Fracture Flow, SAND94-2663A, presented at the International High-Level Radioactive Waste Management Conference, Las Vegas, NV, May 1-5, 1995.

Ho, C.K., "Multicomponent Three-Phase Equilibria, SAND95-1063, June, 1995.

Ho, C.K. 1994. Modeling Infiltration into a Tuff Matrix from a Saturated Vertical Fracture, SAND93-3503C, presented at the 1994 International High-Level Radioactive Waste Management Conference, Las Vegas, NV.

Gas and Vapor Transport and Phase Change

Ho, C.K. and S.W. Webb, eds., 2006, *Gas Transport in Porous Media*, Springer, 444 pages.

Ho, C.K., 2006, Vapor Transport Processes, Chapter 3 in *Gas Transport in Porous Media*, C.K. Ho and S.W. Webb (eds.), Springer, pp. 27-46.

Ho, C.K., M. Kelly, and M.T. Itamura, 2006, Measurement of Vapor Concentrations, Chapter 18 in *Gas Transport in Porous Media*, C.K. Ho and S.W. Webb (eds.), Springer, pp. 27-46.

Ho, C.K., 2000, "Scale-Dependent Mass Transfer During SVE," *Vadose Zone Science and Technology Solutions*, B.B. Looney and R.W. Falta eds., Battelle Press, Columbus, OH, pp. 1170-1176.

Gu, L., C.K. Ho, O.A. Plumb, and S.W. Webb, Vapor Diffusion in Partially Saturated Packed Beds, in *Proceedings of the 1999 ASME/JSME Joint Thermal Engineering Conference*, San Diego, CA, 3/99.

Webb, S.W. and C.K. Ho, Enhanced Vapor-Phase Diffusion in Porous Media LDRD Final Report, *SAND98-2772*, 12/98.

Ho, C.K., and S.W. Webb, 1998, Review of Porous Media Enhanced Vapor-Phase Diffusion Mechanisms, Models, and Data–Does Enhanced Vapor-Phase Diffusion Exist?, *Journal of Porous Media*, 1(1), pp. 71-92.

Ho, C.K., 1998, Analytical Inverse Model for Multicomponent Soil Vapor Extraction, *J. Environmental Engineering*, v. 124, no. 6, 504-509.

Ho, C.K., 1997, Evaporation of Pendant Water Droplets in Fractures, *Water Resources Research*, Vol. 33, No. 12, pp. 2665-2671.

Gu, L., C.K. Ho, O.A. Plumb, and S.W. Webb, 1998, Diffusion with Condensation and Evaporation in Porous Media, SAND98-0618C, *Proceedings of the 1998 Joint AIAA/ASME Thermophysics and Heat Transfer Conference*, 6/98.

Webb, S.W. and Ho, C.K., Pore-Scale Modeling Using TOUGH2, *Proceedings of the TOUGH98 Workshop*, SAND98-1976C, 5/98.

Webb, S.W. and Ho, C.K., Pore-Scale Modeling of Enhanced Vapor Diffusion in Porous Media, SAND97-2013C, *Proceedings of the 1997 ASME International Mechanical Engineering Congress and Exposition*, 11/97.

Ho, C.K., "Numerical Simulations of Multicomponent Evaporation and Gas-Phase Transport Experiments Using M2NOTS, SAND95-0566C, in proceedings of the ASME/AIChE National Heat Transfer Conference, Portland, OR, August 5-8, 1995.

Sobolik, S., C.K. Ho, E. Dunn, T. Robey, W. Cruz,"Sensitivity of Hydrological Performance Assessment Analyses to Variations in Material Properties, Conceptual Models, and Ventilation Models", SAND94-0779, 1/95.

Ho, C.K., E. Dunn, S. Sobolik, "Ventilation and Vapor-Phase Transport Near the ESF Tunnel, SAND94-2658A, in proceedings of the International High-Level Radioactive Waste Management Conference, Las Vegas, NV, May 1-5, 1995.

Ho, C.K. and K.S. Udell, 1995, Mass Transfer Limited Drying of Porous Media Containing an Immobile Binary Liquid Mixture, *Int. J. Heat Mass Transfer*, Vol. 38 No. 2, pp. 339-350.

Ho, C.K., S. -W. Liu, and K.S. Udell, 1994, Propagation of Evaporation and Condensation Fronts During Multicomponent Soil Vapor Extraction, *J. Contam. Hydrol.*, 16, pp. 381-401.

Ho, C.K. and K.S. Udell, 1993. Mechanisms of Multicomponent Evaporation During Soil Venting, ASME Multiphase Transport in Porous Media, HTD-Vol. 265, pp. 83-91, presented at the 1993 ASME Winter Annual Meeting, New Orleans, LA.

Ho, C.K. and K.S. Udell, 1992, An Experimental Investigation of Air Venting of Volatile Liquid Hydrocarbon Mixtures from Homogeneous and Heterogeneous Porous Media, *J. Contam. Hydrol.*, 11, 291-316.

Heat Transfer and Coupled Processes

Birkholzer, J. and C.K. Ho, A Monte-Carlo Analysis of Episodic Preferential Flow into Superheated Fractured Rock, 2003, *J. Hydrology*, 284(1-4), 151-173.

Birkholzer, J. and C.K. Ho, A Systematic Study of Episodic Localized Infiltration into Superheated Fractured Rock, SAND2002-2451A, Geological Society of America 2002 Annual Meeting and Exposition, October 27-30, 2002, Denver, CO.

