Technical Feasibility of Compressed Air Energy Storage (CAES) Utilizing a Porous Rock Reservoir

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Abstract

Pacific Gas & Electric Company (PG&E) conducted a project to explore the viability of underground compressed air energy storage (CAES) technology.

CAES uses low-cost, off-peak electricity to compress air into a storage system in an underground space such as a rock formation or salt cavern. When electricity is needed, the air is withdrawn and used to drive a generator for electricity production.

The project screened potential sites in California and selected two locations: King Island, near Stockton, and East Island in San Joaquin County. All necessary rights were acquired at both sites to conduct tests and develop a CAES facility. Core drilling provided information on reservoir rock properties, caprock properties, reservoir pressure, and reservoir fluid. Results found the conditions at the King Island site to be more favorable than East Island. Air injection testing at King Island produced data on flow dynamics, rock mechanics, and other factors. Finally, the project team developed a conceptual engineering design for a CAES facility and reservoir infrastructure, and analyzed the environmental impacts and permitting requirements.

To determine the interest and qualifications of potential third parties, the project issued a Request for Offer (RFO), which required applicants to describe their technical qualifications to develop, construct, own, operate, and maintain a CAES facility at the King Island site, and to estimate their costs for participation in the project. Offers were received, but the best offer was not economically competitive with alternative storage technologies.

The project demonstrated the technical feasibility of using an abandoned natural gas reservoir for storing high-pressure compressed air for a 300-MW-by-10-hour CAES facility. The reservoir at the King Island site was shown to be capable of accommodating the flow rates and pressures necessary for the operation of the facility. However, the estimated high cost of a CAES facility will have to be addressed in the context of the cost of alternative energy storage technologies.

Chapter 8 Attachments

A801: Final Environmental Assessment
A802: Final Environmental Assessment Appendices
A803: Finding of No Significant Impact
A804: KICP Appendix 5.3E SWCA GeoTest 2012
A805: KICP Appendix 5.3F Comp Test 05.31.2013
A806: KICP Appendix 5.3G Subsurface Testing KICP Compression
A807: KICP ESLPA FINAL-Volume 1 - Document
A808: KICP ESLPA FINAL-Volume 2 - Appendixes

A801: Final Environmental Assessment

DOE/EA-1752

FINAL ENVIRONMENTAL ASSESSMENT

FOR THE

PACIFIC GAS AND ELECTRIC COMPANY (PG&E) COMPRESSED AIR ENERGY STORAGE (CAES) COMPRESSION TESTING PHASE PROJECT, SAN JOAQUIN COUNTY, CALIFORNIA

U.S. Department of Energy
National Energy Technology Laboratory

May 2014

DOE/EA-1752

FINAL
ENVIRONMENTAL ASSESSMENT

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PACIFIC GAS AND ELECTRIC COMPANY (PG&E) COMPRESSED AIR ENERGY STORAGE (CAES) COMPRESSION TESTING PHASE PROJECT, SAN JOAQUIN COUNTY, CALIFORNIA

U.S. Department of Energy
National Energy Technology Laboratory

May 2014

COVER SHEET

Responsible Agency: U.S. Department of Energy (DOE)

Title: *Final Environmental Assessment for the Pacific Gas and Electric Company (PG&E) Compressed Air Energy Storage (CAES) Compression Testing Phase Project, San Joaquin County, California (DOE/EA-1752*)

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Abstract: DOE prepared this EA to evaluate the potential environmental consequences of providing a financial assistance grant under the *American Recovery and Reinvestment Act of 2009* (Recovery Act; Public Law 111-5, 123 Stat.115) in a cooperative agreement with Pacific Gas and Electric Company (PG&E) as part of the Smart Grid Demonstrations Program. The project is co-funded by the federal DOE, California Public Utilities Commission, and the California Energy Commission. If PG&E receives the funding, the company proposes construction, operation, and closure of an injection and withdrawal well and associated temporary site facilities required to conduct compression testing of a depleted gas field. The geological formation to be tested is located on King Island, San Joaquin County, California. The project would consist of pressure testing a CAES reservoir to further examine and confirm the geological suitability of the site and provide more detailed information to provide a basis for engineering a possible future use of this site as a CAES facility. The permitting process includes the DOE serving as the lead federal agency for compliance with the National Environmental Policy Act of 1969, as amended (NEPA) and the U.S. Environmental Protection Agency for an Underground Injection Control Program Class V Injection & Withdrawal Well. This EA analyzes the potential environmental impacts of DOE's proposed action of providing Recovery Act funding for the PGE& CAES compression-testing project and of the No-Action Alternative.

The total cost of the compression-testing component of the project would be approximately $20 to $25 million.

In this EA, DOE evaluated the impacts to air quality; land resources/land use; biological resources; geology and soils; noise & vibration; cultural, historical and paleontological resources; socioeconomics and environmental justice; public and occupational health and safety; waste management; aesthetics and visual resources; utilities, energy and minerals; transportation; and water resources from PG&E's proposed Project.

Availability: DOE encourages public participation in the NEPA process. A Notice of Availability was placed in *The Record* (Stockton) and the *Lodi News-Sentinel* on November 26, 2013. *DOE made the draft EA* available for public review on *its* National Energy Technology Laboratory web site and at the San Joaquin County Public Library System beginning November 26, 2013. This EA is available on DOE's National Energy Technology Laboratory web site, http://www.netl.doe.gov/library/environmental-assessments, and DOE's NEPA web site at http://energy.gov/nepa/nepa-documents. *Additions and revisions to the text are presented in italics.*

ACRONYMS AND ABBREVIATIONS

AAQ	Ambient Air Quality
AFC	*Application for Certification*
AMM	Avoidance and Minimization Measure
APE	area of potential effects
ARB	California Air Resources Board
BMP	best management practices
BCA	biological constraints analysis
CAES	Compressed Air Energy Storage
CAISO	*California Independent System Operator*
CARB	California Air Resources Board
CDFW	California Department of Fish and Wildlife
CEC	California Energy Commission
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CH_4	methane
CFR	*Code of Federal Regulations*
CNDDB	California Natural Diversity Database
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
CPUC	California Public Utilities Commission
CRHR	California Register of Historical Resources
dB	decibel
dBA	A-weighted decibel
DOE	U.S. Department of Energy
DOGGR	Department of Oil, Gas, and Geothermal Resources
EA	*Environmental Assessment*
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ESA	federal Endangered Species Act
FEMA	Federal Emergency Management Agency
FWS	U.S. Fish and Wildlife Service
gpm	gallon(s) per minute
HFCs	hydrofluorocarbons
Hz	Hertz
IPCC	Intergovernmental Panel on Climate Change
IW	injection and withdrawal
M	Richter Magnitude
MCE	maximum credible earthquake

MMscf	million standard cubic foot
MW	*Megawatt*
N_2O	nitrous oxide
NAHC	Native American Heritage Commission
NEPA	National Environmental Policy Act of 1969, as amended
NO_2	nitrogen dioxide
NOx	nitrogen oxides
NRC	National Academy of Sciences
NRHP	National Register of Historic Places
NSR	North State Resources
NWI	National Wetlands Inventory
PFC	perfluorocarbon
PG&E	Pacific Gas and Electric Company
PM_{10}	particulate matter with median aerodynamic diameter of 10 micrometers or less
$PM_{2.5}$	particulate matter with median aerodynamic diameter of 2.5 micrometers or less
RFO	*Request for Offers*
ROG	reactive organic gas
RPR	California Rare Plant Rank
SF_6	sulfur hexafluoride
SHPO	California State Historic Preservation Officer
SJMSCP	San Joaquin County Multispecies Habitat Conservation and Open Space Plan
SJVAPCD	San Joaquin Valley Air Pollution Control District
SO_2	sulfur dioxide
Stat.	*United States Statutes at Large*
TDS	total dissolved solids
THPO	*Tribal Historic Preservation Officer*
tpy	tons per year
TSF	Temporary Site Facilities
U.S.C.	*United States Code*
UIC	Underground Injection Control
USDW	Underground Sources of Drinking Water
WRAP	Western Regional Air Partnership

Note: Numbers in this EA generally have been rounded to two or three significant figures. Therefore, some total values might not equal the actual sums of the values.

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SUMMARY

The U.S. Department of Energy (DOE) prepared this *final* environmental assessment (EA) to evaluate the potential environmental impacts of providing a financial assistance grant for up to $25 million under the *American Recovery and Reinvestment Act of 2009* in a cooperative agreement with Pacific Gas and Electric Company (PG&E) as part of the Smart Grid Demonstrations Program. The study is co-funded by the federal DOE, California Public Utilities Commission and the California Energy Commission. If PG&E receives the funding, the company proposes construction, operation, and decommissioning of an injection and withdrawal well, compression equipment, and associated temporary site facilities required to conduct pressure testing of a depleted gas field. PG&E proposes testing the gas field to confirm its geologic and engineering suitability for future use as the air storage reservoir for a compressed air energy storage (CAES) facility. PG&E proposes to conduct the testing program of a geological formation located below King Island, San Joaquin County, California. Testing would consist of the injection of air to build a subsurface bubble within the reservoir sands of the depleted King Island Gas Field, and then conducting a series of pressure tests to further confirm the geologic suitability of the site and provide more detailed information for the engineering of a future CAES facility. The permitting process for the CAES compression testing project includes the DOE's compliance with the *National Environmental Policy Act* (42 U.S.C. Section 4321 et seq.) and DOE's *National Environmental Policy Act* implementing regulations (10 CFR Part 1021) and procedures, and the federal Environmental Protection Agency Underground Injection Control Program Class V Injection & Withdrawal Well (Safe Drinking Water Act, 40 CFR Part 144, Sections 1421 and 1422).

The total cost of the compression-testing project would be approximately $20 to $25 million.

In this EA, DOE evaluated the potential environmental consequences of DOE's proposed action of providing financial assistance, and PG&E's proposed compression testing project. The EA also examined the No-Action Alternative, under which DOE assumes that because of its denial of financial assistance, PG&E would not proceed with the project.

DOE evaluated the environmental resource categories it commonly addresses in environmental assessments and identified no significant adverse effects from the proposed project. For the resource categories land use / land resources; waste management; aesthetics and visual resources; utilities, energy, and minerals; and transportation, DOE determined there would be no impacts or the potential impacts would be small, temporary, or both, and therefore did not carry those forward for additional analysis. DOE focused its analyses on those resources that could require new or amended permits, or have the potential for environmental impacts or controversy. These included air quality, biological resources, noise and vibration, public and occupational health and safety, and water resources as well as those resource areas that typically interest the public, such as socioeconomics and environmental justice and cultural, historic, and paleontological resources. The following paragraphs summarize the analyses.

During construction and operation, air emissions would include: (1) combustion emissions from vehicles, heavy-duty equipment, and *various* drilling rig *engines* used to construct the test facilities; (2) fugitive dust from site preparation activities; and (3) emissions of volatile organic compounds including greenhouse gases (GHG) from the injection and withdrawal well during test operations. These emissions would have minor but short-term impacts that are below the San Joaquin Valley Air Pollution Control District's recommended thresholds of significant impact or the General Conformity *de minimis* threshold values. Similarly, the GHG emissions associated with construction and operation activities are less than the Council on Environmental Quality significance threshold and would not have a significant impact on climate change.

Irrigation ditches along Eight Mile Road, dirt access roads, and near the development site provide marginal- to moderate-quality habitat for the giant garter snake (*Thamnophis gigas*), which is federal and state listed as threatened. The irrigation ditches and ponds also provide habitat for the western pond turtle (*Emys marmorata*), a California species of special concern. Trees within 0.5 mile of the study area provide nesting habitat for Swainson's hawk (*Buteo swainsoni*) and the white-tailed kite (*Elanus leucurus*), state listed as threatened. With the implementation of standard avoidance and minimization measures, DOE determined that the proposed project would not adversely affect these species. These measures include preconstruction surveys, exclusionary fencing, worker environmental training, burrow avoidance, road shoulder avoidance, speed limits, and biological monitoring. DOE consulted the U.S. Fish and Wildlife Service (FWS). The FWS responded and concurred with DOE's determination.

The project would involve the productive reuse of a depleted natural gas field, a geological resource. The potential of the project to induce seismicity is extremely low, based on recent studies of this phenomenon that involve thousands of oil and gas wells and analysis of the geologic setting.

Well drilling and construction equipment would create noise during the installation phase, and compressors, the withdrawal well air release vent, and choke manifold would create noise during test operation. Detailed modeling of project noise sources and noise attenuation with distance shows that, with the application of an air release stack silencer and other measures, the project would meet San Joaquin County's noise standards at the nearest sensitive receptor.

No previously recorded historic or cultural resources of significance occur in the project's area of potential effects. In addition, given that the project location is in a former marsh area of the Sacramento-San Joaquin Delta, the discovery of buried archaeological deposits during construction or operation is unlikely DOE consulted the California State Historic Preservation Officer and interested Native American Tribes. DOE determined there would be no impacts to federally listed or eligible historic properties. The California State Historic Preservation Officer responded and agreed with DOE's determination. The project site is in an area of recent alluvial deposits of low paleontological sensitivity and there are no previously recorded vertebrate paleontological finds near the project site. *In the event that cultural deposits are discovered during ground disturbance activities at the compression testing site, work would stop immediately and PG&E*

would notify the Tribes, the California State Historic Preservation Officer and others in accordance with the Unanticipated Discovery Plan.

The project would create indirect economic consequences because vendors and equipment suppliers would benefit from the orders for project components and support systems. The positive economic benefits would be small.

The evaluation of environmental justice impacts is dependent on determining if high and adverse effects from the proposed project would disproportionately affect low-income or minority populations. DOE determined that no high and adverse impacts would occur to any member of the community, including socioeconomic effects. Therefore, there would be no high and adverse impacts to any minority or low-income population.

Injected air would mix to some extent with residual natural gas contained in the reservoir sands. Work done to date suggests that the percentage of natural gas contained in air withdrawn from the reservoir should be relatively low; however, some uncertainty remains until preliminary findings can be verified through reservoir testing. It is thus possible that withdrawal air may contain methane in concentrations potentially posing a hazard for onsite workers. This potential hazard would be mitigated by modeling the reservoir behavior during injection and withdrawal testing to determine expected hydrocarbon concentrations, monitoring of the reservoir and withdrawal air for actual concentrations, operational controls to prevent hazardous mixtures from reaching the surface and, if needed, injection of air with a depleted molar oxygen concentration of five percent or less to reduce the hydrocarbon concentrations in the withdrawal air.

Site preparation and construction could result in stormwater runoff and soil erosion. To limit the potential for storm water runoff and prevent runoff from entering potential waters of the U.S., PG&E would use permeable materials to construct the drilling and operation pad. The pad design would direct runoff away from equipment. PG&E would prepare a Storm Water Pollution Prevention Plan in accordance with the National Pollutant Discharge Elimination System General Permit for Storm Water Discharges. The project would use an *air-cooled* closed-loop cooling system that would minimize the use of fresh water for project operation. Produced water from the compressed air withdrawal would be stripped from the air stream, captured, and trucked offsite along with other wastewater to be disposed of *properly* at a certified commercial *disposal facility*.

The project would not cause impacts cumulatively with other reasonably foreseeable projects. The project site is agricultural and no development projects are currently proposed for this area. In addition, project activity would take place over a period of only *12* months so that long-term and cumulative impacts are unlikely to occur when combined with projects currently under development in the region.

DOE assumed for the EA analyses that PG&E would not proceed with the project without DOE assistance. Therefore, there would be no impacts to any resource category from the No-Action Alternative. The small, positive socioeconomic impacts would also not occur under the No-

Action Alternative. In addition, DOE's ability to achieve its objectives under the Smart Grid Demonstrations Program and the Recovery Act would be impaired.

1. INTRODUCTION

As part of the American Recovery and Reinvestment Act of 2009 (the Recovery Act; Public Law 111-5, 123 Stat. 115), the U.S. Department of Energy (DOE) National Energy Technology Laboratory, on behalf of the Office of Electricity Delivery and Energy Reliability's Smart Grid Demonstrations Program, is providing up to $435 million in financial assistance through competitively awarded grants for the deployment of Smart Grid Demonstration projects. These projects verify technology viability, quantify costs, validate new business models at a scale that can be readily adapted and replicated around the country, and develop new and innovative forms of energy storage. The funding of the selected projects requires compliance with the National Environmental Policy Act of 1969 (NEPA; 42 United States Code [U.S.C.] 4321 et seq.), Council on Environmental Quality (CEQ) regulations (40 Code of Federal Regulations [CFR] Parts 1500 to 1508), and DOE NEPA implementing procedures (10 CFR Part 1021).

To comply with NEPA, DOE prepared this *final* environmental assessment (EA) for the Pacific Gas and Electric Company (PG&E) compressed air energy storage (CAES) compression testing project, in San Joaquin County, California. The DOE also examined the potential environmental consequences of DOE's proposed action, which is to provide federal financial assistance to the project. If PG&E receives the funding, the company proposes construction, operation and decommissioning of an injection and withdrawal (IW) well, air compression equipment, and associated temporary site facilities required to conduct compression testing of a depleted natural gas field. Its purpose is to simulate operation of a CAES facility to confirm geological and engineering suitability for this use.

The EA also examines the No-Action Alternative, under which DOE assumes that, because of its denial of financial assistance, PG&E would not proceed with the project.

This chapter explains NEPA and related regulations (Section 1.1), the background of the Smart Grid Demonstrations Program (Section 1.2), the EA's purpose and need for action (Section 1.3), the environmental resources DOE did not analyze in detail (Section 1.4), and the consultation and public comment process (Section 1.5). Chapter 2 discusses DOE's proposed action, PG&E's proposed project, the No-Action Alternative, and DOE's Alternative Actions. Chapter 3 details the affected environment and the potential environmental consequences of the proposed project and of the No-Action Alternative, and it considers resource commitments. Chapter 4 addresses cumulative impacts, and Chapter 5 provides DOE's conclusions from the analyses. Chapter 6 lists the references cited for this document. Appendix A contains the distribution list, and Appendix B contains correspondence between DOE, the California State Historic Preservation Officer (SHPO), tribal leaders of interested Native American Tribes, additional Native American individuals, the FWS, *and the San Joaquin County Environmental Health Department*. Appendix C contains a copy of a recent biological survey of areas in and around the proposed project site. Appendix D contains a copy of an environmental synopsis for proposals of this type that DOE used in the evaluation of potential impacts for Smart Grid Demonstrations Program Area of Interest 2 projects.

1.1 National Environmental Policy Act and Related Regulations

In accordance with DOE NEPA implementing procedures, DOE must evaluate the potential environmental effects of a proposed action that could have a significant impact on human health and the environment including decisions on whether to provide financial assistance to states and private entities. In compliance with these regulations and DOE's procedures, this EA:

- Examined the potential environmental impacts of the proposed action and the No-Action Alternative;
- Identified unavoidable adverse environmental impacts of the proposed action;
- Described the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity; and
- Characterized any irreversible and irretrievable commitments of resources that would be involved if DOE decides to implement its proposed action.

DOE must meet these requirements before it can make a final decision to proceed with a proposed federal action that could cause adverse impacts to human health or the environment. This EA fulfills DOE's obligations under NEPA and provides DOE with the information needed to make an informed decision about helping to finance the development of PG&E's proposed project in San Joaquin County, California. Note that California has an environmental review process under the California Environmental Quality Act (CEQA), which state or local agencies conduct for projects requiring a discretionary permit. The compression-testing project as currently proposed does not require any discretionary permits, so a CEQA review is not being conducted. However, certain issue areas typically addressed in the CEQA review process have been included in this NEPA document, as appropriate.

This EA evaluated the potential individual and cumulative impacts of the proposed project. No other action alternatives were analyzed. For purposes of comparison, this EA also evaluated the impacts that could occur if DOE did not provide funding (the No-Action Alternative), under which DOE assumed that PG&E would not proceed with the project. This assumption allowed DOE to compare the impacts of an alternative in which the project occurred with one in which it does not.

PG&E completed preliminary geological reservoir verification and analysis at the King Island and one other site in May 2013. These activities consisted of drilling test wells to conduct down-hole analysis and core sampling to determine viability for compression and pressure testing.

PG&E used standard skid-mounted well drilling equipment to collect core samples from the formation caprock and potential storage zone. Construction activities consisted of minor improvements to existing roads, construction of well pads, and drilling wells into the subsurface porous rock formation. Wells were constructed to meet local and state requirements thereby

ensuring that the groundwater was protected. Upon completion, surfaces were left as constructed at the request of the landowner. The two analysis sites were located in active agriculture areas. Biological Assessments prepared by North State Resources before the core drilling activities began documented that habitats and listed or sensitive species would not be affected. Cultural resource surveys conducted by SWCA Environmental Consultants prior to the analysis concluded no historic or prehistoric resources impacts.

PG&E would extend the existing electrical distribution system over a distance of 4.25 miles from the Eight Mile Road Substation to the Temporary Site Facility (TSF) site starting in November 2013. Work on the distribution line would consist of the reconductoring of a portion of the existing line and the installation of new distribution line along approximately two miles of the route. PG&E would use standard construction techniques to install new conductor on existing supports and to install new supports and conductor where needed. A small portion of the line near the substation would be constructed underground. These construction methods would meet local and state requirements. Upon completion, the wells would be decommissioned and the site would be turned over to the owner of the subsurface rights. The distribution line route is located along existing roadways, including Eight Mile Road, King Island Road, and unnamed agricultural access roads. A Biological Assessment prepared by North State Resources has documented that habitats and listed or sensitive species would not be affected. Cultural resource surveys conducted by North State Resources have concluded that no historic or prehistoric resources impacts would occur.

In accordance with criteria established by the CEQ in its regulations implementing the procedural provisions of NEPA (40 CFR Parts 1500-1508), DOE's NEPA implementing regulations (10 CFR Part 1021), which rely on those criteria, and DOE Order 451.1B, *National Environmental Policy Act Compliance Program*, DOE determined that, as interim actions, the subsurface geological exploration activities and distribution line construction would not have adverse environmental impacts and would not limit the choice of reasonable alternatives for the project. As a result, DOE allowed PG&E to proceed with the requisite subsurface investigation and distribution line upgrades. *PG&E completed preliminary geological reservoir verification and analysis at two sites in May 2013. Distribution line upgrades started in November of 2013 and are expected to be completed by June of 2014.*

1.2 Background of the Smart Grid Demonstrations Program

DOE's National Energy Technology Laboratory and the Office of Electricity Delivery and Energy Reliability manage the research and development portfolio of the Smart Grid Demonstrations Program. Its mission is to lead national efforts to modernize the electrical grid; enhance the security and reliability of the energy infrastructure; and improve recovery from disruptions to electricity supply. The Smart Grid Demonstrations Program will help verify the technological and business viability of new technologies and show how fully integrated smart grid systems can be readily adapted and copied around the country. Further, implementation of smart grid technologies could reduce electricity use by more than 4 percent by 2030. During that

time span, smart grid technologies can save U.S. businesses and consumers about $20.4 billion in electricity costs (DOE, 2009).

Congress appropriated funding for the Smart Grid Demonstrations Program in the Recovery Act to stimulate the economy and reduce unemployment, in addition to furthering the existing objectives of the program. DOE solicited applications for this funding by issuing a competitive Funding Opportunity Announcement (DE-FOA-0000036), "Recovery Act: Smart Grid Demonstrations," on June 25, 2009. The announcement invited applications in two areas of interest:

- Area of Interest 1, Smart Grid: Regionally unique demonstration projects to quantify smart grid costs, benefits, and cost-effectiveness; to verify smart grid technology viability; and to validate new smart grid business models at a scale that can be readily adapted and replicated around the county. Smart grid technologies of interest include advanced digital technologies for use in planning and operation of the electric power system and the electricity markets such as microprocessor-based measurement and control, communications, computing, and information.

- Area of Interest 2, Energy Storage: Demonstrations projects for major, utility-scale energy storage installations to help establish costs and benefits, to verify technical performance, and to validate system reliability and durability at scales that can be readily adapted and replicated across the United States. Energy storage systems include advanced battery systems (including flow batteries), ultra-capacitors, flywheels, and compressed air energy systems. Application areas include wind and photovoltaic integration with the grid, upgrade deferral of transmission and distribution assets, congestion relief, and system regulation.

DOE prepared an environmental synopsis to evaluate and provide a comparison of potential environmental impacts for each proposal it deemed to be within the competitive range. DOE used the synopsis to evaluate appreciable differences in the potential environmental impacts from those proposals. The synopsis included: (1) a brief description of background information for the Smart Grid Demonstration area of interest, (2) a general description of the proposals DOE received in response to the Funding Opportunity Announcement and deemed to be within the competitive range, (3) a summary of the assessment approach DOE used in the initial environmental review to evaluate the potential environmental impacts associated with the proposals, and (4) a summary of the environmental impacts that focused on potential differences among the proposals. Appendix D contains a copy of the environmental synopsis for Area of Interest 2.

On November 24, 2009, DOE announced its selections of 16 projects in Area of Interest 1 and 16 projects in Area of Interest 2 based on the evaluation criteria in the funding opportunity announcement and giving special consideration to projects that promoted the objectives of the Recovery Act—job preservation or creation and economic recovery—in an expeditious manner.

PG&E's proposed project, the installation and operation of a CAES facility, was one of the 16 projects DOE selected for funding under Area of Interest 2. The company would store energy by compressing air for storage in an underground storage reservoir, a depleted natural gas well field, during off-peak hours of electricity use. During the hours of peak use, the facility would withdraw the compressed air to power a turbine and generate electricity. Phase I of the project consists of site selection, geologic verification, permit filing preparation and engineering for the CAES plant. For this project's compression testing, PG&E would inject compressed air to build a test bubble in the subsurface reservoir. The test bubble would then be subjected to a battery of pressure tests to gather information regarding reservoir characteristics and support further refinement of computer models and conceptual engineering design of the CAES facility. If the test is successful, PG&E or other parties may move forward with full-scale development and permitting of a CAES facility. At the conclusion of the proposed compression testing project, all constructed facilities would be decommissioned and removed. DOE's proposed action is to provide PG&E with about $25 million in financial assistance in a cost-sharing arrangement with the California Public Utilities Commission (CPUC) and the California Energy Commission (CEC) for the compression-testing project. The total cost of the proposed project would be about $20 to $25 million.

1.3 Purpose and Need for DOE Action

In June 2009, DOE initiated a process to identify suitable projects to lead the way for deploying integrated smart grid systems by issuing Funding Opportunity Announcement DE-FOA-00000036, "*Recovery Act: Smart Grid Demonstrations*." This funding opportunity announcement was funded under the Recovery Act.

The purpose of the proposed action is to support the objectives of the Smart Grid Demonstrations Program—to demonstrate advanced smart grid technologies and integrated systems that would help build a smarter, more efficient, more resilient electrical grid—and the goals of the Recovery Act. The Program would help verify smart grid technology viability, quantify smart grid costs and benefits, and validate new smart grid business models at a scale that can be readily adapted and replicated around the country. DOE believes PG&E's proposed project can meet these objectives because it would: (1) increase power quality and reliability in its service area; (2) reduce impacts associated with carbon emissions; (3) increase energy security through reduced oil consumption; and (4) further national knowledge and technology of new renewable energy-generating and peak-shifting systems.

The Recovery Act seeks to create jobs, restore economic growth, and strengthen America's middle class through measures that modernize the nation's infrastructure, enhance America's energy independence, expand educational opportunities, preserve and improve affordable health care, provide tax relief, and protect those in greatest need. The Recovery Act provided DOE with the monies it is using for grants in the Smart Grid Demonstrations Program.

There has been chronic underinvestment and parochialism in getting energy where it needs to go through new transmission and distribution systems, further limiting grid efficiency and reliability. DOE's proposed action of providing this project with funding would help initiate modernization of a small portion of the nation's electrical grid system.

1.4 Environmental Resources Not Carried Forward

Chapter 3 of this EA describes the affected environment and examines the potential environmental impacts of the proposed project, associated actions, and the No-Action Alternative for the following resource areas:

- Air quality
- Biological resources
- Geological hazards and resources
- Noise
- Cultural, historic and paleontological resources
- Socioeconomics and environmental justice
- Public and occupational health and safety
- Water resources

The focus of the more detailed analyses in Chapter 3 is on those resources that could require new or amended permits, have the potential for significant impacts or controversy, or typically interest the public, such as socioeconomics and historical and cultural resources.

DOE EAs commonly address the environmental resource areas listed in Table 1-1. However, in an effort to streamline the NEPA process and enable a timely award to the project, DOE did not examine the resource areas in the table at the same level of detail as the above-mentioned areas. Table 1-1 describes DOE's evaluation of those resource areas. In each case, there would be no impacts or the potential impacts would be small or temporary in nature, or both. Therefore, DOE determined that further analysis is unnecessary. In terms of the No-Action Alternative, the potential impacts Table 1-1 lists would not occur because DOE assumes the proposed project would not proceed.

Table 1-1. Environmental Resource Areas with No, Small, or Temporary Impacts

Environmental Resource Area	Impact Consideration and Conclusions
Land Use, Land Resources	The project site is located in an area zoned agricultural (minimum 40-acre parcel) within which petroleum and gas extraction is a permitted use. The compression-testing project would not conflict with neighboring land uses, which are agricultural, and would not conflict with existing land use plans or policies, habitat conservation plans, or natural community conservation plans. It would not physically divide an established community.

Table 1-1. Environmental Resource Areas with No, Small, or Temporary Impacts

Environmental Resource Area	Impact Consideration and Conclusions
	The project site is classed as prime farmland by the California Department of Conservation and the project would involve conversion of approximately 1.7 acres from walnut orchard to energy research use as the TSF Pad. This conversion could be temporary. However, if the project does not move forward, the pad would be transferred to King Island Gas Storage, the owner of the subsurface rights, who may choose to return the pad to agricultural production. The project parcel is not under a Williamson Act agricultural preservation contract and so would not involve the conversion of an agricultural preserve to non-agricultural uses.
Waste, Hazardous Materials	Site preparation and construction would generate small amounts of construction-related wastes, primarily solid nonhazardous waste, such as such as packaging materials, sludge and earthen materials (drilling mud and drill cuttings). Construction would generate approximately 8 tons of waste. Temporary operations, followed by decommissioning, would generate small amounts of wastes (primarily solid nonhazardous waste) such as drilling mud, and building materials. The project would also generate some hazardous wastes, such as light bulbs and batteries. Operations and decommissioning would generate approximately 45 tons of waste. PG&E would send these wastes to a *commercial* disposal facility such as the San Joaquin County North County Recycling Center and Sanitary Landfill, Aqua Clear Farms in Rio Vista (for drilling mud), *or* a deep injection well operated by ASTA Construction in Rio Vista (for produced water). The amount of waste generated would not affect local landfill capacities. The project site is not located on or near a location on the Cortese list (CA Government Code Section 65962.5) of hazardous sites and would not create a hazard to the public in terms of its use or transportation of wastes.
Aesthetics and Visual Resources	The proposed project would not adversely affect aesthetics or visual resources, and the proposed project site is not located near sensitive visual resources receptors such as residential or recreational viewers. It would not block significant or scenic views and is not located on a designated scenic highway. The drilling equipment would be 120 feet tall and could be seen for a distance, but would not represent a visually intrusive element out of character with other utilitarian structures in this rural and agricultural area. In addition, the drilling equipment would be on site for less than two months. The compressors and other operation equipment would have a relatively low profile, would not be seen at a distance, and would be removed at the conclusion of the test. The visual character of this area is that of a highly engineered landscape devoted almost exclusively to large-scale, mechanized agriculture and gas wells. Few viewers would be likely to see the visual changes that would occur on the site. The closest residence is a ranch-related home located over one- half mile away.

Table 1-1. Environmental Resource Areas with No, Small, or Temporary Impacts

Environmental Resource Area	Impact Consideration and Conclusions
	Given the flat terrain and the intervening orchard trees, the changes to the project site would not be readily visible from this residence.
Utilities, energy, and materials	The proposed project would not affect community infrastructure or facilities. It would use up to 10 MW of power on a temporary basis for compression testing, but this would not result in energy shortages in the PG&E grid. The project would not involve the use of significant quantities of other materials that are in short supply. It would involve leakage of a small amount of water in the closed-loop cooling system, but this would not interfere with local agricultural irrigation or other activities.
Transportation	The proposed project would not affect local traffic and transportation. Construction worker traffic to and from the project would involve a maximum of 44 worker commute vehicles and 11 truck deliveries per day during the second month of construction, using Interstate 5, West Eight Mile Road, and agricultural roads that have little traffic on them and the use would be temporary. During operation, eight employees would travel to and from the site daily.

1.5 Consultations and Public Comments

1.5.1 Consultations

Prior to the release of the draft EA for public comment, DOE sent project information to the California SHPO, FWS, and twelve interested Native American Tribes and individuals for their consideration.

California State Historic Preservation Officer

On June 7, 2013, DOE sent a letter to the California SHPO in accordance with the review requirements of Section 106 of the National Historic Preservation Act, as amended (16 U.S.C. 470 et seq.), and implementing regulations at 36 CFR Part 800. The letter detailed DOE's investigation of nearby historic properties and concluded that no historic properties would be affected by the proposed project. The California State Historic Preservation Officer responded on June 26, 2013, with a letter indicating their agreement with DOE's determination that the project would not affect historic properties. On June 28, DOE notified the California SHPO of a minor change in the area of potential effect related to distribution line construction and the California SHPO responded on July 3, 2013, with a letter of concurrence that the area of potential effects, as amended, would not affect historic properties. Additionally, on August 1, 2013, DOE informed the California SHPO of an additional minor change involving additional expansion of

the distribution line construction work area. On August 7, 2013, the California SHPO responded with a letter of concurrence that, with the additional expansion of the area of potential effects the project also would not affect historic properties. Appendix B1 contains copies of this correspondence.

U.S. Fish and Wildlife Service

On May 31, 2013, DOE sent a formal consultation letter to the FWS in accordance with the review requirements of Section 7 of the Endangered Species Act. The FWS responded and concurred with DOE's determination that the proposed project is not likely to adversely affect threatened and endangered species. On June 28, DOE notified the FWS of a minor change in the affected area related to distribution line construction. Additionally, on July 24, 2013, DOE informed the FWS of a minor change involving additional expansion of the distribution line construction work area. On August 2, the FWS concurred with DOE's determination that the project, as amended, would not be likely to adversely affect listed species.

On April 28, 2014, DOE sent a follow-up consultation letter and an updated Biological Effects Assessment to the FWS in accordance with the review requirements of Section 7 of the Endangered Species Act. The updated information detailed the necessary revised avoidance and mitigation measures as required by FWS to ensure that the proposed project is not likely to adversely affect threatened and endangered species. PG&E cannot proceed with additional construction beyond the original authorization as noted in the FWS letter dated August 2, 2013, until FWS issues an updated concurrence review. Delays in completing the project's environmental review process resulted in changing the project construction schedule, which requires follow-up review by FWS. PG&E will comply with all avoidance and mitigation measures as required by FWS.

Native American Tribes

In June of 2013, PG&E contacted the Native American Heritage Commission (NAHC) to request a list of potentially interested Native American Tribes and organizations. PG&E received a response from Ms. Silvia Burley of the California Valley Miwok Tribe. Ms. Burley had no specific concerns regarding the project but did request that she be notified in the event that any Miwok-associated materials or human interments were discovered during the course of ground-disturbing project activities.

The Ione Band of Miwok Indians contacted DOE on or about December 20, 2013, requesting information related to cultural resources records searches, surveys and geo-technical testing, as well as an in-person consultation between DOE and the Tribe. In response, DOE contacted PG&E and asked that they provide the Tribe with the requested information. DOE then made arrangements to meet in-person with the Ione Band of Miwok Indians and the Buena Vista Rancheria of Me-Wuk Indians at their Tribal offices in California.

On January 28, 2014, DOE staff met in-person with tribal members of the Buena Vista Rancheria of Me-Wuk Indians Tribal Historic Preservation Office (THPO) Board at their office located on 4650 Coalmine Road in Ione, California. Those attending the meeting included THPO board members; tribal monitors; a THPO advisor; and DOE's Project Manager, Tribal Liaison and NEPA Document Manager. THPO board members provided DOE with information regarding their concerns about the consultation process and construction monitoring and asked questions about and made requests related to unanticipated discoveries, future project actions, comments on the draft EA, and distribution of the EA and other documents. THPO board members requested that an unanticipated discovery plan be included as part of the final EA. THPO board members also requested that the small abalone shell fragment discovered near the distribution line right-of-way be recorded and the Tribes be notified about the find. THPO board members also asked DOE to provide an explanation in the final EA as to how this project might proceed forward upon successful completion of the compression testing phase. A response to this request can be found in Section 2.2.3. DOE sent all participating Tribes copies of the discovery documentation form and location map regarding the abalone shell fragment discovery. A copy of the transmittal letter is included in Appendix B2.

On January 29, 2014, DOE and PG&E staff met in-person with cultural committee members of the Ione Band of Miwok Indians at their office located in Plymouth, California. Those attending the meeting included the Cultural Committee Chairman and one additional Cultural Committee member, along with PG&E's Project Manager; PG&E's Archeologist; and DOE's Project Manager, Tribal Liaison and NEPA Document Manager. Tribal Cultural Committee members provided DOE with a list of cultural and environmental resource areas for discussion at the meeting. Tribal members informed DOE and PG&E of their concerns about potential impacts regarding water quality controls as they relate to the floodplain, groundwater and surface water; wildlife and fisheries impacts as they relate to fish habitat, golden eagles, condors and endangered species habitat; greenhouse gas mitigation; sediment contamination and mitigation; native plant restoration; traditional cultural properties; burial sites; cultural sites; and noise. Analyses for each of these resource areas are provided in the final EA in the follow sections: water quality controls – Sections 3.2.2.1.1, 3.8.1.1, 3.8.1.2, 3.8.1.3, 3.8.2.1.2 and 3.8.2.2; wildlife and fisheries – Sections 3.2.1.2, 3.2.1.4 and 3.9.3; greenhouse gas mitigation – Sections 3.1.1.2, 4.1, 4.2 and 5; sediment contamination and mitigation – Sections 3.3.1 and 3.8.2.1.2; native plants – Sections 3.2.1; traditional cultural properties – Sections 1.5.1 and 3.5; ; and cultural sites – Sections 1.1, 1.4, 1.5.1, 3.5.1.1, 3.5.2.1.1, 3.5.2.1.2, 4.1, 4.2 and 5. Cultural Committee members also requested information related to site geology and the equivalent number of homes the proposed project would provide with electricity. DOE provided the Ione Band of Miwok Indians the requested information pertaining to site geology and the equivalent number of homes potentially served by a full-scale, commercial facility in a letter dated February 14, 2014, which is included in Appendix B2. In addition, Cultural Committee members requested that sub-surface pre-testing be completed at the compression testing site prior to performing any additional vegetation removal.

On January 30, 2014, DOE and PG&E staff met in-person with Ione Band of Miwok Indians' cultural committee members at the King Island project site along and near Eight Mile Road. Those attending the site meeting included the Cultural Committee Chairman and one additional Cultural Committee member, along with PG&E's Project Manager, PG&E's Archeologist, and DOE's Project Manager, Tribal Liaison and NEPA Document Manager. PG&E lead a windshield tour of the project site beginning at the substation along Eight Mile Road and ending at the compression testing site. At the compression testing site all parties exited their vehicles and walked the project site. Cultural Committee members expressed concerns that the DEA had not properly assessed Traditional Cultural Properties and Native American cultural resources. They also requested that additional testing be conducted in the walnut orchard prior to tree removal to determine if cultural artifacts or burial sites exist within the immediate project area.

On February 7, 2014, DOE held a teleconference with the Wilton Rancheria Tribe to discuss the ongoing preparation of the final EA and to provide information on the status of the distribution line upgrade work and monitoring activities, and the timeline for future project activities. The Wilton Rancheria requested: (1) that they be provided copies of all daily monitoring logs completed to date along with copies of future monitoring logs; (2) that they be allowed to monitor the remaining distribution line upgrade work and walnut tree removal at the compression testing site and be compensated for their time; and (3) that DOE expand the cultural resource section of the final EA to incorporate more ethnographic information, including the results of interviews with tribal elders. DOE contacted PG&E and their cultural resource contractor, who in-turn provided the Tribe with the requested daily monitoring logs.

DOE received a letter dated March 18, 2014, signed by tribal chairpersons from the Buena Vista Rancheria of Me-Wuk Indians, the Ione Band of Miwok Indians, the Shingle Springs Band of Miwok Indians, and Wilton Rancheria. The letter noted their collective concerns and requests relating to consultation, communication, protocols and procedures, cultural resource studies, agreements, subsurface testing, traditional cultural landscapes, unanticipated discoveries, and an ethnographic study. At the request of the Tribes, DOE prepared an Unanticipated Discovery Plan for buried cultural resources. On April 22, 2014, DOE provided the four participating Tribes with a draft of the plan for their review and comment. The Tribes' March 18, 2014, letter is included in Appendix B2.

DOE contacted the participating four Tribes by phone and followed with a teleconference on April 25, 2014. During the teleconference, the four participating Tribes and the Bureau of Indian Affairs discussed the ethnographic study, subsurface testing, tribal monitoring, self-determination, the Unanticipated Discovery Plan and issuance of a final EA.

As a direct result of the consultation process, DOE will require PG&E to prepare an ethnographic study and perform subsurface testing at the compression testing site. To determine the presence or absence of buried cultural resources, subsurface testing is to be conducted in the walnut orchard area adjacent to the existing well pad. Subsurface testing will be required prior

to construction. The ethnographic study will be conducted concurrently with the project activities. PG&E will select the subcontractor to perform the testing and study. PG&E shall require this work be performed by professionals meeting the requirements of completing such work in California. The subsurface testing will include up to 15 shovel pits (approximately 1.5'x3'x1.5-3' in depth). Material recovered from these test pits will be screened through one-quarter inch mesh, or suitable sized mesh acceptable for archeological investigation. The selected subcontractor is responsible for determining the details of the ethnographic study. Currently interested Tribes may participate in monitoring during the subsurface testing at the compression testing site. PG&E, or its representative, will cover the cost for one monitor from each participating Tribe. Compensation would be at the same hourly, per diem and mileage rates as provided for the temporary power monitoring effort. To protect cultural resources, PG&E shall maintain a copy of the Unanticipated Discovery Plan at the site and all parties will follow the plan during sub-surface testing and ground disturbance activities at the compression testing site. In the event that cultural deposits are discovered, work would stop immediately and PG&E would notify the Tribes, the California State Historic Preservation Officer and others in accordance with the Unanticipated Discovery Plan.