Arnold, B.W., C.K. Ho, and M.T. Itamura, "Effect of Capillary Forces on Fluid Inclusion Formation in the Vadose Zone: Implications For Geothermometry," SAND2000-2999C, in Proceedings of the 9th International High-Level Radioactive Waste Management Conference, Las Vegas, NV, April 29-May 2, 2001.

Ho, C.K. and N.D. Francis, Coupled Thermo-Hydro-Mechanical Simulations of the Potential Repository at Yucca Mountain, SAND97-2711C, in *Proceedings of the International High-Level Radioactive Waste Management Conference*, 5/98.

Itamura, M.T. and C.K. Ho, Scaling Analysis of Repository Heat Load for Reduced Dimensionality Models, SAND97-2830A, in *Proceedings of the International High-Level Radioactive Waste Management Conference*, 5/98.

Ho et al., 1997, The Effects of Infiltration on the Thermohydrologic Behavior of the Potential Repository at Yucca Mountain, SAND97-0098C, In Proceedings of the ASCE Fourth Congress on Computing in Civil Engineering, Philadelphia, PA, June 16-18, pp. 387-394.

Ho, C.K., 1997, Models of Fracture-Matrix Interactions During Multiphase Heat and Mass Flow in Unsaturated Fractured Porous Media, SAND97-1198C, in Proceedings of the ASME Fluids Engineering Division, FED-Vol. 244, pp. 401-412.

Francis, N.D., S.R. Sobolik, C.K. Ho, R.R. Eaton, and D. Preece, 1997, Pre-Experiment Thermal-Hydrological-Mechanical Analyses for the ESF Heated Drift Test, SLTR97-0002, Sandia National Labs.

Ho, C.K. and N.D. Francis, 1996, The Effects of Conduction, Convection, and Radiation on the Thermodynamic Environment Surrounding a Heat Generating Waste Package, SAND96-0032C, in proceedings of 1996 National Heat Transfer Conference, ANS session on Fundamental Aspects of Radioactive Waste Management, Houston, TX, Aug. 3-6.

Ho, C.K., Pre-Test Simulations of Laboratory-Scale Heater Experiments in Tuff, SAND95-1905.

Ho, C.K. and R.R. Eaton, 1995, TOUGH2 Model of the G-Tunnel Heater Experiment, SAND94-2636A, in proceedings of the 1995 International High-Level Radioactive Waste Management Conference, Las Vegas, NV, May 1-5.

Ho, C.K. and R.R. Eaton, 1994, "Studies of Thermohydrologic Flow Processes Using TOUGH2", SAND94-2011.

Ho, C.K., K. Maki, and R. J. Glass, 1994. Studies of Non-Isothermal Flow in Saturated and Partially Saturated Porous Media, SAND93-4045C, presented at the 1994 International High-Level Radioactive Waste Management Conference, Las Vegas, NV.

Ho, C.K., K. Maki, and R. J. Glass, 1994. Experimental and Numerical Investigations of Non-Isothermal Flow in Saturated and Partially Saturated Porous Media, Sandia Report, SLTR93-0002.

Performance Assessment Modeling for Waste Management

Ho, C.K., 2008, Analytical Risk-Based Model of Gaseous and Liquid-Phase Radon Transport in Landfills with Radium Sources, *Environmental Modelling & Software*, 23(9), 1163-1170 (SAND2008-1236J).

Ho, C.K., T.A. Goering, J.L. Peace, M.L. Miller, 2007, Probabilistic Performance-Assessment Modeling of the Mixed Waste Landfill at Sandia National Laboratories (2nd Edition), SAND2007-0170, Sandia National Laboratories, Albuquerque, NM.

Ho, C.K., T.A. Goering, J.L. Peace, M.L. Miller, 2006, Development of Probabilistic Fate and Transport Models for the Mixed Waste Landfill at Sandia National Laboratories, SAND2005-7321C, in Proceedings of the 2006 Waste Management Conference, Tucson, AZ, Feb. 26 – Mar. 2, 2006.

Ho, C.K., T.A. Goering, J.L. Peace, M.L. Miller, 2005, Probabilistic Performance-Assessment Modeling of the Mixed Waste Landfill at Sandia National Laboratories, SAND2005-6888, Sandia National Laboratories, Albuquerque, NM.

Peace, J.L. T.A. Goering, C.K. Ho, M.L. Miller, D.E. Fate, 2005, Mixed Waste Landifll - Corrective Measures Implementation Plan, 2005-7126 P, Sandia National Laboratories, Albuquerque, NM.

Knowlton, R.G., B.W. Arnold, N.-C. Tien, F.-L. Chang, L.-M. Chi, C.K. Ho, W.-S. Chuang, and H.-N. Jow, 2006, Performance Assessment Methodology and Preliminary Results for Low-Level Radioactive Waste Disposal in Taiwan, in proceedings of the 2006 Waste Management Conference, Tucson, AZ, February 26 – March 2, 2006.

Peterson, C. and C.K. Ho, 2005, Evaluation of FRAMES for Probabilistic Risk-Based Simulation of Long-Term Cover Systems, in proceedings of the Waste Management Symposium, SAND2005-0501C, February 27-March 3, 2005, Tucson, AZ.

Bodvarsson, G.S., C.K. Ho, and B.A. Robinson (editors), 2003, *Journal of Contaminant Hydrology Special Issue on Yucca Mountain*, Vol. 62-63, 750 pp.

Robinson, B.A., C. Li, and C.K. Ho, 2003, Performance Assessment Model Development and Analysis of Radionuclide Transport in the Unsaturated Zone, Yucca Mountain, Nevada, *Journal of Contaminant Hydrology*, Vol. 62, pp. 249-268.

Ho, C.K., B.W. Arnold, J.R. Cochran, R.Y. Taira, and M. Pelton, 2004, A Probabilistic Model and Software Tool for Evaluating the Long-Term Performance of Landfill Covers, *Environmental Modelling and Software Journal*, 19(1), 63-88.

Ho, C.K., B.W. Arnold, J.R. Cochran, and R.Y. Taira, 2002, Development of a Risk-Based Probabilistic Performance-Assessment Method for Long-Term Cover Systems–2nd Edition, SAND2002-3131, Sandia National Laboratories, Albuquerque, NM.

Ho, C.K., B.W. Arnold, J.R. Cochran, and R.Y. Taira, Risk-Based Performance Assessments for Long-Term Cover Systems: Sensitivity and Uncertainty Analyses, SAND2002-1951C, In Proceedings of the Spectrum 2002 Conference, Reno, NV, August 4-8, 2002, ISBN: 0-89448-664-0.

Wilson, M.W. and C.K. Ho, TSPA Model For The Yucca Mountain Unsaturated Zone, in proceedings of the Waste Management Symposium, SAND2001-3800C, Tucson AZ, February 24-28, 2002.

Ho, C.K., B.W. Arnold, J.R. Cochran, S.W. Webb, and R.Y. Taira, Development of a Risk-Based Performance-Assessment Method for Long-Term Cover Systems—Application to the Monticello Mill Tailings Repository, SAND2001-3032, Sandia National Laboratories, Albuquerque, NM, 2001.

Ho, C.K., et al., "Stochastic Simulations for Risk-Based Performance Assessments of Long-Term Cover Systems," SAND2001-1132C, In Proceedings of the 2001 Containment and Remediation Conference, Orlando, FL, June 10-13, 2001.

Ho, C.K., R. Baca, S. Conrad, G. Smith, L. Shyr, T. Wheeler, 1999, Stochastic Parameter Development for PORFLOW Simulations of the Hanford AX Tank Farm, *SAND98-2880*, Sandia National Laboratories, 1/99.

Westrich, H., J. Krumhansl, P. Zhang, H. Anderson, M. Molecke, C. Ho, B. Dwyer, G. McKeen, Stabilization of In-Tank Resdiual Wastes and External-Tank Soil Contamination for the Hanford Tank Closure Program: Applications to the AX Tank Farm, *SAND98-2445*, 11/98.

Ho, C.K. and B.A. Robinson, Flow and Transport Calculations of Yucca Mountain Using TOUGH2 and FEHM, SAND97-2710C, *Proceedings of the International High-Level Radioactive Waste Management Conference*, 5/98.

Stockman, H., J. Krumhansl, C.K. Ho, V. McConnell, "The Valles Natural Analogue Project, NUREG/CR-6221, SAND94-0650, December, 1994.

Microchemical Sensors

K. Peterson, K. Patel, C.K. Ho, S. Rohde, B. Rohrer, M. Okandan, O. Spahn, T. Turner, D. De Smet, 2007, LTCC in Microsystems, in Proceedings of the XXXI International Conference of IMAPS Poland Chapter, Rzeszów - Krasiczyn, Poland, September 23-26, 2007.

Hua, L., W.G. Pitt, L.K. McGrath, and C.K. Ho, 2007, Modeling carbon black/polymer composite sensors, *Sensors and Actuators B, 125, 396-407*.

K.A. Peterson, K.D. Patel, C.K. Ho, B.R. Rohrer, C.D. Nordquist, B.D. Wroblewski, K.B. Pfeifer, 2006,LTCC Microsystems and Microsystem Packaging and Integration Applications, *J. Microelectronics and Electronic Packaging*, 3(3), 109-120.

Ho, C.K., K.A. Peterson, L.K. McGrath, T.S. Turner, 2006, Development of LTCC Smart Channels for Integrated Chemical, Temperature, and Flow Sensing, *J. Microelectronics and Electronic Packaging*, 3(3), 136-144.

K.A. Peterson, K.D. Patel, C.K. Ho, B.R. Rohrer, C.D. Nordquist, B.D. Wroblewski, K.B. Pfeifer, 2006 LTCC Microsystems and Microsystem Packaging and Integration Applications, in proceedings of the 2006 International Conference on Ceramic Interconnect and Ceramic Microsystems Technologies, Denver, CO, April 25-27, 2006.

Ho, C.K., K.A. Peterson, L.K. McGrath, T.S. Turner, 2006, Development of LTCC Smart Channels for Integrated Chemical, Temperature, and Flow Sensing, SAND2006-1169C, in proceedings of the 2006 International Conference on Ceramic Interconnect and Ceramic Microsystems Technologies, Denver, CO, April 25-27, 2006.

Peterson, K.A., K. D. Patel, C. K. Ho, S. B. Rohde, C. D. Nordquist, C. A. Walker, B. D. Wroblewski, and M. Okandan, 2005, Novel Microsystem Applications with New Techniques in Low-Temperature Co-Fired Ceramics, *Int. Journal of Applied Ceramic Technology*, 2 (5) 371–389.

Ho, C.K. (Guest Editor), 2005, Special Issue on Sensors for Environmental Monitoring, *Sensors*, 5, 1-117.

Ho, C.K., A. Robinson, D.R. Miller, and M.J. Davis, 2005, Overview of Sensors and Needs for Environmental Monitoring, *Sensors*, 5, 4-37.