DOE also extended an offer to all of the consulting Tribes to include any special cultural resource language, data or related information that they may want to provide within the final EA. The Tribes were contacted on the following dates: The Buena Vista Rancheria of Me-Wuk Indians - December 30, 2013; Shingle Springs Band of Miwok Indians - December 30, 2013; the Ione Band of Miwok Indians - January 29, 2014; and the Wilton Rancheria Tribe - February 7, 2014.

1.5.2 Comment-Response Process

DOE issued the draft EA for comment on November 26, 2013 and advertised its release in *The Record* and the *Lodi News-Sentinel* on November 26, 2013. In addition, DOE sent a copy for public review to the San Joaquin County Public Library System. DOE established a 35-day public comment period beginning on November 26, 2013 and ending on December 31, 2013. DOE announced comments would be accepted by mail, email, or facsimile. The draft EA was also sent to the applicable Federal, state, and local agencies. *During the 35-day public comment period, which ended on December 31, 2013, DOE received one comment letter from the San Joaquin County Environmental Health Department. This letter indicated that this agency had reviewed the draft EA and has no substantive comments on the document. A copy of the letter is in Appendix B4. DOE also received and accepted comments on the draft EA on March 12, 2014, from the Buena Vista Rancheria of Me-Wuk Indians. The Tribe's comments and DOE's response are included in Appendix B4.*

2. DOE PROPOSED ACTION AND ALTERNATIVES

This chapter describes DOE's proposed action (Section 2.1), PG&E's proposed project (Section 2.2), the No-Action Alternative (Section 2.3), and DOE Alternative Actions (Section 2.4).

2.1 DOE's Proposed Action

DOE's proposed action is to provide up to $25 million in financial assistance to PG&E, who has also received approval from the CPUC to obtain equal matching funds. The cost of the pressure testing phase, which is the subject of this draft EA, is estimated to be approximately $20 to $25M. The total project cost of full development of a commercial-scale CAES facility (i.e. 300 MW nominal output) over the full period of performance may be up to $356 million. This amount includes subsequent phases of the project leading to full implementation of a CAES facility, which are not currently funded and may or may not be realized.

2.2 Pacific Gas and Electric Company's Proposed Compressed Air Energy Storage Compression Testing Project

2.2.1 Project Overview

Renewable energy resources, such as wind and solar power, have the potential to reduce dependence on fossil fuels and greenhouse gas emissions in the electric sector. Concerns regarding climate change have spurred state regulation encouraging the integration of renewable resources into the power generating fleet. For example, under California's existing Renewable Portfolio Standard, utilities must supply 33 percent of all electricity retail sales from eligible renewable resources by the year 2020. Much of this new generation is expected to be derived from the addition of new solar and wind power generation[1]. Because wind and solar resources are by nature variable (i.e., the sun does not always shine and wind does not always blow when power is actually needed), their addition to the power generating fleet poses challenges to the reliable operation of the power distribution grid and the cost of their integration. Energy storage has been identified as an important component of strategies to mitigate these effects and facilitate greater penetration of wind and solar power into the existing power generation and distribution system. CAES has been identified as a key enabling technology for expanding reliance on renewable resources for electricity production[2] and typically provides a larger energetic return on investment when compared to many other types of storage technologies[3].

[1] California ISO, 2010, Integration of Renewable Resources, Operational Requirements and Generation Fleet Capability at 20% RPS, August 31.

[2] Denholm, Paul, E. Ela, B. Kirby, and M. Milligan, 2010, The Role of Energy Storage with Renewable Power Generation, NREL Technical Report NREL/TP-6A2-47187, January.

PG&E is currently studying the feasibility of using a porous underground rock formation (depleted natural gas field) in its service territory for a CAES project. CAES technology involves two major processes: (a) air compression and underground injection for storage and (b) air release for electricity generation. During the air compression and storage process, electric motor-driven compressors inject air into a sealed and porous underground geological formation for storage under high pressure. During the air release phase, the high-pressure air is released from the underground reservoir, heated using natural gas (if necessary), and expanded through sequential turbines ("expanders"), which drive an electrical generator. The stored energy can be used during periods of higher electric demand, improving the efficiency of energy distribution through the power grid. Worldwide, two CAES plants using man-made caverns in salt formations—the McIntosh plant in Alabama and the Huntorf facility in Germany—have operated successfully for over 20 years.

The first phase of the feasibility study was completed in June 2013 and involved collection of core samples at depleted natural gas fields on King Island and East Island, San Joaquin County, California. The rock core samples were analyzed to determine whether the formation would support a CAES facility and King Island was selected for the second phase. The second phase, which is the subject of this EA, would be to conduct pressure testing of the formation. This would consist of injecting air to build a subsurface bubble within the reservoir sands of the depleted King Island Gas Field, and then conducting a series of pressure tests to further confirm the geologic suitability and provide more detailed information for project engineering. The permitting process includes the DOE's compliance with NEPA and the federal Environmental Protection Agency Underground Injection Program Class V Injection & Withdrawal Well. This study is co-funded by the DOE, CPUC, and CEC.

2.2.2 King Island Storage Reservoir Geology

The proposed compressed air storage reservoir consists of permeable sands of the Upper Cretaceous Mokelumne River Formation that occur at depths between approximately 4,675 feet and 4,800 feet below ground. The reservoir is an elliptically shaped erosional remnant of approximately 235 acres in horizontal area that is enclosed on all sides by shales of the Paleocene Meganos Gorge Fill and capped by the Eocene Capay Shale. This geological formation created an impermeable natural trap in which natural gas collected over geologic time and was stored under pressure for millions of years prior to extraction by natural gas production activities between 1980 and the present. As such, the reservoir may be suitable for storage and extraction of compressed air with its potential energy. Compressed air would be stored in the pores between particles of sand and the shale cap would hold the compressed air in place. The thickness of the storage reservoir is approximately 100 feet at this location.

[3] Barnhart, Charles, M. Dale, A. Brandt, and S. Benson, 2013, The Energetic Implications of Curtailing Versus Storing Solar- and Wind-Generated Electricity, Energy and Environmental Science, DOI: 10.1039/c3ee41973h, August 14.

2.2.3 King Island Temporary Site Facilities

The proposed location of the King Island Temporary Site Facilities (TSF) is approximately 1.8 miles northwest of the city of Stockton's northern boundary at Eight Mile Road in northwestern San Joaquin County, California (Figures 2-1 and 2-2). The TSF site would be situated about two miles north of West Eight Mile Road between White Slough and Bishop Cut, and can be accessed from Interstate 5 via West Eight Mile Road. The area surrounding the TSF site is generally level and ranges in elevation from approximately 5 to 10 feet below sea level. Water levels in White Slough and Bishop Cut are slightly above sea level and are separated from King Island by a series of levees topped by paved and unpaved roads.

The area surrounding the test site is crossed by a series of dirt and gravel ranch roads that provide access to the various ranch fields and to the test site. A ranch yard and a series of ranch houses are located approximately 0.5 to 0.75 mile south of the test site along the south side of an east-west-trending gravel road.

The TSF site pad would be approximately 650 feet by 165 feet, or 2.5 acres in size, of which 0.7 acre was created for the geological core-drilling task associated with this project. The pad would be constructed at the locations shown on the site plan (Figure 2-3). Construction activities associated with the project include access road improvements, work pad construction, and well drilling, and would take approximately five months to complete.

PG&E would expand the existing 0.7-acre pad by additional clearing, grubbing, scarifying, and compacting into an area that is currently planted with sapling-stage walnut trees, requiring the removal of approximately 90 small trees. Geotextile material would be placed over the compacted work area, then up to 18 inches of sub-base material and Class II aggregate base would be placed and compacted. The work area would be crowned and sloped so that stormwater sheet-flows off the pad. PG&E would limit all construction activities to the pad and a 10-foot buffer area.

Once the TSF pad is constructed, a drilling rig and associated equipment would be moved onto the work pad. The primary equipment includes the drill rig, mud and water tanks and pumps, shaker tanks, electric generators, diesel fuel tanks, drill pipe racks and support trailers. *A new* well would be drilled into the formation *and used* for injection and withdrawal of air. *A* second *existing* well *would be instrumented* to monitor field pressures and responses to the injection and withdrawal process. The construction contractor would place all wastes, cuttings and drilling mud associated with well drilling in proper storage receptacles and transported them offsite to an authorized disposal facility.

Water for pad construction and well drilling would be trucked to the project area from off-site municipal water supply sources. All drilling activities would comply with the *EPA underground injection control (UIC) permit*. Construction wastewater would be hauled offsite and disposed of at a permitted, commercial *disposal facility*.

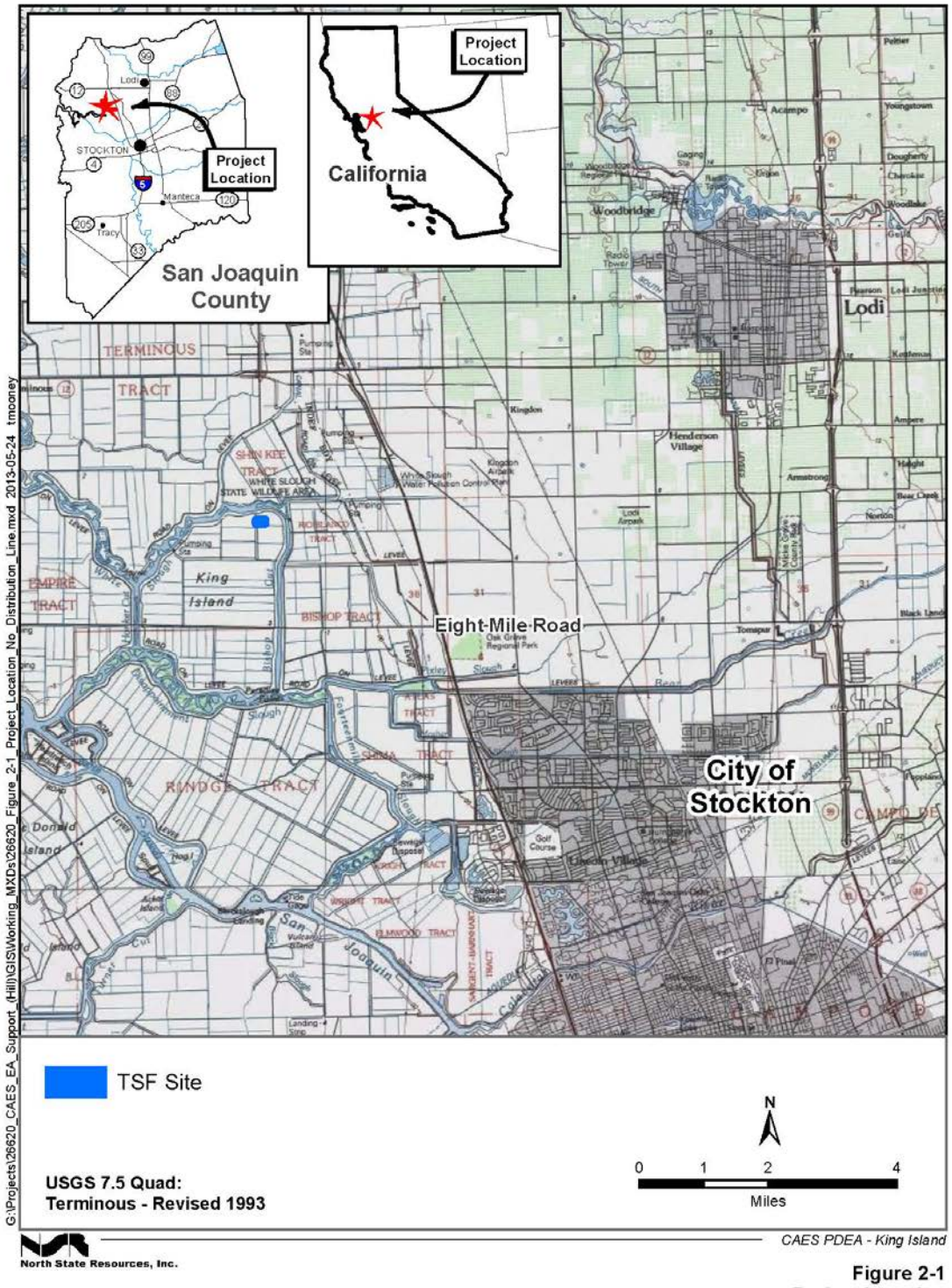
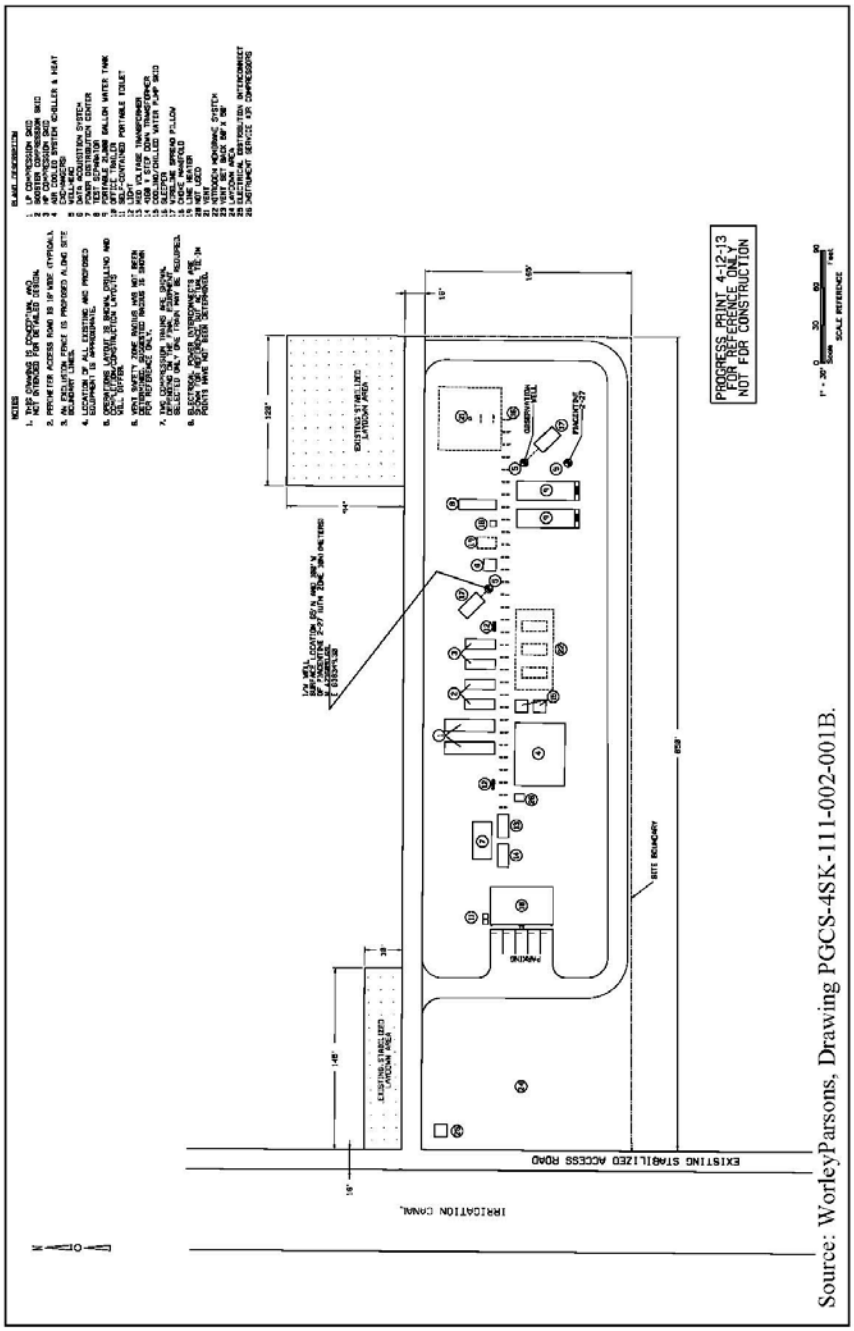


Figure 2-1
Project Location



Figure 2-2
TSF Facility



Source: WorleyParsons, Drawing PGCS-4SK-111-002-001B.

Figure 2-3. Site layout.

Access road and pad construction would involve approximately eight workers, five trucks, a road grader/maintainer, dozer (D-5 or equal), sheep's foot compactor, roller compactor, water truck, and similar construction equipment. Up to 5,000 cubic yards of road gravel and aggregate base would be required. Total duration of this task is approximately 6 weeks.

The drilling crew, engineers, temporary workers and site visitors would number an average of approximately 12 workers/people per shift, with three shifts per day during pad construction and drilling. A maximum of 20 workers may be present at one time during various operations. In addition to worker vehicles, service, equipment and material delivery vehicles would access the site during the drilling phase.

The well construction and installation would be followed by four to five months of compression and withdrawal cycling that simulates the operation of a CAES facility. During this period, approximately 12 workers would be onsite per day, staffing three eight-hour shifts. Before testing can begin, the compressors would create a subsurface air "bubble" of compressed air in the reservoir that is about one billion cubic feet in size. This would take approximately 14 days to complete.

After the bubble is created, a series of pressure tests would be conducted and data would be collected from the IW well, the observation well and possibly from additional existing nearby gas wells to assess the reservoir response. Testing protocols are still being developed and would include a series of sequential injection, pressure buildup, pressure fall-off and possibly flow tests. The test would include periods of injection, typically from several hours to several days in length, followed by shut in periods from several hours to several days in length. Flow testing, if conducted, would consist of a series of sequential flow tests at increasing rates over a period of about a day. In addition, cyclical injection, shut in and flow tests may be conducted to simulate daily reservoir cycling over a period several days to several weeks. The final compression testing plan would be developed to collect data that allows assessment of the reservoirs characteristics to support refinement of the computer reservoir model constructed for the project. Maximum pressures, injection rates and flow rates used during the testing would not exceed those used for evaluating potential environmental effects in this EA.

During each cycle, daily injection would take place for several hours, followed by a short shut-in period and five to *fifteen* hours of withdrawal. The length of the injection and flow periods would depend on the testing rates.

The CAES compression test project would take place at reservoir pressures up to several hundred pounds per square inch above the original reservoir pressure in order to allow sufficient flow to build the bubble. Pressures would be highest near the injection well during injection and would dissipate rapidly with distance from the well Injection pressures would be maintained consistently below the fracture pressure of the geological cap formation, as determined for other nearby projects and as would be confirmed in advance by geo-mechanical testing. Pressure in the well would be monitored and observed throughout the test period. Operational pressure is

expected to be somewhat below the original field pressure, under which natural gas was trapped in the reservoir for several million years.

Preliminary reservoir modeling indicates that air withdrawn from the reservoir is likely to produce some amount of residual natural gas in the extracted flow. The data suggest the concentrations of natural gas should be relatively low; however, model refinement is still in progress and the modeling entails some assumptions and uncertainties. Therefore, the possibility that using ambient air for the test could create a combustible withdrawal mixture cannot be ruled out for safety planning purposes. Engineering approaches to assure safety during the test include measures to automatically shut in the well before natural gas concentrations reach hazardous levels, injection of air with its oxygen content depleted to a molar concentration of approximately 5 percent, and/or limiting the extent and duration of any flow testing.

During the above tests, regular pressure, temperature, injection rate, flow rate, water production and gas chemistry measurements would be collected and recorded using an automated data acquisition system. Additional measurements would be made in the field and selected process gas samples would be submitted for laboratory analysis.

Because compressing air generates heat, PG&E would use an air-cooled closed-loop cooling system that consists of pumps, heat exchangers and air-cooled radiators. The cooling water system would have two circulating water pumps each capable of 1,500 gallons per minute (gpm). The closed-loop water systems would require about 4,200 gallons for the compressor-cooling portion. Nominal water loss is conservatively expected to be 25 gallons per day from *seal, flange, or tube leakage*. The initial water requirements and this small quantity of loss would be supplied by a municipal source and hauled to the site in a water truck. After compression testing is complete, the *closed-loop* cooling *system* water would be hauled offsite in trucks and disposed of in a permitted, commercial *disposal facility*.

Other than the IW well itself, the primary equipment used during the compression test would include the following:

- High-pressure compressor train capable of injecting the compressed air at flow rates up to 17 million standard cubic feet per day and compressor outlet pressures up to a maximum of 2,700 pounds per square inch

- After-cooler to cool the compressed air to a temperature no higher than approximately 140 degrees Fahrenheit before injection

- If necessary for safety purposes, the air supply stream may include oxygen-depleted air generated using a portable membrane filtration system or similar equipment.

- Appurtenant equipment including a temporary electrical supply, a step-down transformer, a power distribution system, a compressor cooling system, high-pressure piping, and control circuitry

- Equipment to support withdrawal testing including high-pressure piping, a choke valve, an electric line heater, a phase separator, one or more produced water storage tanks, and an air discharge vent

- Monitoring and measurement equipment including:

  – Wellhead pressure and temperature sensors at the wells

  – A sensor array along the discharge piping to measure flow, pressure, temperature, combustible gas concentrations, oxygen concentrations and relative humidity

  – A sensor array along the injection piping to measure flow, pressure, temperature, oxygen concentrations, and relative humidity

Pressure and temperature readings may be taken during compression testing using wire-line gauges that are lowered into the IW well and observation well. In addition, wire logs (e.g., gamma and pulsed neutron spectrometry) of the observation well may be conducted to assess the size of the air bubble over time. Sampling ports would be provided along the injection and discharge lines near the wellhead so that gas samples can be collected for field testing and laboratory analysis.

Following completion of the compression testing, all of the drilling, compression, and other equipment would be removed from the site. If compression testing indicates that the reservoir and site demonstrate the appropriate characteristics to support a commercial, utility-scale compressed air energy project, the pads and wells could be utilized in the development and operation of the full-scale CAES project.

Prior to making a decision on whether to move forward with the development and operation of the full scale CAES project, PG&E would issue a Request for Offers (RFO). The RFO would seek qualified bidders (engineer-procure-construct contractors, equipment vendors, independent power producers and storage facility operators are examples of potential participants) who are interested in constructing, owning and/or operating the full-scale scale CAES project. Based on the technical and economic results of the RFO, PG&E would make a determination on whether to move forward with commercial scale development.

If a decision were made to move forward, multiple approvals must be secured before construction can commence. First, PG&E must file an application with the CPUC, seeking their approval for the project. Additionally, the project developer would need to file an Application for Certification (AFC) with the CEC and a UIC application with the EPA. Both the CEC and UIC permits must be obtained prior to starting construction. The AFC process acts as a clearinghouse for all state and local permitting activities. It includes a public review process that reaches out to all Tribes identified by the Native American Heritage Commission (NAHC). Additional information on the AFC process is available at: http://www.energy.ca.gov/sitingcases/.

The following table provides a high-level forecast/timeline of milestones beginning upon issuance of the RFO:

Milestone	***Forecasted Date***
Issue RFO	*2015*
Go/No-Go Decision	*2016*
File CPUC Application	*2016*
File AFC with the CEC	*2017*
File UIC with the EPA	*2017*
Construction Begins	*2019*
Plant Operation Commences	*2021*

The project site, located in the Northern California service territory of PG&E, would be connected to the electric transmission grid, which is operated by the California Independent System Operator (CAISO). The CAISO manages the flow of electricity for approximately 80% of California; the project would provide capacity, energy, ancillary services (such as spinning and non-spinning reserve), and voltage support, as well as assist with integrating intermittent renewable resources on the CAISO grid. The current feasibility study is investigating a project of up to 300 megawatts (MWs) with up to 10 hours of storage capacity; this is enough power to supply approximately 225,000 homes when the plant is operating at full load.

If the testing demonstrates otherwise, the wells would be plugged and abandoned per California Department of Conservation Division of Oil, Gas, and Geothermal Resources (DOGGR) regulations and the requirements of the UIC permit issued by the EPA for the project. If the project does not move forward, the well pad and associated wells would be transferred to the King Island Gas Storage as the owner of the subsurface rights.



Figure 2-4. Views of and around the site.

2.2.4 Access Roads

The preferred site access route during project construction and operation would be via the levee road extending northward along the west side of Bishop Cut from Eight Mile Road (King Island Road), and from there via improved, gravel agricultural access roads to the site. Passage across the levee road would take place under conditions required under an encroachment permit from the local reclamation district responsible for maintenance of the levee (RD2044).

The gravel-surfaced roads are graded and well maintained and no new road construction or improvements would be necessary for the proposed project activities. The access roadways would be maintained as necessary during project construction and operation, and the following preventative measures would be implemented to protect the roadways from damage:

- Periodic dust control may be necessary and would be provided by wetting the road surface using a water truck. It is assumed that one daily application of water would be needed for the duration of the project.

- Steel plates may be placed over the irrigation siphons that penetrate beneath the levee road as a preventative measure to protect them from potential wheel loading.

- Potholes or cracks in the levee road may be filled with aggregate base, cold patch asphalt, or hot patch asphalt as needed to facilitate passage and prevent damage.

- Sections of gravel road may be re-leveled and re-compacted or resurfaced with imported aggregate base as needed for proper draining.

- Improvements to the existing access roads would be limited to light graveling if determined to be necessary (e.g., if work were scheduled to occur during the wet season) with the assumption that no additional grading would be required. If grading were required, it would be limited to the existing road and not extend beyond the compacted surface.

- Equipment used for road maintenance may include dump trucks, front-end loaders, water trucks, graders, smooth drum rollers and other equipment as needed.

The project would obtain coverage under the General Construction Stormwater National Pollutant Discharge Elimination System permit, Best Management Practices (BMP) would be deployed to prevent the potential release of sediment into adjacent waterways, including the placement of biodegradable fiber rolls, silt fences, sand bags, and other appropriate BMPs.

2.3 No-Action Alternative

Under the No-Action Alternative, DOE would not provide financial assistance for the proposed project. As a result, the project might be delayed as PG&E sought other funding sources to meet its needs or be completely abandoned if other funding sources could not be obtained. As a result, DOE's ability to achieve its objectives under the Smart Grid Demonstrations Program and the Recovery Act would be impaired.

Although this and other selected projects might proceed if DOE decided not to provide financial assistance, DOE assumes for purposes of this EA that the project would not proceed without their assistance. If PG&E did proceed without DOE's financial assistance, the potential impacts would be essentially identical to those if DOE provided the funding. To allow a comparison between the potential impacts of a project as implemented and the impacts of not proceeding with a project, DOE assumes that, if it were to decide to withhold assistance from a project, the project would not proceed

2.4 Alternatives

DOE's alternatives to this proposed project consist of the 31 other technically acceptable applications it received in response to Funding Opportunity Announcement DE-FOA-0000036, "*Recovery Act: Smart Grid Demonstrations*." Before selection, DOE made preliminary determinations about the level of review under NEPA based on potentially significant impacts it identified during review of the technically acceptable applications. DOE conducted these preliminary reviews pursuant to 10 CFR 1021.216 and prepared environmental critiques and

synopses for projects under the Funding Opportunity Announcement. These preliminary NEPA determinations and environmental reviews were provided to the selecting official, who considered them during the selection process. Appendix D contains a copy of the environmental synopsis for Area of Interest 2.

Because DOE's proposed action under the Smart Grid Demonstrations Program is limited to providing financial assistance in cost-sharing arrangements to selected applicants in response to a competitive funding opportunity, DOE's decision is limited to either accepting or rejecting the project as proposed by the proponent, including its proposed technology and selected sites. DOE's consideration of reasonable alternatives is therefore limited to the technically acceptable applications and the No-Action Alternative for each selected project.

3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Sections 3.1 to 3.8 detail the affected environment and potential environmental consequences for the proposed project and the No-Action Alternative. The sections discuss air quality; biological resources; geology and soils; noise and vibration; cultural, historical and paleontological resources; socioeconomics and environmental justice; public and occupational safety and health; and water resources. Section 3.9 discusses resource commitments.

3.1 Air Quality

Section 3.1.1 discusses regional air quality, and Section 3.1.2 provides estimates of emissions from PG&E's proposed project.

3.1.1 Affected Environment

3.1.1.1 Criteria Pollutants

The ambient air quality in an area can be characterized in terms of whether it complies with the primary and secondary National Ambient Air Quality (AAQ) Standards. The Clean Air Act (42 U.S.C. 7401 et seq.) requires the EPA to set national standards for pollutants that are considered harmful to public health and the environment. The EPA established standards for six criteria pollutants: carbon monoxide (CO), lead, nitrogen dioxide (NO_2), ozone, particulate matter [both with median aerodynamic diameter of less than or equal to 10 micrometers (PM_{10}) and less than or equal to 2.5 micrometers ($PM_{2.5}$)], and sulfur dioxide (SO_2). Primary standards define levels of air quality for each of the six criteria pollutants that would provide an adequate margin of safety to protect public health, including the health of sensitive populations such as children and the elderly. Secondary standards define levels of air quality that are deemed necessary to protect the public welfare, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings. EPA designates regions that do not meet the standards as nonattainment areas.

EPA has designated San Joaquin County as an extreme non-attainment area for ozone, a non-attainment area for $PM_{2.5}$, a maintenance area for PM_{10}, and an attainment area for lead, NO_2, and SO_2 (EPA, 2013a). Additionally, EPA has designated the urban area of Stockton as a moderate maintenance area for CO. EPA has designated all other areas within San Joaquin County as attainment areas for CO (EPA, 2013a). Table 3-1 lists the primary National Ambient Air Quality Standards for each criteria pollutant and 2011 AAQ monitoring data for San Joaquin County, as measured at the Stockton-Hazelton monitoring station, unless otherwise noted.

The proposed project would emit measurable quantities of ozone precursors (reactive organic gas [ROG] and nitrogen oxides [NOx]), CO, SO_2, PM_{10}, and $PM_{2.5}$ from the burning of fossil fuels in vehicles and heavy-duty equipment. ROG emissions are also expected from air[3] released during compression testing. Fugitive PM_{10} and $PM_{2.5}$ emissions are expected from site preparation, including soil disturbance, onsite cut / fill activities, and wind-blown erosion of stockpiles, as well as from vehicle travel on paved and unpaved roads. Lead emissions from the burning of fossil fuels were not estimated as they are expected to be negligible.

Table 3-1. Primary AAQ Standards and 2011 San Joaquin County AAQ Monitoring Data

Pollutant	Averaging period	Primary standard	2011 San Joaquin County AAQ Monitoring Data
Carbon monoxide	1-hour	35 ppm	3.2 ppm
	8-hour	9 ppm	2.1 ppm
Lead	Rolling 3-month Average	0.15 µg/m^3	NA [a]
Nitrogen dioxide	1-hour	0.100 ppm	0.062 ppm
	Annual Arithmetic Mean	0.053 ppm	0.015 ppm [b]
Ozone	8-hour	0.075 ppm	0.068 ppm
PM_{10}	24-hour	150 µg/m^3	66 µg/m^3
$PM_{2.5}$	24-hour	35 µg/m^3	65.5 µg/m^3
	Annual Arithmetic Mean	12 µg/m^3	13.9 µg/m^3
Sulfur dioxide	1-hour	75 ppb	16 ppb [c]

[a] Lead data for the 3-month averaging period were not available for any monitoring station.

[b] NO_2 data for the annual averaging period were not available from the EPA and were instead obtained from the ARB.

[c] SO_2 is not monitored in San Joaquin County; as a result, ambient SO_2 data were obtained from the monitoring station located at 3425 N First Street in Fresno, assuming that Fresno County would have ambient air conditions similar to San Joaquin County.

Source: California Air Resources Board (ARB), 2013a; ARB, 2013b; EPA, 2013b

µg/m^3 = micrograms per cubic meter
ppm = parts per million
ppb = parts per billion
NA = not available

[3] The air released from gas wells during compression testing is expected to contain low amounts of natural gas with estimates ranging from less than 0.5 percent to as much as 2 percent. According to laboratory analytical reports, 2.09 pounds of ROG are contained in each million standard cubic foot (MMscf) of King Island natural gas.

3.1.1.2 Greenhouse Gases

The burning of fossil fuels, such as diesel and gasoline, emits carbon dioxide (CO_2), which is a GHG. In addition, the withdrawal well test may result in the release of small amounts of methane, another GHG, from the air storage reservoir. GHGs can trap heat in the atmosphere and have been associated with global climate change. The Intergovernmental Panel on Climate Change (IPCC) 2007 Fourth Assessment Report stated that the earth's climate system is warming and that most of the observed increase in globally averaged temperatures since the mid- twentieth century is due to the observed increase in concentrations of GHGs from human activities (IPCC, 2007). GHGs are well mixed throughout the lower atmosphere, such that any emissions would add to cumulative regional and global concentrations of CO_2. The six key GHGs include CO_2, methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). The proposed project is expected to emit CO_2 and CH_4 from burning of fossil fuels in vehicles and heavy-duty equipment as well as from air[4] released during compression testing. N_2O emissions from the burning of fossil fuels were not estimated because they are expected to be negligible.

Projects requiring approval of funding from federal agencies that are in areas designated as nonattainment or maintenance for the National Ambient Air Quality Standards are subject to the EPA General Conformity Rule. Therefore, the emissions associated with the proposed project were compared to the General Conformity *de minimis* threshold values applicable to the proposed project site. The results of this comparison are included in the following section.

Additionally, the San Joaquin Valley Air Pollution Control District (SJVAPCD) has provided recommended thresholds of significant impact to be used in CEQA evaluations. Although this project does not require state or local discretionary permits and is therefore not subject to CEQA, these recommended thresholds would be used to further evaluate the potential impacts of the proposed project. The results of this comparison are also included in the following section.

The CEQ has provided draft guidance suggesting that quantities of direct GHG emissions equal to or greater than 25,000 metric tons of carbon dioxide equivalent (CO_2e) on an annual basis are meaningful and should be quantified and disclosed for project evaluations within the NEPA framework (CEQ, 2010). This threshold would be used as a guide for assessing whether GHG emissions from construction activities are meaningful.

[4] The air released from gas wells during compression testing is expected to contain trace amounts (approximately 2 percent) of natural gas, of which 92 percent is expected to be CH_4.

3.1.2 Environmental Consequences

3.1.2.1 Proposed Project

3.1.2.1.1 Construction Emissions

Air emissions from construction activities at the proposed site would include fugitive dust from site preparation and combustion emissions from vehicles and heavy-duty equipment for construction of new *temporary* facilities. *A* summary of the calculation methodology and results is presented below.

Construction emissions were estimated using construction equipment emission factors from the *California Emissions Estimator Model (CalEEMod) User's Guide* (Environ, 2011) or manufacturer guarantees and vehicle emission factors from EMFAC2007 (version 2.3). PM_{10} and $PM_{2.5}$ emissions from vehicle travel on paved and unpaved roads were estimated using emission factors from EPA's compilation of air pollutant emission factors, known as *AP-42* (EPA, 2011; EPA, 2006). PM_{10} emissions from soil disturbance and onsite cut / fill activities were quantified using emission factors from the *Software User's Guide: URBEMIS2007 for Windows* (JSA, 2007). $PM_{2.5}$ emissions from soil disturbance and onsite cut / fill activities were assumed to be 20.8 percent of the PM_{10} emissions per the *Final – Methodology to Calculate Particulate Matter (PM) 2.5 and PM 2.5 Significance Thresholds* (SCAQMD, 2006). PM_{10} and $PM_{2.5}$ emissions from wind-blown erosion of stockpiles were quantified using emission factors from the *Western Regional Air Partnership (WRAP) Fugitive Dust Handbook* (Countess Environmental, 2006). *Estimates for applicable construction equipment quantities, sizes, and utilization were based on contractor/engineering schedules and plans for all site work associated with the compression testing project (mobilization, civil improvements, well construction/work-over, infrastructure/equipment installation, testing and demobilization).*

The project's estimated construction emissions, summarized in Table 3-2, would be short-term as the construction period is only *four to six* months in duration. As shown in Table 3-2, construction emissions would not exceed either the SJVAPCD's recommended thresholds of significant impact or the General Conformity *de minimis* threshold values. Because the potential emissions from construction activities would be below these thresholds and short-term, these emissions would have a less-than-significant impact on air quality.

Table 3-2. Proposed Project Emissions

Criteria Pollutant Summary	Annual Emissions (tpy)					
	ROG	**CO**	**NOx**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Construction Emissions	*0.11*	*0.63*	*1.97*	*0.004*	*5.27*	*0.67*
Operation Emissions	*0.04*	*0.20*	*0.79*	*0.002*	*1.25*	*0.15*
SJVAPCD Significance Thresholds	10	NA	10	NA	NA	NA
Project Exceeds Thresholds?	No	No	No	No	No	No
General Conformity *de minimis* Thresholds	10	N/A	10	N/A	100	100
Project Exceeds Thresholds?	No	No	No	No	No	No

Source: SJVAPCD, 2002; EPA, 2010

tpy = tons per year
NA = threshold of significance not available

Similarly, the GHG emissions associated with construction activities, presented in Table 3-3, are less than the CEQ significance threshold of 25,000 metric tons of CO_2e per year (CEQ, 2010). As such, these emissions would have a less-than-significant impact on climate change.

Table 3-3. Proposed Project GHG Emissions

GHG Summary	Annual Emissions (metric tons/year)		
	CO_2	**CH_4***	**CO_2e**
Construction Emissions	*326.59*	*0.01*	*326.87*
Operation Emissions	*140.44*	*104.08*	*2,742.45*
CEQ Significance Threshold			25,000
Project Exceeds Threshold?			No

*Operation CH_4 emissions based on a worst-case estimate of 317 MMscfd total air withdrawn with a natural gas concentration of 2 percent.

Source: CEQ, 2010

3.1.2.2 Operations Emissions

Air emissions from operation activities at the proposed site would include combustion emissions from vehicles and ROG and CH_4 emissions contained in the air released during compression testing. The project's estimated operation emissions, also summarized in Table 3-2, would be short-term as the proposed operation period is only five months in duration. These emissions were estimated using based on analysis of native gas analysis and modeling of the reservoir to

determine the relatively small amounts of VOCs and GHG expected to be in the air during withdrawal. *The worst-case scenario of blowing down (venting) 200 MMSCF of air after flow testing in order to meet EPA reservoir pressure requirements was assumed.*

As shown in Table 3-2, operation emissions would not exceed either the SJVAPCD's recommended thresholds of significant impact or the General Conformity *de minimis* threshold values. Because the potential emissions from operation activities would be below these thresholds and would be short-term emissions, they would have a less-than-significant impact on air quality.

Similarly, the GHG emissions associated with operation activities, presented in Table 3-3, are less than the CEQ significance threshold of 25,000 metric tons of CO_2e per year (CEQ, 2010). As such, these emissions would have a less-than-significant impact on climate change.

3.1.2.3 No-Action Alternative

Under the No-Action Alternative, DOE would not provide funding to PG&E for the proposed project, and DOE assumed for this EA that the project would not proceed without DOE assistance. Under the No-Action Alternative, therefore, air emissions from project operation activities at the proposed site would not occur. However, there would also be no potential for a beneficial increase in electrical grid operation efficiency and decrease in regional emissions of pollutants from the development of the energy storage system.

3.2 Biological Resources and Soils

Section 3.2.1 describes biological resources in and near the proposed project site. Section 3.2.2 discusses the potential impacts. DOE sent a consultation letter to FWS with a copy of the survey to comply with Section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531 et seq.), and received a reply. The FWS concurred on August 2, 2013 with the determination (Section 3.4.2) that the project may affect, but is not likely to adversely affect listed species. Appendix C *contains* a biological resources constraints analysis *(BCA) and survey report* for the project. *This appendix also contains an addendum to the BCA, dated April 2014, that takes into consideration changes in the construction schedule made since the BCA was initially prepared in July 2013.*

3.2.1 Affected Environment

PG&E conducted *the* BCA of the proposed project area during 2012 and 2013. The BCA included a desktop review of biological resources and field surveys of the project area. For the purpose of this environmental assessment, the 'project area' includes a 200-foot buffer around the proposed TSF pad, a 20-foot buffer around all dirt access roads.

The purpose of the BCA was to: (1) characterize the habitats and vegetation communities present; (2) evaluate the potential for the occurrence of special-status plant and animal species; (3) determine the presence or absence of waters of the United States; (4) determine the presence

or absence of other sensitive biological resources (e.g., riparian habitats, nesting raptors); (5) determine potential impacts on biological resources resulting from project construction and operation; and (6) identify practicable avoidance and minimization measures to reduce the potential for adverse effects. A discussion of the methodology for the desktop review and field surveys is provided below.

The desktop review of biological resources included the use of the following information resources:

- Available baseline data, including National Agricultural Imagery Program aerial imagery, National Resources Conservation Service soil maps, and National Wetlands Inventory maps

- Resource database records, including California Natural Diversity Database (CNDDB) records, California Native Plant Society Inventory, and FWS species lists.

A field reconnaissance of the project area was conducted on April 3, 2103, by biologist Brandon Amrhein. The reconnaissance consisted of vehicle and pedestrian surveys of the project area to document the existing conditions and evaluate the presence of habitat for special status species, their potential to occur in the project area, and the potential of the project to affect these species.

This section provides the required wetland and floodplain assessment and this environmental assessment provides an opportunity for public review in compliance with regulations promulgated at 10 CFR 1022, "Compliance with Floodplain and Wetland Environmental Review Requirements." These regulations provide a guide for DOE compliance with Executive Order (EO) 11988, "Floodplain Management," and EO 11990, "Protection of Wetlands." EO 11988 requires federal agencies, while planning their actions, to avoid to the extent possible adverse impacts associated with the modification of floodplains and to avoid support for development in a floodplain when there is a better practicable alternative. EO 11990 requires that federal agencies, while planning their actions, consider alternatives to affecting wetlands, if applicable, and limit adverse impacts to the extent practicable if impacts cannot be avoided.

3.2.1.1 General Habitat

The proposed location of the King Island TSF is in the Delta Islands of San Joaquin County, in a landscape that currently supports active agricultural operations and an existing natural gas well site. The Delta Islands are areas of former marshlands of the Sacramento–San Joaquin Delta that were historically reclaimed for agricultural use by the construction of levees/dikes and draining.

The TSF site is located in an orchard of walnut tree saplings with surrounding dirt access roads. Vegetation communities occurring in the project area include annual grassland, cropland/ orchard, fresh emergent wetland, riverine, and ruderal communities. Project areas on either side of Bishop Cut support annual grassland. Cropland/orchard is the dominant vegetation community within the TSF site. The TSF site is entirely within the walnut orchard and the strips between tree

rows are regularly mowed or disked. All agricultural fields in the area are actively farmed, annually disked, and harvested and/or disturbed up to the edge of existing roads. Fresh emergent wetlands occur in portions of the irrigation ditches that are located adjacent to the TSF site and gravel access roads.

No seasonal wetlands, vernal pools, elderberry shrubs (*Sambucus nigra*), riparian habitats, or other sensitive natural communities (e.g., CNDDB ranked rare natural communities) are present in the project area.

3.2.1.2 Special-Status Species

As a result of the biological desktop review, it was determined that sixteen special-status plant and animal species could occur within the proposed project area and surrounding vicinity. Special-status plants include species that are: (1) listed as threatened or endangered under the California Endangered Species Act (CESA) or the federal Endangered Species Act (ESA); (2) proposed for federal listing as threatened or endangered; (3) state or federal candidate species; (4) designated as rare by the California Department of Fish and Wildlife (CDFW); and (5) have a California Rare Plant Rank (RPR) of 1A, 1B, or 2 species. Special-status animal species include species that are: (1) listed as threatened or endangered under the CESA or ESA; (2) proposed for federal listing as threatened or endangered; (3) state or federal candidate species; and (4) identified by the CDFW as species of special concern or fully protected species.

Special-status species that could occur in the project area and surrounding vicinity are discussed below.

Plants. Irrigation ditches along the gravel access road and TSF site provide habitat for special-status plant species. No habitat for federal-listed plant species is present in the project area. Seven California Rare Plant Rank (RPR) 1B species potentially occur including slough thistle (*Cirsium crassicaule*), woolly rose-mallow (*Hibiscus lasiocarpus* var. *occidentalis*), Delta tule pea (*Lathyrus jepsonii* var. *jepsonii*), Mason's lilaeopsis (*Lilaeopsis masonii*), Sanford's arrowhead (*Sagittaria sanfordii*), and Suisun marsh aster (*Symphyotrichum lentum*). Five RPR 2 species potentially occur and include watershield (*Brasenia schreberi*), bristly sedge (*Carex comosa*), Delta mudwort (*Limosella subulata*), eel-grass pondweed (*Potamogeton zosteriformis*), marsh skullcap (*Scutellaria galericulata*), and side-flowering skullcap (*Scutellaria lateriflora*). The CNDDB contains reported occurrences of watershield, woolly rose-mallow, Delta tule pea, Mason's Lilaeopsis, Delta mudwort, side-flowering skullcap, and Suisun marsh aster within five miles of the project area.

Reptiles. Irrigation ditches and adjacent uplands near the TSF pad area provide low-quality habitat for the giant garter snake (*Thamnophis gigas*), which is federal- and state-listed as threatened. An extant population of giant garter snakes occurs approximately 0.6 mile east of the project area. The irrigation ditches also provide habitat for the western pond turtle (*Emys marmorata*), a California species of special concern. Western pond turtles are reported by the CNDDB to occur 0.9 miles southeast of the TSF site.

Birds. Trees within 0.5 mile of the project area provide nesting habitat for the Swainson's hawk (*Buteo swainsoni*) and white-tailed kite (*Elanus leucurus*). The Swainson's hawk is state-listed as threatened and reported by the CNDDB to nest at several locations within two miles of the project area. The white-tailed kite is a California Fully Protected species and is reported by the CNDDB to nest within three miles northeast of the project area. Additionally, trees and shrubs provide habitat for loggerhead shrikes (*Lanius ludovicianus*) and may provide nesting habitat for northern harriers (*Circus cyaneus*). Both the loggerhead shrike and northern harrier are California species of special concern.

Burrows and other structures (e.g., culverts) in annual grasslands and ruderal habitats along road shoulders, open areas, and levee berms, provide habitat for burrowing owls (*Athene cunicularia*). The burrowing owl is a California species of special concern and is reported by the CNDDB to occur within 3.8 miles southeast of the project area.

3.2.1.3 Waters of the United States

Irrigation ditches occur immediately adjacent west of the TSF site and along the access roads. The ditches may qualify as waters of the United States.

3.2.1.4 Other Sensitive Biological Resources

Migratory birds and raptors (i.e., birds of prey) protected under the federal Migratory Bird Treaty Act and California Fish and Game Code may nest on open ground, vegetation, or structures within the project area or surrounding vicinity.

Wildlife corridors connect habitat separated by human activities. Wildlife corridors are important as they increase available habitat by providing protective passage between suitable habitat areas. Nursery habitat provides habitat elements necessary to raise young to maturity (e.g., caves, rookeries, wetland, rivers). Bishop Cut provides migratory, spawning, and rearing habitat for several fish species. Project activities would not occur within Bishop Cut and would not interfere with the movement of any native resident or migratory fish or wildlife species, with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery habitat.

Tree removal required for the project is limited to removal of approximately 90 sapling-sized walnut trees located at the TSF site. The walnut orchard is not considered a sensitive biological resource. Tree removal would not require authorization under, or conflict with, a tree ordinance.

The project area occurs within the San Joaquin County Multispecies Habitat Conservation and Open Space Plan (SJMSCP) planning area. The proposed project is not subject to discretionary approval by San Joaquin County, and as such, would not conflict with the SJMSCP.

3.2.2 Environmental Consequences

3.2.2.1 Proposed Project

3.2.2.1.1 Construction Impacts

Irrigation ditches provide potential habitat for special-status plant species. The proposed project would not include work or disturbance within the irrigation ditches. Therefore, no effects on special-status plant that reside in this habitat would occur.

Construction of the TSF site could affect seven special-status animal species including the giant garter snake, western pond turtle, Swainson's hawk, white-tailed kite, northern harrier, western burrowing owl, and loggerhead shrike. Within the project area there is a low potential for giant garter snakes and western pond turtles to occur in aquatic habitats near the TSF site and gravel access road. Swainson's hawks, white-tailed kites, northern harriers, and loggerhead shrikes have a low potential to occur near the TSF site. The western burrowing owl has a low potential to occur along the roadways and irrigation ditches.

Construction of the TSF site may affect giant garter snakes and western pond turtles during project activities (e.g., traffic, noise, lighting, ground disturbance, pole placement, or road improvement activities). Refueling or other fluid or chemical applications could result in impacts on water quality in irrigation ditches, which could affect these species or their prey base. Due to the low likelihood of giant garter snakes to occur in the project area, project avoidance of aquatic habitat, and the implementation of avoidance and minimization measures, the proposed project is not likely to adversely affect the giant garter snake. Although there is a low potential for western pond turtles to occur in the project area, no effects are expected because they are generally restricted to aquatic habitat and work would not occur in such habitats.

Vegetation removal, and noise and lighting generated during construction activities could affect Swainson's hawks, white-tailed kites, northern harriers, loggerhead shrikes, western burrowing owls and other nesting migratory birds or raptors if nests are physically removed or noise affects nest success. Nesting substrates are limited within the TSF site area. By implementing nesting bird surveys *and other avoidance and minimization measures*, adverse effects on nesting birds would be avoided.

Construction activities would be short term (approximately *five* months) and implementation of avoidance and minimization measures (AMMs) described in the *BCA* (Appendix C) would reduce effects on special-status species. These measures include preconstruction surveys, exclusionary fencing, worker environmental training, burrow avoidance, road shoulder avoidance, limiting speed, and an onsite biological monitor.

Based on the above information, DOE determined that the project should not adversely affect the giant garter snake, which is federally threatened. No effects are expected on any other, endangered, threatened or candidate species.

The project would not result in any physical disturbance of irrigation ditches nor result in direct impacts on waters of the United States during construction. AMMs have also been incorporated into the project activities to preclude the potential for indirect impacts on these habitats.

3.2.2.1.2 Operations Impacts

Operational impacts would be short-term, with operation of the project being limited to approximately *seven* months from approximately *December, 2014* to *June, 2015*. Because such impacts are limited to the pressure testing at the TSF site and light vehicular traffic on the gravel access road, potential effects on special-status species would be limited to four species. These species include the giant garter snake, Swainson's hawk, white-tailed kite, and loggerhead shrike.

Traffic to the TSF site would be limited to light vehicles and the occasional service trucks. Adverse effects *to special-status species* are not expected because: (1) the potential for giant garter snakes to occur in the project area is low, (2) work would not occur in aquatic habitat, and (3) vehicular traffic would be light.

Project construction, operation and decommissioning would produce noise that could affect nesting birds in the immediate vicinity of the TSF site. *If work starts during the nesting season, AMMs have been incorporated into the project to preclude the potential for impacts to nesting birds.*

The project would not result in any physical disturbance of irrigation ditches. AMMs have been incorporated into the project to preclude the potential for indirect impacts.

Implementation of AMMs presented in the Biological Constraints Analysis (Appendix C) would reduce the potential for effects on these species further. PG&E's standard BMPs would also be in place for equipment refueling and maintenance, and no adverse effects on aquatic species are expected.

3.2.2.2 No-Action Alternative

Under the No-Action Alternative, DOE would not provide funding to PG&E and, consequently, PG&E would not implement the proposed project. Since there would be no site preparation or operations, there would be no effects on biological resources.

3.3 Geological Hazards and Resources

3.3.1 Affected Environment

The project site is in an area of relatively flat topography typical of the California Central Valley. Near-surface sediments close to the site have been deposited primarily from the Sacramento, Mokelumne, and San Joaquin river systems. Surficial geology at the project site consists of

Quaternary Modesto Formation deposits of undifferentiated alluvium, forming a toe of Mokelumne alluvial fan, generally covered by Holocene intertidal deposits.

Active faults within 30 miles of the project site include segments of the Great Valley and Greenville faults. These faults run along the eastern margins of the Coast Ranges approximately 20 miles from the project site and are capable of generating maximum credible earthquake (MCE) moment magnitudes up to 7.3 (Blake, 2004). No major surface faults have been mapped near or crossing the project site and the site is not within an Alquist-Priolo Special Studies Zone.

3.3.2 Environmental Consequences

3.3.2.1 Proposed Project

The proposed project would not expose members of the public or property to geological hazards and would not prevent the use of geological resources. The project would make use of a natural gas field that has been depleted and therefore would involve the re-use and renewal of an existing geological resource. Because the surrounding topography is flat, the public would not be exposed to landslide hazards.

Recently, there have been public concerns about induced seismicity that could result from deep injection and from the use of hydraulic fracturing (fracking) techniques that involve the deep injection of fluids to enable withdrawal of natural gas from shale deposits. Comprehensive studies have concluded, however, that earthquakes due to deep injection are rare events. A study prepared in 2012 by the National Academy of Sciences (NRC, 2012) for example, found that injection/withdrawal projects that maintain a balance between the amount of fluid injected and the amount withdrawn were found to induce fewer felt seismic events than projects that do not maintain fluid balance. Consistent with this observation, the study reported that wastewater disposal was suspected or determined to be a likely cause of earthquakes felt by people (Richter Magnitude over 2.0) at eight locations in the central United States, but these events occurred in proximity to the injection points. To place this in perspective, these eight locations represent a tiny percentage (less than 0.03 percent) of the approximately 30,000 wastewater disposal wells in the United States. Interestingly, no seismic events were reported to be associated with any gas storage projects. This would be expected, because these projects tend to maintain a balance within the original gas content of a depleted reservoir.

Furthermore, an induced seismic event is much more likely in an area of active faults and high seismic activity, as these are indicative of accumulated tectonic stress that could be released by changes in pore pressures. The King Island site is located in a part of California's Central Valley that is not seismically active. The nearest reported faults in the United States Quaternary Fault and Fold Database (U.S. Geological Survey, 2013) are the Antioch Fault, which is located approximately 20 miles west of the TSF site, two unnamed faults located approximately 15 miles west of the site and one unnamed fault located approximately 19 miles north of the site. None of these faults show any evidence of activity over the past 1.5 million years. The nearest historically active fault is the Greenville Fault, which is located near the City of Livermore approximately 28

miles southwest of the site. The Concord Fault, which is believed to have been active within the last 15,000 years, is located approximately 27 miles southwest of the site.

Evaluation of the subsurface geology near the site did not identify any evidence of major inactive or potentially active faults. A small west-northwest trending normal fault has been interpreted to be located approximately 0.75 mile southwest of the proposed I/W Well and outside the boundaries of the target injection reservoir in the Mokelumne River Formation. This fault terminates in the Eocene Markley Formation, and thus has not been active for over 30 million years.

Induced seismicity is relatively rare and most prevalent in wastewater injection wells near seismically active areas. The project proposes to inject an air bubble that is smaller in volume than the original gas in place in the reservoirs, and would result in a temporary pressure increase within the target injection reservoir. Based on the nature of the project and the absence of potentially active faults near the site, there is very little likelihood that the project would induce significant seismic events.

The project would not expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving the rupture of a known earthquake fault, seismic-related ground failure, including liquefaction, result in landslides, or result in substantial soil erosion or the loss of topsoil. The project would have minimal and temporary impacts to geology and soil resources.

3.3.2.2 No-Action Alternative

Under the No-Action Alternative, PG&E would not implement the proposed project. Therefore, the benefits of the reuse of the existing depleted gas well would not occur.

3.4 Noise and Vibration

3.4.1 Affected Environment

The project site is located in a rural and agricultural area. Sources of ambient noise include mostly agricultural vehicles and machinery. Traffic noise from the City of Stockton and Interstate Highway 5 located approximately 2.2 miles to the east is audible at a low level.

The nearest sensitive noise receptors to the project site are rural ranch residences located to the south of the project site, which include the Foppiano and Solari properties. These are approximately 2,900 and 3,200 feet south of the well pad, respectively. The nearest residential receptor to the north is approximately 4,800 feet from the proposed pad. To the east and west, there are no residential receptors within two miles.

Sources of project noise would be notably different during well pad construction as well as the well drilling and operations phases. During construction drilling, project noise would come from

large vehicles transporting the equipment to the site, heavy equipment preparing the pad (spreading and compacting aggregate), and vehicles transporting the drill rig and associated equipment. The drill rig, when in operation, would also generate noise.

During operation, the major noise sources would be the injection equipment, which includes the compressors; and the extraction equipment, which includes the choke manifold, piping, air release stack, and transformers. While the injection equipment may operate at any time of day, the extraction equipment, including the loudest noise sources in the choke manifold and the air release stack, would operate only during the daytime hours (as defined by the County noise ordinance). Table 3-4 lists the major noise-producing equipment.

Table 3-4. Operational Noise Sources, Without Attenuation

Equipment, Without Attenuation	Estimated Sound Pressure Level, dBA, 3 feet
Injection:	
Primary Compressor/Motor	109.4
Mid Pressure Compressor/Motor	107.4
High Pressure Compressor/Motor	107.4
Cooling Water Pumps/Motors	Pump 106.4 Motor 99.0
Extraction:	
Choke Manifold	118.2
Air Release Vent	134.0

dBA = A-weighted decibel

3.4.2 Environmental Consequences

The San Joaquin County noise ordinance designates noise limits that a project can generate in terms of average hourly (L_{eq}) and maximum noise, in decibels (dB) during the daytime and nighttime hours, respectively, in an outdoor location, regardless of the zoning district (Title 9, Section 9-1025.9 Development Title of San Joaquin County, California). Table 9-1025.9 in the County noise ordinance is summarized as Table 3-5.

Table 3-5. San Joaquin County Noise Ordinance Noise Standards for Outdoor Activity Areas

Noise Specification	Daytime (7 a.m. to 10 p.m.)	Nighttime (10 p.m. to 7 a.m.)
Hourly Equivalent Sound Level (L_{eq}), dB	50	45
Maximum Sound Level (L_{max}), dB	70	65

Applied to the CAES compression test project, the noise ordinance requires that noise attributable to the proposed project not exceed 50 dBA during the daytime or 45 dBA during the nighttime in outdoor activity areas during at the nearest residence, the Foppiano property. It is assumed that "dB" means the A-weighted sound pressure level (commonly abbreviated as dBA), which is the unit commonly used for environmental noise limits.

3.4.2.1 Proposed Project

3.4.2.1.1 Construction Impacts

Construction-related noise from vehicles and the well drilling rig would be temporary (*five* months) and, given the distance to the nearest residential receptors, would not contribute significantly to ambient noise or cause adverse noise impacts.

3.4.2.1.2 Operations Impacts

Noise that the project would generate at the nearest receptors was modeled using the computer software noise model, CADNA/A® by DataKustik GmbH of Munich, Germany. This is a sophisticated program capable of fully modeling very complex facilities. The sound propagation algorithms and factors used in the model have been adopted from ISO 9613-2 *Acoustics - Sound Attenuation During Propagation Outdoors* and VDI 2714 *Outdoor Sound Propagation*.

The noise sources were modeled as point sources at their expected locations (as determined from the General Arrangement drawing) and heights. A-weighted sound power levels were assigned at 500 Hertz (Hz), and full octave band sound power level data were assigned, when available. The model then calculated sound pressure levels that would occur at each receptor from the noise sources after losses from distance, air absorption, ground effects, and the barrier effect of noise walls, buildings, and terrain (if any). Similar calculations were made for points located on a systematic grid placed over the area surrounding the project site. Noise level isolines for mapping were generated by the model based on the grid calculations.

The attenuation calculations for those sources for which only A-weighted sound levels are available are based on the assumption that all of the sound was at 500 Hz. This is consistent with guidance in ISO 9613 (Acoustics – attenuation of sound during propagation outdoors – Part 2: General method of calculation).

Figure 3-1 shows the model results for daytime operation of the withdrawal equipment only, with a silencer providing a 35 dBA insertion loss for the air release stack. This results in a maximum estimated noise level to 50 dBA at the nearest receptor, the Foppiano property, which would comply with the San Joaquin County daytime limit.

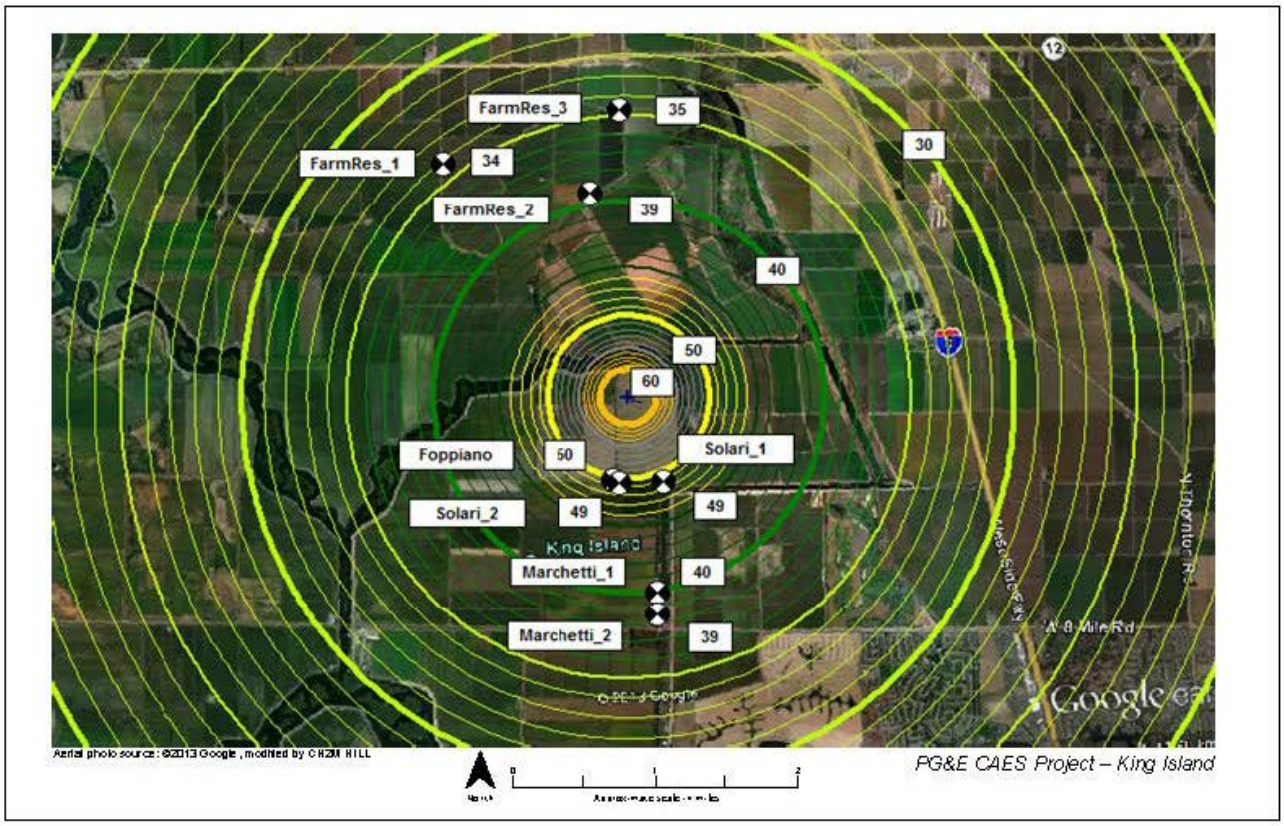


Figure 3-1. Noise Contours (dBA) for Daytime Operation of the Withdrawal Equipment, with Noise Attenuation.

Figure 3-2 shows the results for nighttime operation when the compression equipment is operating and the withdrawal equipment is not in operation. This figure also includes the effect of noise barrier walls on the south sides of the compressors. This results in reducing the maximum estimated receptor noise level to 44 dBA, which would comply with the San Joaquin County nighttime limit.

The preliminary noise modeling evaluation indicates that it is feasible to mitigate the CAES compression testing equipment sufficiently to comply with the San Joaquin County noise limits. Although this modeling effort applied specific noise attenuation methods (stack silencer and barrier wall), there are a number of additional attenuation methods that could be used for the equipment to achieve compliance with the noise ordinance.

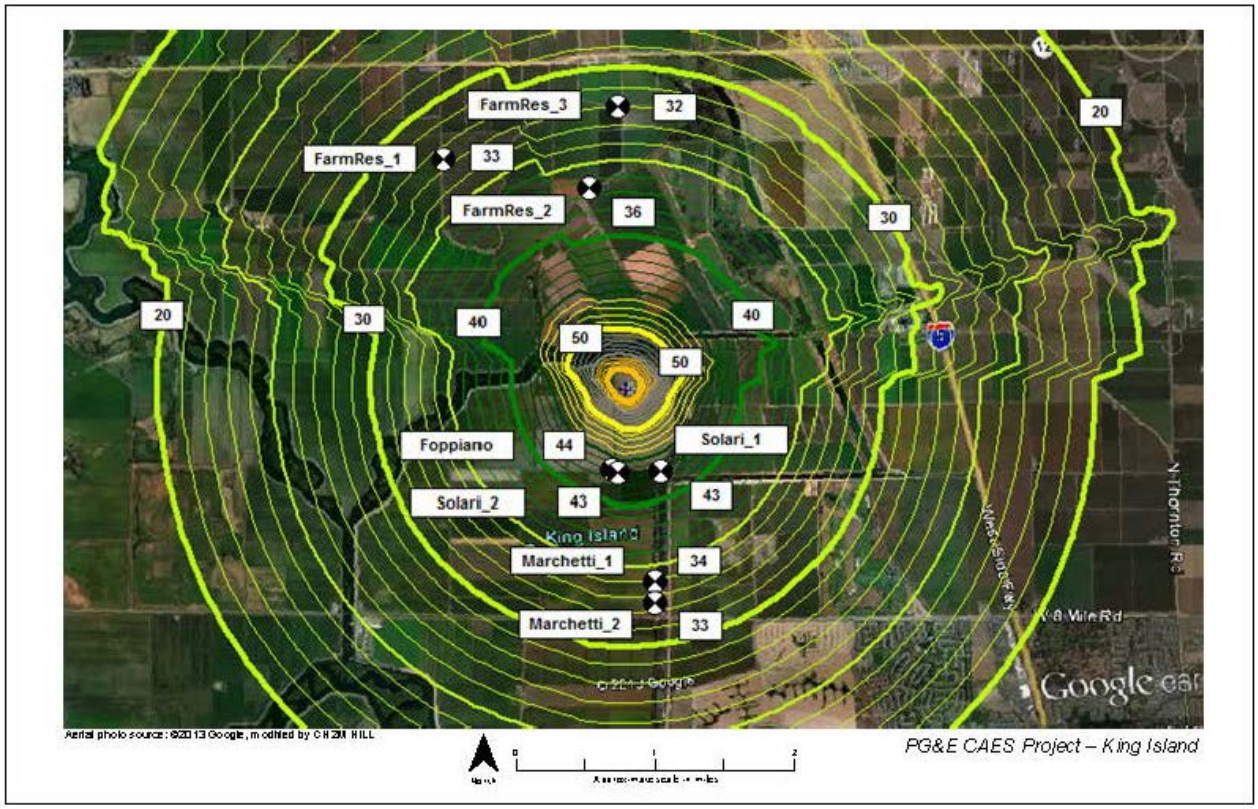


Figure 3-2. Noise Contours (dBA) for Nighttime Operation of the Injection Equipment ,with Noise Attenuation.

3.4.2.2 No-Action Alternative

Under the No-Action Alternative, PG&E would not implement the proposed project. Therefore, the noise generated by construction and operation would not occur.

3.5 Cultural Historical and Paleontological Resources

DOE must comply with Section 106 of the National Historic Preservation Act (16 U.S.C. 470 et seq.). As such, the DOE often consults with SHPOs and interested Native American Tribes. In the case of this proposed action and PG&E's proposed project, DOE consulted with the California SHPO. The California State Historic Preservation Officer responded on June 26, 2013, with a letter indicating their agreement with DOE's determination that the project would not affect historic properties. On June 28, DOE notified the California SHPO of a minor change in the area of potential effect related to distribution line construction and the California SHPO responded on July 3, 2013, with a letter of concurrence that the area of potential effects, as amended, would not affect historic properties. Additionally, on August 1, 2013, DOE informed the California SHPO of an additional minor change involving additional expansion of the distribution line construction work area. On August 7, 2013, the California SHPO responded with a letter of concurrence that, with the additional expansion of the area of potential effects the

project also would not affect historic properties. Appendix B contains copies of this correspondence.

On June 20, 2013, DOE sent letters to Native American Tribes to inform them of the project. DOE also requested any comments or concerns the Tribes might have on the potential for the proposed project to affect cultural or archaeological resources. On June 28, DOE sent letters to the Tribes to notify them of a minor change in the area of potential effects resulting from expansion of the distribution line construction work area. DOE sent letters to the Tribes on August 1, 2013, to notify them of a minor change in the area of potential effects resulting from an additional expansion of the distribution line construction work area. The California Valley Miwok Tribe responded and requested that DOE notify them if Miwok artifacts or human remains were discovered at the project locations. The Shingle Springs Rancheria/Shingle Springs Band of Miwok Indians requested that the DOE consult with them on this project regarding traditional cultural properties and requested that construction monitoring be conducted in sensitive areas. DOE held several teleconferences and PG&E sponsored a site visit with the Shingle Springs Rancheria leading to an agreement between PG&E and the Tribe regarding the monitoring of construction. The Buena Vista Rancheria of Me-Wuk Indians also requested that the DOE consult with them regarding the project's potential effects on Native American cultural heritage. DOE held teleconferences and PG&E also conducted a site visit with the Buena Vista Rancheria of Me-Wuk Indians leading to an agreement between PG&E and the Tribe regarding the monitoring of construction. Appendix B contains copies of the letters and responses DOE received.

Section 3.5.1 describes historic and cultural resources in and near the proposed project site, and Section 3.5.2 discusses the potential impacts. Appendix B contains copies of the correspondence between DOE, the California SHPO, and the interested Native American Tribes.

3.5.1 Affected Environment

3.5.1.1 Cultural and Historical Resources

The cultural resources APE included: (1) the 2.8-acre TSF site and its 200-foot-wide buffer, and (2) the dirt access roads and their 20-foot-wide buffer. The desktop review of cultural resources included the following information sources:

- Cultural Resource Survey for the PG&E CAES – King Island Project, San Joaquin County, California. SWCA Environmental Consultants, October 2012 (Treffers and Dietler, 2012)
- National Historical Topographic Map Collection (U.S. Geological Survey)
- National Register of Historic Places (NRHP)
- California Register of Historical Resources (CRHR)

- A field review of the proposed development site and access roads was conducted on April 3, 2103, by North State Resources (NSR) archaeologists Kristina Crawford and Mim Roeder. Archeologists walked pedestrian transects over the study area at intervals of approximately 15 meters or less as conditions warranted. Subsurface investigations were not conducted.

A previous investigation by SWCA (Treffers and Dietler, 2012) identified four potentially historic buildings and structures within and immediately adjacent to the APE. These consisted of three buildings dating to between approximately 1939 and 1952, and an irrigation canal built in 1939, known as Bishop Cut. NSR also noted the presence of these resources in the April 3, 2013, survey and visually confirmed their condition and potential age as noted by Treffers and Dietler in 2012. In addition, NSR archaeologists noted the presence of a sparse scatter of mid-late twentieth century debris. This debris consisted of several glass and porcelain fragments located along the margin of an unpaved access road and adjacent agricultural field at the westernmost extent of the project area in the vicinity of the King Island TSF pad. However, this debris probably dates to the 1960s or 1970s, is highly fragmented, and exhibits no potential historic association or integrity. Consequently, it was not documented in the field due to its probable recent age and ephemeral nature.

Neither the SWCA 2012 study, input from the Native American Heritage Commission and suggested contacts, nor the NSR investigation identified any additional cultural resources or potentially sensitive properties within or near the APE. In order to determine if cultural resources or properties of significance to the present-day Native American community exist within or near the APE, Treffers and Dietler (2012) contacted the Native American Heritage Commission (NAHC) and requested a search of the Sacred Lands File. They also requested a list of appropriate Native American representatives and tribal organizations that might have an interest in consulting regarding the proposed project. The NAHC search did not note any culturally significant locations within the current proposed project's APE or in the general area. *In addition, consultations with the Native American representatives and tribal organizations on the NAHC's list have not identified culturally significant locations (see discussion in Section 1.5.1, above).*

3.5.1.2 Paleontological Resources

Surficial geological deposits of the project area consist of the Quaternary Modesto Formation and consist of alluvium of the Mokelumne River alluvial fan; chiefly sand with minor gravel and silt deposited as glacial outwash during the late Pleistocene. A search of the University of California Museum of Paleontology database conducted on April 2, 2013, yielded records of eight fossil localities from the Modesto Formation. Two of these are finds of fossil plants only. One of these is from Fresno and the other from Sutter County. The remaining six localities yielded vertebrate fossils: three from Stanislaus, two from Fresno, and one from Yolo County.

3.5.2 Environmental Consequences

3.5.2.1 Proposed Project

3.5.2.1.1 Construction and Operation Impacts

Cultural and Historical Resources

None of the three mid-twentieth century vernacular buildings associated with agricultural activities on King Island meet the criteria for listing in the NRHP or CRHR. None of these buildings is associated with any historically significant individual or event and, as such, would not be eligible for NRHP listing under criteria A or B or for CRHR listing under criteria 1 or 2. In addition, farm buildings such as these are commonly encountered in the Central Valley and Delta and these examples are not particularly early or unusual examples of their kind or the work of a master architect. As a result, they are not eligible for NRHP/CRHR listing under Criterion C/3. Lastly, it is unlikely that further investigation would reveal information regarding these buildings that would render any of them significant and suitable for NRHP/CRHR listing. The data potential for these buildings has been realized through the existing documentation and, as a result, none of them is eligible for NRHP/CRHR listing under Criterion D/4 (data potential).

The large irrigation and navigation canal referred to as Bishop Cut was not constructed during the most significant periods of Delta land reclamation (circa 1870-1880, 1910-1920) and is not associated with any other historically significant individual, event, or series of events. As such, is not eligible for NRHP listing under criteria A or B or for CRHR listing under criteria 1 or 2. In addition, features such as Bishop Cut essentially define the character of the Delta and are commonly encountered in this area. Bishop Cut is not a particularly unusual example of its kind, it is not one of the earliest, nor is there any evidence to suggest its design or construction were accomplished by a noted engineer or builder. As a result, it is not eligible for NRHP/CRHR listing under Criterion C/3. Lastly, it is unlikely that further investigation would reveal information regarding this canal that would render it significant and suitable for NRHP/CRHR listing. The data potential for this canal has been realized through the previous documentation and, as a result, is not eligible for NRHP/CRHR listing under Criterion D/4 (data potential).

Paleontological Resources

Although the Modesto Formation has yielded vertebrate and plant fossil remains, very few records appear to come from the Great Valley at these low elevations immediately adjacent to the Delta. All identifiable paleontological localities are more than one mile distant from the proposed project sites. No known paleontological sites occur within one mile of the proposed project sites including the associated access routes. It is therefore unlikely that the proposed project would encounter paleontological resources, given the low sensitivity for significant fossils and the fact that little to no excavation is planned.

3.5.2.1.2 Sensitivity for Buried Archaeological Sites

Given the former natural character of the landscape (marsh or otherwise frequently flooded land in the Sacramento-San Joaquin River Delta) prior to early twentieth century reclamation, it is unlikely that extensive prehistoric Native American occupation occurred on King Island. In addition, it does not appear that any landforms conducive to prehistoric settlement exist within the proposed APE or in the general area. The proposed project area is of low sensitivity for prehistoric Native American sites, features, artifacts, or human interments in surface or subsurface contexts.

Historic-era developments within and near the APE and on King Island appears to consist solely of those associated with twentieth century land reclamation, agriculture, and transportation. Levees, ditches, and roadways within and adjacent to the APE have been well-documented through previous cultural resources investigations, Caltrans bridge assessments, or coincidental mapping and aerial photography since the land was reclaimed and initially tilled in the early-middle decades of the 1900s. As a result, it is unlikely that any previously undiscovered and potentially significant archaeological deposits of the historic era would be encountered during construction and operation.

If any new cultural resources are located during project activities, all ground-disturbing work near the find would cease and a qualified professional archaeologist would be consulted regarding their management. If human remains were encountered during any project-related activity, all work would halt in that vicinity immediately. A qualified cultural resources specialist would be contacted to evaluate the find before the San Joaquin County sheriff/coroner is contacted. If the human remains are of Native American origin, the coroner must notify the Native American Heritage Commission within 24 hours of such identification, per Section 7050 of the California Health and Safety Code.

3.5.2.2 No-Action Alternative

Under the No-Action Alternative PG&E would not proceed with the proposed project, so there would be no activities that might cause impacts to either previously recorded or unknown resources that are either listed on, nominated to, or eligible for listing on the NRHP or CRHR.

3.6 Socioeconomics and Environmental Justice

Section 3.10.1 describes the socioeconomic environment in San Joaquin County, Section 3.10.2 discusses the potential impacts, and Section 3.10.3 addresses environmental justice concerns.

3.6.1 Affected Environment

The proposed project site is in San Joaquin County, California, near Stockton and Lodi. San Joaquin County's estimated population of about 702,612 persons in 2012 reflects growth of 2.5 percent since 2010. The county hosted about 269,072 jobs in 2010, of which 30,919 jobs

(11 percent) were in retail trade and 55,506 (20.5 percent) were in health care and social assistance. Unemployment rates fell in all San Joaquin area counties from December 2010 to December 2012. The largest decreases occurred in San Joaquin County, down 3.6 percentage points, followed by Kings County, down 2.9 points. San Joaquin has cultivated extensive transportation facilities including the Port of Stockton, interstate highways throughout the county, five railroads, and an airport.

The per capita income over 12 months (2011 dollars), in San Joaquin County of $22,857 was about 23 percent less than the State of California per capita income of $29,634. In 2007-2011, about 16.7 percent of county residents and 14.4 percent of California residents were living in poverty. Section 3.6.3 discusses racial and ethnic populations and the low-income population in more details in relation to environmental justice.

3.6.2 Environmental Consequences

3.6.2.1 Proposed Project

The proposed project would create direct jobs during the three-month construction phase and five-month operation phase. Direct socioeconomic changes, as a result of the proposed project, would not be likely, however, and there would be no changes to population, infrastructure, or the level of social services. In addition, vendors and equipment suppliers would benefit from lease or capital orders for the drilling rig, compressors, motors, and other equipment.

3.6.2.1.1 Construction Impacts

Construction and equipment installation would take about five months. PG&E estimates the cost of procurement, installation, and startup would be approximately $20 to $25 million for the proposed compression-testing project. Of this amount, the CPUC would pay 50 percent and the Recovery Act funding would cover the remaining 50 percent balance of $25 million. DOE used standard multipliers to estimate the indirect economic effects of the proposed project. The estimated total earnings effect in the region due to the expected $25 million expenditure would be about $53.8 million. Much of the construction-related spending would directly benefit the suppliers of the equipment and the vendors who would provide materials and services for manufacture of the equipment.

3.6.2.1.2 Operations Impacts

The operation and maintenance of the proposed compressed air testing system would not have noticeable direct or indirect socioeconomic impacts.

3.6.3 Environmental Justice

Executive Order 12898, “Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations,” directs federal agencies to address environmental and human health conditions in minority and low-income communities. The evaluation of

impacts to environmental justice is dependent on determining if high and adverse impacts from the proposed project would disproportionately affect low-income or minority populations in the affected community.

DOE determined that direct socioeconomic impacts from the proposed project are unlikely. The proposed project would not result in workers moving to the area, so there would be no impact to infrastructure including housing and the level of social services in the area. However, there would be small and positive economic impacts from indirect employment opportunities in the region.

Table 3-6 lists racial and ethnic data about persons in San Joaquin County and, for comparison, the state of California. San Joaquin County has a large ethnic minority population; persons of Hispanic or Latino origin made up about 39.4 percent of county residents in 2011. This is similar to the statewide average of about 38.1 percent. The aggregate percent of all racial minorities (Black, American Indian or Alaskan Native, Asian, or of two or more races) was15.8 percent in San Joaquin County and 26 percent in California. Hispanics may be of any race, so are included in applicable race categories. Neither racial nor ethnic minority persons would experience adverse socioeconomic impacts from the proposed project. There would be no direct socioeconomic impacts to any population, and the indirect impacts would be small and positive. The indirect economic impacts from the project would include indirect employment opportunities in the region and enhanced final output because of the infusion of project-related spending.

Table 3-6. 2010 Racial and Ethnic Characteristics, San Joaquin County and California.

Racial and Ethnic Characteristics	San Joaquin County (percent)	California (percent)
White	68.7	74.0
Black	8.2	6.6
American Indian and Alaska Native	2.0	1.7
Asian persons	15.5	13.6
Persons reporting two or more races	4.9	3.6
Persons of Hispanic or Latino Origin	39.4	38.1
White but not Hispanic	35.4	39.7

Source: U.S. Department of Commerce, Census Bureau, 2013

DOE also determined that there would be no high and adverse impact to low-income populations. In 2010, about 13 percent of the residents in San Joaquin County lived below the poverty level, and the statewide rate was about 10.8 percent. There would be no direct socioeconomic impacts to any population, and the indirect impacts would be small and positive. The indirect economic impacts from the project would include indirect employment opportunities in the region and enhanced final output because of the infusion of project-related spending.

In summary, DOE determined that no high or adverse impacts would occur to any member of the community. Therefore, there would be no adverse or disproportionate impacts to minority or low-income populations.

3.6.3.1 No-Action Alternative

Under the No-Action Alternative PG&E would not proceed with the project and would not buy the major project components, and associated equipment. Therefore, the potential positive benefits of the proposed project, including the indirect total earnings effect and the final output effect, would not occur.

3.7 Public and Occupational Health and Safety

3.7.1 Affected Environment

The construction of the facility would require a small work force for the short three-month construction phase. DOE expects that potential worker accidents would remain within the national averages for construction activities. During operations, there would be approximately eight full-time workers on the site. PG&E would construct and operate the facility in accordance with its existing company occupational health and safety plans.

Preliminary reservoir modeling indicates that withdrawal testing is likely to produce some amount of natural gas in the extracted flow, but that the concentrations of natural gas would be relatively low. The quantity of the natural gas and how it would be mixed with the withdrawal stream cannot be predicted conclusively until the test program is conducted. For this reason, it is possible mixing reservoir release air with ambient air could create a combustible mixture. The presence of a combustible mixture significantly increases the risk of ignition leading to a risk of detonation and loss of containment.

3.7.2 Environmental Consequences

DOE estimated health and safety impacts to workers from industrial hazards by using 2011 incidence rates for both nonfatal occupational injuries and occupational fatalities from the BLS data. The construction of the facility would require a small work force (approximately 40 workers) for the short 3-month construction phase. DOE expects that potential worker accidents would remain within the national averages for construction activities. During operations, there would be eight full-time workers on the site. PG&E would construct and operate the facility in accordance with its existing company occupational health and safety plans.

The use and storage of hazardous materials and waste at the project area during construction would also increase health and safety risks. The temporary presence and use of hazardous materials at the project area increase the risk of accidents that could affect the health and safety of workers and other persons in the vicinity.

The following BMPs would be used to reduce these risks to less than significant:

- Workers would be notified of any potential health hazards associated with hazardous materials at the project area
- Material safety data sheets would be available on-site for workers to review
- A site-specific health and safety plan would be developed and would include detailed information on safe work practices, proper health and safety procedures, and emergency procedures
- Workers performing activities that could expose them to hazardous substances would be trained and certified by the Occupational Safety and Health Administration
- Fences and signs would be used at the project area as necessary to control access and to make workers and the public aware of potential hazards.