Ho, C.K. and J.L. Wright, 2005, Integrated Chemiresistor Sensors with Preconcentrators for Monitoring Volatile Organic Compounds in Water, SAND2005-1037C, in proceedings of the ASCE 2005 World Water and Environmental Resources Congress, Anchorage, AK, May 15-19, 2005.

Ho, C.K., L.K. McGrath, and J.L. Wright, 2005, FY04 Field Evaluations of an In-Situ Chemiresistor Sensor at Edwards Air Force Base, CA, SAND2005-0336, Sandia National Laboratories, Albuquerque, NM.

Davis, C.E., C.K. Ho, R.C. Hughes, and M.L. Thomas, 2005, Enhanced Detection of m-Xylene Using a Preconcentrator with a Chemiresistor Sensor, *Sensors and Actuators B: Chemical*, 104(2), 207-216.

Hua, L, Pitt, W.G., McGrath, L.K., and Ho, C.K., 2004, Modeling chemiresistor sensors 1: Conductivity model, 2004, in proceedings of the AIChE Annual Meeting, Nov. 7-12 2004, Austin, TX, p.9725-9732.

Hua, L, Pitt, W.G., McGrath, L.K., and Ho, C.K., 2004, Modeling chemiresistor sensors 1: Conductivity model, 2004, in proceedings of the AIChE Annual Meeting, Nov. 7-12 2004, Austin, TX, p.9725-9732.

Wang, Y., H. Gao, R.C. Hughes, C.K. Ho, M.L. Thomas, J.L. Wright, L.K. McGrath, C.E. Davis, and P.I. Pohl, 2004, Potential Application of Microsensor Technology in Radioactive Waste Management with Emphasis on Headspace Gas Detection, SAND2004-4813, LDRD Final Report, Sandia National Laboratories, Albuquerque, NM.

Ho, C.K., A. Robinson, D.R. Miller, and M.J. Davis, 2004, Sensors for Environmental Monitoring and Long-Term Environmental Stewardship, SAND2004-4596, Albuquerque, NM, 54 pp.

Lei, H., W.G. Pitt, L.K. McGrath, and C.K. Ho, 2004, Resistivity measurements of carbon–polymer composites in chemical sensors: impact of carbon concentration and geometry, *Sensors and Actuators B: Chemical*, 101(1-2), 122–132.

Ho, C.K., 2004, In-Situ Microchemical Sensors for Long-Term Monitoring of Subsurface Contaminants, SAND2003-4519C, in proceedings of the *Waste Management Conference*, Tucson, AZ, February 29-March 4, 2004.

Ho, C.K., L.K. McGrath, C.E. Davis, M.L. Thomas, J.L. Wright, A.S. Kooser, and R.C. Hughes, 2003, Chemiresistor Microsensors for In-Situ Monitoring of Volatile Organic Compounds: Final LDRD Report, SAND2003-3410, Sandia National Laboratories, Albuquerque, NM.

Ho, C.K., E.R. Lindgren, K.S. Rawlinson, L.K. McGrath, and J.L. Wright, 2003, Development of a surface acoustic wave sensor for in-situ monitoring of volatile organic compounds, *Sensors*, 3, 236-247.

Ho, C.K., 2003, Development of an In-Situ Chemiresistor Sensor for Continuous Monitoring of Volatile Organic Compounds in Air, Soil, and Water, SAND2003-1709A, abstract presented at FAME (Frontiers in Assessment Methods for the Environment) Symposium, Minneapolis, MN, August 10-13, 2003.

Rivera, D., M.K. Alam, C.E. Davis, and C.K. Ho, 2003, Characterization of the ability of polymeric chemiresistor arrays to quantitate trichloroethylene using partial least squares (PLS): effects of experimental design, humidity, and temperature, *Sensors and Actuators B: Chemical*, v. 92, no. 1-2, 110-120.

Ho, C.K. and C.F. Lohrstorfer, Subsurface Monitoring of TCE Using an In-Situ Chemiresistor Sensor, 2003, *Groundwater Monitoring and Remediation*, 23(4), 85-90.

Ho, C.K., J. Wright, L.K. McGrath, E.R. Lindgren, K.S. Rawlinson, and C.F. Lohrstorfer, 2003, Field Demonstrations of Chemiresistor and Surface Acoustic Wave Microchemical Sensors at the Nevada Test Site, SAND2003-0799, Albuquerque, NM.

Ho, C.K., and R.C. Hughes, 2002, *In-Situ* Chemiresistor Sensor Package for Real-Time Detection of Volatile Organic Compounds in Soil and Groundwater, 2002, *Sensors*, 2, 23-34.

Ho, C.K. and C.F. Lohrstorfer, 2002, Demonstration of Chemiresistor Microsensors for Subsurface Monitoring of Volatile Organic Compounds, SAND2002-1968C, In Proceedings of the Spectrum 2002 Conference, Reno, NV, August 4-8, 2002, ISBN: 0-89448-664-0.

Ho, C.K., L.K. McGrath, and J. May, 2002, FY02 Field Evaluations of an In-Situ Chemiresistor at Edwards Air Force Base, CA, SAND2002-4135, Albuquerque, NM.

Davis, C.E. R.C. Hughes, M.L. Thomas, C.K. Ho, Data Analysis Methods for Real-Time VOC Chemiresistor Sensor, SAND2002-0591C, in proceedings of the Sensors Expo Conference, San Jose, CA, May 20-23, 2002, 179-191.

Ho, C.K. et al., "Microchemical Sensors for In Situ Monitoring and Characterization of Volatile Contaminants," SAND2001-1093C, In Proceedings of the 2001 Containment and Remediation Conference, Orlando, FL, June 10-13, 2001.