Standard process safety engineering protocols dictate that the potential for a combustible mixture to occur must be decreased as low as reasonably practical. To achieve proposed testing objectives in a safe and practical manner, PG&E is considering different alternatives for decreasing the potential for a combustible mixture in the withdrawal stream. Measures under consideration include the use of nitrogen or carbon dioxide prior to and/or after the injection of compressed air or filtering the pressurized air through a membrane to remove some of the oxygen in the air before further compressing it and injecting it into the reservoir. In addition to these depletion strategies, PG&E would employ various sensors and monitoring equipment, with the appropriate amount of redundancy, to continually monitor the percentage of methane in the withdrawal stream. Operating procedures would clearly articulate that, if the amount of methane in the withdrawal stream reaches a certain percentage (the percentage would be below the Lower Explosive Limit), PG&E would immediately take action to shut-in the well and to displace the mixture in the wellbore into the reservoir.

The presence of hazardous materials on the project site would have small and temporary impacts based on the DOE's evaluation and the implementation of the BMPs identified in this section.

3.7.2.1 No-Action Alternative

Under the No-Action Alternative, PG&E would not implement the proposed project. Therefore, the potential for the project to create an occupational safety hazard would not occur.

3.8 Water Resources

Section 3.2.1 describes current conditions for surface water, groundwater, and floodplains and wetlands. Section 3.2.2 discusses the potential impacts of the proposed project to these water resources.

3.8.1 Affected Environment

3.8.1.1 Surface Water

Surface waters in the project area include Sacramento-San Joaquin waterway remnants White Slough to the north and Disappointment Slough to the south. Bishop Cut is an artificial canal that connects these waterways on the east side of King Island; Honker Cut connects them on the west side. The area surrounding the proposed project site ranges in elevation from approximately five to ten feet below sea level, whereas water levels in White Slough and Bishop Cut are slightly above sea level and separated from King Island by levees. Farmers on the island obtain water to irrigate crops from these waterways. There are no streams, rivers, ponds, or lakes on the island.

3.8.1.2 Groundwater

Groundwater at the proposed project site is maintained at a level of approximately six to eight feet below surface by a system of drains. The freshwater aquifer zone, defined by California State Water Resources Control Board Resolution 88-63 as containing less than 3000 milligrams per liter of total dissolved solids (TDS), extends for up to 600 feet below the ground surface.

Underground Sources of Drinking Water (USDW) are defined in the UIC regulations as being groundwater resources with TDS concentrations less than 10,000 mg/L (40 CFR 144.3). As such, they include water that is more saline than California-defined fresh water resources and they typically underlie these fresh water resources to a greater depth. An evaluation of electrical logs from gas exploration and production wells located in and near the King Island Gas Field indicates that the base of USDW occurs at about 3,500 to 3,700 feet below the ground surface and is separated from the target injection reservoir by about 1,000 feet of sedimentary rocks, including two competent shale formations (the Nortonville Shale and the Capay Shale).

3.8.1.3 Floodplains and Wetlands

The proposed project site is located within a Special Flood Hazard Area and subject to a 100-year flood (one percent chance flood), according to Federal Emergency Management Agency (FEMA) floodplain insurance maps (FEMA, 2012). King Island is protected from flooding by levees that surround the island on all sides, but is mostly below sea level and subject to floods that could occur if the protecting levees were to breach.

3.8.2 Environmental Consequences

3.8.2.1 Proposed Project

3.8.2.1.1 Construction Impacts

Site preparation and construction could result in stormwater runoff and soil erosion. Runoff during construction would be regulated and controlled under a National Pollutant Discharge Elimination System stormwater construction permit and a stormwater pollution prevention plan.

PG&E would implement a soil erosion management plan that would also help to control runoff. The company would spray disturbed soils with water to suppress dust as necessary; the water would be hauled by truck from municipal water sources. All wastewater from drilling would be stored in portable tanks located at the proposed testing site and then trucked to a commercial injection well for disposal.

3.8.2.1.2 Operations Impacts

Surface Water

The compressors would use a closed-loop water system that would not involve the use of well or irrigation water from surface water supplies. The closed-loop water systems would require about 4,200 gallons for compressor cooling, which would be supplied by local municipal water source and trucked to the site. Nominal water loss is conservatively expected to be 25 gallons per day from *seal, flange, or tube leakage*. This small quantity of leak loss would be made up periodically from a water truck. After the test phase is complete, the cooling water would be hauled off-site in trucks and disposed of in a permitted, commercial *disposal facility*. Therefore, project operations would have little or no effect on surface water or water supplies.

Groundwater

The project would not use groundwater for construction or operation. The proposed injection/withdrawal well would be cased in cement for the upper 600 feet or so in order to prevent contamination to local aquifers from drilling operations. *The well will then be cased to its total depth prior to testing, which will prevent contamination of the shallower formation* from produced water. The *existing* observation wells *have been completed in as similar fashion as the I/W well.*

The target injection reservoir is separated from the nearest overlying aquifer by more than 1,000 feet, including two shale layers of sufficient impermeability, thickness, and horizontal extent to protect the aquifer. The Eocene-age Capay shale provides a geological seal on top of the King Island Gas Field and its thickness mostly ranges from 90 to 120 feet in the vicinity of King Island. The Eocene-age Nortonville Shale, also overlies the King Island Gas Field and deepest overlying aquifer and reaches a thickness of approximately 100 feet in the vicinity of King Island. There are no faults that cut the King Island Field that could serve as potential conduit for upward movement of saline formation brines into the nearest overlying aquifer. Similarly, the review of data for active, plugged, and abandoned gas wells near the King Island Gas Field indicates that these wells would not act as conduits for the upward migration of formation brines to the aquifer. The proposed IW well would be constructed and operated in accordance with the requirements of the EPA issued in the UIC permit for the project to assure that the water quality of the aquifers is protected.

Produced water would be mechanically separated from the withdrawal air and contained at the withdrawal well in one or more storage tanks. The amount of produced water is estimated to be

no more than 1,000 barrels. The produced water would be disposed of in a *certified* commercial *disposal facility*.

Floodplains and Wetlands

The project would have no effect on floodplains or wetlands (see Section 3.2, Biological Resources). The use of standard BMPs would prevent contamination of water bodies during construction and operation phases.

3.8.2.2 No-Action Alternative

Under the No-Action Alternative, there would be no water use and no activity to affect water resources from potential erosion, runoff, or spills. Therefore, there would be no impacts to surface water, groundwater, floodplains, or wetlands.

3.9 Resource Commitments

3.9.1 Relationship Between Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity

PG&E's proposed project to install equipment to support and conduct a compression testing program to examine the feasibility of installing a compressed air energy storage project at the King Island site in San Joaquin County, California, would result in a short-term use of land. In this context, *short-term use* of resources means the ten-month-long construction and operating life of the testing program, and *long-term productivity* refers to the period after the facility has ceased operation and undergone decommissioning and demolition. At that time, the land could be occupied and used for other activities, or it could be reclaimed and used for agricultural purposes.

3.9.2 Irreversible and Irretrievable Commitments of Resources

The use of land as a resource to support the construction and operation of the proposed project would be irretrievable in the short-term. Although the compression testing equipment would be removed after completion of the compression testing, the operations pad may remain. If the proposed project is constructed and operated and later decommissioned, or if after the testing phase is over the proposed project does not move forward, the pad, at the discretion of the owner, could easily be removed and the land returned to agricultural use. Some limited unrecyclable construction materials, energy, and the fuel for facility construction and maintenance would be irreversible and irretrievable commitments of resources. DOE would also have expended funding on the proposed project that would also be irretrievable.

3.9.3 Unavoidable Adverse Impacts

The proposed project would result in the unavoidable small and adverse impacts of construction noise, fugitive dust, vehicle emissions, and possible loss of wildlife due to onsite traffic and construction equipment. These small unavoidable impacts would be offset by the positive effects

of developing an innovative new technology for storing electricity that would, in turn, improve voltage regulation and load shifting from the use of intermittent renewable power sources. This could result in reduced emissions from conventional fossil-fuel power plants.

4. CUMULATIVE IMPACTS

Cumulative impacts result from the incremental effects the proposed project could have in combination with the impacts of other past, present, and reasonably foreseeable actions. The proposed project would install a temporary facility for air compression testing and well equipment.

As Figure 2-1 shows, the proposed project site is in an agricultural area northwest of Stockton, California. The environmental impacts of past actions including the development of agriculture and natural gas resources in the area have already passed through the environment or been captured as part of the current baseline conditions. DOE considered nearby present actions (Section 4.1) and reasonably foreseeable actions (Section 4.2) in combination with the potential impacts of the proposed project (Table 1-1 and Chapter 3) to assess potential cumulative impacts.

4.1 Present Actions

PG&E has ongoing actions to reduce use of carbon-based fuels and greenhouse gas emissions, to increase the use of renewable energy sources such as solar and wind energy and biogas power, and to increase energy efficiency. These initiatives would have net beneficial cumulative impacts. The proposed project would be part of and consistent with those initiatives and would therefore contribute in a small way to those positive benefits.

There are two major development projects in the general vicinity of the proposed CAES compression testing project that are undergoing permitting through either the San Joaquin County Planning and Development Services Division or the City of Stockton Community Development Department. These are:

- Love's Travel Stops freeway service (gas and food) development along Interstate 5 at State Route 12, approximately 3.3 miles from the project site in unincorporated San Joaquin County (San Joaquin County Community Development Department, 2012)

- Bear Creek East Specific Plan residential development, along Eight Mile Road in northeast Stockton, approximately seven miles east the project site (City of Stockton Community Development Department, 2011).

Construction schedules for these developments depend on project approval processes and market conditions, and are uncertain at this time. There is some potential, however, for construction of one or both of these developments to begin during the time that the proposed CAES compression-testing project would be under construction or in operation.

The contribution of PG&E's proposed project to potential cumulative effects in relation to the Bear Creek East master-planned community and the Love's Travel Stops facilities would be small and temporary. The nominal short-term increase in traffic during the construction and

operation of the proposed project may or may not coincide with construction traffic to and from these projects. Noise from the proposed compression-testing project would not be noticed at the Bear Creek East development, given the distance, if the timing of the two projects were to coincide. The monetary investment in the proposed CAES compression-testing project would result in indirect beneficial impacts to the region. Given the size of the regional economy compared to the proposed project, however, the impacts would be small. There would be no contributions to operational air or water impacts and no adverse effects on threatened or endangered species, or cultural resources of importance. The proposed project would have no or a negligible long-term effect on agricultural land availability.

4.2 Reasonably Foreseeable Actions

DOE authorized as an interim action upgrading the electrical distribution system in the vicinity of the proposed CAES compression testing project so that it can provide electricity to the project. This action consists of reconductoring some segments of the 4.3-mile-long route and new distribution lines along other segments. PG&E determined through field studies that biological and cultural resources would not be affected significantly by the upgrading of the distribution line. The impacts of this action would be minor and temporary and would not combine with the later effects of the compression-testing project to cause impacts that would be cumulatively significant.

PG&E presently serves 5.1 million electricity customer and 4.3 million natural gas customer accounts in central and northern California. PG&E's electric grid network consists of 141,215 circuit miles of electric distribution lines and 18,616 circuit miles of interconnected transmission lines, The natural gas system includes over 42,141 miles of natural gas distribution pipelines and 6,438 miles of transportation pipelines. On average, approximately half of the electricity PG&E delivers to its customers comes from a combination of renewable and GHG-free resources.

PG&E's reasonably foreseeable actions would continue the company's initiatives to reduce use of carbon-based fuels and greenhouse gas emissions by increasing the use of renewable energy sources such as solar and wind energy and biogas power and to increase energy efficiency. These include aggressively adding more renewable energy to its power mix under California's renewable portfolio standard of delivering 33 percent renewables by the end of 2020. PG&E is also investing in a range of clean energy resources such as solar, wind, geothermal, biomass and small community and industrial-based hydroelectric power generation facilities.

5. CONCLUSIONS

PG&E proposes to install *temporary* compression *equipment* and injection/*withdrawal* and observation wells for the compressed air energy storage compression-testing project. In this EA, DOE considered: (1) the proposed action of providing a financial assistance grant under the Recovery Act in a cost-sharing arrangement with PG&E, (2) PG&E's proposed project, and (3) the No-Action Alternative.

DOE evaluated the environmental resource categories it commonly addresses in environmental assessments and identified no significant adverse impacts from the proposed project. For the resource categories of land use and land resources; geology and soils; waste; aesthetics and visual resources; utilities, energy and minerals; and transportation, DOE determined there would be no impacts or the potential impacts would be small, temporary, or both, and therefore did not carry those forward for additional analysis. DOE focused its analyses on those resources that could require new or amended permits, have the potential for significant impacts or controversy, or typically interest the public, such as socioeconomics and historic and cultural resources. In total, DOE performed more detailed analyses of potential impacts on eight resource categories.

During construction *and operation*, air emissions would include: (1) combustion emissions from vehicles, heavy-duty equipment, and *various* drilling rig *engines,* (2) fugitive dust from site preparation activities, and (3) emissions of VOCs including GHGs from the IW well. These emissions would have minor but short-term impacts and are below the SJVAPCD's recommended thresholds of significant impact or the General Conformity *de minimis* threshold values. Similarly, the GHG emissions associated with construction activities are less than the CEQ significance threshold and would not have a significant impact on climate change.

Irrigation ditches along dirt access roads, and near the TSF site provide low- to moderate-quality habitat for the giant garter snake (*Thamnophis gigas*), which is federal and state listed as threatened. The irrigation ditches and ponds also provide habitat for the western pond turtle (*Emys marmorata*), a California species of special concern. Trees within 0.5 mile of the project area provide nesting habitat for the Swainson's hawk (*Buteo swainsoni*) and the white-tailed kite (*Elanus leucurus*), state listed as threatened. With the implementation of standard avoidance and minimization measures that include preconstruction surveys, exclusionary fencing, worker environmental training, burrow avoidance, road shoulder avoidance, speed limits, and biological monitoring, the proposed project would not adversely affect these species.

The proposed project would involve the productive reuse of a depleted natural gas well field, a geological resource. The potential of the proposed project to induce seismicity is extremely low, based on recent studies of this phenomenon that involve thousands of injection wells.

Well drilling and construction equipment would create noise during the installation phase. Compressors and the IW well air release stack and choke manifold would also create noise during compression testing. Detailed modeling of project noise sources and noise attenuation

with distance shows that, with the application of an air release stack silencer and other measures, the project would meet San Joaquin County's noise standards at the nearest sensitive receptor- a residence approximately 3,000 feet from the project site- and would not cause adverse noise impacts to wildlife.

No previously recorded historic or cultural resources of significance occur in the proposed project area of potential effects. In addition, given that the proposed project would be located in a former marsh area, the discovery of buried archaeological deposits during construction or operation is unlikely. If PG&E were to find cultural deposits during project activities, it would stop work immediately and notify the California SHPO and its own cultural resource specialists. DOE consulted the California SHPO and interested Native American Tribes. DOE determined there would be no impacts to federally listed or eligible historic properties. The proposed project site is in an area of recent alluvial deposits of low paleontological sensitivity and there are no previously recorded vertebrate paleontological finds near the project site.

The project would create indirect economic consequences because vendors and equipment suppliers would benefit from the orders for the project components and support systems. The positive economic benefits would be small.

The evaluation of impacts to environmental justice is dependent on determining if major or adverse impacts from the proposed project would disproportionately affect low-income or minority populations. DOE determined that no major or adverse impacts would occur to any member of the community, including socioeconomic impacts, so there would be no major or adverse impacts to any minority or low-income population.

If withdrawal testing is conducted, withdrawal air may contain methane in concentrations potentially posing a hazard for onsite workers. This potential hazard would be mitigated by modeling the reservoir behavior during injection and withdrawal to determine expected outcomes, careful monitoring of concentrations of withdrawal air for hydrocarbons, control of withdrawal rates and durations, operational controls to prevent hazardous mixtures from reaching the surface, and, if required, injection of oxygen-depleted air.

Site preparation and construction could result in stormwater runoff and soil erosion. The drilling and operation pad is pervious to stormwater and PG&E would design the slope of the pad to direct any runoff away from equipment as well as implement a soil erosion management plan. The project would use an *air-cooled* closed-loop cooling system that minimizes the use of fresh water for project operation. Wastewater, including produced water stripped from the withdrawal air stream, would be disposed of at a certified commercial *disposal facility*. Fresh water resources and USDW would be protected by implementation of IW well completion and operating requirements under the UIC permit issued for the project and are separated from the injection reservoir by over 1000 feet of sediments, including two competent and aerially extensive shale-confining zones.

The proposed project would not cause impacts cumulatively with other reasonably foreseeable projects. The proposed project site is agricultural and no development projects are currently planned for this area. In addition, project activity would take place over a period of only *12* months, so that long-term and cumulative impacts are unlikely to occur, when combined with other projects under development in the region.

DOE assumed for the EA analyses that PG&E would not proceed with the project without DOE assistance. Therefore, there would be no impacts to any resource category from the No-Action Alternative. The small, positive socioeconomics impacts, the potential to reduce new conventional power plant construction, and the potential reduction in greenhouse gases would also not occur under the No-Action Alternative. In addition, DOE's ability to achieve its objectives under the Smart Grid Demonstrations Program and the Recovery Act would be impaired.

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Chicken Ranch Rancheria of Me-Wuk Indians of California
Lloyd Mathieson, Chairman
P.O. Box 1159
Jamestown, CA 95327
Phone No: 209-984-4806 Fax No.: 209-984-5606
Express Mail: 16955 Nelson Road, Jamestown, CA 95327
E-mail: chixrnch@mlode.com

Ione Band of Miwok Indians of California
Johnny Jamerson, Acting Tribal Chairperson
P.O. Box 699
Plymouth, CA 95669
Phone No.: 209-245-5800 Fax: 209-245-3112
Express Mail: 9252 Bush Street, Plymouth, CA 95669
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Jackson Rancheria of Me-Wuk Indians of California
Irvin Marks, Chairperson
P.O. Box 1090
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Phone No: Fax No: 209-223-1935 Fax No.: 209-223-5366
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Middletown Rancheria of Pomo Indians of California
Carl Rivera, Chairman
P.O. Box 1035
Middletown, CA 95461
Phone No. 707-87-3670
Express Mail: 22223 Hwy 29 @ Rancheria Road, Middletown, CA 95461
Web site: None

Shingle Springs Band of Miwok Indians, Shingle Springs Rancheria (Verona Tract), California
Nick H. Fonseca, Chairman
P.O. Box 1340 (Verona Tract)
Shingle Springs, CA 95682
Phone No: 530-676-8010 Fax No: 530-676-8033
Express Mail: 5281 Honpie Road, Placerville, CA 95667
Web site: www.shinglespringsrancheria.com

Andrew Godsey

Assistant Cultural Resource Director
Shingle Springs Band of Miwok Indians
5281 Honpie Road,
Placerville, CA 95667

Tuolumne Band of Me-Wuk Indians of the Tuolumne Rancheria of California
Kevin Day, Chairman
P.O. Box 699
Tuolumne, CA 95379
Phone No: 209-928-3475 Fax No: 209-928-1677
Express Mail: 19595 Mi-wu Street, Tuolumne, CA 95379
Web site: www.miwok.com

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Wilseyville, CA 95257

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Chairperson
Wilton Rancheria
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Suite 200
Elk Grove, CA 95758

Katherine Erolinda Perez
PO Box 717
Linden, CA 95236

Randy Yonemura
4305 – 39th Avenue
Sacramento, CA 95824

State, Regional and Local Government Agencies and Other recipients:

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ESA / Regulatory Division
Bay - Delta Fish & Wildlife Office
U.S. Fish and Wildlife Service
650 Capital Mall, Suite 8-300
Sacramento, CA 95814

Habitat Conservation Planning Branch

CA Department of Fish and Wildlife
1416 Ninth Street, 12th Floor
Sacramento, CA 95814
(916) 653-4875

California State Parks
Office of Historic Preservation
State Historic Preservation Officer (SHPO)
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(916) 322-1110
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California State Lands Commission
Environmental Planning and Management
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San Joaquin County Board of Supervisors
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Stockton CA 95202

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kvogel@sjgov.org

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Lodi City Manager
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rbartlam@lodi.gov

Wally Sandelin
Lodi Public Works Director
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Lodi, CA 95240
(209) 333-6709
wsandelin@lodi.gov

San Joaquin County Environmental Health Department
1868 East Hazelton Avenue
Stockton, CA 95202-6232

San Joaquin County Emergency Services, Office of (OES)
2101 East Earhart Avenue, Suite 300
Stockton, CA 95206

San Joaquin County Sheriff's Office
Attn: Phil George
7000 Michael N. Canlis Blvd.
French Camp, CA 95231

Steve R. Butler; Fire Chief
Woodbridge Fire District
400 E. Augusta
Woodbridge, Ca 95258
(209) 369-1945
(209) 327-8287 Cell

APPENDIX B
CONSULTATIONS AND PUBLIC COMMENTS

This appendix contains copies of the correspondence between the DOE and regulatory agencies, and also comments on the draft EA and any DOE responses. The Appendix sections are as follows:

- Appendix B1 – California State Historic Preservation Office, Section 106, National Historic Preservation Act consultation
- Appendix B2 – Native American tribal officials of the following Native American groups and individuals who have expressed interest in federal actions in San Joaquin County:
    - Buena Vista Rancheria of Me-Wuk Indians of California
    - California Valley Miwok Tribe, California
    - Chicken Ranch Rancheria of Me-Wuk Indians of California
    - Ione Band of Miwok Indians of California
    - Jackson Rancheria of Me-Wuk Indians of California
    - Middletown Rancheria of Pomo Indians of California
    - Shingle Springs Band of Miwok Indians
    - Tuolumne Band of Me-Wuk Indians of the Tuolumne Rancheria of California
    - Wilton Rancheria
- Appendix B3 – U.S. Fish and Wildlife Service Section 7, Endangered Species Act consultation
- Appendix B4 – Comments on the Draft EA and Responses

Within each appendix, the correspondence is ordered by date.

APPENDIX B1

CORRESPONDENCE WITH THE STATE HISTORIC PRESERVATION OFFICER

NATIONAL ENERGY TECHNOLOGY LABORATORY
Albany, OR • Morgantown, WV • Pittsburgh, PA

U.S. DEPARTMENT OF ENERGY

June 7, 2013

Ms. Carol Roland-Nawi
State Historic Preservation Officer
Office of Historic Preservation
1725 23rd Street, Suite 100
Sacramento, CA 95816
E-mail: calshpo@parks.ca.gov

Re: National Historic Preservation Act Section 106 Compliance
Compressed Air Energy Storage Compression Testing Project

Dear Ms. Roland-Nawi:

The U.S. Department of Energy (DOE) is proposing to provide a financial assistance grant (DOE's Proposed Action) to Pacific Gas and Electric Company (PG&E) as part of the Smart Grid Technologies Program, which is funded through the American Recovery and Reinvestment Act of 2009. If PG&E receives the grant, it would construct a temporary site facility (TSF) to test the performance of a geological formation as a potential storage reservoir for possible future use as a Compressed Air Energy Storage (CAES) facility. PG&E would install wells and temporary compressors for injecting compressed air into a depleted natural gas field at a depth of several thousand feet, followed by controlled releases of this air to observe and measure the performance of the air storage reservoir. Associated facilities would include a 2.5-acre gravel work pad, temporary compression equipment and the extension of electrical service to the TSF on a distribution line. The 4.25-mile-long distribution line would include the unmodified use of existing lines, reconductoring of existing lines, and construction of 2.4 miles of new line.

The compression testing would take approximately 10 months, including site preparation and equipment installation and would begin in 2014. However, PG&E would upgrade and install the distribution line starting in August 2013 under authorization by DOE as an interim action. Upon completion of the proposed testing project, the wells would be capped and either retained for future use or abandoned in accordance with state and federal standards. If the project does not move forward, the well pad and associated wells would be transferred to the owner of the subsurface rights.

The TSF would be located adjacent to an existing natural gas well in an agricultural area on King Island in rural San Joaquin County, California, 1.8 miles northwest of the City of Stockton's northern boundary. Access to the site would be along Eight Mile Road, King Island Road, and unpaved agricultural access roads. Figure 1, attached, shows the proposed project location.

In May 2013, a technical report was completed for a historical and archaeological resources investigation of the project's Area of Potential Effects (APE). The report indicates that intensive field studies of the APE did not result in the identification of properties meeting the criteria for listing in the National Register of Historic Places (NRHP) within or immediately adjacent to the Project APE. A total of four historic-era properties were identified near the APE, consisting of

three mid-twentieth century vernacular buildings associated with agricultural activities, and the navigation and irrigation canal referred to as Bishop Cut. None of these appear to be historic properties as defined under Section 106 of the National Historic Preservation Act (NHPA) and the criteria for NRHP listing in 36 CFR 60.4.

Based on these findings of the literature research and field inventory of the project APE, DOE has made a finding of No Historic Properties Affected for historic and archeological properties in regards to this undertaking. DOE asks for your concurrence with this finding and thanks you in advance for your consideration. Please see the supporting documents attached to this letter for further details on this project.

An environmental assessment (EA) is being prepared and will be released to the public in the near future. DOE will provide your office a copy of the EA where you may further comment on any of your concerns. All correspondence between DOE and the SHPO will be included in an appendix to the EA. At this time, DOE anticipates a 30-day public comment period for this proposed project.

If you have any questions, I can be reached at (304) 285-4913 or by e-mail at Joseph.Zambelli@NETL.doe.gov.

DOE asks for your concurrence and thanks you in advance for your consideration. Please forward the results of your review and any requests for additional information to:

Mr. Joe Zambelli
U.S. Department of Energy
National Energy Technology Laboratory
3610 Collins Ferry Road
P.O. Box 880
M/S: I07
Morgantown, WV 26507-0880
Email: joseph.zambelli@netl.doe.gov

Sincerely,

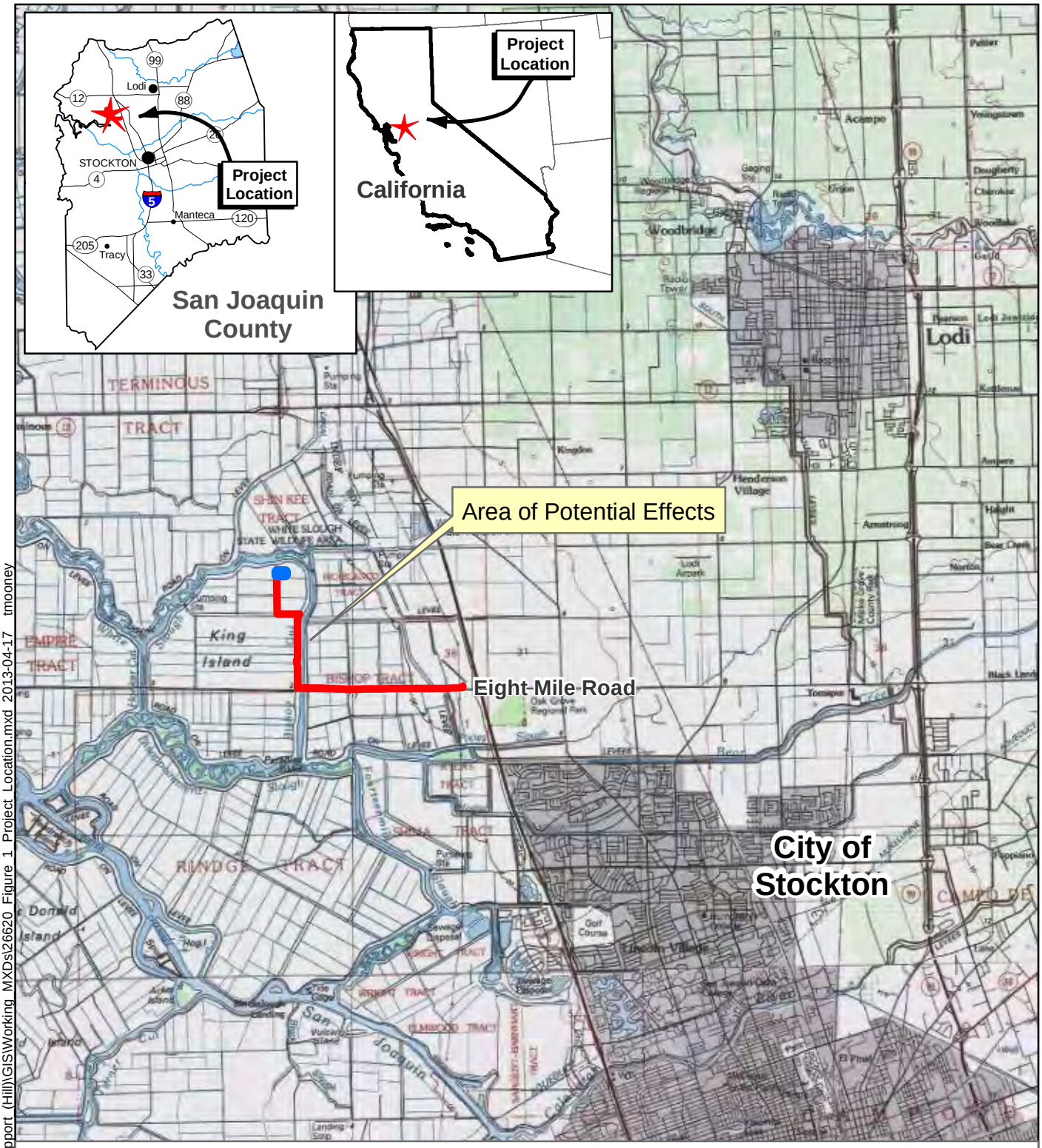


Joe Zambelli
NEPA Document Manager

Attachments:

Figure 1 – Project Location
Cultural Resources Inventory and Evaluation Report of the PG&E Compressed Air Energy Storage Compression Testing Project, King Island, San Joaquin County, California

cc: PG&E (Mr. Bob Booth)
Ms. Nuhfer



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North State Resources, Inc.

CAES PDEA - King Island

Figure 1
Project Location

OFFICE OF HISTORIC PRESERVATION
DEPARTMENT OF PARKS AND RECREATION
1725 23rd Street, Suite 100
SACRAMENTO, CA 95816-7100
(916) 445-7000 Fax: (916) 445-7053
calshpo@parks.ca.gov
www.ohp.parks.ca.gov

June 26, 2013 Reply Reference To: DOE_2013_0612_001

Joseph Zambelli, M/S: I07
NEPA Document Manager
U.S. Dept. of Energy - National Energy Technology Laboratory
3610 Collins Ferry Road
PO Box 880
Morgantown, WV 26507-0880

Re: Section 106 Consultation for Compressed Air Energy Storage Compression Testing Project, King Island, San Joaquin County, CA

Dear Mr. Zambelli:

Thank you for initiating consultation regarding the Department of Energy's (DOE) efforts to comply with Section 106 of the National Historic Preservation Act of 1966 (16 U.S.C. 470f), as amended, and its implementing regulation found at 36 CFR Part 800. Funding for this undertaking was provided by the Department of Energy through the American Recovery and Reinvestment Act.

The DOE is proposing to provide a financial assistance grant to Pacific Gas and Electric through the Smart Grid Technologies Program. Funding would be used to construct a temporary site facility to determine whether a porous geological formation would be a suitable site for a future Compressed Air Energy Storage facility. Project components include the injection of compressed air approximately 4800 feet below grade, establishment of a 2.5 acre gravel work pad, installation of a 4.25 mile electrical distribution line extension and 2.4 miles of new distribution line and construction of well pads and access roads.

According to the *Cultural Resource Inventory and Evaluation Report: Compassed Air Energy Storage Compression Testing Project, King Island, San Joaquin County, California* (Ludwig: May 2013), no eligible or listed National Register of Historic Places properties have been identified within the project area. The DOE is requesting my concurrence with their effects determination of no historic properties affected pursuant to 36 CFR Part 800.4 (d)(1). After reviewing the information provided, I concur with this finding of effects. Please be advised that under certain circumstances, such as an unanticipated discovery or a change in project description, you may have future responsibilities for this undertaking under 36 CFR Part 800.

Thank you for seeking my comments and considering historic properties as part of your project planning. If you have any questions or concerns, please contact Ed Carroll of my staff at (916) 445-7006 or Ed.Carroll@parks.ca.gov.

Sincerely,

Carol Roland-Nawi, PhD
State Historic Preservation Officer

NATIONAL ENERGY TECHNOLOGY LABORATORY
Albany, OR • Morgantown, WV • Pittsburgh, PA

U.S. DEPARTMENT OF ENERGY

June 28, 2013

Ms. Carol Roland-Nawi
State Historic Preservation Officer
Office of Historic Preservation
1725 23rd Street, Suite 100
Sacramento, CA 95816
E-mail: calshpo@parks.ca.gov

Re: National Historic Preservation Act Section 106 Compliance Compressed Air Energy Storage Compression Testing Project

Dear Ms. Roland-Nawi:

In support of Pacific Gas and Electric Company's (PG&E's) Compressed Air Energy Storage (CAES) Compression Testing project, the U.S. Department of Energy (DOE) initiated National Historic Preservation Act Section 106 consultation with the Office of Historic Preservation on June 7, 2013, with the submittal of a technical report completed for a historic properties inventory and evaluation of the project's Area of Potential Effects (APE). This letter supplements the historic properties report and request for concurrence submitted on June 7, 2013, with a minor expansion of the APE.

After submittal of the technical report, PG&E revised the project description to accommodate the installation or replacement of three electrical distribution line poles adjacent to Bishop Cut. To accommodate the pole installation, the APE has been expanded by 1.1 acres east of the project's distribution line crossing of Bishop Cut. PG&E would replace one distribution pole north of the crossing along a levee road, and install two poles south of the crossing on the south side of and adjacent to Eight Mile Road.

Replacement Figure 2a (attached) for the historic properties report depicts the expanded APE. The intensive cultural resources survey conducted on April 3, 2013, included the expanded APE. No prehistoric or historic-era cultural resources were noted within the expanded APE as a result of this survey.

If you have any questions, I can be reached at (304) 285-4913 or by e-mail at Joseph.Zambelli@NETL.doe.gov.

3610 Collins Ferry Road, P.O. Box 880, Morgantown, WV 26507
joseph.zambelli@netl.doe.gov • Voice (304) 285-4913 • Fax (304) 285-4403 • www.netl.doe.gov

DOE asks for your concurrence and thanks you in advance for your consideration. Please forward the results of your review and any requests for additional information to:

Mr. Joe Zambelli
U.S. Department of Energy
National Energy Technology Laboratory
3610 Collins Ferry Road
P.O. Box 880
M/S: I07
Morgantown, WV 26507-0880
Email: joseph.zambelli@netl.doe.gov

Sincerely,

Joe Zambelli
NEPA Document Manager

Attachments:
Replacement Figure 2a – APE Map-Distribution Lines and Roadways

cc: Bob Booth - PG&E
Kimberly Nuhfer - NETL



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North State Resources, Inc.

CAES - PDEA King Island

Replacement Figure 2a
APE Map-Distribution Lines and Roadways
June 25, 2013

OFFICE OF HISTORIC PRESERVATION
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www.ohp.parks.ca.gov

July 03, 2013 Reply Reference To: DOE_2013_0612_001

Joseph Zambelli, M/S: I07
NEPA Document Manager
U.S. Dept. of Energy - National Energy Technology Laboratory
3610 Collins Ferry Road
PO Box 880
Morgantown, WV 26507-0880

Re: Section 106 Consultation Amendment for Compressed Air Energy Storage Compression Testing Project, King Island, San Joaquin County, CA

Dear Mr. Zambelli:

Thank you for continuing consultation regarding the Department of Energy's (DOE) efforts to comply with Section 106 of the National Historic Preservation Act of 1966 (16 U.S.C. 470f), as amended, and its implementing regulation found at 36 CFR Part 800. Funding for this undertaking was provided by the Department of Energy through the American Recovery and Reinvestment Act.

The DOE previously received concurrence from my office that the above referenced project will not affect historic properties. Since that time, the APE has been modified to accommodate the installation of additional electrical distribution lines. The amended project area was addressed by the archeological survey and literature search previously submitted in support if this project.

The DOE is requesting my concurrence with their determination that modifications to the APE and undertaking definition will not alter their original finding of no historic properties affected. After reviewing the submitted information, I concur with this determination. Please be advised that under certain circumstances, such as an unanticipated discovery or a change in project description, you may have future responsibilities for this undertaking under 36 CFR Part 800.

Thank you for seeking my comments and considering historic properties as part of your project planning. If you have any questions or concerns, please contact Ed Carroll of my staff at (916) 445-7006 or Ed.Carroll@parks.ca.gov.

Sincerely,

Carol Roland-Nawi, PhD
State Historic Preservation Officer

NATIONAL ENERGY TECHNOLOGY LABORATORY
Albany, OR • Morgantown, WV • Pittsburgh, PA

U.S. DEPARTMENT OF ENERGY

August 1, 2013

Ms. Carol Roland-Nawi
State Historic Preservation Officer
Office of Historic Preservation
1725 23rd Street, Suite 100
Sacramento, CA 95816

Re: National Historic Preservation Act Section 106 Compliance Compressed Air Energy Storage Compression Testing Project

Dear Ms. Roland-Nawi:

In support of Pacific Gas and Electric Company's (PG&E) Compressed Air Energy Storage (CAES) Compression Testing project, U.S. Department of Energy (DOE) initiated National Historic Preservation Act Section 106 consultation with the Office of Historic Preservation on June 7, 2013, with the submittal of a technical report completed for a historic properties inventory and evaluation of the project's area of potential effects (APE). This letter supplements the historic properties report and request for concurrence submitted on June 7, 2013 with a minor expansion of the APE.

After submittal of the technical report, PG&E sent a letter to your office on June 20, 2013, notifying you of revisions to the project description necessary to accommodate the replacement or installation of poles to support electrical distribution lines adjacent to Bishop Cut; this modification expanded the APE a total of approximately 1.1-acres. This letter is to inform you that PG&E has made additional modifications to the project description resulting in the further expansion of the APE near the intersection of Eight Mile Road and Regatta Lane (1.13-acres) and at Eight Mile Road and Bishop Cut (12.35-acres) (see attached Replacement Figure 2a). With the addition of these new areas, the project APE now encompasses a total of approximately 57.04-acres.

Intensive cultural resources surveys conducted on April 3, 2013, examined the property contained within the initial APE including the expanded APE discussed in the June 20, 2013, letter. On July 25, 2013, the newly revised APE outlined above was also subjected to a cultural resources survey. No prehistoric or historic-era sites, features, or artifacts were noted within the newly revised APE as a result of this survey.

DOE asks for your concurrence and thanks you in advance for your consideration. Please forward the results of your review and any requests for additional information to:

3610 Collins Ferry Road, P.O. Box 880, Morgantown, WV 26507
joseph.zambelli@netl.doe.gov • Voice (304) 285-4913 • Fax (304) 285-4403 • www.netl.doe.gov

Mr. Joe Zambelli
U.S. Department of Energy
National Energy Technology Laboratory
3610 Collins Ferry Road
P.O. Box 880
M/S: I07
Morgantown, WV 26507-0880
Email: joseph.zambelli@netl.doe.gov

If you have any questions, I can be reached at (304) 285-4913 or by e-mail at Joseph.Zambelli@NETL.doe.gov.

Sincerely,

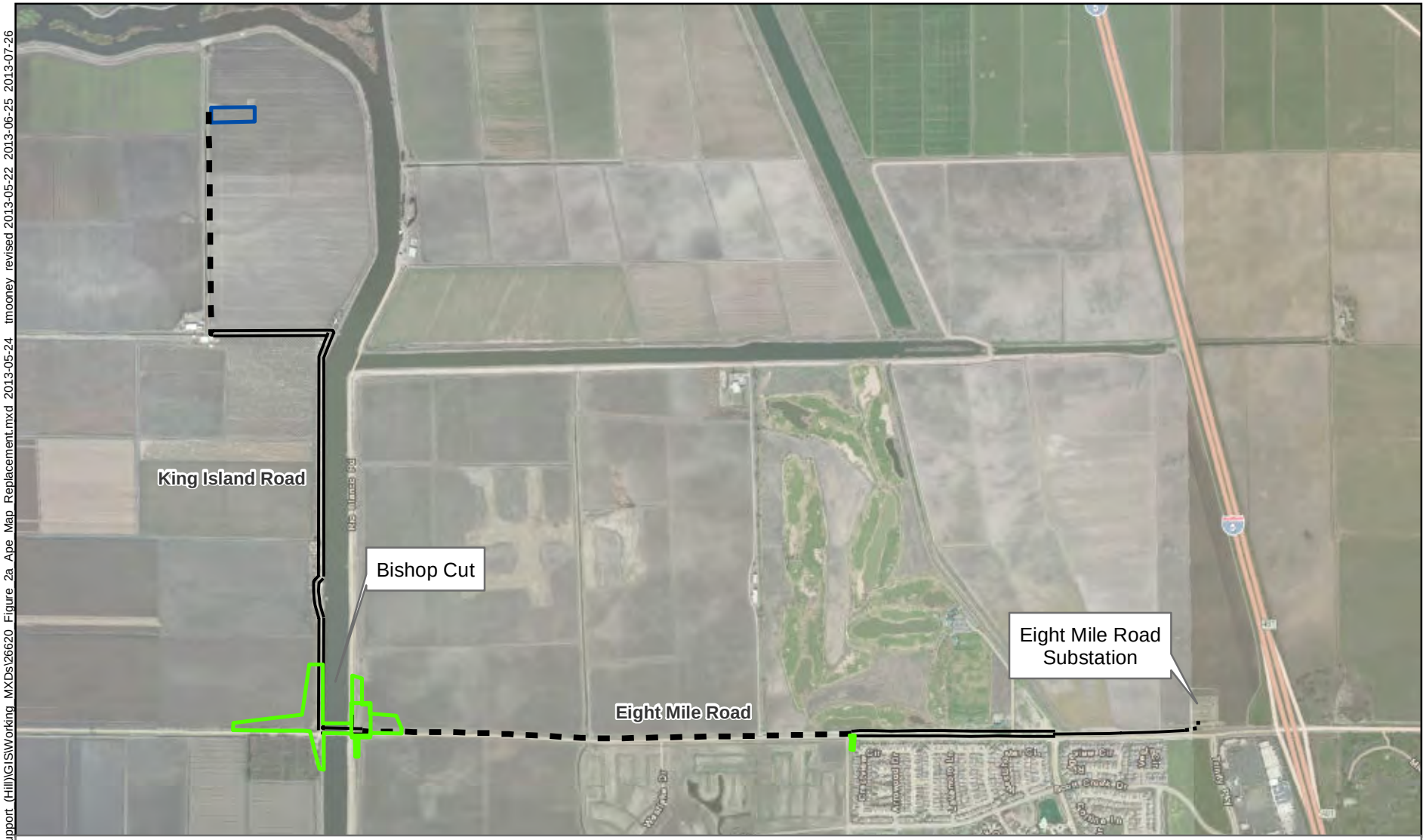


Joe Zambelli
NEPA Document Manager

Attachments:
Replacement Figure 2a – APE Map-Distribution Lines and Roadways

cc:
Mr. Bob Booth, PG&E

Ms. Kimberly Nuhfer,NETL



G:\Projects\26620_CAES_EA_Support (Hill)\GIS\Working_MXDs\26620_Figure_2a_Ape_Map_Replacement.mxd 2013-05-24 tmooney revised 2013-05-22 2013-06-25 2013-07-26

North State Resources, Inc.