Ho, C.K., M.T. Itamura, M. Kelley, R.C. Hughes, 2001, Review of Chemical Sensors for In-Situ Monitoring of Volatile Contaminants, SAND2001-0643, Sandia National Laboratories, Albuquerque, NM.

Bio-Engineering

Ho, C.K., 2004, Probabilistic Modeling of Percutaneous Absorption for Risk-Based Exposure Assessments and Transdermal Drug Delivery, *Statistical Methodology,* Vol. 1/1-2, 47-69.

Ho, C.K., 2003, A Stochastic Model of Chemical Transport through Human Skin, SAND2003-1521C, published in proceedings of the *ASME International Congress and Exposition*, Bio-Heat and Mass Transfer Session, Washington, D.C., Nov. 16-21, 2003.

Cygan, R.T., C.K. Ho, and C.J. Weiss, 2002, Linking the Geosciences to Emerging Bio-Engineering Technologies, SAND2002-3690, Sandia National Laboratories, Albuquerque, NM.

Explosives Detection

Parmeter, J., C.K. Ho, et al., Studies of Trace Explosives Contamination on Vehicles and Trace Plumes Emanating from Moving Vehicles that Contain Explosives, in Proceedings of the Insititute of Nuclear Materials Management 47th Annual Meeting, July 16-20, 2006, Nashville, TN.

Hannum, D.W., A.O. Falase, C.K. Ho, and J.E. Parmeter, 2005, Investigations of the Detection of Trace Contamination of Ammonium Nitrate and Ammonium Nitrate/Fuel Oil on a Vehicle, SAND2005-5874, Unclassified Controlled Nuclear Information, Sandia National Laboratories, Albuquerque, NM.

Phelan, J., C.K. Ho, L. DeChant, P. J. Rodacy, J. Lee, D. Hannum, M. Mitchell, and J. Parmeter, 2005, Detecting Explosives in Moving Vehicles, SAND2005-6155, Unclassified Controlled Nuclear Information, Sandia National Laboratories, Albuquerque, NM.

Ho, C.K., 2005, Modeling Evaporation of Explosives from Stationary Surfaces and Moving Vehicles, SAND2005-0394, Sandia National Laboratories, Albuquerque, NM.

Ho, C.K., A.O. Falase, D.W. Hannum, J.E. Parmeter, 2004, Field and Laboratory Investigations of Factors that Impact the Performance of Trace Explosives Detectors for Vehicle Screening, SAND2004-4748, Sandia National Laboratories, Albuquerque, NM.

Ho, C.K., A.O. Falase, D.W. Hannum, J.E. Parmeter, 2004, Evaluation of TSA Test Kits for Verification of IONSCAN 400-Series Trace Explosives Detectors, SAND2004-4827, Sandia National Laboratories, Albuquerque, NM.

Yucca Mountain Reports Supporting the License Application

Contributing author of "Total System Performance Assessment for the Site Recommendation," 2000, TDR-WIS-PA-000001 Rev 00, ICN 01, MOL.20001220.0045.

Ho, C.K., 2000, "Abstraction of Flow Fields for TSPA," Analysis and Model Report, ANL-NBS-HS-000023 Rev 00, ICN 01.

Ho, C.K., 2000, "Abstraction of Flow Fields for RIP," Analysis and Model Report, ANL-NBS-HS-000023 Rev 00, ICN 00. (http://www.ymp.gov/documents/amr/index.html)

Ho, C.K., 2000, "Analysis of Base-Case Particle Tracking for Base-Case Flow Fields," Analysis and Model Report, ANL-NBS-HS-000024 Rev 00.

Pan, L. and C.K. Ho, 2000, "Analysis Comparing Advective-Dispersive Transport Solution to Particle Tracking" Analysis and Model Report, ANL-NBS-HS-000001 Rev 00.

Co-author and co-editor of "Unsaturated Zone Flow and Transport Model Process Model Report," TDR-NBS-HS-000002 Rev 0.

Contributing author of "Viability Assessment of a Repository at Yucca Mountain—Volume 3: Total System Performance Assessment," 1998, DOE/RW-0508.

Ho, C.K. et al., 1998, "Total System performance Assessment-Viability Assessment (TSPA-VA) Analyses Technical Basis Document—Chapter 2 Unsaturated Zone Hydrology Model," B00000000-01717-4301-00002 Rev 01.

Ho, C.K. et al., 1996, "Thermo-Hydrologic Modeling of the Potential Repository at Yucca Mountain Including the Effects of Heterogeneities and Alternative Conceptual Models of Fractured Porous Media," Rev.00 Level 3 Milestone T6536, MOL.19961219.0269, 186 pages.

Small Business Assistance

Robinson, A. and C.K. Ho, 2005, Investigation of Issues Regarding Colorimetric Stickers for Fruit: Final Report for RediRipe LLC, SAND2005-5175, Sandia National Laboratories NM Small Business Assistance Program, Albuquerque, NM.

Ho, C.K. and T.A. Bibeau, 2005, Finite Element Stress Analyses of Ties for Masonry Applications: Final Report for The Arquin Corporation, SAND2005-5877, Sandia National Laboratories, Albuquerque, NM.

Invited Presentations

Ho, C.K., Continuous Monitoring of Volatile Organic Compounds in the Subsurface Using an In-Situ Chemiresistor Sensor, invited presentation at the 2004 North American Environmental Field Conference, Tampa Bay, FL, January 13-16, 2004.