PG&E CAES Project - King Island

Replacement Figure 2a
APE Map-Distribution Lines and Roadways
July 31, 2013

OFFICE OF HISTORIC PRESERVATION
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calshpo@parks.ca.gov
www.ohp.parks.ca.gov

August 07, 2013

Reply Reference To: DOE_2013_0612_001

Joseph Zambelli, M/S: I07
NEPA Document Manager
U.S. Dept. of Energy - National Energy Technology Laboratory
3610 Collins Ferry Road
PO Box 880
Morgantown, WV 26507-0880

Re: Section 106 Consultation Second Amendment for Compressed Air Energy Storage Compression Testing Project, King Island, San Joaquin County, CA

Dear Mr. Zambelli:

Thank you for continuing consultation regarding the Department of Energy's (DOE) efforts to comply with Section 106 of the National Historic Preservation Act of 1966 (16 U.S.C. 470f), as amended, and its implementing regulation found at 36 CFR Part 800. Funding for this undertaking was provided by the Department of Energy through the American Recovery and Reinvestment Act.

The DOE previously received concurrence from my office that the above referenced project will not affect historic properties. Since that time the APE has been modified to accommodate additional project activities. It is my understanding the additional project area has been subject to a records search and pedestrian survey.

The DOE is requesting my concurrence with their determination that this APE revision will not alter their original finding of no historic properties affected. After reviewing the submitted information, I concur with this determination. Please be advised that under certain circumstances, such as an unanticipated discovery or a change in project description, you may have future responsibilities for this undertaking under 36 CFR Part 800.

Thank you for seeking my comments and considering historic properties as part of your project planning. If you have any questions or concerns, please contact Ed Carroll of my staff at (916) 445-7006 or Ed.Carroll@parks.ca.gov.

Sincerely,

Carol Roland-Nawi, PhD
State Historic Preservation Officer

APPENDIX B2

CORRESPONDENCE WITH NATIVE AMERICAN TRIBES AND INDIVIDUALS

NATIONAL ENERGY TECHNOLOGY LABORATORY
Albany, OR • Morgantown, WV • Pittsburgh, PA

U.S. DEPARTMENT OF ENERGY

June 20, 2013

[See attached list of names and addresses]

Re: Pacific Gas and Electric Company Compressed Air Energy Storage Compression Testing Project, King Island, San Joaquin County, California.

Dear [*name*]:

The U.S. Department of Energy (DOE) is proposing to provide financial assistance (DOE's Proposed Action) to Pacific Gas and Electric Company's Compressed Air Energy Storage (CAES) Compression Testing Project (the Project) located on King Island in San Joaquin County, California. All cultural resources investigations are being conducted in accordance with Section 106 of the National Historic Preservation Act and the National Environmental Policy Act.

The Project Area of Potential Effects (APE) is located in unincorporated San Joaquin County near the cities of Lodi and Stockton and lies within the U.S. Geological Survey 7.5-minute *Terminous* topographic quadrangle map (Figure 1). The proposed project would involve the use of compressors to inject air into an underground reservoir for later withdrawal. The air compression and withdrawal will simulate the operation of CAES facility that would store electricity from the grid during off-peak hours for late use during periods of peak energy use. This new technology, if successful, will allow for efficient storage of electricity from intermittent sources, such as wind and solar renewables. The CAES project would expand and modify an existing well pad to approximately 2.5 acres. The extension of electrical distribution lines for 4.5 miles to the site by use of existing lines, reconductoring of existing lines, and construction of new lines would also be required.

DOE is initiating consultation and requesting information you may have on properties of traditional religious and cultural significance within the vicinity of the proposed CAES Compression Testing Project and any comments or concerns you have regarding the potential for the Project to affect those properties. This information is being requested to aid in the preparation of an Environmental Assessment (EA) and to meet our obligations under Section 106 of the National Historic Preservation Act.

Please forward the results of your review and any requests for information to:

Mr. Joe Zambelli
U.S. Department of Energy
National Energy Technology Laboratory
3610 Collins Ferry Road
P.O. Box 880
M/S: I07

Morgantown, WV 26507-0880
Email: joseph.zambelli@netl.doe.gov

An EA is currently being prepared and will be released to the public in the near future. DOE will provide your office a copy of the EA where you may further comment on any of your concerns. All correspondence between the DOE and yourself will be included in an appendix to the EA. At this time, DOE anticipates a 30-day public comment period for the Project.

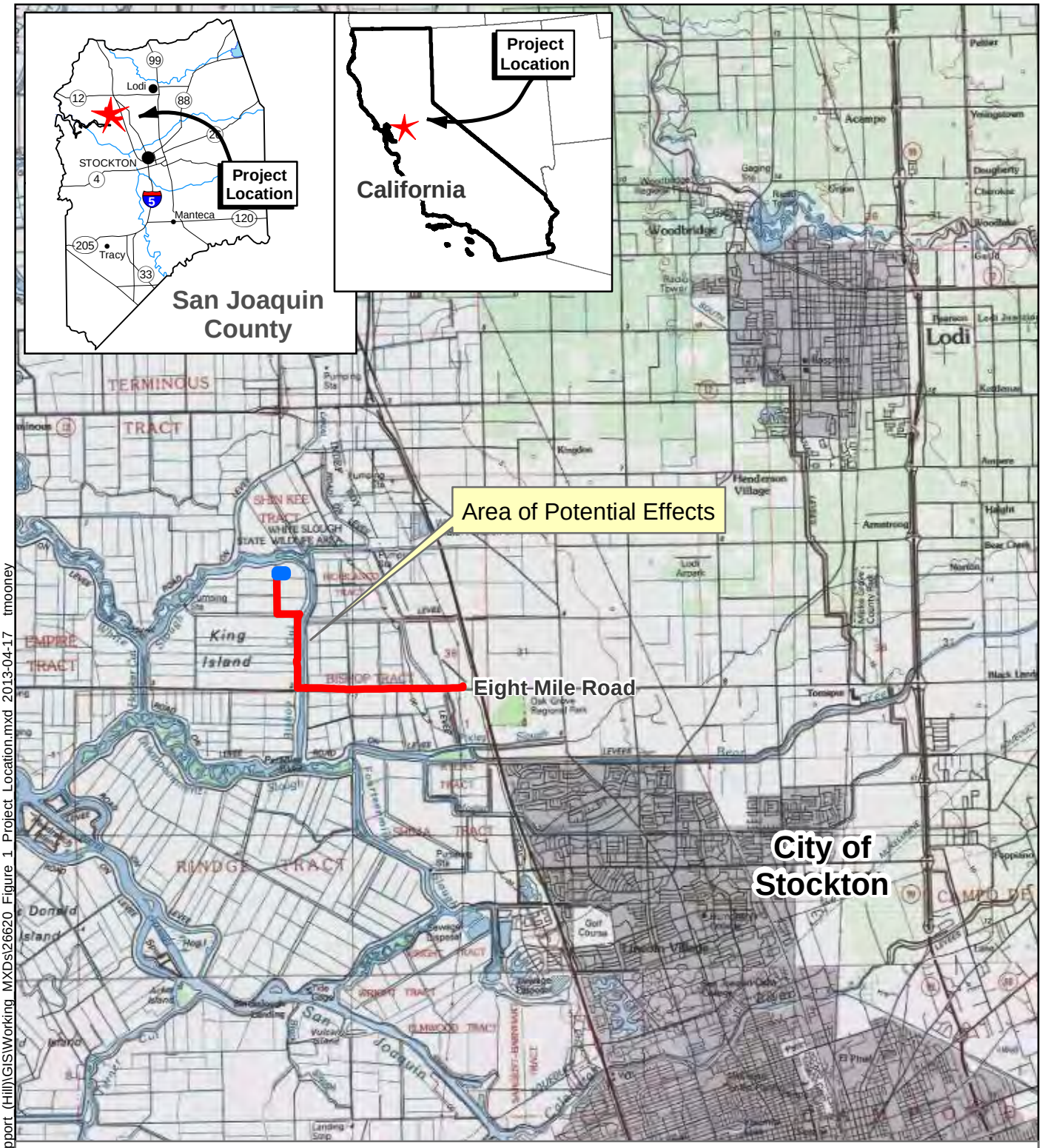
If you have any questions, please feel free to contact me at your convenience. I can be reached by phone at (304) 285-4913 or by e-mail at joseph.zambelli@netl.doe.gov.

Sincerely,

Joe Zambelli
NEPA Document Manager

Attachments:
Figure 1 – Project Location
Cultural Resources Inventory and Evaluation Report of the PG&E Compressed Air Energy Storage Compression Testing Project, King Island, San Joaquin County, California

cc: PG&E (Mr. Bob Booth)
Ms. Nuhfer



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North State Resources, Inc.

CAES PDEA - King Island

Figure 1
Project Location

This letter was distributed on June 20, 2013 to the following names/addresses:

Silvia Burley
Chairperson
California Valley Miwok Tribe of California
10601 N. Escondido Place
Stockton, CA 95212

Anthony Burris
Chairperson
Ione Band of Miwok Indians
Cultural Committee
PO Box 699
Plymouth, CA 95699

Briana Creekmore
PO Box 84
Wilseyville, CA 95257

Kevin Day
Chairman
Tuolumne Band of Me-Wuk Indians of the Tuolumne Rancheria
Of California
PO Box 699
Tuolumne, CA 95379

Katherine Erolinda Perez
P.O. Box 717
Linden, CA 95236

Nick H. Fonseca
Chairman
Shingle Springs Band of Miwok Indians
Shingle Springs Rancheria
(Verona Tract) California
PO Box 1340 (Verona Tract)
Shingle Springs, CA 95682

Andrew Franklin, Chairperson
Wilton Rancheria
9300 W. Stockton
Suite 200
Elk Grove, CA 95758

Steven Hutchason
Director of Cultural Preservation
Wilton Rancheria
9300 W. Stockton

Suite 200
Elk Grove, CA 95758

Johnny Jamerson
Acting Tribal Chairperson
Ione Band of Miwok Indians of California
PO Box 699
Plymouth, CA 95669

Irvin Marks, Chairperson
Jackson Rancheria of Me-Wuk Indians of California
PO Box 1090
Jackson, CA 95642

Lloyd Mathieson, Chairman
Chicken Ranch Rancheria of Me-Wuk Indians of California
PO Box 1159
Jamestown, CA 95327

Rhonda Morningstar Pope, Chairperson
Buena Vista Rancheria of Me-Wuk Indians of California
PO Box 162283
Sacramento, CA 95816

Carl Rivera, Chairman
Middletown Rancheria of Pomo Indians of California
PO Box 1035
Middletown, CA 95461

Randy Yonemura
4305 39th Avenue
Sacramento, CA 95824

CALIFORNIA VALLEY MIWOK TRIBE

501 N. Escondido Pl.. Stockton. CA 95212 Ph: (209) 931.4567 Fax: (209) 931.4333
Website: http://www.californiavalleymiwoktribe-nsn.gov **Email:** office@cvmt.net



CALIFORNIA VALLEY MIWOK TRIBE
A Federally Recognized Native Sovereign Nation

Silvia Burley
Chairperson



10601 North Escondido Place
Stockton, CA 95212-9231
Phone: 209.931.4567 Fax: 209.931.4333
s.burley@californiavalleymiwoktribe-nsn.gov
Main Office Email: office@cvmt.net
http://californiavalleymiwoktribe-nsn.gov

June 11, 2013

Mr. Joe Zambelli,
NEPA Document Manager
U.S. Department of Energy
National Energy Technology Laboratory
3610 Collins Ferry Road
P.O. Box 880
Morgantown, WV 26507-0880
Email: joseph.zambelli@netl.doe.gov

Re: Pacific Gas and Electric Company Compressed Air Energy Storage Compression Testing Project, King Island, San Joaquin County, California

Dear Mr. Zambelli,

The California Valley Miwok Tribe (CVMT) is in receipt of your letter (dated June 20, 2013) in which the U.S. Department of Energy (DOE) is proposing to provide a financial assistant grant to the Pacific Gas and Electric Company's Compressed Air Energy Storage (CAES) Compression Testing Project located on King Island in San Joaquin County, California.

CVMT is of the understanding that the APE is located in unincorporated San Joaquin County near the cities of Lodi and Stockton. The proposed project would involve the use of compressors to inject air into an underground reservoir for later withdrawal. The air and compression and withdrawal will simulate the operation of CAES facility that would store electricity from the grid during off-peak hours for late use during periods of peak energy use. It is stated that the CAES project would expand and modify an existing well pad to approximately 2.5 acres. The extension of electrical distribution lines for 4.5 miles to the site by use of existing lines, reconductoring of existing lines, and construction of new lines would also be required.

Comments:
The only concern that the California Valley Miwok Tribe has with the proposed project is that with ground disturbance occurring, there is a heightened possibility that Miwok artifacts and/or human remains may be found, therefore, the tribe is requesting that it be notified of Miwok artifacts and/or human remains if any are discovered at the project site location(s).

Respectfully,

Silvia Burley
Chairperson

NATIONAL ENERGY TECHNOLOGY LABORATORY
Albany, OR • Morgantown, WV • Pittsburgh, PA

U.S. DEPARTMENT OF ENERGY

June 28, 2013

[See attached list of names and addresses]

Re: Pacific Gas and Electric Company Compressed Air Energy Storage Compression Testing Project, King Island, San Joaquin County, California.

Dear [*name*]:

The U.S. Department of Energy (DOE) is proposing to provide financial assistance to Pacific Gas and Electric Company's Compressed Air Energy Storage (CAES) Compression Testing Project located on King Island in San Joaquin County, California. On June 20, 2013, the DOE sent a letter to you requesting information you may have on properties of traditional religious and cultural significance within the vicinity of the proposed CAES Compression Testing Project, and any comments or concerns you have regarding the potential for the project to affect those properties. This letter supplements that request with a notification that PG&E has made a minor expansion of the project's Area of Potential Effects (APE).

After DOE sent the information request letter, PG&E revised the project description to accommodate the replacement or installation of poles to support electrical distribution lines adjacent to Bishop Cut. To accommodate the pole placement, the APE has been expanded by 1.1 acres east of the project's distribution line crossing of Bishop Cut. PG&E would replace one distribution pole north of the crossing along a levee road, and replace two poles south of the crossing on the south side of and adjacent to Eight Mile Road.

Replacement Figure 1 (attached) depicts the expanded APE. The intensive cultural resources survey conducted on April 3, 2013, included the area within this expanded APE. No prehistoric or historic-era cultural resources were noted within the expanded APE as a result of this survey.

As stated in the previous letter, this information is being requested to aid in the preparation of an environmental assessment (EA) and to meet our obligations under Section 106 of the National Historic Preservation Act.

Please forward the results of your review and any requests for information to:

Mr. Joe Zambelli
U.S. Department of Energy
National Energy Technology Laboratory
3610 Collins Ferry Road
P.O. Box 880
M/S: I07
Morgantown, WV 26507-0880

Email: joseph.zambelli@netl.doe.gov

If you have any questions or require additional information, please feel free to contact me at your convenience. I can be reached by phone at 304-285-4913.

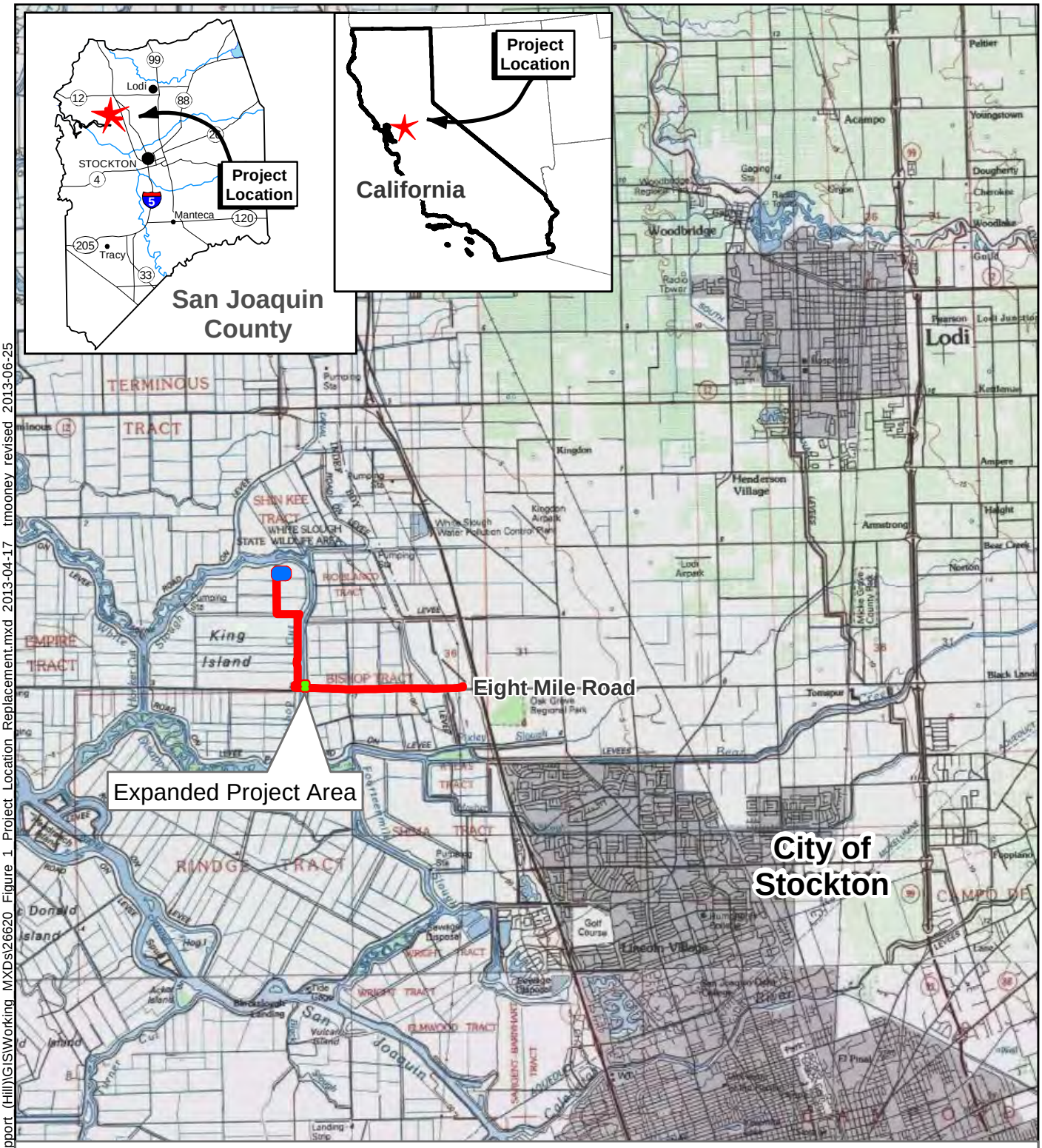
Sincerely,

Joe Zambelli

Joe Zambelli
NEPA Document Manager

Attachments:
Figure 1 – Project Location

cc: Bob Booth - PG&E
Kimberly Nuhfer - NETL



USGS 7.5 Quad:
Terminous - Revised 1993

G:\Projects\26620_CAES_EA_Support_(Hill)\GIS\Working_MXDs\26620_Figure_1_Project_Location_Replacement.mxd 2013-04-17 tmooney revised 2013-06-25

North State Resources, Inc.

CAES PDEA - King Island

Replacement Figure 1
Project Location
June 25, 2013

This letter was distributed on June 28, 2013 to the following names/addresses:

Silvia Burley
Chairperson
California Valley Miwok Tribe of California
10601 N. Escondido Place
Stockton, CA 95212

Anthony Burris
Chairperson
Ione Band of Miwok Indians
Cultural Committee
PO Box 699
Plymouth, CA 95699

Briana Creekmore
PO Box 84
Wilseyville, CA 95257

Kevin Day
Chairman
Tuolumne Band of Me-Wuk Indians of the Tuolumne Rancheria
Of California
PO Box 699
Tuolumne, CA 95379

Katherine Erolinda Perez
P.O. Box 717
Linden, CA 95236

Nick H. Fonseca
Chairman
Shingle Springs Band of Miwok Indians
Shingle Springs Rancheria
(Verona Tract) California
PO Box 1340 (Verona Tract)
Shingle Springs, CA 95682

Andrew Franklin, Chairperson
Wilton Rancheria
9300 W. Stockton
Suite 200
Elk Grove, CA 95758

Steven Hutchason
Director of Cultural Preservation
Wilton Rancheria
9300 W. Stockton

Suite 200
Elk Grove, CA 95758

Johnny Jamerson
Acting Tribal Chairperson
Ione Band of Miwok Indians of California
PO Box 699
Plymouth, CA 95669

Irvin Marks, Chairperson
Jackson Rancheria of Me-Wuk Indians of California
PO Box 1090
Jackson, CA 95642

Lloyd Mathieson, Chairman
Chicken Ranch Rancheria of Me-Wuk Indians of California
PO Box 1159
Jamestown, CA 95327

Rhonda Morningstar Pope, Chairperson
Buena Vista Rancheria of Me-Wuk Indians of California
PO Box 162283
Sacramento, CA 95816

Carl Rivera, Chairman
Middletown Rancheria of Pomo Indians of California
PO Box 1035
Middletown, CA 95461

Randy Yonemura
4305 39th Avenue
Sacramento, CA 95824

SHINGLE SPRINGS RANCHERIA
P.O. BOX 1340; SHINGLE SPRINGS, CA 95682
(530) 676-8010; FAX (530) 676-3582

July 9, 2013

National Energy Technology Laboratory
3610 Collins Ferry Road
Morgantown, WV 26507

RE: Pacific Gas and Electric Company Compressed Air Energy Storage Compression Testing Project, King Island, San Joaquin County, California.

Dear Joe Zambelli

Thank you for your letter dated for June 28, 2013 seeking information regarding the proposed Compressed Air Energy Storage Compression Testing Project that is located in San Joaquin County. Based on the information provided, the Shingle Springs Band of Miwok Indians not aware of any known cultural resources on this site. However, SSR would like to have continued consultation through updates, as the project progresses this will foster a greater communication between the Tribe and your agency.

SSR would also like to request any and all completed record searches and or surveys that were done in or around the project area up to and including environmental, archaeological and cultural reports.

If during the progress of the project new information or human remains are found we would like to be able to go over our process with you that we currently have in place to protect such important and sacred artifacts (especially near rivers and streams).

Please contact the following individuals if such finds are made:

Andrew Godsey, Assistant Cultural Resource Director / NAI
Office: (530) 698-1403 agodsey@ssband.org

And copy all communications to:
Angela Rivera, Administrative Assistant anrivera@ssband.org Office: (530) 698-1557

Thank you for providing us with this notice and opportunity to comment.

Sincerely,

Daniel Fonseca
Cultural Resource Director
Tribal Historic Preservation Officer (THPO)
Most Likely Descendent (MLD)

SHINGLE SPRINGS RANCHERIA

Shingle Springs Band of Miwok Indians,
Shingle Springs Rancheria
(Verona Tract), California
5281 Honpie Road, Placerville, CA 95667

July 19, 2013

National Energy Technology Laboratory
3610 Collins Ferry Road
Morgantown, WV 26507

Dear Joe Zambelli

The Most likely Descendant, Daniel Fonseca would like to initiate consultation process with NETL for the proposed Compressed Air Energy Storage Compression Testing Project that is located in San Joaquin County. Among other things, we would like this consultation to address the cultural and historic resource issues, pursuant to the regulations implementing Section 106 of the National Historic Preservation Act.

Prior to meeting we would like to request any and all completed record searches and or surveys that were done in or around the project area up to and including environmental, archaeological and cultural reports.

Please let this letter serve as a formal request for the Shingle Springs Band of Miwok Indians to be added as a consulting party in identifying any Traditional Cultural Properties (TCPs) that may exist within the project's Area of Potential Effects (APE).

Please contact Andrew Godsey, Assistant Cultural Resource Director, (530) 391-7091 agodsey@ssband.org or Angela Rivera, Administrative Assistant at (530) 698-1557 anrivera@ssband.org, to schedule a consultation meeting pursuant to Section 106 of the NHPA.

Sincerely,

Daniel Fonseca
Cultural Resources Director
Tribal Historic Preservation Officer (THPO)
Most Likely Descendent (MLD)

NATIONAL ENERGY TECHNOLOGY LABORATORY
Albany, OR • Morgantown, WV • Pittsburgh, PA

U.S. DEPARTMENT OF ENERGY

August 1, 2013

[See attached list of names and addresses]

Re: Pacific Gas and Electric Company Compressed Air Energy Storage Compression Testing Project, King Island, San Joaquin County, California.

Dear [*name*]:

The U.S. Department of Energy (DOE) is proposing to provide financial assistance to Pacific Gas and Electric (PG&E) Company's Compressed Air Energy Storage (CAES) Compression Testing Project located on King Island in San Joaquin County, California. On June 20, 2013, DOE sent a letter to you requesting information you might have on properties of traditional religious and cultural significance within the vicinity of the proposed CAES Compression Testing Project and any comments or concerns you have regarding the potential for the project to affect those properties.

After DOE sent the June 20, 2013, information request letter, PG&E revised the project description to accommodate the replacement or installation of poles to support electrical distribution lines adjacent to Bishop Cut. This modification expanded the area of potential effects (APE) a total of approximately 1.1-acres. This letter is to inform you that PG&E has made additional modifications to the project description resulting in the further expansion of the APE near the intersection of Eight Mile Road and Regatta Lane (1.13-acres) and at Eight Mile Road and Bishop Cut (12.35-acres) (see Figure 1). With the addition of these new areas, the project APE now encompasses a total of approximately 57.04-acres.

The entire project APE, including the new areas at Eight Mile Road and Regatta Lane and around Bishop Cut, is situated on a landform that was developed in the late 19th and early 20th centuries. Prior to this time, King Island consisted of marshes and did not exist as a dry landform until massive reclamation efforts that were largely complete by the mid-1900s. These efforts consisted of the construction of a widespread levee system, roadways and canals, and the draining and filling of low-lying areas and marshes. Consequently, the land on which the APE has been mapped did not exist during the prehistoric era and would not exhibit traces of early Native American habitation and activities.

Intensive cultural resources surveys conducted on April 3, 2013, examined the property contained within the APE including the expanded APE discussed in the June 20, 2013, letter. On July 25, 2013, the newly revised APE outlined above was also subjected to a cultural resources survey. No prehistoric or historic-era sites, features, or artifacts were noted within the newly revised APE as a result of this survey. As stated in the previous letters, DOE is requesting any information you might have regarding Native American resources and traditional properties that could be affected by the proposed project. This information will aid DOE in the preparation of an environmental assessment (EA) and to meet our obligations under Section 106 of the National Historic Preservation Act.

3610 Collins Ferry Road, P.O. Box 880, Morgantown, WV 26507
joseph.zambelli@netl.doe.gov • Voice (304) 285-4913 • Fax (304) 285-4403 • www.netl.doe.gov

Please forward the results of your review and any requests for information to:

Mr. Joe Zambelli
U.S. Department of Energy
National Energy Technology Laboratory
3610 Collins Ferry Road
P.O. Box 880
M/S: I07
Morgantown, WV 26507-0880

Email: joseph.zambelli@netl.doe.gov

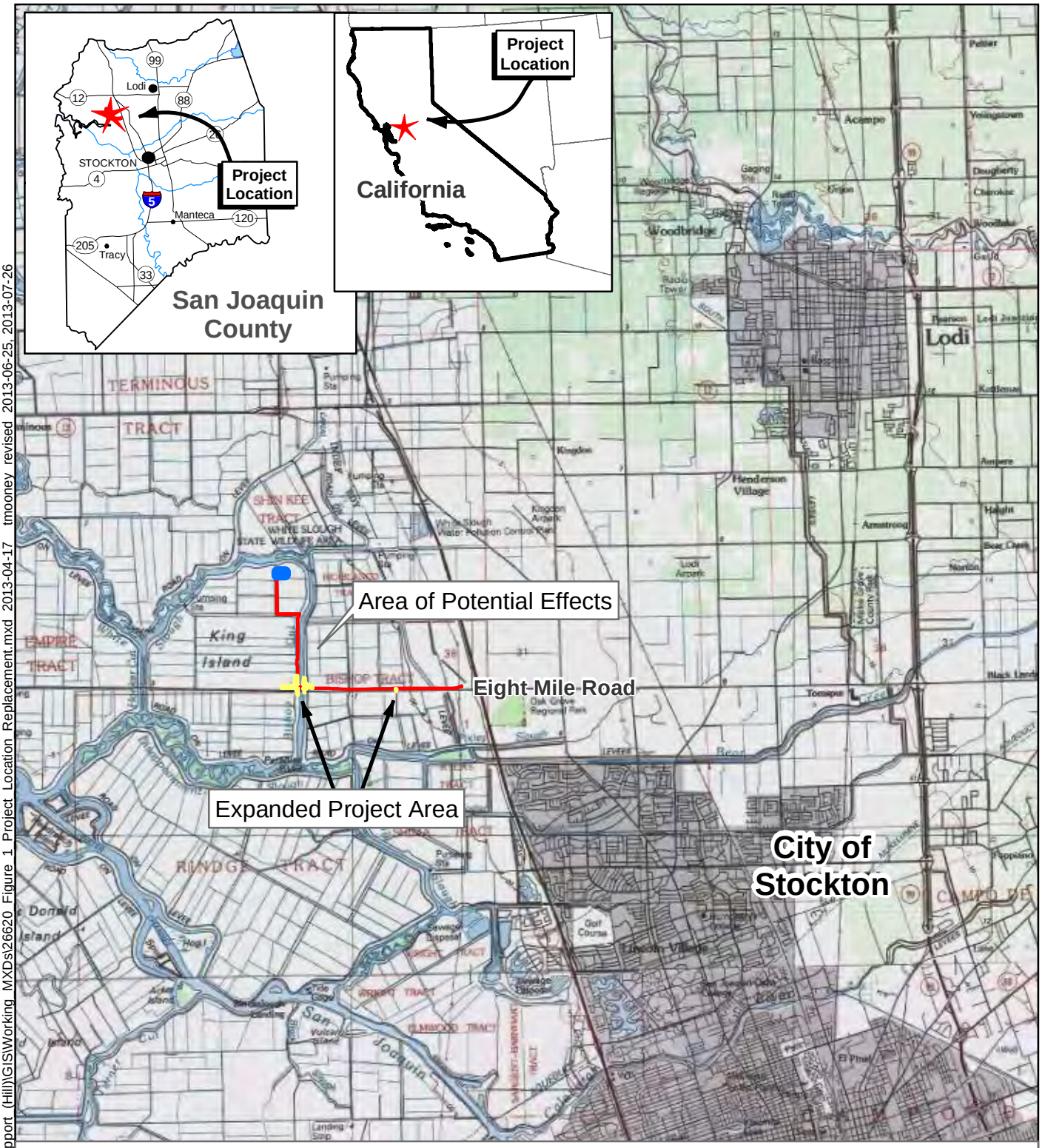
If you have any questions or require additional information, please feel free to contact me at your convenience. I can be reached by phone at 304-285-4913 or by e-mail at joseph.zambelli@netl.doe.gov.
.

Sincerely,

Joe Zambelli
NEPA Document Manager

Attachments:
Figure 1 – Project Location

cc: Bob Booth - PG&E
Kimberly Nuhfer - NETL



G:\Projects\26620_CAES_EA_Support_(Hill)\GIS\Working_MXDs\26620_Figure_1_Project_Location_Replacement.mxd 2013-04-17_tmooney_revised_2013-06-25, 2013-07-26

North State Resources, Inc.

PG&E CAES Project - King Island

Replacement Figure 1
Project Location
Revised July 31, 2013

This letter was distributed on August 1, 2013 to the following names/addresses:

Silvia Burley
Chairperson
California Valley Miwok Tribe of California
10601 N. Escondido Place
Stockton, CA 95212

Anthony Burris
Chairperson
Ione Band of Miwok Indians
Cultural Committee
PO Box 699
Plymouth, CA 95699

Briana Creekmore
PO Box 84
Wilseyville, CA 95257

Kevin Day
Chairman
Tuolumne Band of Me-Wuk Indians of the Tuolumne Rancheria
Of California
PO Box 699
Tuolumne, CA 95379

Katherine Erolinda Perez
P.O. Box 717
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Nick H. Fonseca
Chairman
Shingle Springs Band of Miwok Indians
Shingle Springs Rancheria
(Verona Tract) California
PO Box 1340 (Verona Tract)
Shingle Springs, CA 95682

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Wilton Rancheria
9300 W. Stockton
Suite 200
Elk Grove, CA 95758

Steven Hutchason
Director of Cultural Preservation
Wilton Rancheria
9300 W. Stockton

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PO Box 699
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Irvin Marks, Chairperson
Jackson Rancheria of Me-Wuk Indians of California
PO Box 1090
Jackson, CA 95642

Lloyd Mathieson, Chairman
Chicken Ranch Rancheria of Me-Wuk Indians of California
PO Box 1159
Jamestown, CA 95327

Rhonda Morningstar Pope, Chairperson
Buena Vista Rancheria of Me-Wuk Indians of California
PO Box 162283
Sacramento, CA 95816

Carl Rivera, Chairman
Middletown Rancheria of Pomo Indians of California
PO Box 1035
Middletown, CA 95461

Randy Yonemura
4305 39th Avenue
Sacramento, CA 95824

Joseph Zambelli - PG and E Compressed Air Energy Storage Compresstion Testing Project, King Island, San Joaquin Co. CA

From: <s.burley@californiavalleymiwoktribe-nsn.gov>
To: <joseph.zambelli@netl.doe.gov>
Date: 8/5/2013 2:33 AM
Subject: PG and E Compressed Air Energy Storage Compresstion Testing Project, King Island, San Joaquin Co. CA

August 04, 2013

Mr. Joe Zambelli
U.S. Department of Energy
National Energy Technology Laboratory
3610 Collins Ferry Road
P.O. Box 880 M/S: 107
Morgantown, WV 26507-0880
joseph.zambelli@netl.doe.gov

Re: Pacific Gas and Electric Company Compressed Air Energy Storage Compression Testing Project, King Island, San Joaquin County, California

Dear Mr. Zambelli,

This letter is in response to your letter dated 06/28/2013, in regards to the Pacific Gas and Electric Company Compressed Air Energy Storage Compression Testing Project, King Island, San Joaquin County, California

Comments
The California Valley Miwok Tribe (CVMT) is of the understanding that PG and E has revised its project description to accommodate the replacement or installation of poles to support electrical distribution lines adjacent to Bishop Cut. To accommodate the pole placement, the APE has been expanded by 1.1. acres east of the project's distribution line crossing of Bishop Cut. PG and E would replace one distribution pole north of the crossing along a levee road, and replace two poles south of the crossing on the south side of and adjacent to Eight Mile Road. With ground disturbance occurring, there is a heightened possibility that Miwok artifacts and/or human remains may be found; therefore, the Tribe is requesting that it be notified of Miwok artifacts and /or human remains if any are discovered at the proposed project site location(s).

Respectfully,

/s/
Silvia Burley, Chairperson
s.burley@californiavalleymiwoktribe-nsn.gov

.....
California Valley Miwok Tribe
10601 N. Escondido Pl.
Stockton, CA 95212
Ph: (209) 931-4567 Fax: (209) 931-4333
Office Email: office@cvmt.net
Tribal Council: tribe@californiavalleymiwoktribe-nsn.gov

Website: http://www.californiavalleymiwoktribe-nsn.gov

From: Roselynn Lwenya <rlwenya@buenavistatribe.com>
To: Joseph Zambelli <Joseph.Zambelli@NETL.DOE.GOV>
Date: 10/1/2013 2:34 PM
Subject: Re: Pacific Gas and Electric Company Compressed Air Energy Storage Compression Testing Project, King Island, San Joaquin County, California
Attachments: # 4native-american-traditional-cultural-landscapes-action-plan-11-23-2011[1].pdf; # 4 NA Trad Cul Lands ACHP.pdf; 20131001110516341.pdf

Dear Mr. Zambelli,

The Buena Vista Rancheria of Me-Wuk Indians is in receipt of your letter dated August 1, 2013 providing updated information on the area of potential effect (APE) for the above referenced project and; for according us the opportunity to comment and provide information.

Please find attached comments and observations from Buena Vista Rancheria. In addition, Buena Vista Rancheria encourages the Department of Energy, National Energy Technology Laboratory, to study the attached documents prepared by the Advisory Council on Historic Preservation concerning American Indian traditional cultural resources and landscapes (Native American Traditional Cultural Landscapes and the Section 106 Review Process: Questions and Answers; and Native American Traditional Cultural Landscapes Action Plan).

I have send the packet out by surface mail as well.

If you have any questions feel free to call me at (916)-491-0011 or by email me at roselynn@buenavistatribe.com<mailto:roselynn@buenavistatribe.com> . Thank you.

Sincerely,

Roselynn Lwenya, Ph.D
Environmental Resources Director / THPO
Buena Vista Rancheria
1418 20th Street, Suite 200
Sacramento, CA 95811
TEL: 916.491.0011
FAX: 916.491.0012
roselynn@buenavistatribe.com<mailto:roselynn@buenavistatribe.com>

October 1, 2013

Mr. Joe Zambelli
U.S. Department of Energy
National Energy Technology Laboratory
3610 Collins Ferry Road
P.O. Box 880
M/S: I07
Morgantown, WV 26507-0880

Re: Pacific Gas and Electric Company Compressed Air Energy Storage Compression Testing Project, King Island, San Joaquin County, California

Thank you for your letter dated August 1, 2013 providing updated information on the area of potential effect (APE) for the subject project and the opportunity to comment and provide information. According to your letter, the entire project APE, including the new areas, is situated on a landform that was developed in the late 19th and earth 20th centuries. Prior to that time, King Island consisted of marshes and until reclamation efforts that were completed by the mid-1900s. Reclamation included the construction of a widespread levee system, roadways and canals, and the draining and filling of low-lying areas and marshes. Your letter further states that because the land on which the APE has been mapped did not exist during the prehistoric era it would not exhibit traces of early Native American habitation and activities. In addition, your letter states that intensive cultural resources surveys conducted suggest there are no prehistoric or historic era sites, features, or artifacts noted within the new APE.

The Buena Vista Rancheria of Me-Wuk Indians offers the following comments:

The APE is within ancestral homelands of the Me-Wuk peoples, who for thousands of years would have managed and nurtured the marshlands as a source of spiritual and cultural sustenance. The Buena Vista Rancheria believes that it is unlikely that no trace of the ancestor's habitation and activities exist in the APE landscape. It is highly likely that materials including resources such as artifacts protected by the National Historic Preservation Act, materials protected under the Native American Graves Protection and Repatriation Act are present within the APE. In as much as there were no laws and no protective measures practiced in the 19th and 20th centuries when the marshland was destroyed and turned to levees, roadways, canals, and so on, there is a high probability for secondary deposits containing Native American ancestral materials, as well as a possibility for an unexpected discovery of an intact deposit containing artifacts, human remains, funerary objects, and objects of cultural patrimony.

No information is provided in your letter identifying who conducted the intensive cultural resources surveys, their professional qualifications, or what role Native Americans had in the survey and decision making concerning the presence/absence of resources having spiritual and cultural significance to American Indians within the APE. Buena Vista Rancheria encourages

P.O. BOX 162283 Sacramento, CA 95816
TEL: 916.491.0011 FAX: 916.491.0012
www.buenavistatribe.com

the Department of Energy, National Energy Technology Laboratory, to study the attached documents prepared by the Advisory Council on Historic Preservation concerning American Indian traditional cultural resources and landscapes (*Native American Traditional Cultural Landscapes and the Section 106 Review Process Questions and Answers*, and *Native American Traditional Cultural Landscapes Action Plan*).

We believe it is important to preserve what remains of the rich cultural and natural heritage, and that it is important for the American Indian community be involved with any ground disturbing activities that have potential to expose remnants of their ancestors. Financial assistance provided by the U.S. Department of Energy to Pacific Gas and Electric Company to implement this Compressed Air Energy Storage Commission Testing Project on King Island in San Joaquin County, California should include funds to ensure the involvement of the American Indian community in the protection of their heritage.

Buena Vista Rancheria appreciates the opportunity to comment on this project, and requests that you keep us informed regarding the progress. If you have any questions feel free to contact me at (916)-491-0011 or by email at roselynn@buenavistatribe.com.

Sincerely,

Roselynn Lwenya, Ph D
THPO/Environmental Resources Director
Buena Vista Rancheria of Me-Wuk Indians

Preserving America's Heritage

Native American Traditional Cultural Landscapes and the Section 106 Review Process: Questions and Answers

The consideration of Native American traditional cultural landscapes in Section 106 reviews has challenged federal agencies, Indian tribes, and Native Hawaiian organizations for some time. There has been confusion regarding what makes a place a traditional cultural landscape, whether they can be considered historic properties, and whether the size of such places influences their consideration under the National Historic Preservation Act. While these are all critical issues worthy of much thought and deliberation among federal agencies, Indian tribes, and Native Hawaiian organizations, the Advisory Council on Historic Preservation (ACHP) wishes to advance this dialogue by first addressing common questions about how such historic properties should be considered in the Section 106 process. While we anticipate that further dialogue will be necessary to resolve these and other issues, this Q and A is offered to move the dialogue forward and improve the consideration of these places in the Section 106 process.