Ho, C.K., From Chemiresistor Sensors to Real-Time Subsurface Hydrocarbon Monitoring Systems: Lessons Learned, SAND2002-4095A, invited presentation at the National American Chemical Society Meeting, New Orleans, LA, March 23-27, 2003.

Ho, C.K., L.K. McGrath, and J. May, 2003, In-Situ Chemiresistor Sensors for Monitoring Subsurface Contaminants, invited presentation at the 2003 CUPA Conference, Anaheim, CA, 2/5/03.

Invited presentation to Senator Bingaman on microsensors for real-time water-quality monitoring, Cooperative Monitoring Center, Albuquerque (2/19/01).

Invited presentation to Sandia Leadership Council on microsensors for real-time soil- and water-quality monitoring, Albuquerque (4/02).

Invited presentation on unsaturated-zone flow and traceability of TSPA-VA to Nuclear Regulatory Commission and Nuclear Waste Technical Review Board (3/98 & 4/98).

Invited presentations on enhanced vapor diffusion at New Mexico Tech (9/23/96), Washington State University (10/4/96), and Intera (10/10/96).

RICONDO & ASSOCIATES

Mark R. Johnson, AICP

Director

Education	Bachelor of Arts – Geography, University of Nebraska Master of Arts – Urban and Regional Planning, University of Iowa.
Professional Associations	American Planning Association American Institute of Certified Planners
Selected Speaking Engagements and Publications	Presentations on noise and land use compatibility, National Organization to Insure a Sound-Controlled Environment (NOISE) annual conferences (2004, 2005, 2006) Presentations on airport/community planning and economic development at American Planning Association National Conferences (2003, 2004, 2005, 2009, 2010) Presentation on airport land use compatibility, FAA's National Environmental Conference, 2003 Presentation on Part 161 noise and access restriction studies, FAA Great Lakes Regional Airports Conference, 2001 "The Airport/Land Use Interface," in *Planning and Urban Design Standards*, edited by American Planning Association, John Wiley & Sons, 2006. "Noise," (with Eric Seavey) in *Planning and Urban Design Standards*, edited by American Planning Association, John Wiley & Sons, 2006.

Experience

Mr. Johnson joined Ricondo & Associates in 2008. He began his airport consulting career in 1986, specializing in airport noise and land use compatibility studies and environmental impact analysis. He has successfully managed over 25 airport noise studies, including 20 FAR Part 150 noise compatibility studies, and over 20 airport land use compatibility plans across the United States. He has also supported local planning departments in the review of development proposals for compatibility with nearby airports. Most of the Part 150 studies included substantial land use planning and mitigation programs. The studies at Milwaukee, Toledo Express, and Palwaukee considered mitigation measures that would combine AIP noise funds with either private funding or other sources of public financing to facilitate the redevelopment of property acquired for noise mitigation.

Mr. Johnson has a reputation as an excellent communicator and facilitator on planning assignments where collaboration with diverse stakeholders is required. He is an imaginative technical analyst who has developed innovative approaches to aircraft noise analysis and the presentation of those analyses. He has also developed innovative techniques for the application of benefit-cost analysis to noise abatement studies.

Among his recent assignments is management of the comprehensive airport land use compatibility plan for the environs of San Francisco International Airport. This project is among the first land use compatibility studies funded through the

FAA's Section 160 program, authorized by Congress in the 2003 FAA Reauthorization Act. The study includes the development of airspace protection policies accounting for both Part 77 and TERPS surfaces.

Mr. Johnson is also managing the airport land use compatibility planning project for San Diego County's public and military airports, including San Diego International Airport.

A theme common to both the San Francisco and San Diego projects is the need to balance airport protection with airport vicinity economic development. This requires consideration of the State mandates required of the municipalities (related to housing and transit-oriented development), and the economic forces to which developers are subject. The objective of both projects is to protect the airports while also preserving and enhancing their roles as special nodes of economic activity.

Mr. Johnson also recently served on the advisory panel for ACRP Project 03-03, Enhancing Airport Land Use Compatibility.

Prior to entering airport consulting, Mr. Johnson worked for eight years as a city planner for municipalities in Iowa and Oregon.

Representative Assignments

Aircraft Noise Abatement Analysis
Airspace and Air Traffic Control Procedures Analysis
Airport Environs Planning
Airport Vicinity Safety Analysis
Benefit-Cost Analysis
Environmental Impact Assessments and Impact Statements
FAR Part 150 Noise Compatibility Studies
FAR Part 161 Noise and Access Restriction Studies
Land Acquisition Planning

Representative Clients

Albany County Airport Authority
Baton Rouge Metropolitan Airport Authority
Burbank-Glendale-Pasadena Airport Authority
City of Chicago Department of Aviation
City of Palm Springs Aviation Department
City of Phoenix Department of Aviation
City of St. George (Utah) Public Works Department
City of Scottsdale (Arizona) Aviation Department
City/County Association of Governments of San Mateo County, California
FAA, Air Traffic Organization (Western and Central Regions)
FAA, Airports Division (Northwest Mountain, Southwest, and Western Pacific Regions)
Little Rock Municipal Airport Authority
Metropolitan Knoxville (Tennessee) Airport Authority
Milwaukee County Department of Aviation
Riverside County (California) Aviation Department
San Diego County Regional Airport Authority
Toledo Port Authority

BLYTHE AIRPORT RISK ASSESSMENT

Supplemental Testimony of Alvin Greenberg, Ph.D.

The Blythe Solar Power Plant (BSPP) fence line is located one mile north of the fence line of Blythe Airport, a general aviation airport with no tower and thus following “visual” rules for approach, landings, and departures. The nearest solar collector trough array will be located approximately two miles from the end of the closest runway (the north/south runway).

If a plane should crash during approach or take off, it is conceivable that the crash could occur in the solar field of the BSPP. Such a crash would be catastrophic in nature to the plane’s occupants and to the solar field as the damage to the pipes containing the highly flammable heat transfer fluid (HTF - an oxygenated hydrocarbon material) would undoubtedly result in a fire at the crash site. Because a crash could result in the failure of some safety shut-off systems, there is a high potential for escalation of crash induced-fire in the solar field. The occupants of an airplane involved in a crash into a solar field would undoubtedly experience severe injuries and have a high probability of death. Staff initially described this type of accident as a **low probability/high consequence** event, yet the consequences would be low in terms of population impacts and impacts to the power grid.

Staff does not consider an aircraft flying over the solar array at high altitude in transit to be a significant contributor to the risk of a plane crashing. The ability of general aviation aircraft to glide a considerable distance after malfunction reduces the probability of a plane crashing specifically into the BSPP to below a level of significance. However, because the probability of such an event during approach and take off increases, the proximity of the solar fields to the Blythe Airport increases risk of a crash into the solar fields. Staff evaluated similar accident scenarios during the High Desert Project and BEP-I proceedings and determined that the probability of occurrence in those cases were less than 1 in 10,000,000 (Tyler 1999).

The probability of an aircraft crash into the solar field is proportional to the frequency of flights (specifically take offs and approaches from runways that would have the plane flying over or very near the solar field) and the relative location of the target facility in relationship to the runway (Hodges et al 1993). The National Transportation Safety Board (NTSB) and the California Department of Transportation (Caltrans) Division of Aeronautics found that airport size is a significant determinant in assigning an accident statistic to the category of being airport-related. They both determined that an accident located a certain distance beyond the runway - “airport vicinity” - within a 5-mile radius (as measured from the airport center in accordance with the NTSB data format) would meet the definition of an accident in the airport vicinity. This radius would include much of the BSPP site.

In order to more accurately determine the probability of such an accident occurring, staff conducted a risk assessment. Staff conducted its analysis based using two methodologies:

1. Airport safety zones, as described in The California Airport Land Use Planning Handbook, State of California Department of Transportation, Division of Aeronautics, January 2002; and
2. Actual aviation accident statistics for the most recent year available (2009) obtained from the NTSB.

Probability of a Crash into the Solar Array using the California Airport Land Use Planning Handbook

In reviewing, establishing, and maintaining airport safety zones, the surrounding land use (present and future) is the most important factor. The consequences of an off-airport aircraft accident are highly dependent upon the nature of the land use at the accident site. The California Department of Transportation (Caltrans) evaluates three criteria when assessing an airport's need for a safety zone:

1. Intensity of land use (people per acre),
2. Residential versus nonresidential land uses, and
3. Sensitive uses which contain two subcategories:
    - Low Effective Mobility Occupancies (schools, day care centers, hospitals, and nursing homes), and
    - Hazardous Materials locations (aboveground storage tanks).

Caltrans has developed runway protection zones (RPZs) which are trapezoidal-shaped areas located at ground level beyond each end of a runway. The size of an RPZ is airport-specific and depends upon type of landing approach available at the airport (visual, non-precision, or precision) and the type of aircraft (e.g., single or multi-engine, commercial or private) operating at the airport. If a part of a RPZ is not under direct airport control, the FAA recommends that churches, schools, hospitals, office buildings, shopping centers, and other places of public assembly, as well as fuel storage facilities, be prohibited. Beyond the runway protection zones, the FAA has no specific safety-related land use guidance other than airspace protection. Caltrans, however, recommends Safety Compatibility Zones depending upon the length of the runways. The safety zones are described as follows:

Zone 1: Runway protection zone;
Zone 2: Inner approach/departure zone;
Zone 3: Inner turning zone;
Zone 4: Outer approach/departure zone;
Zone 5: Sideline zone; and

Zone 6: Traffic pattern zone.

The zones are specific to runway length. In this case, the two runway lengths are in different Categories, the shorter in the Medium General Aviation Runway category and the longer in the Long General Aviation Category. The Blythe airport runway lengths are:

- East/West runways 8/26: 6543 ft.
- North/South runways 17/35: 5800 ft.

Caltrans Figure 9B depicts the accident distribution contours for all general aviation arrival accidents and Fig. 9C for departures in the database for all runway lengths. The results show the following:

- Arrival accident sites tend to be located close to the extended runway centerline.
- Some 40 percent fall within a narrow strip, approximately 500 feet wide and extending some 2,000 feet from the runway end.
- Over 80 percent of the arrival accident sites are concentrated within just 2,000 feet laterally from the extended runway centerline, but extending outward to approximately 11,000 feet (about 2.0 miles) of the runway end.
- Departure accident sites also tend to be located near the runway end, but are not as concentrated close to the runway centerline as are the arrival accident sites.
- Some 40 percent of the points lie within an area 1,500 feet wide, extending approximately 2,000 feet beyond the runway end, but also adjacent to the edges of the runway.
- About 80 percent of departure accidents extend up to 6,000 feet beyond the runway end plus laterally along the sides of the runway approximately 2,000 feet from the runway centerline.