This guidance assumes that readers have a basic understanding of the Section 106 review process. For more information, go to www.achp.gov.

Since this is not an exhaustive list of the issues related to Native American traditional cultural landscapes that one might encounter in a Section 106 review process, we would welcome suggestions for additional questions the ACHP should consider addressing. Further, please send us additional information or sources regarding Native American traditional cultural landscapes that you believe would be helpful for others.

1) What is a traditional cultural landscape?

The term "traditional cultural landscape" has not yet been formally defined by the National Park Service, the agency responsible for defining historic properties and maintaining the National Register of Historic Places (NRHP). While there is currently no formal NRHP definition of a traditional cultural landscape, the recent interest in these places has led the National Park Service to launch an initiative regarding updating National Register (NR) Program guidance for identifying, evaluating, and documenting properties that are historically significant as Traditional Cultural Properties (TCPs) and/or Native American landscapes. NPS will be soliciting written comments and suggestions through October 31, 2012, and may be submitted to **nr_info@nps.gov**. Respondents should identify their submission(s) as a "TCP/NAL Comment" in their e-mail "subject" box. Responses submitted via email will be posted on an ongoing basis beginning the first week of June 2012 on the NR website located at: **http://www.nps.gov/history/nr/publications/guidance/TCP comments.htm**. Respondents who do not want their names and/or e-mail addresses posted on the NR website along with their comments, or do not want their comments published at all, should clearly indicate that preference in their e-mail.

2) Can traditional cultural landscapes be considered historic properties under Section 106 of the National Historic Preservation Act?

Traditional cultural landscapes are considered by the NRHP to be a type of significance rather than a property type. Property types are limited to those specified in the NHPA and the NRHP regulations and include districts, buildings, structures, sites, and objects. Traditional cultural landscapes can and often do embrace one or more of these property types. It is important to note that the size of such properties or the potential challenges in the management of them should not be considerations in the evaluation of their significance. Any questions regarding eligibility for listing in the National Register of Historic Places should be referred to the National Register of Historic Places. Information about the National Register can be found at www.nps.gov/nr. See question 8 for additional resources.

3) How are traditional cultural landscapes identified in the Section 106 review process?

Traditional cultural landscapes, because they are often a property type such as a district or site, are identified in the same manner in the Section 106 process as other types of historic properties of religious and cultural significance to Indian tribes or Native Hawaiian organizations. The regulations at 36 CFR Section 800.4 outline several steps a federal agency must take to identify historic properties. In summary, to determine the scope of identification efforts, a federal agency, in consultation with the State Historic Preservation Officers (SHPO)/Tribal Historic Preservation Officer (THPO), must:

1. Determine and document the area of potential effect for its undertaking;
2. Review existing information; and,
3. Seek information from consulting parties including Indian tribes or Native Hawaiian organizations.

Based on the information gathered through these efforts, the federal agency, in consultation with the SHPO and any Indian tribe or Native Hawaiian organization that attaches religious and cultural significance to historic properties that may be affected by the undertaking, develops and implements a strategy to identify historic properties within the area of potential effects. Identification efforts may include background research, oral history interviews, scientific analysis, and field investigations.

A federal agency's consultation with Indian tribes or Native Hawaiian organizations is intended to ensure historic properties that may be of religious and cultural significance to them are both identified and appropriately considered in the Section 106 review process. In fact, the Section 106 regulations at Section 800.4(c)(1) require federal agencies to acknowledge the special expertise of Indian tribes and Native Hawaiian organizations in assessing the eligibility of historic properties that may be of religious and cultural significance to them.

4) Why is it important for federal agencies to consult with Indian tribes or Native Hawaiian organizations regarding traditional cultural landscapes?

Many assume that archaeologists can identify, through archaeological surveys, those properties that are of significance to Indian tribes or Native Hawaiian organizations. However, unless an archaeologist has been specifically authorized or permitted by an Indian tribe or Native Hawaiian organization to speak on its behalf, or has been determined by that entity to be qualified to conduct such surveys, it should not be assumed that the archaeologist possesses the appropriate expertise to determine what properties are or are not of religious and cultural significance to an Indian tribe or Native Hawaiian organization. The appropriate individual to make such a determination is the representative designated by the tribe or Native Hawaiian organization for this purpose. Efforts to identify these types of properties may include site visits and interviews with tribal elders or cultural experts.

Additionally, unless such traditional cultural landscapes have already been publicly identified, frequently the only entities aware of these landscapes are either an Indian tribe or a Native Hawaiian organization. Since such places are often comprised of related locations across some distance and for which the connections may not be obvious to those outside of the culture that holds them significant, it stands to reason that the most appropriate entity to inform such identifications and evaluations are either Indian tribes or Native Hawaiian organizations.

5) How can issues of confidentiality be addressed when traditional cultural landscapes may be affected by an undertaking?

Many Indian tribes or Native Hawaiian organizations have belief systems that require the location and even the existence of properties of traditional religious and cultural significance, including traditional cultural landscapes, not be divulged. Therefore, it is vital that the federal agency work with tribes or Native Hawaiian organizations to identify sensitive locations while respecting desires to withhold specific information about such sites. The Section 106 regulations at 36 CFR Section 800.4(b)(1) state, in part, that "[t]he agency official shall take into account any confidentiality concerns raised by Indian tribes or Native Hawaiian organizations during the identification process."

The NHPA and the Section 106 regulations also provide a vehicle for protecting information that an Indian tribe or Native Hawaiian organization has disclosed for the purpose of identification and evaluation of historic properties in the Section 106 process. Section 304 of the NHPA (16 U.S.C. 470w-3(a)) and the regulations at 36 CFR Section 800.11(c)(1) provide that the head of an agency, after consultation with the Secretary of the Interior, "shall withhold from disclosure to the public" information about the location, character, or ownership of a historic property when the agency head determines that the disclosure of such information may cause a significant invasion of privacy; risk harm to the historic property; or, impede the use of a traditional religious site by practitioners. After such a determination, the Secretary of the Interior, in consultation with the relevant agency, will determine who, if anyone, may have access to the information for purposes of the NHPA. When the information in question has been developed in the course of an agency's compliance with Section 106, the Secretary shall consult with the ACHP in reaching determinations on the withholding and release of information.

One important caveat: the Section 304 confidentiality provisions only apply to properties that are listed or eligible for listing in the NRHP. Thus, it is possible that information disclosed prior to an eligibility determination may not be protected. Therefore, the ACHP suggests that agencies and Indian tribes or Native Hawaiian organizations contact NR staff for guidance regarding the amount of information and detail needed to make a determination of eligibility when such information may be at risk of disclosure. It may be possible for a tribe or Native Hawaiian organization to share just enough information for the agency to identify the existence of a site and make a determination of eligibility without compromising the site or the beliefs associated with it. Such information might include general aspects of the historic property's attributes, i.e., that an important yearly ceremony takes place in a certain general location, that quiet is required in the area, that visual impacts will impede the ability to properly perform a required ritual, or that important ceremonial harvesting activities must occur at a particular place, time, or under certain conditions, as well as basic information about the relationship of the property to the project area. However, if there are questions about the adequacy of such information in making determinations of eligibility, the NR staff should be consulted.

Issues of confidentiality and sensitivity of information require flexibility and cooperation among the consulting parties. There may be situations where a tribe or Native Hawaiian organization is only willing to share information with the federal agency and not with the other non-federal consulting parties. This can challenge the traditional Section 106 process where the federal agency also consults with the SHPO to

determine eligibility of properties. In such cases, it is recommended that the agency promptly talk with the ACHP or the NR staff about how to resolve such a situation.

6) What types of features may be part of a traditional cultural landscape?

There is no single defining feature or set of features that comprise a traditional cultural landscape. Such places could be comprised of natural features such as mountains, caves, plateaus, and outcroppings; water courses and bodies such as rivers, streams, lakes, bays, and inlets; views and view sheds from them, including the overlook or similar locations ; vegetation that contributes to its significance; and, manmade features including archaeological sites; buildings and structures; circulation features such as trails; land use patterns; evidence of cultural traditions, such as petroglyphs and evidence of burial practices; and markers or monuments, such as cairns, sleeping circles, and geoglyphs.

7) What is the role of the Advisory Council on Historic Preservation in the consideration and protection of traditional cultural landscapes in the Section 106 process?

A federal agency must afford the ACHP an opportunity to participate in consultation regarding the resolution of adverse effects to any historic property, including a traditional cultural landscape, if the property is listed or determined eligible for listing on the NRHP. The ACHP can also offer its advisory opinion on the substance of any finding, determination, or decision regarding the adequacy of an agency's compliance with the Section 106 regulations at any time at the request of any individual, agency, or organization. The ACHP cannot, however, comment on the eligibility of a property for listing on the NRHP. Therefore, an Indian tribe or Native Hawaiian organization can request that the ACHP review an agency's finding, determination, or decision regarding the potential effects of its undertaking and the resolution of effects to historic properties of significance to them.

8) Where can I get more information on cultural landscapes in general?

The U.S. National Park Service (NPS) provides additional information on cultural landscapes at:

http://www.nps.gov/history/hps/hli/landscape_guidelines/index.htm
http://www.nps.gov/history/hps/hli/landscape_guidelines/using.htm

NPS also provides additional information on traditional cultural properties, which can also be landscapes at:

http://www.nps.gov/nr/publications/bulletins/pdfs/nrb38.pdf

International sources of information:

http://unesdoc.unesco.org/images/0013/001331/133121e.pdf
http://www.international.icomos.org/centre_documentation/bib/culturallandscapes.pdf
http://whc.unesco.org/en/news/588

Issued on July 11, 2012

Preserving America's Heritage

NATIVE AMERICAN TRADITIONAL CULTURAL LANDSCAPES ACTION PLAN

The Advisory Council on Historic Preservation (ACHP) has seen an increasing number of Section 106 reviews involving large scale historic properties of religious and cultural significance to Indian tribes or Native Hawaiian organizations (NHOs). Improvements in federal agency consultation with Indian tribes and NHOs and greater recognition of their expertise in identifying historic properties of significance to them have likely contributed to this increase. It is equally likely that there have also been increasing development pressures in places not previously developed.

These large scale properties are often comprised of multiple, linked features that form a cohesive "landscape." The recognition, understanding, and treatment of such places can be a struggle for the non-tribal or non-Native Hawaiian participants in the Section 106 process, partly due to the lack of experience in addressing such places and partly due to the lack of guidance regarding these traditional cultural landscapes.

In response to growing concerns about the impacts to these properties of religious and cultural significance to Indian tribes and Native Hawaiian organizations, in 2009, the ACHP began an informal dialogue with tribal representatives primarily via teleconferences and e-mail exchanges. During the Tribal Summit on Renewable Energy in January 2011 (go to www.achp.gov/renewable_energy.html for more information), participants recognized the importance of identifying and considering historic properties at the landscape level and avoiding inappropriately breaking these larger properties into smaller units that are managed separately and out of context. As a result of these discussions as well as the ACHP's experience in individual Section 106 reviews, it is evident that the issues are complex and warrant the attention of the larger preservation community. To that end, the ACHP held a forum in August 2011, to introduce the ACHP members to the challenges of recognizing and protecting Native American traditional cultural landscapes and to elevate the issues to policy levels within the federal preservation program (go to www.achp.gov for more information).

This proposed plan is based on the suggestions the ACHP has received and the discussions with its preservation partners since 2009. It sets forth actions designed to affirmatively address the challenges the ACHP believes are most critical for both protecting these important historic properties as well as addressing identified hurdles in the Section 106 and National Environmental Policy Act (NEPA) processes when proposed projects may impact Native American traditional cultural landscapes. The appropriate and early involvement of those parties for whom these places are so important, Indian tribes and NHOs, and the clarification of how these landscapes are to be recognized and treated in Section 106 and NEPA reviews are key elements to accomplishing these goals.

The first set of action items focuses on raising awareness both within the preservation community and among our partners about the existence of traditional cultural landscapes and their importance to Indian tribes and Native Hawaiian organizations. This purpose of this outreach is to ensure that Native American traditional cultural landscapes are considered early in land management and project planning decisions.

Early consultation with Indian tribes and Native Hawaiian organizations to identify areas of religious and cultural significance prior to project siting decisions is not only the most effective means to avoid impacts to these places but is also the best way to minimize project delays.

The second set of action items focuses on the Section 106 process and the development of tools to assist all participants in the recognition and consideration of Native American traditional cultural landscapes. Given the increasing threats to these places from large-scale developments, the ACHP will focus its attention on this action items in FY 2012 and early FY 2013.

In order to ensure the success of these proposed measures, the ACHP and the Department of Interior (DOI) must formally commit to work together to address the broad issues surrounding Native American traditional cultural landscapes. The ACHP, as the agency with responsibility for overseeing the Section 106 review process, and DOI, through the National Park Service (NPS), as the agency with responsibility for overseeing the National Register of Historic places, should provide leadership in addressing Native American cultural landscapes in the national historic preservation program. Together, the ACHP and NPS should:

- Promote the recognition and protection of Native American traditional cultural landscapes both within the federal government and the historic preservation community as well as at the state and local levels, and,

- Address the challenges of the consideration of these historic properties in the Section 106 review process as well as in NEPA reviews.

To meet these goals, the ACHP and NPS should, in consultation with key partners including Indian tribes, Tribal Historic Preservation Officers (THPOs), Native Hawaiian organizations, State Historic Preservation Officers (SHPOs), federal agencies, preservation organizations, cultural landscape experts, and industry representatives, carry out the following actions:

1. Promote the recognition and protection of Native American traditional cultural landscapes both within the federal government and the historic preservation community as well as at the state and local levels.

- NPS and the ACHP should work with the National Association of Tribal Historic Preservation Officers (NATHPO) and other intertribal organizations to advance the recognition of Native American traditional cultural landscapes in the broader national preservation program through their interaction with preservation partners including the National Conference of State Historic Preservation Officers, the National Trust for Historic Preservation, federal agencies, and others.

- DOI, the ACHP, the Council on Environmental Quality (CEQ), and other federal agencies should work with Indian tribes, THPOs, and NHOs to reach out to applicants and trade associations to promote the early consideration of, and consultation with Indian tribes, THPOs, and NHOs about sacred sites and Native American traditional cultural landscapes in project planning and scoping.

- Federal agencies should develop long-term, meaningful relationships with Indian tribes, THPOs, and NHOs to ensure effective and early consultation that leads to better planning and, where appropriate, identifying areas of cultural sensitivity.

- The ACHP and CEQ should encourage federal agencies to integrate consultation and coordination with Indian tribes, THPOs, and NHOs as early as possible in their planning processes to identify and address potential cultural resource concerns.

- The Administration should include the protection of Native American landscapes and historic properties in its agenda for the annual Tribal Nations Meeting at the White House to engage and hear from tribal leaders on this issue.

- The Administration should promote training for federal officials on working more effectively with tribal governments and developing greater cultural sensitivity.

2. Address the challenges of the consideration of Native American traditional cultural landscapes in the Section 106 review process as well as in NEPA reviews.

- NPS should issue additional guidance on how to apply the National Register criteria to these historic properties. The guidance should define "traditional cultural landscapes" as they relate to Indian tribes or Native Hawaiian organizations. It should also address what constitutes adequate documentation; how to protect sensitive and confidential Native American cultural knowledge and information; and, the role of traditional cultural knowledge in making determinations of eligibility.

- NPS should update National Register Bulletin 38: *Guidelines for Evaluating and Documenting Traditional Cultural Properties* to clarify how this guidance applies to historic properties of religious and cultural significance to Indian tribes and Native Hawaiian organizations. NPS should also explore how guidance regarding Native American traditional cultural landscapes might inform the treatment of large historic properties or landscapes of significance to non-Native communities.

- The ACHP should develop a policy statement and issue formal guidance on the need for early tribal and Native Hawaiian consultation and the consideration of Native American traditional cultural landscapes in the Section 106 review process to include the role of Indian tribes, THPOs, and Native Hawaiian organizations and how to determine effects on such historic properties.

- The ACHP should work with NATHPO to develop a special case digest of Section 106 cases, best practices, and examples where federal agencies effectively managed such places, consulted tribes, developed innovative mitigation approaches, etc.

- The ACHP and DOI should work with their preservation partners to address the perceived conflicts regarding confidentiality of sensitive information and the transparency of agency decision making in the Section 106 process.

- The ACHP should promote the consideration of Native American traditional cultural landscapes through its leadership role in the Interagency Working Group on Indian Affairs as a means to reach a broader federal audience and to explore the potential intersections with other federal programs and initiatives including climate change and sacred sites protection.

With the formal adoption of this action plan by the ACHP members on November 10, 2011, the ACHP is committed to carrying out its responsibilities under this plan.

November 23, 2011

October 28, 2013

Joseph Zambelli
NEPA Document Manager
U S Department of Energy
National Energy Technology Laboratory
3610 Collins Ferry Road
P.O. Box 880
Morgantown, WV 26507-0880

RE: Pacific Gas and Electric Company Compressed Air Energy Storage Compression Testing Project, King Island, San Joaquin County, California

Dear Mr. Zambelli:

On behalf of the Buena Vista Rancheria of Me-Wuk Indians ("Tribe"), I am writing to follow up on your letter dated August 1, 2013, to initiate tribal consultation regarding the above referenced project. By way of background, a project site visit was arranged for the Tribe on October 11, 2013, with Pacific Gas & Electric Company ("PG&E") and North State Resources ("NSR"). The site visit was followed by conference call on October 16, 2013, in which the Tribe, PG&E, NSR and the U.S. Department of Energy ("DOE") participated. During the conference call, the Tribe requested for the following information:

1. Status of the National Environmental Protection Act (NEPA) and National Historic Preservation Act (NHPA) tribal consultation and review process as it pertains to the subject project;
2. Clarification of the DOE's government-to-government consultation policies, in general, and how they are to be specifically applied for this project;
3. Information on timing and sequencing of project activities;
4. Identification of which Native American tribes are participating in the project;
5. Copies of the following documents regarding the project: relevant permits, environmental assessments, feasibility study documents, and categorical exclusions documents among others;
6. Project timelines and implementation schedule(s); and
7. The historical properties treatment plan, archeological discovery plan and monitoring protocol for the project

The Tribe, during the call, also expressed interest in monitoring the project during ground disturbance work (temporary power phase and related activities).

The Tribe has received the requested information under Item 1 above and eagerly looks forward to receiving the remaining items. We also look forward to our active participation in the consultation process and to further discussing the Tribe's role monitoring activities as the project progresses.

P.O. BOX 162283 Sacramento, CA 95816
TEL: 916.491.0011 FAX: 916.491.0012
www.buenavistatribe.com

If you have any questions concerning this letter, feel free to contact me by email at roselynn@buenavistatribe.com or by telephone at (916) 491-0011. Thank you

Sincerely,

Roselynn Lwenya, Ph.D
Tribal Historic Preservation Officer
BUENA VISTA RANCHERIA OF ME-WUK INDIANS

>>> Roselynn Lwenya <rlwenya@buenavistatribe.com> 11/1/2013 4:53 PM >>>

Dear Mr. Zambelli,

Thank you for your October 29 letter that provided responses to issues raised by Buena Vista Rancheria of Me-Wuk Indians. Although there are still details to be worked out regarding finalizing a monitoring agreement with BVR prior to the start of construction of the temporary electrical distribution system, we feel that you and PG&E have substantially addressed our concerns and that we have a clear understanding of how we can all work together for a successful project while meeting our mutual responsibilities to protect the natural resource and Native American cultural resource heritage; while meeting our respective needs. Thus, upon finalizing the agreement, BVR is available to move forward in partnership with DOE/PG&E to install the temporary power upgrade portion of the project later this month. However, we do request that all subsequent project phases be addressed in the forthcoming EA.

If you have any questions please contact me by email at roselynn@buenavistatribe.com or by phone at (916) 491-0011.

Thank you

Respectfully,

Roselynn Lwenya, Ph.D
Environmental Resources Director / THPO
Buena Vista Rancheria
1418 20th Street, Suite 200
Sacramento, CA 95811
TEL: 916.491.0011
FAX: 916.491.0012
roselynn@buenavistatribe.com

NATIONAL ENERGY TECHNOLOGY LABORATORY
Albany, OR • Morgantown, WV • Pittsburgh, PA

U.S. DEPARTMENT OF ENERGY

February 14, 2014

Anthony Burris
Chairman of Cultural Committee
Ione Band of Miwok Indians
PO Box 699
Plymouth, CA 95699

RE: Pacific Gas and Electric (PG&E) Compressed Air Energy Storage Compression (CAES) Testing Project, King Island, San Joaquin County, California.

Dear Mr.Burris:

Thank you for taking the time to meet with the U.S. Department of Energy during our January 29, 2014, consultation meeting. In response to your question and information request regarding the above referenced project, please see the following.

Site Geology
Attached are the results from two borings PG&E conducted in 2013 at King Island in preparation for the well pad work. These reports summarize the site's geology. Boring #1 was performed to a depth of 25-feet. Boring #2 extended down to a depth of 50-feet. The last sheet explains the various soil classifications. If you have questions on this information, please contact Mike Medeiros at MJML@pge.com or call him at 415-973-6270.

Full-Scale CAES Facility Generation Capacity
A question was asked concerning the equivalent number of homes that might be provided with electricity by PG&E's proposed 300-megawatt (MW) CAES facility. Based on a maximum power output of 300-MW, the proposed CAES facility could provide electricity to approximately 225,000 homes when operating at full power. Please note that this projected generation capacity only applies to a full-scale CAES facility, and not the compression testing phase. The compression testing will not produce any electricity.

If you have any questions on the above information or any other matter, please let me know.

Sincerely,

Joseph Zambelli

Joe Zambelli
NEPA Document Manager

3610 Collins Ferry Road, P.O. Box 880, Morgantown, WV 26507
Joseph.zambelli@netl.doe.gov • Voice (304) 285-4913 • Fax (304) 285-4403 • www.netl.doe.gov

Enclosure

cc:
Randy Yonemura, Member of Cultural Committee
Jesse Garcia, NETL
Kimberly Nuhfer, NETL

NATIONAL ENERGY TECHNOLOGY LABORATORY
Albany, OR • Morgantown, WV • Pittsburgh, PA

U.S. DEPARTMENT OF ENERGY

February 14, 2014

Randy Yonemura
Member of Cultural Committee
4305 39th Avenue
Sacramento, CA 95824

RE: Pacific Gas and Electric (PG&E) Compressed Air Energy Storage Compression (CAES) Testing Project, King Island, San Joaquin County, California.

Dear Mr.Yonenura:

Thank you for taking the time to meet with the U.S. Department of Energy during our January 29, 2014, consultation meeting. In response to your question and information request regarding the above referenced project, please see the following.

Site Geology
Attached are the results from two borings PG&E conducted in 2013 at King Island in preparation for the well pad work. These reports summarize the site's geology. Boring #1 was performed to a depth of 25-feet. Boring #2 extended down to a depth of 50-feet. The last sheet explains the various soil classifications. If you have questions on this information, please contact Mike Medeiros at MJML@pge.com or call him at 415-973-6270.

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If you have any questions on the above information or any other matter, please let me know.

Sincerely,

Joseph Zambelli

Joe Zambelli
NEPA Document Manager

3610 Collins Ferry Road, P.O. Box 880, Morgantown, WV 26507
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Enclosure

cc:
Anthony Burris, Chairman of Cultural Committee
Jesse Garcia, NETL
Kimberly Nuhfer, NETL

Project: PG&E CAES Pad Project Location: King Island, San Joaquin County, CA MPE Number: 01526-01	LOG OF SOIL BORING D1 Sheet 1 of 2

Date(s) Drilled: 5/30/2013	Logged By: DCS	Checked By: DCS
Drilling Method: 8" Hollow Stem Auger	Drilling Contractor: V&W Drilling	Total Depth of Drill Hole: 25 ft.
Drill Rig Type: CME 75	Diameter(s) of Hole, Inches: 8	Approx. Surface Elevation, ft MSL: N/A
Groundwater Depth [Elevation], feet: Initial = 13', Final = 6'	Sampling Method(s): 140 lb hammer, 30 inch drop	Drill Hole Backfill: Soil Cuttings
Remarks		

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	BLOWS PER FOOT	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Black-gray, sandy silty clay/sandy clayey silt (CL/ML) with organics		D1-1	7			
			gray mottled		D1-2	9	19	100	UCC 0.7 tsf
	5		Gray, clayey, very fine sandy silt/silty very fine sand (ML/SM), wet ▼		D1-3	6	25	98	UCC 0.4 tsf
	10		very fine sandy		D1-4	26	14	119	
			Gray, medium sand (SP) ▽		D1-5	16	20	99	
	15		Gray-brown mottled, silty clay (CL),		D1-6	15	32	91	UCC 1.2 tsf
	20		sandy						
	25		Bottom of Hole = 25 feet Initial Groundwater = 13 feet Final Groundwater = 6 feet		D1-7	22			

MPE *Mid Pacific Engineering, Inc.*

FIGURE 4

Project: PG&E CAES Pad

Project Location: King Island, San Joaquin County, CA

MPE Number: 01526-01

LOG OF SOIL BORING D2

Sheet 1 of 2

Date(s) Drilled: 5/30/2013	Logged By: DCS	Checked By: DCS
Drilling Method: 8" Hollow Stem Auger	Drilling Contractor: V&W Drilling	Total Depth of Drill Hole: 50 ft.
Drill Rig Type: CME 75	Diameter(s) of Hole, Inches: 8	Approx. Surface Elevation, ft MSL: N/A
Groundwater Depth [Elevation], feet: Initial = 14'	Sampling Method(s): 140 lb hammer, 30 inch drop	Drill Hole Backfill: Grout
Remarks		

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	BLOWS PER FOOT	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
	0		Black-gray, clayey sandy silt (ML) with organics		D2-1	21			
					D2-2	15	15	107	UCC 1.2 tsf
	5		Gray, mottled, clayey very fine sandy silt/silty very fine sand (ML/SM)		D2-3	10	17	114	UCC 0.6 tsf
					D2-4	8	25	96	
	10		dark gray						
			clayey		D2-5	18			
	15								
			Dark gray, silty, very fine to fine sand (SM), micaceous		D2-6	35	27	96	
	20								
			Brown-gray, mottled, sandy, silty clay (CL)		D2-7	23			
	25								

MPE Mid Pacific Engineering, Inc.

FIGURE 5

Project: PG&E CAES Pad
Project Location: Kings Island, San Joaquin County, CA
MPE Number: 01526-01

LOG OF SOIL BORING D2

Sheet 2 of 2

Date(s) Drilled: 5/30/2013	Logged By: DCS	Checked By: DCS
Drilling Method: 8" Hollow Stem Auger	Drilling Contractor: V&W Drilling	Total Depth of Drill Hole: 50 ft.
Drill Rig Type: CME 75	Diameter(s) of Hole, Inches: 8	Approx. Surface Elevation, ft MSL: N/A
Groundwater Depth (Elevation), feet: Initial = 14'	Sampling Method(s): 140 lb hammer, 30 inch drop	Drill Hole Backfill: Grout
Remarks		

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	BLOWS PER FOOT	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
	30		Brown, fine to medium sand (SP)		D2-8	41	18	110	
	35				D2-9	37	21	104	
	40		Brown-rust-gray, mottled, very fine sandy clay (CL)		D2-10	22			
	45		Brown, silty, very fine sand (SM/ML) micaceous		D2-11	34	27	91	
	50		Black-gray, fine to medium sand with gravel (SW/GW) Bottom of Hole = 50 feet Initial Groundwater = 14 feet		D2-12	72			

MPE *Mid Pacific Engineering, Inc.*

FIGURE 5

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		SYMBOL	CODE	TYPICAL NAMES
COARSE GRAINED SOILS (More than 50% of soil > no. 200 sieve size)	GRAVELS (More than 50% of coarse fraction > no. 4 sieve size)	GW		Well graded gravels or gravel - sand mixtures, little or no fines
		GP		Poorly graded gravels or gravel - sand mixtures, little or no fines
		GM		Silty gravels, gravel - sand - silt mixtures
		GC		Clayey gravels, gravel - sand - silt mixtures
	SANDS (50% or more of coarse fraction < no. 4 sieve size)	SW		Well graded sands or gravelly sands, little or no fines
		SP		Poorly graded sands or gravelly sands, little or no fines
		SM		Silty sands, sand - silt mixtures
		SC		Clayey sands, sand clay mixtures
FINE GRAINED SOILS (More than 50% of soil < no. 200 sieve size)	SILTS & CLAYS LL< 50	ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
		CL		Inorganic clays of low to medium plasticity, gravely clays, sandy clays, silty clays, lean clays
		OL		Organic silts and organic silty clays of low plasticity
	SILTS & CLAYS LL ≥ 50	MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH		Inorganic clays of high plasticity, fat clays
		OH		Organic clays of medium to high plasticity, organic silty clays, organic silts
HIGHLY ORGANIC SOILS		Pt		Peat and other highly organic soils
ROCK		RX		Rocks, weathered to fresh
FILL		FILL		Artificially placed fill material

OTHER SYMBOLS

= Drive Sample: 2-1/2" O.D. Modified California sampler

= Hand Driven Sample

=SPT Sampler

= Initial Water Level

= Final Water Level

= Estimated or gradational material change line

= Observed material change line

Laboratory Tests

PI = Plasticity Index
EI =Expansive Index
UCC = Unconfined Compression Test
TR = Triaxial Compression Test
GR = Gradation Analysis (Sieve)
K = Permeability Test

GRAIN SIZE CLASSIFICATION

CLASSIFICATION	RANGE OF GRAIN SIZES	
	U.S. Standard Sieve Size	Grain Size in Millimeters
BOULDERS	Above 12"	Above 305
COBBLES	12" to 3"	305 to 76.2
GRAVEL coarse (c) fine (f)	3" to No. 4 3" to 3/4" 3/4" to No. 4	76.2 to 4.76 76.2 to 19.1 19.1 to 4.76
SAND coarse (c) Medium (m) fine (f)	No. 4 to No. 200 No. 4 to No. 10 No. 10 to No. 40 No. 40 to No. 200	4.76 to 0.074 4.76 to 2.00 2.00 to 0.420 0.420 to 0.074
SILT & CLAY	Below No. 200	Below 0.074

MPE
Mid Pacific Engineering, Inc.

UNIFIED SOIL CLASSIFICATION SYSTEM
PG&E CAES PROJECT
TEMPORARY SITE FACILITY
Kings Island,
San Joaquin County, California

FIGURE 6	
DRAWN BY	TF
CHECKED BY	DCS
PROJECT MGR	DCS
DATE	6/13
MPE No. 01526-01	

March 18, 2014

Mr Joe Zambelli
U.S. Department of Energy
National Energy Technology Laboratory
3610 Collins Ferry Road
P.O. Bos880
Morgantown, WV 26307-0880

SUBJECT: Compressed Air Energy Storage (CAES) Compression Testing Phase Project/American Indian Consultation

Dear Mr Zambelli,

To create a working partnership among the Department of Energy (DOE), Pacific Gas and Electric (PG&E), and culturally associated Miwok tribes concerning consultation for the subject project, four tribes convened a meeting at the Wilton Rancheria on March 4, 2014 Attending the meeting were representative from the Buena Vista Rancheria of Me-Wuk Indians, the Ione Band of Miwok Indians, the Shingle Springs Band of Miwok Indians, and Wilton Rancheria. Each of these four tribes began active consultation with DOE and PG&E at various times during the project, beginning in the summer of 2013 until now.

It is important to note that the project is funded through the 2009 American Recovery and Reinvestment Act funds The project is co-funded by the Federal DOE, California Public Utilities Commission, and the California Energy Commission. The total cost of the testing component of the project will be approximately $20-$25 million.

The project area, referred to as Kings Island, and the associated traditional cultural landscape throughout the environs holds cultural and spiritual significance for each of the four tribes. For each of the tribes, the cultural and spiritual significance is based in their oral histories and traditional values concerning the relationship between the land, the ancestors, and the living descendants. The natural character of the landscape before it was modified to its present state was a critical source of sustenance to the ancestral Miwok for food, medicine, and manufacture materials The area would have been a place for cultural and spiritual activities and ceremonies at harvest gatherings and other occasions.

At the March 4 meeting, the tribes agreed on the following topics concerning the testing pad activity when the walnut trees are removed:

1. Government- to- government consultation has not been satisfactory DOE is not complying with Section 106 of the National Historic Preservation Act, and other historic preservation laws, regulations, and executive orders concerning American Indian resources and values. Specifically, 42 USC 4321-47 [NEPA]; 16 USC 1531-1544 (ESA) and Executive Orders 12898, 13007;

2. Communications among the parties must be open and honest The Tribes were not consulted about this project prior to the 1st testing pad and; removal of trees that would necessitate drilling to the depths of 5000 feet;
3. By no means shall it be assumed or presumed that only one Tribe shall represent all the Tribes currently involved in this project, communications or otherwise;
4 Protocol and procedures developed in consultation among the tribes, PG&E, and the contractors must be honored.
5. The cultural resources study conducted by North State Resources Inc (NSR) was unsatisfactory from the American Indian perspective Professional decisions about the cultural sensitivity of the area were made without input from the American Indian community, and therefore, failed to account for the cultural and spiritual significance of the project area to the Indian people as required by the above cited provisions;
6. During consultation, verbal agreements were made by DOE and PG&E representatives and tribal representatives from Ione Band of Miwok Indians and Wilton Rancheria concerning the need to have a subsurface testing program and ethnographic study conducted The four tribes agreed that DOE and PG&E should honor their verbal agreement to conduct the ethnographic study and subsurface testing program to determine the potential for human burials in the testing pad at the walnut orchard;
7. The four tribes also agreed:
    a The subsurface testing program and ethnographic study should be conducted by professional's selected in consultation with the tribes;
    b The project area is within a traditional cultural landscape that is eligible for listing on the National Register of Historic Places as a Traditional Cultural Property;
    c. A discovery plan should be developed prior to ground disturbance;

DOE and PG&E must maintain an active consultation with all the tribes, honoring the verbal agreements made during face to face consultation and telephone conferences and written agreement executed by all parties. The four tribes look forward to hearing from you soon concerning these important matters.

Sincerely,

Chairman

Buena Vista Rancheria of Me-Wuk Indians Date: 3-18-14

Yvonne Miller, Chairperson

Ione Band of Miwok Indians Date: 3-20-14

Chairman

Shingle Springs Band of Miwok Indians 3-25-14 Date:

Chairperson

3/20/14

Wilton Rancheria Date:

Cc

Jesse Garcia, Tribal Liaison
U.S. Department of Energy
3610 Collins Ferry Road, P.O. Box 880
Morgantown, WV 26307-0880

APPENDIX B3

CORRESPONDENCE WITH THE UNITED STATES FISH AND WILDLIFE SERVICE

NATIONAL ENERGY TECHNOLOGY LABORATORY
Albany, OR • Morgantown, WV • Pittsburgh, PA

U.S. DEPARTMENT OF ENERGY

June 3, 2013

Ms. Kim Turner
ESA Regulatory Division
Bay-Delta Fish and Wildlife Office
U.S. Fish and Wildlife Service
650 Capitol Mall, Suite 8-300
Sacramento, California 95814

Subject: Section 7 Consultation under the Endangered Species Act. Compressed Air Energy Storage Compression Testing Project

Dear Ms. Turner:

The U.S. Department of Energy (DOE) is proposing to provide a financial assistance grant (DOE's Proposed Action) to Pacific Gas and Electric Company (PG&E) as part of the Smart Grid Technologies Program, which is funded through the American Recovery and Reinvestment Act of 2009. If PG&E receives the grant, it would construct a temporary site facility to test the performance of a geological formation as a potential storage reservoir for future use as a Compressed Air Energy Storage (CAES) facility. PG&E would install wells and compressors for injecting compressed air into a depleted natural gas field at a depth of several thousand feet, followed with controlled releases of this air to observe and measure the performance of the air storage reservoir. Associated facilities would include a 2.5-acre gravel work pad for the temporary site facilities (TSF) and an electrical distribution line. The 4.5-mile distribution line would include the use of existing lines for 0.3-miles, reconductoring over 1.8-miles, and construction of 2.4-miles of new line. Under authorization as an interim action, PG&E would upgrade and install the majority of the distribution line between August and October 2013. Some segments of the line may be upgraded or installed between November 2013 and March 2014.

The compression testing will take approximately 10 months, including site preparation and equipment installation, beginning in 2014. PG&E would upgrade and install the distribution line in 2013 under authorization as an interim action. Upon completion of the proposed testing project, the wells would be capped and possibly retained for future use or abandoned in accordance with state and federal standards. Ownership of the well work pad would be transferred to the subsurface rights owner as a condition its agreement with PG&E. The goal of the project is to evaluate the geological formation for potential use as a compressed air energy storage facility at this location, at a future date.

The TSF would be located adjacent to an existing natural gas well in an agricultural area on King Island in rural San Joaquin County, California, 1.8-miles northwest of the City of Stockton's

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joseph.zambelli@netl.doe.gov • Voice (304) 285-4913 • Fax (304) 285-4403 • www.netl.doe.gov

northern boundary. Access to the site would be along Eight Mile Road, King Island Road, and unpaved agricultural access roads. Figure 1, attached, shows the proposed project location.

One of the species that is listed on the federal threatened list that may occur on the project site or be affected by project activities is the giant garter snake (*Thamnophis gigas*) (GGS). Irrigation ditches and adjacent uplands near the TSF pad area provide low-quality habitat for the GGS. DOE reviewed the U.S. Fish and Wildlife Service (USFWS) list of federally endangered and threatened species that are known to be found in San Joaquin County and found no other threatened or endangered species that might occur on the site.

A biological survey and effects assessment (attached) found that the potential aquatic and upland habitats for the GGS in the proposed project area are of low-quality and isolated from higher quality habitats. The survey also concluded that given the GGS populations in the Sacramento-San Joaquin Delta region are generally at very low densities with most suitable habitat unoccupied they are unlikely to occur in the proposed project area, or in areas where project activities would result in ground disturbance.

There is minimal likelihood that the GGS would occur within the proposed TSF work pad area, where the majority of ground disturbances and other activities associated with the project are planned. Furthermore, PG&E has committed to following the avoidance and mitigation measures listed in the biological survey report that further reduce the risk to the GGS. These include preconstruction surveys, exclusionary fencing, worker environmental training, burrow and road shoulder avoidance, speed limits, and biological monitoring.

In relation to migratory birds, if any construction activities occurred during the nesting season, PG&E would survey the site to ensure there were no active migratory bird nests present. If nests are found, PG&E would take steps to avoid impacts or develop appropriate mitigation actions.

The parcel where the compression testing would occur is adjacent to an existing gas well and surrounded by active farms that are regularly harvested and disked on an annual rotation. Based on the above information and attachments, DOE determined that the proposed compression testing activity is not likely to adversely affect federally threatened or endangered species. After the compression testing is completed, the proposed test site would be evaluated to determine its viability for further development of a CAES energy storage facility.

An environmental assessment (EA) is being prepared for the TSF and compression testing. DOE will release the draft EA for public review and comment within the next several weeks. Although the activities associated with upgrading the electrical distribution lines, to provide power to the compression testing equipment, would take place prior to DOE's completion of the EA (DOE/EA-1752) for the compression testing project, DOE has determined that upgrading of the existing distribution line would not have an adverse environmental impact nor limit the choice of reasonable alternatives for the project.

DOE will provide your office a copy of the draft EA and you may further comment on any of your concerns. All correspondence between DOE and the USFWS will be included in the EA's appendix. At this time, DOE anticipates a 30-day public comment period for this proposed project.

DOE asks for your concurrence. Please forward the results of your review and any requests for additional information to:

Mr. Joe Zambelli
U.S. Department of Energy
National Energy Technology Laboratory
3610 Collins Ferry Road
P.O. Box 880
M/S: I07
Morgantown, WV 26507-0880
Email: joseph.zambelli@netl.doe.gov

Thank you in advance for your consideration.

Sincerely,

Joe Zambelli
NEPA Document Manager

Attachments:
Figure 1 – Project Location
Effects Assessment of the King Island Site, San Joaquin County, California

cc: PG&E (Mr. Bob Booth)
Ms. Nuhfer

NATIONAL ENERGY TECHNOLOGY LABORATORY
Albany, OR • Morgantown, WV • Pittsburgh, PA

U.S. DEPARTMENT OF ENERGY

June 28, 2013

Ms. Kim Turner
ESA Regulatory Division
Bay-Delta Fish and Wildlife Office
U.S. Fish and Wildlife Service
650 Capitol Mall, Suite 8-300
Sacramento, California 95814

Re: Section 7 Consultation Under the Endangered Species Act Compressed Air Energy Storage Compression Testing Project—Revised Action Area

Dear Ms. Turner:

In support of Pacific Gas and Electric Company's (PG&E) Compressed Air Energy Storage (CAES) facility, the U.S. Department of Energy (DOE) initiated Endangered Species Act Section 7 consultation with the U.S. Fish and Wildlife Service on May 31, 2013 with the submittal of the *Pacific Gas and Electric Company Compressed Air Energy Storage Compression Testing Project-Draft Assessment of Effects on Federally Listed Species* (effects assessment) and request for concurrence. This letter supplements the effects assessment submitted on May 31, 2013, with a minor expansion of the action area and an additional assessment of effects on the giant garter snake (GGS) within the expanded area.

After submittal of the effects assessment, PG&E revised the project description to accommodate the installation or replacement of three electrical distribution line poles adjacent to Bishop Cut (expanded action area). To accommodate the pole installation, the action area has been expanded by 1.1 acres north and south of the original footprint on the east side of the project's distribution line crossing of Bishop Cut (revised effects assessment Figure 3d, attached). PG&E would replace one distribution pole north of the crossing along a levee road, and install two poles south of the crossing on the south side of and adjacent to Eight Mile Road.

The vegetation communities and aquatic habitat within the expanded action area are consistent with those described in the effects assessment dated May 31, 2013, for other parts of the action area. Ruderal habitat occurs throughout the expanded action area, with sparse fresh emergent vegetation occurring in an irrigation ditch that runs perpendicular to Eight Mile Road. Annual row crops occur east of the irrigation ditch. The irrigation ditch is intermittently wetted throughout the irrigation season.

The expanded action area is a minor extension of the location previously evaluated for effects and includes a portion of an irrigation ditch that was previously described in the effects assessment. The irrigation ditch contains low quality habitat and, based on low densities of the GGS in the region as described in the effects assessment, it is unlikely the GGS would occur in the expanded action area. PG&E will implement the Avoidance and Minimization Measures as described in the effects analysis to further reduce the risk to the GGS in this area.

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joseph.zambelli@netl.doe.gov • Voice (304) 285-4913 • Fax (304) 285-4403 • www.netl.doe.gov

If you have any questions, I can be reached at (304) 285-4913 or by e-mail at Joseph.Zambelli@NETL.doe.gov.

Thank you for your consideration in this matter.

Please forward the results of your review and any requests for additional information to:

Mr. Joe Zambelli
U.S. Department of Energy
National Energy Technology Laboratory
3610 Collins Ferry Road
P.O. Box 880
M/S: I07
Morgantown, WV 26507-0880
Email: joseph.zambelli@netl.doe.gov

Sincerely,



Joe Zambelli
NEPA Document Manager

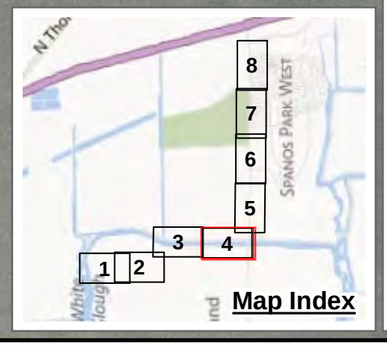
Attachments:
Replacement Figure 3d – Survey Results

cc: Bob Booth - PG&E
Kimberly Nuhfer - NETL

King Island Road

Bishop Cut

Expanded Action Area



Vegetation Communities

- Annual Grassland
- Fresh Emergent Wetland
- Orchard/Cropland
- Riverine
- Ruderal

- Action Area
- Expanded Action Area
- Distribution Line
- TSF Facility
- Existing Well Pad
- Culvert

Potential Waters of the United States

- Irrigation Ditch
- Perennial Stream

200 0 200

Feet

N

G:\Projects\26620_CAES_EA_Support_(Hill)\GIS\Working_MXDs\26620_Figure_3_Survey_Results_Replacement.mxd 2013-04-25 tmooney revised 2013-06-25

North State Resources, Inc.

PG&E CAES Project - King Island

Replacement Figure 3d
Survey Results
June 25, 2013

NATIONAL ENERGY TECHNOLOGY LABORATORY
Albany, OR • Morgantown, WV • Pittsburgh, PA

U.S. DEPARTMENT OF ENERGY

July 24, 2013

Ms. Kim Turner
ESA Regulatory Division
Bay-Delta Fish and Wildlife Office
U.S. Fish and Wildlife Service
650 Capitol Mall, Suite 8-300
Sacramento, California 95814

Re: Section 7 Consultation Under the Endangered Species Act for the Pacific Gas and Electric Company's Compressed Air Energy Storage Compression Testing Project—Revised Project Description

Dear Ms. Turner:

Please find attached a revised project description to assist you in your review, regarding the U.S. Department of Energy's initiated Endangered Species Act Section 7 consultation, as it pertains to Pacific Gas and Electric Company's (PG&E) Compressed Air Energy Storage facility. Maral Kasparian has been in communication with Ernie Ralston of PG&E and requested that the attached information be provided.

If you have any questions, I can be reached at (304) 285-4913 or by e-mail at Joseph.Zambelli@NETL.doe.gov.

Thank you for your consideration in this matter.

Sincerely,

Joe Zambelli

Joe Zambelli
NEPA Document Manager

Attachment:
Project Description

cc: Bob Booth - PG&E
Kimberly Nuhfer - NETL

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
San Francisco Bay-Delta Fish and Wildlife Office
650 Capitol Mall, Suite 8-300
Sacramento, California 95814

In reply refer to:
08FBDT00-2013-I-0036

AUG 02 2013

Mr. Joe Zambelli
NEPA Document Manager
U.S. Department of Energy
National Energy Technology Laboratory
3610 Collins Ferry Road
M/S: B07
Morgantown, West Virginia 26507-0880

Subject: Informal Consultation for the Pacific Gas and Electric Compressed Air Energy Storage Compression Testing Project at King Island, San Joaquin County, California

Dear Mr. Zambelli:

This letter is in response to the U.S. Department of Energy's (DOE) June 3, 2013, letter requesting informal consultation with the U.S. Fish and Wildlife Service (Service) on the Pacific Gas and Electric (PG&E) Compressed Air Energy Storage (CAES) Compression Testing Project (project) at King Island, in San Joaquin County, California. The DOE has determined that the proposed project may effect, but is not likely to adversely affect the threatened giant garter snake (GGS; *Thamnophis gigas*). This response is in accordance with Section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (Act).

In reviewing this project, the Service has relied upon: (1) the June 3, 2013, DOE letter requesting consultation initiation for the project; (2) the May 29, 2013, *Pacific Gas and Electric Compressed Air Energy Storage Compression Testing Project Draft Assessment of Effects on Federally Listed Species* document, prepared by North State Resources, Inc. (consultants); (3) the July 24, 2013, DOE letter describing changes to the project footprint; (4) and other information available to the Service.

Project Description

Project Purpose

The objective of the proposed project is to study the feasibility of using an underground porous rock formation (depleted natural gas field) for a Compressed Air Energy Storage (CAES) project. CAES technology involves two major processes: (a) air compression for storage and (b) air release for electricity generation. During the air compression and storage process, electric motor-driven compressors inject air into a sealed and porous underground geological formation for storage under high pressure. During the air release phase, the high-pressure air is released from the underground reservoir, heated using natural gas (if necessary), and expanded through sequential turbines ("expanders"), which drive an electrical generator. The stored energy can be used during periods of higher electric demand, improving the efficiency of energy distribution through the power grid. This proposed project's goal is to conduct pressure testing of the formation. This would consist of injecting air to build a subsurface bubble within the reservoir sands of the depleted King Island Gas Field, and then conducting a series of pressure tests to further confirm the geologic suitability of the formation and provide more detailed information for project engineering.

PG&E proposes to construct a temporary site facility (TSF), and perform drilling and compression tests to determine if a geological formation has the potential as a storage reservoir for future use as a CAES facility. An action that is interrelated to the construction of the TSF, drilling, and compression testing is the development of an electric distribution line that would provide power to the TSF. Development of the distribution line would involve re-conductoring existing lines and construction of new lines. This site for the compression tests is located at the King Island Piacentine Well Pad Site (King Island), located in San Joaquin County, California.

King Island Well Pad Site Setting

The proposed King Island TSF for compression testing is located approximately 1.8-miles northwest of the city of Stockton at Eight Mile Road in northwestern San Joaquin County, California. It is situated immediately north of West 8 Mile Road between White Slough and Bishop Cut, and can be accessed from Interstate 5 via West Eight Mile Road and King Island Road (31.082284° Longitude and -121.421892° Latitude). For project construction , site access is from the southwest, along an unnamed dirt road. The dirt road is graded and well-maintained, and is surfaced with gravel. The project area includes the area for the development of the TSF site and the electric distribution line, and the following: (1) a 200-foot buffer around the TSF pad; (2) a 20-foot buffer around all dirt access roads; and (3) a 50-foot-wide corridor along the 4.25-mile electrical distribution alignment that would provide power to the TSF pad.

The area surrounding the TSF is generally level and ranges in elevation from approximately 5 to 10-feet below sea level. Water levels in White Slough and Bishop Cut are slightly above sea level and are separated from King Island by a series of levees topped by paved and unpaved roads. The area surrounding the TSF is crossed by a series of dirt and gravel ranch roads that provide access to the various ranch fields and to the test site. Several agricultural residences are located approximately 0.5 to 0.75-mile south of the TSF along the south side of an east-west-trending gravel road.

Cropland and/or orchard (e.g., corn, asparagus, onions, safflower, and walnut orchard) are the dominant vegetation types within the proposed TSF pad and along the distribution line, with the exception of few areas along Eight Mile Road that are dominated by annual grassland. The TSF pad is entirely within a young walnut orchard and the open areas between the rows are disked and or mowed on an annual basis. Most crops along the distribution line are annual row crops. All fields are actively farmed and annually disked, harvested and/or disturbed up to the edge of existing roads.

The project area on either side of the Bishop Cut and along the golf course on Eight Mile Road support annual grassland. Since the golf course installation, non-native annual grasses have re-colonized the area. Fresh emergent wetlands are present in irrigation ditches with sufficient hydration throughout the project area and in ponds located on the golf course in the eastern portion of the project area. Irrigation ditches are located parallel to the gravel access road to the TSF pad, and are located perpendicular and parallel to Eight Mile Road. The irrigation ditches appear to be subject to regular vegetation management using both mechanical and chemical techniques. Irrigation ditches adjacent to the TSF pad and gravel access road, and those perpendicular to Eight Mile Road, are perennially inundated and support fresh emergent vegetation. Irrigation ditches on either side of Bishop Cut, and those at the western portion of the project area near the PG&E Eight Mile substation are intermittently inundated during the irrigation season and are generally devoid of vegetation. Perennially inundated irrigation ditches and ponds support patches of fresh emergent vegetation.

Bishop Cut provides riverine habitat for aquatic species at the Eight Mile Road Bridge crossing. The Bishop Cut is an artificial navigation and irrigation channel connecting White Slough to the north and Disappointment Slough to the south. Within the project area, the levee banks are rip-rapped with large rock and the channel is generally devoid of vegetation. Banks of Bishop Cut and adjacent road shoulders show signs of frequent disturbance (e.g., mowed, disked).

No seasonal wetlands, vernal pools, elderberry shrubs (*Sambucus nigra*), riparian wetlands or other sensitive natural community are present in the project area. Fresh emergent wetlands exist only in the ditches and golf course ponds. Farmed agricultural lands do not provide habitat for special-status plant species. Vernal pools, mesic areas, alkaline or serpentine soils, chenopod scrub, and riparian forest or scrub habitats that would support special-status plant species are not present within the project area.

Construction Activities

Project construction actions for developing the King Island TSF include construction of the TSF pad, well drilling, and compression and cycling testing. All staging, well drilling, compression, and cycling testing would occur on the TSF pad. Other associated project activities include access road maintenance (if deemed necessary) and development of the distribution line to power the activities at the TSF site. The expected timeline for construction activities is as follows:

- The development of the distribution line is expected to occur between August 2013 through March 2014;

- The access road maintenance, if needed, is expected to occur during the TSF pad construction time period of January 2014 through March 2014; and
- TSF pad construction, well drilling, and compression testing would occur from February 2014 through August 2014.

TSF Pad Construction and Well Drilling

A pad to support the project and its operations (TSF pad) would be constructed to approximately 650-feet by 165-feet, or 2.5-acres in size, of which 0.7-acre was previously created for the geological core drilling task associated with this project. The TSF pad would be constructed as shown on the site plan. Access road maintenance, pad construction, and drilling of the wells to complete the TSF pad at King Island are expected to take approximately 3 months.

The existing 0.7-acre pad would be expanded by additional clearing, grubbing, scarifying, and compacting into an area that is currently planted with sapling-stage walnut trees, requiring the removal of approximately 90 small trees. Geotextile material would be placed over the compacted work area, then up to 18-inches of sub-base material and Class II aggregate base would be placed and compacted. The work area would be crowned and sloped so that stormwater sheet-flows off the pad. PG&E would constrain all construction activities to the pad and a 20-foot buffer area. During the construction of the TSF pad, eight workers, five trucks and trucks to haul material, road grader/maintainer, dozer (D-5 or equal), sheep's foot compactor, roller compactor, water truck, and similar construction equipment would be used. Approximately 28 truck trips would be required to import material to the TSF pad.

Once the TSF pad is constructed, a drilling rig and associated equipment would be mobilized to the project. Primary drilling equipment includes the drill rig, mud and water tanks and pumps, shaker tanks, electric generators, diesel fuel tanks, and drill pipe racks. Two wells would be drilled into the formation–one well for injection and withdrawal of air (IW well), and the second well for monitoring field pressures and responses to the injection and withdrawal process. The construction Contractor would place all waste, cuttings, and drilling mud associated with well drilling in proper storage receptacles for offsite disposal at an authorized disposal facility. An additional five truck trips would be required to remove drill cuttings and associated material from the site. Drilling crew, engineers, temporary workers and site visitors would number an average of approximately 12 workers/people per shift, with three shifts per day. To accommodate continuous work shifts, night-time lighting would be used. Up to a maximum of 20 workers may be present at one time during various operations. In addition to worker vehicles, service, equipment, and material delivery vehicles would access the site during the drilling phase, generating an estimated 40 trips per day. Total duration of this task is approximately six-weeks.

Water for pad construction and well drilling would be trucked to the project area from off-site municipal water supply sources. All drilling activities would be completed in compliance with the U.S. Environmental Protection Agency (EPA) Underground Injection Control (UIC) permit. Construction wastewater would be hauled offsite and disposed of in a permitted, commercial injection well in Rio Vista. Once the two wells are drilled and the drilling equipment demobilized from the work area, the compression and cycling equipment would be installed.

Development of the facility includes installation of compression equipment, closed-loop cooling system, portable office trailer, tank for drilling mud, and lighting.

Compression and Cycling Testing

The construction and installation phase would be followed by four to five months of compression and withdrawal cycling that simulates the operation of a CAES facility. The testing will involve, initially, creating the compressed air reservoir or "bubble" by pumping the compressed air into the geological formation. Creation of this bubble can take up to two months.

After the bubble is created, a series of pressure tests would be conducted and data would be collected from the IW well, the observation well and possibly from additional existing nearby gas wells to assess the reservoir response. The testing protocols are still being developed and would include a series of sequential injection, pressure buildup, pressure fall off, and possibly flow tests. The final compression testing plan would be developed to collect data that allows assessment of the reservoirs characteristics to support refinement of the computer reservoir model constructed for the project.

Other than the IW wells, the primary equipment used during the compression test would include the following:

- High-pressure compressor train capable of injecting the compressed air at flow rates up to 17-million standard cubic-feet per day and compressor outlet pressures up to a maximum of 2,700-pounds per square-inch;
- After-cooler to cool the compressed air to a temperature no higher than approximately 140 degrees Fahrenheit before injection;
- If necessary, for safety purposes, the air supply stream may include oxygen-depleted air generated using a portable membrane filtration system or similar equipment;
- Appurtenant equipment including a temporary electrical supply, a step-down transformer, a power distribution system, a compressor cooling system, high-pressure piping, and control circuitry;
- Equipment to support withdrawal testing including high-pressure piping, a choke valve, a propane or electric line heater, a phase separator, one or more produced water storage tanks, and an air discharge vent; and
- Monitoring and measurement equipment including:
    - Wellhead pressure and temperature sensors at the wells,
    - A sensor array along the discharge piping to measure flow, pressure, temperature, combustible gas concentrations, oxygen concentrations and relative humidity, and
    - A sensor array along the injection piping to measure flow, pressure, temperature, oxygen concentrations, and relative humidity.

During this approximate 4 to 5-month period of compression and cycling testing, approximately 12 workers would be on site per day, staffing three eight-hour shifts. Night-time lighting would be required to accommodate a 24-hour work schedule. Workers, service vehicles and site visitors are expected to generate approximately15 trips per day.

Following completion of the compression testing, all of the drilling, compression, and other equipment would be removed from the site. If the compression testing has indicated the formation demonstrates appropriate characteristics for a CAES project, the pad along with established wells would be left in place for use in development of the CAES facility. If the testing demonstrates otherwise, the wells would be plugged and abandoned per California Department of Conservation Division of Oil, Gas, and Geothermal Resources regulations and the requirements of the UIC permit issued by the EPA for the project. If the project does not move forward, the well pad and associated wells would be transferred to the subsurface rights owner as a condition of its agreement with PG&E. The pad material may be retained or removed from the site at the discretion of the subsurface rights owner. If the TSF pad is removed, equipment, workers and trips would be similar to the TSF pad construction as described above, but duration would be shortened to approximately 4-weeks.

Access Road Maintenance

Given that existing access roads are available, no road construction is necessary for project construction. Maintenance to the existing access roads would be limited to light graveling of the unnamed dirt road if determined to be necessary during the TSF pad construction and compression testing (this work would occur between January and March), with the assumption that no additional grading would be required. If grading is required, it would be limited to leveling and/or smoothing the existing road and would not extend beyond the compacted surface. All vehicle traffic would be on the existing access roads and all staging would be contained within the southeast portion of the existing well pad. Water trucks would be used as necessary to reduce dust during site access and other construction activities.

Electric Distribution Line

PG&E would develop an electrical distribution line to provide power to the equipment needed for compression testing. The distribution line would involve a combination of the use of existing overhead lines with no improvements, re-conductoring of existing overhead lines, and construction of new overhead and underground lines. The distribution line would be designed to or retrofitted within avian protection specifications to protect raptors and migratory birds from electrocution.

The distribution line serving the project would begin at the PG&E Eight Mile Road Substation and would be approximately 4.25-miles in length from the substation to the TSF pad. A new 300-foot long underground line would be installed from the substation to an existing overhead line. Continuing west, the first 0.3-mile of this existing overhead line is adequate for project electric load and minimal modifications are required, but the remaining 0.6-mile segment will require re-conductoring and the installation of a pad-mounted transformer in the public road right of way. The route would then continue west to King Island Road along a 1.3-mile segment that would require entirely new construction, and would cross Bishop Cut (a navigation channel) on existing tall lattice steel structures required for vessel passage. After crossing Bishop Cut, the route would

extend north along King Island Road, turning west and then north again on unnamed farm roads to the TSF. The first 1.4-miles of this portion of the route would involve re-conductoring and pole replacement, and the remaining 0.6-mile segment to the TSF pad would require new construction.

Distribution line construction would occur along existing public and private roads, and would not require construction of access routes or roads. Except for the water crossing at Bishop Cut, conductor support would consist of wooden poles with a span length of approximately 300-feet. Construction would occur within a 50-foot wide work area, centered on the line.

The crossing of Bishop Cut would involve extension of the existing lattice steel structures to provide the necessary navigation clearance for the conductors over Bishop Cut. PG&E proposes to use a helicopter to complete the mast extension and re-conductoring of the span over Bishop Cut. Since the existing distribution lines must be removed from the top of the lattice steel structures before the tops can be extended, these lines will be relocated to temporary wood poles installed around the perimeter of the lattice steel structure work areas. A service line to a nursery on the southwest side of Eight Mile Road and the crossing currently connected to the top of the mast will require temporary poles as well. Once the top extension is complete the distribution line will be relocated to the top of the lattice steel structures and the temporary wood poles removed. Construction details such as staging areas, work areas at the pole sites, pull and tension sites, areas where special construction methods may need to be employed, and areas where vegetation removal may occur, etc., would be provided to the Contractor as the information becomes available. The Bishop Cut lattice steel structure extension would require a 100 x 100 foot work area on each side of the levee approximately 300 feet from the base of the mast in the cultivated field.

Electric distribution line construction would include up to two line crews (eight to ten workers total) over a period of approximately 12-weeks. Equipment would include line trucks with augers, bucket trucks, puller rig, conductor reel trailers and crew trucks.

Proposed Avoidance and Minimization Measures

PG&E proposes the following avoidance and minimization measures to be utilized during the development of the transmission line, TSF pad, access road maintenance, drilling and coring to avoid and/or minimize potential negative project effects to GGS and sensitive habitats:

1. Prior to working on any phase of the project, all workers will be provided with Environmental Awareness Training by a qualified biologist. The training will address the identification and general ecology of GGS and other special-status species that have potential to occur in the project area, and the measures to be implemented in order to avoid impacts on these resources. Areas to be avoided will also be addressed in the training. Please contact PG&E project biologist, Catalina Reyes (925-808-8811) two weeks prior to construction to schedule the training.

2. Prior to construction of any phase of the project, all work areas (e.g., vehicle access, parking, staging) needed to complete the project will be identified in coordination with the monitoring biologist. Due to the presence of sensitive resources, some work areas may need to be adjusted. All work areas will be limited to the minimum area necessary to

complete work. Laydown and staging will be limited to the road shoulder or previously developed or disturbed areas.

3. Prior to constructing the TSF pad, high visibility fencing will be erected 20 feet beyond the proposed TSF pad to contain personnel and equipment. The construction Contractor will inspect fencing before the start of each workday and the fencing will be maintained by the Contractor until completion of the project.

4. Because construction of the TSF pad will occur within 200 feet of aquatic habitat for giant garter snake in the irrigation ditch along the gravel access road, exclusionary fencing will be installed along the irrigation ditch on the west side of the road a minimum of 200 feet from the TSF pad in both directions to prohibit snake entry. Exclusionary fencing will be placed during the GGS active period between (May 1 and October 1), so that the fence is erected before snakes move to upland refugia that may occur in the TSF pad. Snake exclusionary fencing will be buried at least six inches below the ground to prevent snakes from attempting to move under the fence. If burrows are present along the ditch, methods to hold the exclusionary fencing flush with the ground (e.g., sand or rock bags, pins) will be employed as appropriate to avoid damage to burrows. The fencing will not contain any holes along the ground large enough for snakes to enter the construction site. Fencing can be as high as 12 to 24 inches above ground.

5. Due to the temporary nature of pole installation along the irrigation ditches along the gravel access road and Eight Mile Road, and near the golf course ponds, exclusionary fencing is not required for the distribution line. However, a biological monitor will be present during all distribution line activities conducted within 200 feet of GGS aquatic habitat (i.e., irrigation ditches and golf course ponds). PG&E proposes to construct the section of distribution line located along the irrigation ditch near the TSF pad during the GGS active period.

6. To ensure that wildlife does not become trapped or entangled, no wattles or other materials with plastic monofilament netting are permitted. Burlap or coconut wattles are appropriate substitutes.

7. If practicable, ground disturbing activity (e.g. vegetation removal, compaction, placement of gravel fill, new pole placement) will be conducted during the active season for GGS (i.e., between May 1 and October 1). If ground-disturbing activity cannot be conducted during the active season, preconstruction surveys for potential wintering sites (e.g., burrows and soils crevices) within proposed disturbance areas will be conducted by a qualified biologist approved by the Service and the California Department of Fish and Wildlife (CDFW). The pre-construction survey will be conducted no more than two weeks prior to construction activities. All burrows or potential refuge habitat will be flagged and avoided. If work is suspended for a period of five days or greater, than the project area must be resurveyed for GGS. If it is determined that potential giant garter snake wintering habitat (e.g., burrows and crevices) is present within areas planned for ground disturbance, ground-disturbing activities will be postponed until the GGS active season (i.e., between May 1 and October 1).

8. A biological monitor approved by the Service and CDFW will be on site during all phases of construction to direct traffic and construction work around irrigation ditches and other sensitive habitats capable of supporting giant garter snake. Full-time monitoring will be employed during construction activities that require increase vehicle traffic and ground disturbance (i.e., TSF pad construction, distribution line development, access road maintenance, and mobilization/demobilization to escort large equipment). Part-time monitoring (1-2 days per week) will be employed during project activities limited to the well pad with limited traffic (i.e., well drilling and compression testing). The purpose of the part-time monitor is to ensure that these measures are in place and to meet the crews monitoring needs (e.g., access road maintenance monitoring, environmental awareness training for new crew members, mobilization/demobilization of large equipment or other unforeseeable need for a monitor). The biological monitor will coordinate closely with construction personnel to ensure monitors are present during key construction activities.

9. If any GGS are observed within the project area during work activities, work will cease and the on-site project manager will immediately contact the PG&E project biologist, Catalina Reyes (925-808-8811) prior to resuming work. The biological monitor has the authority to stop construction to resolve any biological concerns.

10. Access to the TSF pad and distribution line will be confined to existing roads, road shoulders, and other compacted areas. Travel along roads will be restricted to the centerline. If placement of gravel or grading on access roads is necessary, the placement will be limited to the existing road surface. No gravel will be placed on ditch banks or other areas that may support burrows that could be used by GGS. No grading will occur along segments of existing roads that may support burrows that could be used by giant garter snake.

11. The irrigation ditches, golf course ponds, and Bishop Cut will be designated as environmentally sensitive areas and physical disturbance to these features will be avoided during construction.

12. A qualified biologist approved by Service and CDFW will perform a general pre-construction survey for special-status species and other wildlife within 72 hours of the start of project construction.

13. Portable lighting would only be used during construction when absolutely necessary for worker safety, or as necessary to accomplish critical construction equipment maintenance or time-critical continuous process tasks that extend into nighttime hours. When in operation the temporary flood lighting will be directed towards the work area to minimize illumination of areas beyond the immediate work areas, and minimize reflected glare and illumination of the nighttime sky to the maximum extent practicable. When not in immediate use the temporary floodlights will be directed downward or turned off.

14. Reduce construction night lighting on sensitive habitats. Exterior lighting within the project area adjacent to preserved habitat will be of the lowest illumination allowed for human safety, selectively placed, shielded, and directed away from sensitive habitat to the maximum extent practicable.

15. Provide escape ramps at a 45 degree angle or less for any excavations that are greater than one foot that are left open overnight. For smaller holes, cover so that no gaps occur and inspect each morning for wildlife. Inspect prior to filling any trenches or holes. If wildlife become entrapped, work will stop and the PG&E project biologist, Catalina Reyes (925-808-8811), will be notified immediately to determine next steps.

16. Prior to moving parked vehicles or equipment, construction personnel will visually check for snakes and other wildlife.

17. Ground disturbance and vegetation removal will be limited to the minimum amount necessary to complete work.

18. If a plant or animal is found at the work site and is believed to be a protected species, work must STOP and the onsite biological monitor or PG&E Biologist, Catalina Reyes (925-808-8811), must be contacted for guidance. Care will be taken not to harm the plant or animal species. No wildlife or plant species will be handled and/or removed from the site by anyone except qualified biologists.

19. Construction equipment will be maintained to prevent leaks of fuels, lubricants or other pollutants into aquatic habitats.

20. Whenever possible, refueling and maintenance of vehicles will be conducted offsite. In cases when this is not practicable, refueling and maintenance of vehicles and equipment will be conducted over drip pans and at least 100 feet from any waterway.

21. Open ends of pipes, conduits or other materials stored onsite will be covered to exclude wildlife and will be inspected prior to use.

22. Vehicular speed within the project area will be limited to 10 miles per hour in order avoid impacts on wildlife that may be located on or near roadways. If ground disturbing activities, addition of gravel to roads, or movement of large equipment occurs during the GGS active period (May 1 to October 1), a biological monitor will drive in front of heavy construction vehicles (e.g., dump trucks, drill rigs) on all gravel roads during entry/exit of project site. Biologist(s) will lead vehicles at a speed of 10 mph or less, watch for signs of snakes, and stop and investigate the road if there are any concerns.

23. Watering of roads during dry season work will be performed as necessary in order to reduce potential dust resulting from project associated traffic.

24. Caution will be used when handling and/or storing chemicals (fuel, hydraulic fluid, etc.). As part of standard PG&E Best Management Practices (BMPs), crews will have appropriate materials on site to provide secondary containment and prevent and manage spills. If groundwater is encountered, contact PG&E Environmental Specialist Jim Struhs (209-628-7016).

25. Crews will implement all BMPs outlined in the project's National Pollution Discharge Elimination System Construction Storm Water Pollution Prevention Plan.

26. If the scope of work or project location changes, contact PG&E project biologist (Catalina Reyes, 925-808-8811) prior to commencing work. The PG&E project biologist or Land Planner (Ernie Ralston, 707-217-0960) will contact the Service's Bay-Delta Fish & Wildlife Office ESA/Regulatory Division (Kim S. Turner, 916-930-5604) and the CDFW Bay Delta Region (Crystal Spurr, 209-234-3442) upon notice of any such changes.

27. Remove construction related trash from the site daily and upon work completion and return site to near pre-construction contours and conditions upon project completion.

28. A silencer will be used on the air release vent during compression testing that will attenuate noise levels to less than 60dBA within an approximate 0.25 mile distance from the TSF pad, consistent with ambient noise levels (e.g. noise from farm equipment such as tractors, generators and pumps).

At the King Island site, Bishop Cut is connected to White Slough and runs along King Island Road. Perennial irrigation ditches, Bishop Cut, and associated uplands provide potential habitat for GGS. The ditches are located immediately adjacent to the project access road and Bishop Cut is located adjacent to the alternate access road. However, ditches are subject to regular vegetation management using both mechanical and chemical techniques, and these aquatic habitats offer poor to marginal habitat for GGS. The upland habitats adjacent to these ditches are agricultural croplands that are not suited for GGS. The nearest known GGS occurrence is located at Coldani Marsh less than 1.7 miles north of the TSF pad (CNDDB 2012; Hansen 2011)[1]. The TSF pad location is greater than 200 feet from potential GGS aquatic habitat, and therefore the risk of encountering GGS is greatly reduced. Also, the project area lacks marshes, expansive aquatic habitat and/or wet rice fields to attract GGS. PG&E's proposed construction site for both the TSF pad and transmission line footprint is within and/or adjoins actively farmed and regularly harvested cropland. Disked agricultural activities occur near the project site on an annual rotational basis. No burrows or other refugia were observed around the existing well pad, in the pad expansion area, or along the access road, and no ground squirrel activity was observed during PG&E's August 20, 2012, field surveys of these areas. Based on this information, the likelihood of GGS occurring within this project area is very low.

Although the likelihood of GGS occurring in the project area is low, PG&E will incorporate BMPs and avoidance and minimization measures to minimize possible, negative construction effects to GGS, its prey and upland refugia, including the prevention of oil and chemical spills and silting or fill of canals and ditches during construction and decommissioning, limiting the majority of ground disturbing activities during the GGS active period, and installing exclusionary fencing to prevent snakes from entering the project construction areas.

The DOE has determined that the proposed project may effect, but is not likely to adversely affect the GGS. They have made this determination because of the low likelihood that GGS would occur in the project area based on CNDDB occurrence and species survey data, the relatively small project footprint located within actively farmed orchard and cropland, and PG&E will adhere to

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1 California Natural Diversity Database (CNDDB). 2012. Natural Heritage Division, California. Department of Fish and Wildlife. RareFind 4. Accessed October 2012.

Hansen, E. C. 2011. Implementation of Priority 1, Priority 2, and Priority 3 Recovery Tasks for Giant Garter Snake (*Thamnophis gigas*): Status and distribution of giant garter snakes at the eastern Delta's White Slough Wildlife Area, San Joaquin County, CA.

the aforementioned avoidance and minimization measures to minimize negative, project effects to GGS.

The Service concurs with the DOE determination that the proposed project is not likely to adversely affect GGS. The proposed avoidance and minimization measures described above are designed to sufficiently reduce direct, indirect, and/or cumulative effects to GGS to an insignificant or discountable level. This concurrence is provided specifically for project activities at the King Island site and for the Pacific Gas & Electric CAES Compression Testing Project only, as described in this document.

Unless new information reveals effects of the proposed action may affect listed species to an extent not considered or a new species or critical habitat is designated that may be affected by the proposed action, no further action pursuant to the Act is necessary. This letter does not authorize take of listed species. Any actions or proposed actions that are modified in a manner that causes an effect to listed species or critical habitat that was not considered in this consultation will require re-initiation.

This concludes informal consultation for the Pacific Gas & Electric CAES Compression Air Testing Project, in San Joaquin County, California. Please address any questions or concerns regarding this response to Maral Kasparian, Senior Fish and Wildlife Biologist, at Maral_Kasparian@fws.gov or (916) 930-5614. Please refer to Service File No. 08FBDT00-2013-I-0036 in any future correspondence regarding this project.

Sincerely,

For Kim S. Turner
Assistant Field Supervisor

cc:
Crystal Spurr, California Department of Fish and Wildlife, Stockton, California
Thomas Leeman, U.S. Fish and Wildlife Service, Sacramento, California

NATIONAL ENERGY TECHNOLOGY LABORATORY
Albany, OR • Morgantown, WV • Pittsburgh, PA

U.S. DEPARTMENT OF ENERGY

April 28, 2014

Ms. Kim Turner
ESA Regulatory Division
Bay-Delta Fish and Wildlife Office
U.S. Fish and Wildlife Service
650 Capitol Mall, Suite 8-300
Sacramento, California 95814

Re: Section 7 Consultation Under the Endangered Species Act
Compressed Air Energy Storage Compression Testing Project—Revised Schedule

Dear Ms. Turner:

In support of Pacific Gas and Electric Company's (PG&E) Compressed Air Energy Storage facility, the U.S. Department of Energy (DOE) initiated Endangered Species Act Section 7 consultation with the U.S. Fish and Wildlife Service on June 3, 2013 with the submittal of the *Pacific Gas and Electric Company Compressed Air Energy Storage Compression Testing Project-Draft Assessment of Effects on Federally Listed Species* (effects assessment) and request for concurrence. A subsequent request for concurrence was submitted on June 28, 2013 to address a minor expansion of the action area and an additional assessment of effects on GGS within the expanded area. This letter supplements the effects assessment submitted on June 28, 2013 for a change in the project construction schedule resulting from delays in completing the project environmental review.

The revised construction schedule, which is more fully described in the attached revised effects assessment, is generally as follows:

- Site preparation and access road improvements would occur July through December of 2014;
- Well drilling and Temporary Site Facilities (TSF) construction would occur from August through December 2014;
- Air injection testing would occur from December of 2014 through June of 2015; and
- Finally, site decommissioning would occur in July and August of 2015.

PG&E has continued to maintain the GGS exclusion fence adjacent to the existing well pad and proposed TSF pad since installation last fall, and will continue to implement the AMMs included in the effects assessment. Based on the attached revised effects assessment, DOE has confirmed their original determination that the proposed project may effect, but is not likely to adversely affect, the threatened GGS.

DOE kindly asks for your concurrence. Please forward the results of your review and any requests for additional information to:

3610 Collins Ferry Road, P.O. Box 880, Morgantown, WV 26507
joseph.zambelli@netl.doe.gov • Voice (304) 285-4913 • Fax (304) 285-4403 • www.netl.doe.gov

Mr. Joe Zambelli, M/S: I07
U.S. Department of Energy
National Energy Technology Laboratory
3610 Collins Ferry Road
P.O. Box 880
Morgantown, WV 26507-0880
Email: joseph.zambelli@netl.doe.gov

If you have any questions or concerns, I can be reached at (304) 285-4913 or by the e-mail mentioned above.

Thank you for your time and consideration in this matter.

Sincerely,



Joe Zambelli
NEPA Document Manager

Attachment:
Draft Assessment of Effects on Federally Listed Species – Revised April 24, 2014

cc:
PG&E (Mike Medeiros, Bob Booth)
DOE (Kim Nuhfer)

APPENDIX B4

Comments on the Draft EA and Responses

San Joaquin County
Environmental Health Department
1868 East Hazelton Avenue
Stockton, California 95205-6232

Website: www.sjgov.org/ehd
Phone: (209) 468-3420
Fax: (209) 464-0138

DIRECTOR
Donna Heran, REHS

PROGRAM COORDINATORS
Robert McClellon, REHS
Jeff Carruesco, REHS, RDI
Kasey Foley, REHS
Linda Turkatte, REHS
Rodney Estrada, REHS
Adrienne Ellsaesser, REHS

December 31, 2013

Mr. Joe Zambelli
US Department of Energy
National Energy Technology Laboratory
3610 Collins Ferry Road
PO Box 880
M/S 107
Morgantown, WV 26507-0880

Subject: PG&E Compressed Air Energy Storage, Draft Environmental Assessment, San Joaquin County, California

The San Joaquin County Environmental Health Department (EHD) has reviewed the Draft Environmental Assessment, and has no comments to impose on this project.

If you have any questions, please call Rodney Estrada, Program Coordinator at (209) 468-0331.

Rodney Estrada
Program Coordinator

RE:tl

Comments of the Buena Vista Rancheria of Me-Wuk Indians
Dated March 12, 2014

Roselynn Lwenya
rlwenya@buenavistatribe.com
3/12/2014 12:04 PM

Dear Mr. Zambelli,

The Buena Vista Rancheria of Me-Wuk Indians has reviewed the "*Draft Environmental Assessment for the Pacific Gas and Electric Company (PG&E) Compressed Air Energy Storage (CAES) Compression Testing Phase Project, San Joaquin County, California* dated November 2013"; and has the following comments to offer:

1. Page xi, paragraph 5, lines 2, 3, and 4. The statement that it is unlikely to discover archeological deposits during construction because of the former marsh environment fails to consider American Indian values concerning natural environments including marshlands. This statement considers only a single class of resource of interest to archeologists, not Tribes. It does not consider the marsh/wetland that would have been a significant resource to the First People.

2. Page 23, paragraph 1, last sentence: Appendix E is *RECOMMENDED TIMING AND METHODOLOGY FOR SWAINSON'S HAWK NESTING SURVEYS IN CALIFORNIA'S CENTRAL VALLEY.* Appendix D contains the environmental synopsis for Area of Interest

3. Page 29-34, Section 3.2, Biological Resources and Soils: There is no acknowledgement of biological resources having cultural and spiritual significance to the American Indian community; no mention of oak tree population in the project area.

4. Page 41 and 42, Section 3.5.1.1, Cultural and Historical Resources: Only archeological and historical structure resources are discussed and considered. There is no mention of the cultural resource considerations mentioned in the correspondence from both Buena Vista Rancheria of Me-Wuk Indians and Shingle Springs. The only mention is about the California Valley Miwok Tribe.

5. Page 44, Section 3.5.2.1.2, Sensitivity for Buried Archeological Sites: The natural character of the original landscape (marsh/wetland) is now a buried traditional cultural landscape. The marsh/wetland would have been a significant source for food, medicine, manufacture materials, and a place for cultural and spiritual activities and ceremonies.

6. Page 56 of Section 5, Consultations, second paragraph; there needs to be acknowledgement that this area has a buried traditional cultural landscape, and that the American Indian

community believes there is potential to expose resources with cultural and spiritual significance, as stated in the correspondence and in the consultation meetings. Otherwise, why is DOE funding cultural resource monitors? These monitors are a mitigation to minimize the impacts in the event that resources are exposed, a potential that is raised by the three Tribes who responded to DOE.

7. Appendix A, Distribution List: The list is misleading as it gives the impression that drafts of the EA were sent to those on the list and they were not. According to the list Buena Vista was sent three (3) copies of the document to the same address, when none were sent.

If you have any questions please contact me by email at roselynn@buenavistatribe.com or phone (916) 491-0011.

Sincerely,

Roselynn Lwenya, Ph.D
Environmental Resources Director / THPO
Buena Vista Rancheria
1418 20th Street, Suite 200
Sacramento, CA 95811
TEL: 916.491.0011
FAX: 916.491.0012
roselynn@buenavistatribe.com

DOE Responses to
Comments of the Buena Vista Rancheria of Me-Wuk Indians

Comment 1

Page xi, paragraph 5, lines 2, 3, and 4. The statement that it is unlikely to discover archeological deposits during construction because of the former marsh environment fails to consider American Indian values concerning natural environments including marshlands. This statement considers only a single class of resource of interest to archeologists, not Tribes. It does not consider the marsh/wetland that would have been a significant resource to the First People.

DOE Response 1

DOE acknowledges that natural environments including marshlands are of importance to the members of American Indian Tribes. In reviewing the potential environmental effects of the project, DOE has made efforts to identify specific environmental resources for protection, including traditional cultural properties and archaeological sites. To identify these sites, DOE conducted literature searches and archaeological surveys to identify archaeological properties, and requested information from American Indians to identify traditional cultural properties. To date, specific traditional cultural resources that may be affected by project activities, have not been identified by American Indian tribes or as a result of literature searches and archaeological surveys.

Comment 2

Page 23, paragraph 1, last sentence: Appendix E is *RECOMMENDED TIMING AND METHODOLOGY FOR SWAINSON'S HAWK NESTING SURVEYS IN CALIFORNIA'S CENTRALVALLEY.* Appendix D contains the environmental synopsis for Area of Interest 2.

DOE Response 2

The document titled *Smart Grid Demonstrations Program Environmental Synopsis for Area of Interest 2* is included in Appendix D, not Appendix E. This has been corrected in the text. Please note that Appendix E is an appendix to the Biological Constraints Analysis, not the Environmental Assessment.

Comment 3

Page 29-34, Section 3.2, Biological Resources and Soils: There is no acknowledgement of biological resources having cultural and spiritual significance to the American Indian community; no mention of oak tree population in the project area.

DOE Response 3

DOE acknowledges this comment regarding cultural and spiritual significance of some biological resources to the American Indian community.

Comment 4

Page 41 and 42, Section 3.5.1.1, Cultural and Historical Resources: Only archeological and historical structure resources are discussed and considered. There is no mention of the cultural resource considerations mentioned in the correspondence from both Buena Vista Rancheria of Me-Wuk Indians and Shingle Springs. The only mention is about the California Valley Miwok Tribe.

DOE Response 4

Section 1.5.1, Native American Consultation, has been amended to refer to meetings held by teleconference and in person between the DOE and members of the Buena Vista Rancheria of Me-Wuk Indians, Shingle Springs Rancheria Tribe, and Wilton Rancheria. Copies of correspondence with the tribes and resulting from these meetings is included in Appendix B2.

Comment 5

Page 44, Section 3.5.2.1.2, Sensitivity for Buried Archeological Sites: The natural character of the original landscape (marsh/wetland) is now a buried traditional cultural landscape. The marsh/wetland would have been a significant source for food, medicine, manufacture materials, and a place for cultural and spiritual activities and ceremonies.

DOE Response 5

See the response to Comment #1. DOE acknowledges that the marsh and wetland environment was an abundant source of food and other materials for American Indians as well as a place for ceremonies and other activities. DOE also acknowledges that the marsh environment may have been modified by prehistoric humans in such a way (by intentional burning, trails, food gathering patterns, etc.) as to transform it into a cultural landscape. Because of the changes to this landscape (levees and intensive agriculture) that have taken place in the modern era, however, the effects of prehistoric human landscape modifications are no longer visible and the cultural landscape would not retain the integrity necessary for listing in the National Register as a cultural landscape.