Using this data, Caltrans suggests the following safety zones for a minimal use general aviation airport:

Zone 1: Runway Protection Zone
Very high risk requires airport ownership of property, prohibit all new structures.
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Zone 2: Inner Approach/Departure Zone
Substantial risk requires a prohibition on residential and most commercial uses but allows large, agricultural parcels. Prohibit children's schools, day care centers, hospitals, nursing home, and fuel storage tanks.

Zone 3: Inner Turning Zone
This zone primarily applicable to general aviation airports and requires limits on residential uses and commercial uses to very low densities and prohibits schools,

hospital and aboveground fuel tanks. It also includes locations where aircraft typically turn to final approach and the area where departing aircraft complete the transition from takeoff to their route heading

Zone 4: Outer Approach/Departure Zone
This zone is particularly applicable to busy general aviation runways with straight-in instrument approach procedures and other runways where straight-in or straight-out flight paths are common. This zone prohibits schools, day care centers, hospitals, and nursing homes. This zone can be reduced in size or eliminated for runways with very-low activity levels

Zone 5: Sideline Zone
Encompasses close-in area lateral to runways where primary risk is with aircraft losing directional control on takeoff (especially twin engine aircraft). Area is on airport property at most airports.

Zone 6: Traffic Pattern Zone
Generally low likelihood of accident occurrence at most airports; risk concern primarily is with uses for which potential consequences are severe. Zone includes all other portions of regular traffic patterns. Recommends allowing residential uses but avoiding placement of outdoor stadiums, schools, large day care centers, hospitals, nursing homes, and similar uses with very high intensities.

On this basis, Caltrans recommends the following guidelines:

Zone 1: Runway Protection Zone - Maintain all undeveloped land clear of objects in accordance with FAA standards.

Zone 2: Inner Approach/Departure Zone -Seek to preserve 25 percent to 30 percent of the overall zone as usable open land.

Zone 3: Inner Turning Zone - At least 15 percent to 20 percent of the zone should remain as open land.

Zone 4: Outer Approach/Departure Zone - Maintain approximately 15 percent to 20 percent open land within the overall zone.

Zone 5 Sideline Zone—Adjacent to the runway ends and runway protection zones 25 percent to 30 percent usable open land is a desirable objective.

Zone 6: Traffic Pattern Zone - Elsewhere within the airport environment, approximately 10 percent usable open land or an open area approximately every 1/4 to 1/2 mile should be provided.

When this information is applied to the Blythe Airport, it appears that the proposed Blythe Solar Power Plant is outside of all Safety Zones suggested by Caltrans. The closest the BSPP would come to a safety zone would be Zone 4, the Outer Approach/Departure Zone. If runway 17/35, the north/south runway, was to be used, the end of the runway would come closest to the solar array, approximately 2 miles (10,560 ft.) to the left of the approach/departure center line. This places the solar array significantly outside the limits of the safety zones and at the furthest point where over 80 percent of the arrival accident sites are concentrated (but well short of the 6000 ft. distance where 80 percent of departure accidents occur).

Staff concludes, therefore, that the risk of a plane crash into the BSPP due to approach or take off from the Blythe Airport would be less than significant. Staff notes that the application of these criteria by the Riverside County Land Use Commission resulted in Compatibility Zones a bit further out from the center point of the airport than staff found when applying the Caltrans criteria (Riverside County Airport Land Use Compatibility Plan Policy Document, October 2004). Nevertheless, the Riverside County zones would also not prohibit the placement of a thermal solar power plant that uses HTF.

Probability of a Crash into the Solar Array using aviation accident statistics for the most recent year available (2009)

Staff has determined that the number of flights flown into and out of the Blythe Airport averages ~25,000/yr over the past 10 years. The most recent projects have this figure increasing to ~35,000/yr in about 10 years. Using the figure of 35,000/yr, and assuming that departures and landings are evenly distributed, that amounts to ~17,500 departures/yr. According to the NTSB Aviation Accident Statistics, Table 10, General Aviation year 2009, the rate for all accidents was 7.2 per 100,000 flight hours. While it is difficult to convert the number of departures to flight hours, staff assumed that a departure lasted 5 minutes (until a plane reached stable altitude) and that the probability score for crash during take off would be weighted as 75 percent of all crashes to arrive at an accident rate of 17,500 departures/yr x 5min/departure/60 min/hr = 1458 departure hours per year. Taking 1458 dhy/100,000 flight hrs x (7.2 accidents per 100,000 flight hours x 0.75) = 0.0787 = 0.08 accidents per year for departures. If the solar field were active for 30 years, this statistical method would predict 2.4 accidents over a 30 year period upon take-off. However, this method does not predict where the accident would occur in relation to the airport and the solar array.

The probability for approaches would be lower but a simple doubling of the departure probability shows an estimated accident rate at the Blythe airport of 4.8 flight accidents over the 30-year life of the BSPP, again, without predicting where the accidents would occur.

Staff's Conclusion

Applying the estimated flight accident incident rate calculated by staff above for the Blythe airport with the Caltrans California Airport Land Use Planning Handbook (described above), staff believes that the probability of a flight accident at the Blythe Airport is very low and that the location of the accident would be within Safety Zones 1 or 2, not the location of the Blythe Solar Power Plant. Therefore, staff concludes that the risk of a plane crashing into the solar array is less than significant. Staff notes that this analysis assumes conditions (weather, location of structures around the airport, and estimated flight usage though 2020) that exist during the period accident data have been complied continue on a similar trend in the near future. If factors on the ground change (e.g., glare and thermal plumes coming from the proposed solar power plant) in the airport vicinity significantly, staff's conclusion could change. Please see staff's aviation analyses for an assessment of glare and thermal plume impacts on flights.