Comment 6

Page 56 of Section 5, Consultations, second paragraph; there needs to be acknowledgement that this area has a buried traditional cultural landscape, and that the American Indian community believes there is potential to expose resources with cultural and spiritual significance, as stated in the correspondence and in the consultation meetings. Otherwise, why is DOE funding cultural resource monitors? These monitors are a mitigation to minimize the impacts in the event that resources are exposed, a potential that is raised by the three Tribes who responded to DOE.

DOE Response 6

Neither Buena Vista Rancheria nor the other consulting tribes (Shingle Springs Rancheria, Wilton Rancheria, and the Ione Band of Miwok Indians) have provided DOE with

documentation of historical or cultural related finds or discoveries to support the assertion that a buried cultural landscape is present within the CAES project area. Furthermore, CAES project cultural resources studies have not identified any evidence supporting the existence of a buried traditional cultural landscape in or near the project area. These studies have consisted of archaeological surveys conducted by SWCA (2012), and NSR (2013), two CCIC (Central California Information Center of the California Historical Resources Information System) record searches, two separate outreach/consultation programs with the Native American Heritage Commission (NAHC) (SWCA 2012 and NSR 2013), and an addendum APE sensitivity memo developed by NSR for PG&E in 2013. Tribes contacted per NAHC recommendations by SWCA (2012) and NSR (2013) included Buena Vista Rancheria, The California Valley Miwok Tribe, the Ione Band of Miwok Indians, and Wilton Rancheria. During the course of these investigations and following delivery of three Section 106 consultation letters acknowledged by Buena Vista Rancheria administration (signed and dated FedEx receipts), comments and concerns regarding cultural resources were expressed to DOE via letters dated October 1, 2013 or October 28, 2013. In addition, after consulting with the Buena Vista Rancheria tribe, DOE provided for archaeological observers and American Indian tribal representatives to monitor project ground disturbances associated with pre-selected electrical transmission line pole installations and replacements between the Eight Mile Substation and the TSF location on King Island. However, these monitors were part of the Section 106 inadvertent discovery process (36 CFR 800.13) and not part of project mitigation, which only occurs following the identification of cultural resources. The pole installations and replacements that received monitoring were pre-selected by tribal representatives prior to construction. The results of the monitoring of the temporary power work and the associated pole locations has been completed and no evidence of resources/properties with cultural or spiritual significance as defined in Section 106 of the National Historic Preservation Act, was noted in the archaeological or Native American monitoring.

Comment 7

Appendix A, Distribution List: The list is misleading as it gives the impression that drafts of the EA were sent to those on the list and they were not. According to the list Buena Vista was sent three (3) copies of the document to the same address, when none were sent.

DOE Response 7

DOE confirmed that document deliveries of the draft EA were made by FedEx Standard Overnight shipment to Rhonda Morningstar Pope, Dr. Roselynn Lwenya, and Jeannette Simons at the Buena Vista Rancheria of Me-Wuk Indian office located at 1418-20th Street, Suite 200, Sacramento, CA 95811 at 1:54 PM on November 25, 2013, and signed for by H. Bell. This information was provided to the tribe via email dated February 6, 2014. Also, at the request of Dr. Lwenya, an additional copy was provided to the Buena Vista Rancheria of Me-Wuk Indian office via courier on January 29, 2014.

APPENDIX C
BIOLOGICAL SURVEY REPORT

This appendix contains copies of the June 25, 2013 Biological Constraints Analysis (BCA) and survey report and the April 24, 2014 Addendum to the BCA that reflects changes in the project schedule.

North State Resources, Inc.

Date:	April 24, 2014	**PG&E Order #:**	8105484
To:	Pacific Gas and Electric Company		
From:	North State Resources, Inc.		
Project:	PG&E Compressed Air Energy Storage Compression Testing Project		
Subject:	Addendum for the Draft Biological Constraints Analysis, San Joaquin County, California dated July 25, 2014		

North State Resources, Inc. (NSR) prepared a biological constraints analysis (BCA) for the proposed Compression Testing Phase of the Pacific Gas and Electric Company (PG&E) Compressed Air Energy Storage Project (project) at the King Island Temporary Site Facilities (TSF) project area (project area) on July 25, 2013. Since the completion of this report, the project description has changed. The purpose of this addendum is to describe the changes in the project description and how those changes could affect sensitive biological resources.

The following items have changed in the project description: project schedule, number of wells to be drilled, project equipment, and project operation. The project was originally scheduled to commence in August 2013 and be completed by August 2014. Construction of the distribution line began in November 2013. Due to unforeseen circumstances, the project schedule has shifted and will need to be extended to complete the project. The revised construction schedule is as follows:

- Completion of the distribution line by June 2014
- TSF site preparation and access road improvements July through December 2014
- Well drilling and TSF construction from August through December 2014
- Operations (i.e., air injection testing) December 2014 through June 2015
- Site decommissioning is expected to occur July through August 2015

The number of new wells to be drilled has been reduced from two to one well. An existing well will be instrumented for monitoring in lieu of drilling a new well. Revisions have been made to the types of cooling equipment from an air-cooled chiller system to the use of closed-loop cooling pumps, heat exchangers, and air-cooled radiators. The revision to project operation is limited to a change in the venting period from 5-10 hours to 5-15 hours.

Sensitive biological resources identified that could be affected by the project include special-status species, potential waters of the United States, and other biological resources. Special-status species identified in the BCA that could be affected by project activities include giant garter snake (*Thamnophis gigas*) (GGS), western pond turtle (*Emys marmorata*), Swainson's hawk (*Buteo swainsoni*), white-tailed kite (*Elanus leucurus*), northern harrier (*Circus cyaneus*), western burrowing owl (*Athene cunicularia*), and loggerhead shrike (*Lanius ludovicianus*). Changes in potential effects on special-status species that could be affected by the project are discussed below.

Potential project effects on GGS include ground disturbance, traffic, lighting, noise, and hazardous materials. The BCA addresses effects on GGS for traffic, lighting, noise and hazardous materials for both the GGS active and inactive period and the effects analysis for GGS are sufficient. The original project schedule described that ground disturbance would only occur during the inactive period (October 2 through April 30) and the BCA addressed effects on GGS as such. The new project schedule describes

that ground disturbance to develop the TSF pad would occur during both the active and inactive season. During the active season, GGS are generally in aquatic habitat, which reduces the potential to affect an individual. As part of the avoidance measures implemented when the project began, an exclusionary fence was installed 200 feet north and south of the proposed TSF pad along the irrigation ditch west of the access road on September 27, 2013. The fence has been maintained through the winter of 2013-2014 and will continue to be maintained for the duration of the project. Placement of this fence reduces the likelihood that GGS would move from irrigation ditches to bask in the roadways during the active season or occupy upland burrows during the inactive season. Given that the exclusionary fence was installed during the active period of 2013 when GGS are primarily in aquatic habitat, it is not expected that GGS are occupying or will occupy burrows within the TSF pad, thus the potential of direct effects resulting from disturbance to burrows are not expected.

Revisions in the cooling equipment and venting period do not affect the analysis of project effects on the GGS as described in the BCA. Recommended avoidance and minimization measures presented in the BCA are sufficient to avoid effects on GGS.

Potential effects on western pond turtle and nesting birds included impacts on individual western pond turtles and bird nests, and noise disturbance on nesting birds. Revisions in the project schedule, reduction of the number of new wells, revisions in cooling equipment, and revisions in venting duration does not change the project effects analysis provided in the BCA on western pond turtle or nesting birds. Additionally, these changes would not have an effect on waters or the United States or other biological resources. Because no additional effects were identified for sensitive biological resources, no additional AMMs are recommended.

North State Resources, Inc.

Technical Memorandum

Date:	July 25, 2013	**PG&E Order #:**	8105484
To:	Pacific Gas and Electric Company		
From:	North State Resources, Inc.		
Project:	PG&E Compressed Air Energy Storage Compression Testing Project		
Subject:	Draft Biological Constraints Analysis, San Joaquin County, California		

Introduction and Summary

North State Resources, Inc. (NSR) conducted a biological constraints analysis for the proposed Compression Testing Phase of the Pacific Gas and Electric Company (PG&E) Compressed Air Energy Storage Project (project) at the King Island Temporary Site Facilities (TSF) project area (project area).

The project consists of development of a TSF to conduct compression testing and evaluate the feasibility of development of a Compressed Air Energy Storage (CAES) project. Development of the TSF would include limited maintenance on existing access roads. The U.S. Department of Energy (DOE) is co-funding the TSF project and is serving as the National Environmental Policy Act (NEPA) lead agency.

Development of a distribution line is required to provide power to the TSF. Development of the distribution line would involve re-conductoring existing lines and construction of new lines. The DOE is the NEPA lead agency for development of the electric distribution line, which is being authorized separately from the TSF as an interim action.

The objective of the compression testing phase is to confirm the geologic suitability of the site and provide more detailed information for project engineering.

The biological constraints analysis included both a desktop review of biological resources and a field review of the project area. The purpose of the biological constraints analysis is to:

1) Characterize the habitats and vegetation communities present;
2) Evaluate the potential for the occurrence of special-status plant and animal species;
3) Determine the presence or absence of waters of the United States;
4) Determine the presence or absence of other sensitive biological resources (e.g., riparian habitats, nesting raptors)
5) Determine potential impacts on biological resources resulting from site ingress/egress, TSF pad development, localized excavations, pole installation, and temporary stockpiling of excavated material;
6) Recommend practicable avoidance and minimization measures (AMMs) that may be considered by PG&E to minimize and avoid potential impacts; and
7) Evaluate whether the proposed activities, in combination with the recommended AMMs, would avoid adverse effects on sensitive biological resources.

Giant garter snake, listed as threatened under the federal Endangered Species Act (ESA) and the California Endangered Species Act (CESA); Swainson's hawk, listed as threatened under CESA; northern harrier, burrowing owl, and loggerhead shrike, designated as California species of special concern; and white-tailed kite, a state fully protected species, have at least some potential to be present in or near the project area. Without the implementation of AMMs, there is a potential for the project to result in adverse effects on these species. With the implementation of the recommended AMMs, the project is not expected to result in adverse effects on these species.

The irrigation ditches within the project area appear to meet wetland criteria and may be considered potential waters of the United States. One wetland area along Eight Mile Road would not likely qualify as waters of the United States. Bishop Cut is a navigable water and qualifies as a waters of the United States. All determinations concerning waters of the United States should be considered preliminary and tentative unless verified in writing by the U.S. Army Corps of Engineers (USACE).

Because the project would receive federal funding from the DOE, the DOE is required under section 7 of the federal Endangered Species Act to determine whether the project may affect federally listed or designated critical habitat. If the DOE determines that the project may affect federally listed species or designated critical habitat, consultation with the U.S. Fish and Wildlife Service and/or National Marine Fisheries Services is required.

Project Description

Project Purpose

The objective of the proposed project is to study the feasibility of using an underground porous rock formation (depleted natural gas field) for a CAES project. CAES technology involves two major processes: (a) air compression for storage and (b) air release for electricity generation. During the air compression and storage process, electric motor-driven compressors inject air into a sealed and porous underground geological formation for storage under high pressure. During the air release phase, the high-pressure air is released from the underground reservoir, heated using natural gas (if necessary), and expanded through sequential turbines ("expanders"), which drive an electrical generator. The stored energy can be used during periods of higher electric demand, improving the efficiency of energy distribution through the power grid. This proposed project's goal is to conduct pressure testing of the formation. This would consist of injecting air to build a subsurface bubble within the reservoir sands of the depleted King Island Gas Field, and then conducting a series of pressure tests to further confirm the geologic suitability of the formation and provide more detailed information for project engineering.

PG&E proposes to construct a TSF, and perform drilling and compression tests to determine if a geological formation has the potential as a storage reservoir for future use as a CAES facility. An action that is interrelated to the construction of the TSF, drilling, and compression testing is the development of an electric distribution line that would provide power to the TSF. Development of the distribution line would involve re-conductoring existing lines and construction of new lines.

This site for the compression tests is located at the King Island Piacentine Well Pad Site (King Island) located in San Joaquin County, California. The proposed TSF is located approximately 1.8

miles northwest of the City of Stockton's northern boundary at Eight Mile Road in northwestern San Joaquin County, California. The TSF site would be situated on King Island between White Slough and Bishop Cut, and can be accessed from Interstate 5 via West Eight Mile Road and King Island Road (Figures 1 and 2a, Appendix A).

Project activities will include the construction and operation of the King Island TSF and access road maintenance. The electric distribution line will be upgraded by a combination of re-conductoring and new construction to provide power to operate the compression testing.

King Island Temporary Site Facilities

Project construction actions for developing the King Island TSF include construction of the TSF pad, well drilling, and compression and cycling testing. All staging, well drilling, compression, and cycling testing would occur on the TSF pad. Other associated project activities include access road maintenance (if deemed necessary) and development of the distribution line to power the activities at the TSF site. The expected timeline for construction activities is as follows:

- The development of the distribution line is expected to occur between August 2013 through March 2014;
- The access road maintenance, if needed, is expected to occur during the TSF pad construction time period of January 2014 through March 2014; and

TSF pad construction, well drilling, and compression testing would occur from February 2014 through August 2014.

TSF Pad Construction and Well Drilling

A pad to support the project and its operations (TSF pad) would be constructed to approximately 650 feet by 165 feet, or 2.5 acres in size, of which 0.7 acre was previously created for the geological core drilling task associated with this project. The TSF pad would be constructed as shown on the site plan (Figure 2b, Appendix A). Access road maintenance, pad construction, and drilling of the wells to complete the TSF pad at King Island is expected to take approximately 3 months.

The existing 0.7-acre pad would be expanded by additional clearing, grubbing, scarifying, and compacting into an area that is currently planted with sapling-stage walnut trees, requiring the removal of approximately 90 small trees. Geotextile material would be placed over the compacted work area, then up to 18 inches of sub-base material and Class II aggregate base would be placed and compacted. The work area would be crowned and sloped so that stormwater sheet-flows off the pad. PG&E would constrain all construction activities to the pad and a 20-foot buffer area

During the construction of the TSF pad, eight workers, five trucks and trucks to haul material, road grader/maintainer, dozer (D-5 or equal), sheep's foot compactor, roller compactor, water truck, and similar construction equipment would be used. Approximately 28 truck trips would be required to import material to the TSF pad.

Once the TSF pad is constructed, a drilling rig and associated equipment would be mobilized to the project. The primary drilling equipment includes the drill rig, mud and water tanks and pumps, shaker tanks, electric generators, diesel fuel tanks, and drill pipe racks. Two wells would be drilled into the formation– one well for injection and withdrawal of air (IW well), and the second well for monitoring

field pressures and responses to the injection and withdrawal process. The construction contractor would place all waste, cuttings, and drilling mud associated with well drilling in proper storage receptacles for offsite disposal at an authorized disposal facility. An additional five truck trips would be required to remove drill cuttings and associated material from the site. Drilling crew, engineers, temporary workers and site visitors would number an average of approximately 12 workers/people per shift, with three shifts per day. To accommodate continuous work shifts, night-time lighting would be used. Up to a maximum of 20 workers may be present at one time during various operations. In addition to worker vehicles, service, equipment, and material delivery vehicles would access the site during the drilling phase, generating an estimated 40 trips per day. Total duration of this task is approximately six weeks.

Water for pad construction and well drilling would be trucked to the project area from off-site municipal water supply sources. All drilling activities would be completed in compliance with the U.S. Environmental Protection Agency (EPA) Underground Injection Control (UIC) permit. Construction wastewater would be hauled offsite and disposed of in a permitted, commercial injection well in Rio Vista. Once the two wells are drilled and the drilling equipment demobilized from the work area, the compression and cycling equipment would be installed.

Once the two wells are drilled and the drilling equipment demobilized from the work area, the compression and cycling equipment would be installed.

Development of the facility includes installation of compression equipment, closed-loop cooling system, portable office trailer, tank for drilling mud, and lighting.

Compression and Cycling Testing
The construction and installation phase would be followed by four to five months of compression and withdrawal cycling that simulates the operation of a CAES facility. The testing would involve, initially, creating the compressed air reservoir or "bubble" by pumping the compressed air into the geological formation. Creation of bubble can take up to two months.

After the bubble is created, a series of pressure tests would be conducted and data would be collected from the IW well, the observation well and possibly from additional existing nearby gas wells to assess the reservoir response. The testing protocols are still being developed and would include a series of sequential injection, pressure buildup, pressure fall off, and possibly flow tests. The final compression testing plan would be developed to collect data that allows assessment of the reservoirs characteristics to support refinement of the computer reservoir model constructed for the project.

Other than the IW wells, the primary equipment used during the compression test would include the following:

- High-pressure compressor train capable of injecting the compressed air at flow rates up to 17 million standard cubic feet per day and compressor outlet pressures up to a maximum of 2,700 pounds per square inch,

- After-cooler to cool the compressed air to a temperature no higher than approximately 140 degrees Fahrenheit before injection,
- If necessary for safety purposes, the air supply stream may include oxygen-depleted air generated using a portable membrane filtration system or similar equipment,
- Appurtenant equipment including a temporary electrical supply, a step-down transformer, a power distribution system, a compressor cooling system, high-pressure piping, and control circuitry,
- Equipment to support withdrawal testing including high-pressure piping, a choke valve, a propane or electric line heater, a phase separator, one or more produced water storage tanks, and an air discharge vent, and
- Monitoring and measurement equipment including:
    - Wellhead pressure and temperature sensors at the wells;
    - A sensor array along the discharge piping to measure flow, pressure, temperature, combustible gas concentrations, oxygen concentrations and relative humidity; and
    - A sensor array along the injection piping to measure flow, pressure, temperature, oxygen concentrations, and relative humidity.

During this approximate 4- to 5-month period of compression and cycling testing, approximately 12 workers would be on site per day, staffing three eight-hour shifts. Night-time lighting would be required to accommodate a 24-hour work schedule. Workers, service vehicles and site visitors are expected to generate approximately15 trips per day.

Following completion of the compression testing, all of the drilling, compression, and other equipment would be removed from the site. If the compression testing has indicated the formation demonstrates appropriate characteristics for a CAES project, the pad along with established wells would be left in place for use in development of the CAES facility. If the testing demonstrates otherwise, the wells would be plugged and abandoned per California Department of Conservation Division of Oil, Gas, and Geothermal Resources (DOGGR) regulations and the requirements of the UIC permit issued by the EPA for the project. If the project does not move forward, the well pad and associated wells would be transferred to the subsurface rights owner as a condition of its agreement with PG&E. The pad material may be retained or removed from the site at the discretion of the subsurface rights owner. If the TSF pad is removed, equipment, workers and trips would be similar to the TSF pad construction as described above, but duration would be shortened to approximately 4 weeks.

Access Road Maintenance

Given that existing access roads are available, no road construction is necessary for project construction. Maintenance to the existing access roads would be limited to light graveling of the unnamed dirt road if determined to be necessary during the TSF pad construction and compression testing (this work would occur between January and March 2014) with the assumption that no additional grading would be required. If grading is required, it would be limited to leveling and/or smoothing the existing road and would not extend beyond the compacted surface. All vehicle traffic would be on the existing access roads

and all staging would be contained within the southeast portion of the existing well pad. Water trucks would be used as necessary to reduce dust during site access and other construction activities.

Electric Distribution Line

PG&E would develop an electrical distribution line to provide power to the equipment needed for compression testing. The distribution line would involve a combination of the use of existing overhead lines with no improvements, re-conductoring of existing overhead and underground lines to upgrade them to higher voltage and load capacity, and construction of new overhead lines (Figure 2a, Appendix A). The distribution line would be designed to or retrofitted within avian protection specifications to protect raptors and migratory birds from electrocution. Construction and improvements to the distribution line would occur between August 2013 and March 2014.

The distribution line serving the project would begin at the PG&E Eight Mile Road Substation and would be approximately 4.25 miles in length from the substation to the TSF pad (Figure 2a, Appendix A). A new 300-foot long underground line would be installed from the substation to an existing overhead line. Continuing west, the first 0.3-mile of this existing overhead line is adequate for project electric load and minimal modifications are required, but the remaining 0.6-mile segment will require re-conductoring and the installation of a pad-mounted transformer in the public road right of way. The route would then continue west to King Island Road along a 1.3-mile segment that would require entirely new construction, and would cross Bishop Cut (a navigation channel) on existing tall lattice steel structures required for vessel passage. The height of the existing structures will be extended as required for vessel passage. Pole replacement would be required on the east side of the levee to accommodate height extension and re-conductoring of the existing structures. After crossing Bishop Cut, the route would extend north along King Island Road, turning west and then north again on unnamed farm roads to the TSF. The first 1.4 miles of this portion of the route would involve re-conductoring and pole replacement, and the remaining 0.6-mile segment to the TSF pad would require new construction.

Distribution line construction would occur along existing public and private roads, and would not require construction of access routes or roads. Except for the water crossing at Bishop Cut, conductor support would consist of wooden poles with a span length of approximately 300-feet.. Construction would occur within a 50-foot wide work area, centered on the line.

The crossing of Bishop Cut would involve extension of the existing lattice steel structures to provide the necessary navigation clearance for the conductors over Bishop Cut. PG&E proposes to use a helicopter to complete the mast extension and re-conductoring of the span over Bishop Cut. Since the existing distribution lines must be removed from the top of the lattice steel structures before the tops can be extended, these lines will be relocated to temporary wood poles installed around the perimeter of the lattice steel structure work areas. A service line to a nursery on the southwest side of Eight Mile Road and the crossing currently connected to the top of the mast will require temporary poles as well. Once the top extension is complete the distribution line will be relocated to the top of the lattice steel structures and the temporary wood poles removed. Construction details such as staging areas, work areas at the pole sites, pull and tension sites, areas where special construction methods may need to be employed, and areas where vegetation removal may occur, etc., would be provided to the Contractor as the information becomes available. The Bishop Cut lattice steel structure extension would require a 100 x 100 foot work area on each side of the levee approximately 300 feet from the base of the mast in the cultivated field.

Electric distribution line construction would include up to two line crews (eight to ten workers total) over a period of approximately 12 weeks. Equipment would include line trucks with augers, bucket trucks, puller rig, conductor reel trailers and crew trucks.

Habitat and Affected Environment

The project area is situated in a landscape that currently supports active agricultural operations, an existing natural gas well site, access roads, several agricultural residences, and appurtenant facilities/equipment (e.g., farm equipment, staging area, and barn). It also includes a 0.7-acre well pad previously developed for the core-drilling phase of the project. The project area is located within the "Delta Islands," which are areas of former marshlands of the Sacramento–San Joaquin Delta that were historically reclaimed for agricultural use by the construction of levees/dikes and draining.

The area surrounding the TSF is generally level and ranges in elevation from approximately 5 to 10 feet below sea level. Water levels in White Slough and Bishop Cut are slightly above sea level and are separated from King Island by a series of levees topped by paved and unpaved roads. The area surrounding the TSF is crossed by a series of dirt and gravel ranch roads that provide access to the various ranch fields and to the test site. Several agricultural residences are located approximately 0.5 to 0.75 mile south of the test site along the south side of an east-west-trending gravel road.

Most of the project area occurs in agricultural fields and road shoulders that are frequently disturbed and nearly all native vegetation has been removed. The distribution line (existing and proposed new line) borders a golf course and a residential neighborhood in the eastern portion of the project area along the shoulder of Eight Mile Road.

Vegetation communities within the project area, include annual grassland, cropland/orchard, fresh emergent wetland, riverine, and ruderal (Figure 3a–3i, Appendix A). Vegetation communities are classified based on descriptions provided in *A Guide to Wildlife Habitats of California* (Mayer and Laudenslayer 1988).

Areas along the golf course on Eight Mile Road support annual grassland. The golf course was historically farmed up to Eight Mile Road prior to 1998 (Google Earth Imagery, August 17, 1998). Since the golf course installation, non-native annual grasses have re-colonized the area. Herbaceous cover is dense and is dominated by wild oat (*Avena fatua*), Johnson grass (*Sorghum halepense*), perennial ryegrass (*Festuca perenne*), fiddleneck (*Amsinckia menziesii*), wild radish (*Raphanus raphanistrum*), ripgut brome (*Bromus diandrus*), and milk thistle (*Silybum marianum*).

Cropland/orchard (e.g., corn, asparagus, onions, safflower, walnut orchard) is the dominant vegetation community within the proposed TSF pad and along the distribution line, with exception of few areas along Eight Mile Road that are dominated by annual grassland. The TSF pad is entirely within a young walnut orchard and the open areas between the rows are disked and or mowed on an annual basis. Most crops along the distribution line are annual row crops. All fields are actively farmed and annually disked, harvested and/or disturbed up to the edge of existing roads.

Fresh emergent wetlands are present in irrigation ditches with sufficient hydration throughout the project area and in ponds located on the golf course in the eastern portion of the project area. Irrigation ditches are located parallel to the gravel access road to the TSF pad, and are located perpendicular and parallel to Eight Mile Road. The irrigation ditches appear to be subject to regular vegetation management using

both mechanical and chemical techniques. Irrigation ditches adjacent to the TSF pad and gravel access road, and those perpendicular to Eight Mile Road are perennially inundated and support fresh emergent vegetation. Irrigation ditches on either side of Bishop Cut, and those at the western portion of the project area near the PG&E Eight Mile Substation are intermittently inundated during the irrigation season and are generally devoid of vegetation. Perennially inundated irrigation ditches and ponds support patches of fresh emergent vegetation including water primrose (*Ludwigia* sp.), cattails (*Typha* sp.), smartweed (*Persicaria* sp.), mosquito fern (*Azolla* sp.), and water hyacinth (*Eichhornia crassipes*).

Bishop Cut provides riverine habitat for aquatic species at the Eight Mile Road Bridge crossing. The Bishop Cut is an artificial navigation and irrigation channel connecting White Slough to the north and Disappointment Slough to the south. Within the project area, the levee banks are rip-rapped with large rock and the channel is generally devoid of vegetation. The section of the Bishop Cut levee road that will be used for project access is paved.

Areas that are often disturbed (e.g., mowed, disked) were classified as ruderal. Ruderal areas are located along the levee banks of Bishop Cut and adjacent road shoulders. Dominant plant species include common mallow (*Malva neglecta*), poison hemlock (*Conium maculatum*), mustard (*Brassica* sp.), milk thistle, Johnson grass, redroot pigweed (*Amaranthus retroflexus*), and common knotweed (*Polygonum aviculare*).

No seasonal wetlands, vernal pools, elderberry shrubs (*Sambucus nigra*), riparian wetlands or other sensitive natural community (e.g., California Natural Diversity Database (CNDDB) ranked rare natural communities) are present in the project area. Fresh emergent wetlands only occur in the ditches and golf course ponds (outside of the project area). Farmed agricultural lands do not provide habitat for special-status plant species. Vernal pools, mesic areas, alkaline or serpentine soils, chenopod scrub, and riparian forest or scrub habitats that would support special-status plant species are not present within the project area.

Methods

The status of habitat for special-status species, waters of the United States, and other sensitive biological resources within the project area was determined through desktop analysis and field reconnaissance. The following areas were evaluated during the desktop analysis and field reconnaissance and are referred to as the project area: (1) a 200-foot buffer around the TSF pad; (2) a 20-foot buffer around all gravel access roads; (3) a 50-foot-wide corridor along the approximate 4.25-mile electrical distribution alignment, and (4) within the work areas identified on either side of Bishops Cut (Figure 3a-3i, Appendix A). A discussion of the methodology for the desktop analysis and field reconnaissance is provided below.

Desktop Analysis

Multiple information sources were reviewed to evaluate biological resources within the project area. The following is a list of the principal resources:

- The *Terminous, California* USGS 7.5-minute topographic quadrangle;
- Color aerial photographs of the project area and vicinity;
- The U.S. Fish and Wildlife Service (USFWS) official list of endangered and threatened species that may occur, or be affected by projects, in the *Terminous, California*, 7.5-minute quadrangle (Appendix B);

- The California Department of Fish and Wildlife (CDFW) California Natural Diversity Database (CNDDB) (California Department of Fish and Wildlife 2013a) plant and animal records within 5 miles of the project area (Appendix B);
- The California Native Plant Society (CNPS) online Inventory of Rare and Endangered Plants (California Native Plant Society 2010) records for the *Terminous, California* and eight adjacent quadrangles (Appendix B);
- GIS shapefiles of designated critical habitat from the USFWS Critical Habitat Portal website;
- U.S. Department of Agriculture (USDA) Web Soil Survey;
- USFWS National Wetlands Inventory;
- CDFW publications including State and Federally Listed Endangered, Threatened and Rare Plants of California (California Department of Fish and Wildlife 2013a); Special Vascular Plants, Bryophytes, and Lichens (California Department of Fish and Wildlife 2013b); State and Federally Listed and Threatened Animals of California (California Department of Fish and Wildlife 2013c); and Special Animals List (California Department of Fish and Wildlife 2011); and
- Pertinent biological literature including the following: *The Jepson Manual: Vascular Plants of California* (Baldwin et al. 2012), *Amphibian and Reptile Species of Special Concern* (Jennings and Hayes 1994), and *Bird Species of Special Concern in California* (Shuford and Gardali 2008).

These resources were used to create a list of regionally occurring special-status species that may occur near the project area. Species listed in the U.S. Fish and Wildlife (USFWS) species list for San Joaquin County and special-status species identified in the CNDDB records were considered in the evaluation (e.g., listed shrimp, valley elderberry longhorn beetle, giant garter snake) (Appendix B). Additionally, special-status species not included in the USFWS species list or CNDDB records were considered due to their known geographic range and/or the presence of potential habitat (e.g., white-tailed kite and loggerhead shrike).

For the purpose of this evaluation, special-status plant species include plants that are (1) listed as threatened or endangered under the California Endangered Species Act (CESA) or the federal Endangered Species Act (ESA), (2) proposed for federal listing as threatened or endangered, (3) state or federal candidate species, (4) designated as rare by the CDFW, and (5) California Rare Plant Rank (RPR) 1A, 1B, or 2 species. Special-status animal species include species that are (1) listed as threatened or endangered under the CESA or ESA, (2) proposed for federal listing as threatened or endangered, (3) state or federal candidate species, and (4) identified by the CDFW as species of special concern or fully protected species.

Determination of wetlands was based on the approach outlined in the Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory 1987) and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0) (U.S. Army Corps of Engineers 2008). Additionally, the assessment for potential "other waters" was based on the presence of an ordinary high water mark as defined in USACE regulations (33 CFR 328.3 and 33 CFR 328.4).

Field Reconnaissance

A field reconnaissance was conducted on August 20, 2012 by NSR Biologist John Hunt, and PG&E Biologist Catalina Reyes, on April 3, 2013 by NSR Biologist Brandon Amrhein, and on July 17 by NSR

Biologist Patrick Martin. The biological field review consisted of pedestrian surveys to view all areas to the extent necessary to document the existing conditions. Mr. Eric Hansen, Consulting Biologist, reviewed the TSF pad and access road to assess potential giant garter snake aquatic and upland habitat.

Special-Status Species

Table 1 (Appendix C) lists special-status species that have potential to occur within the project area based on habitat documented during the field surveys. Species for which habitat does not exist within the project area were not included in Table 1 and are not discussed further in this document.

Special-Status Plant Species

Irrigation ditches and the area along Bishop Cut within the project area provide potential habitat for 12 special-status plant species. Habitat for seven RPR 1B species potentially occurs in the project area including, slough thistle (*Cirsium crassicaule*), woolly rose-mallow (*Hibiscus lasiocarpus* var. *occidentalis*), Delta tule pea (*Lathyrus jepsonii* var. *jepsonii*), Mason's lilaeopsis (*Lilaeopsis masonii*), Sanford's arrowhead (*Sagittaria sanfordii*), and Suisun marsh aster (*Symphyotrichum lentum*). Habitat for five RPR 2 species potentially occur and include watershield (*Brasenia schreberi*), bristly sedge (*Carex comosa*), Delta mudwort (*Limosella subulata*), eel-grass pondweed (*Potamogeton zosteriformis*), marsh skullcap (*Scutellaria galericulata*), and side-flowering skullcap (*Scutellaria lateriflora*). These species are generally found in marshes and swamp habitat, which the perennially inundated irrigation ditches and Bishop Cut may provide.

Suitable habitat for these species is located within the irrigation ditches and along Bishop Cut. The project would not result in disturbance to the irrigation ditches or Bishop Cut. Therefore, the project would not adversely affect special-status plant species.

Special-Status Animal Species

Seven special-status animal species were determined to have the potential to occur in or near the project area, and could be affected by the proposed project (Table 1, Appendix C). These species include:

- giant garter snake (*Thamnophis gigas*), federal and state threatened;
- western pond turtle (*Emys marmorata*), California species of special concern;
- Swainson's hawk (*Buteo swainsoni*), state threatened;
- white-tailed kite (*Elanus leucurus*), California fully protected species;
- northern harrier (*Circus cyaneus*), California species of special concern;
- western burrowing owl (*Athene cunicularia*), California species of special concern; and
- loggerhead shrike (*Lanius ludovicianus*), California species of special concern.

Giant Garter Snake

Perennial irrigation ditches throughout the project area and the golf course ponds north of the eastern portion of the project area potentially provides low quality aquatic habitat for the giant garter snake (GGS). The uplands within 200 feet of these areas potentially provides low quality upland habitat. Most of the dirt access road to the TSF pad borders a perennially inundated irrigation ditch (Figures 3a – 3i, Appendix A). The distribution line bisects three perennially inundated irrigation ditches and runs parallel to ponds located approximately 45 to 165 feet north of the eastern portion of the project area on the golf course.

The CNDDB contains reported GGS occurrences from marsh habitat within Coldani Marsh approximately 1.7 north of the TSF pad. Documentation of GGS within Coldani Marsh also includes surveys conducted by Eric Hansen during 2009–2010 (Hansen 2011). Although GGS are known to occur in Coldani Marsh, the densities of GGS populations in the Delta region is known to be very low and survey efforts since the mid-1980s suggest that much of the Delta is unoccupied or supports few GGS (Hansen 2013). For example, surveys conducted approximately 2 miles south of Coldani Marsh, which is 1.5 miles north of the eastern portion of the distribution line, did not detect GGS (Hansen 2011).

Essential habitat components required for GGS include (1) adequate water during the snake's primary active period; (2) suitable prey base; (3) abundant emergent, herbaceous wetland vegetation, such as cattails (*Typha* spp.) and bulrushes (*Scirpus* spp.) for escape cover and foraging habitat; (4) upland habitat for basking, cover, and retreat sites; and (5) higher elevation uplands for cover and refuge from flood waters (Miller et al. 1999).

Although vegetation is actively managed along ditches, emergent vegetation persists and these ditches may provide aquatic habitat for GGS when inundated. Because the ditches appear to be subject to regular vegetation management using both mechanical and chemical techniques and the water level fluctuates with respect to different periods of the irrigation cycle, the suitability of the ditches in providing cover and retreat habitat for GGS is limited and the habitat is considered low quality. Prey items such as mosquito fish (*Gambusia affinis*), bullfrogs (*Lithobates catesbeianus*), and Sierran treefrogs (*Psuedacris sierra*) are present within the perennially inundated ditches along the dirt access road and Eight Mile Road.

Based on studies conducted by Wylie et al. (Wylie et al. 1995; Wylie et al. 1997; Wylie et al. 2002a; Wylie et al. 2002b), the Solano Multispecies Habitat Conservation Plan (Solano HCP) analyzed landscape habitat use and found that low quality ditch habitat associated with rice fields include an artificial marsh habitat that provides the essential components (e.g., appropriate cover, high food availability, upland refuge) to support GGS. In addition, studies conducted in high quality marsh habitat surrounded by fallow fields did not locate GGS or found them at very low densities. Based on these results, areas supporting marginal to poor habitat or small, isolated patches of good habitat are presumed to not support GGS due to lack of surrounding aquatic habitat (Solano County Water Agency 2009). The project area lacks marshes or other expansive aquatic habitat (e.g., rice fields) and the potential GGS aquatic habitat that is present (e.g., irrigation ditches) is of marginal to poor quality. Therefore, it is unlikely that GGS would utilize the irrigation ditches in the project area.

Burrows and other underground refugia are important to GGS during winter and summer to escape unfavorable winter cold temperatures or excessive summer heat. The GGS Recovery Plan states that wintering habitat can be up to 250 meters (820 feet) from the edge of marsh habitat (Miller et al. 1999). Typically, the USFWS defines upland habitat as all areas occurring within 200 feet of aquatic habitat (White 1997).

The upland habitat in the agricultural portions of the project area is poor to marginal habitat for GGS. As part of existing agricultural activities, the agricultural uplands are extensively disked, tilled and periodically may be planted with row crops between the walnut orchard rows. These activities largely preclude the development/persistence of burrows created by small mammals that are used as refugia by GGS. Additionally, GGS require open space for basking and predator avoidance, and tend to avoid areas with extensive canopy cover because of excessive shade and lack of basking sites (Miller et al. 1999).

Canopy cover provided by the young walnut orchard that occupies the TSF pad limits available open habitat, which reduces suitability of upland habitat.

The ponds on the golf course north of the distribution line (Figure 3h, Appendix A) support fresh emergent wetlands and provide the essential habitat components for GGS, with the ponds providing potential aquatic habitat and the ruderal areas around the golf course providing potential upland habitat. The golf course ponds are in proximity to a series of irrigation canals, irrigation ditches, and fresh emergent wetland habitat that connects to the Coldani Marsh population of GGS located approximately 3.5 miles north of the distribution line near the golf course ponds. However, the potential for GGS to occur in the golf course ponds is considered to be low for the following reasons: 1) few burrows are present in the ruderal areas of the golf course; 2) the golf course is not surrounding by marshes or other expansive aquatic habitat; 3) surveys for GGS conducted in 2009–2010 in aquatic habitat 2 miles south of Coldani Marsh (e.g., in the aquatic corridor between the golf course and Coldani Marsh) had negative results (Hansen 2011); and 4) the densities of GGS populations in the Delta region is known to be very low (Hansen 2013).

The proximity of the distribution line to the golf course ponds ranges from approximately 65 to 145 feet. A large berm (approximately 20 feet wide and 15 feet tall) separates the golf course from the distribution line and Eight Mile Road is located immediately south of the distribution line. The areas south of Eight Mile Road near the golf course consist of residential developments and upland agricultural fields. GGS are not anticipated to occur within the distribution alignment near the golf course for the following reasons: 1) GGS are not likely to occur in the golf course ponds; 2) a large berm separates the golf course from the distribution alignment; 3) the distribution alignment is limited to the road side of the berm; and 4) no suitable habitat is present within or south of distribution alignment and, thus, there is no reason for GGS to move through the area.

In summary, given the nature of potential aquatic and upland habitats for GGS in the project area (e.g., low-quality and isolated from higher quality habitats) and the characteristics of GGS populations in the Delta region (e.g., very low densities, most potential habitat is unoccupied), GGS are unlikely to occur in the project area and very unlikely to occur in areas where the project activity would result in ground disturbance. The majority of ground disturbance and other activities associated with the project would be at the TSF pad. As part of project planning and environmental review for the well pad that was previously developed at the TSF pad for the core drilling phase, PG&E contracted with Eric C. Hansen (Consulting Environmental Biologist) to evaluate the potential for GGS to occur within the project area. Based on a review of the habitat characteristics, previous survey results in nearby areas of the Delta, and other factors, Mr. Hansen determined that there was minimal to no likelihood that GGS occur within the area of the proposed TSF pad. The report prepared by Mr. Hansen also included a summary of Delta-wide GGS survey efforts. A copy of Mr. Hansen's report is provided as Appendix D.

Project Effects

Project effects on GGS vary based on the GGS activity period (e.g., inactive or active) in which the work is conducted. Construction and operation of all activities associated with this phase of the project are anticipated to commence in August 2013 and continue through October 2014. Development of the distribution line is anticipated to start August 2013 and be completed by March 2014. Construction of the TSF pad and any road maintenance is anticipated to occur January through March 2014, with commissioning and operations to occur April through August 2014, and decommissioning activities to occur in September and October 2014.

The TSF pad construction and decommissioning would be conducted during the GGS inactive period (October 2–April 30). TSF operations would be conducted during the GGS active period (May 1–October 1). The development of the distribution line would be conducted during both the GGS active and inactive period. The following sections describe effects based on the phase of construction and the GGS activity season.

Construction, Drilling, and Decommissioning

Construction of the TSF pad, road maintenance and decommissioning of the project are expected to occur during the GGS inactive period. If GGS are present within the project area, GGS could be affected by road grading, ground disturbance, use of hazardous materials (e.g., fuel, oils), noise disturbance, lighting disturbance, and other activities associated with project construction and decommissioning.

Based on the project schedule, ground disturbance for the TSF pad and road maintenance activities would occur from January through March, and the decommissioning period would occur from September through October, 2014. The periods for construction and decommissioning roughly correspond with the GGS inactive period. During the inactive period, GGS are anticipated to be within burrows or other refugia within 200 feet of aquatic habitat (White 1997). The highest potential for effects on GGS during construction and decommissioning is from activities along the access roads where they border irrigation ditches (e.g., heavy traffic, road grading). Although suitable winter refugia (e.g., burrows) is generally lacking in the project area, GGS could be directly affected if burrows occupied by GGS were disturbed (e.g., effects resulting from crushing or collapsing burrows). Potential direct effects resulting from disturbance to burrows would be avoided with implementation of AMMs.

It is anticipated that construction and decommissioning activities would result in sound levels of approximately 81 to 90 decibels (dB) at the TSF pad based on the equipment that would be used and drilling of two wells (U.S. Fish and Wildlife Service 2006). Sources of construction noise would include medium-sized to large construction equipment, drill rigs, pneumatic tools, and medium-sized to large diesel engines. The level of noise generated from construction and decommissioning would be similar to existing farming activities (e.g., noise from farming equipment like diesel engines, generators, pumps, and power tools), but the noise would be more stationary and longer in duration at specific locations (e.g., drilling at TSF pad). Effects on GGS from construction noise are not expected and are not considered to be adverse because these activities would occur during the inactive period when GGS are in winter refugia.

Well drilling during the construction phase would occur over a 24-hour period, which would require night-time lighting. As with noise disturbance, GGS would be in winter refugia and disturbance from night-time lighting is not expected and would not result in adverse effects.

Construction and decommissioning would not involve ground-disturbance in potential aquatic habitats for GGS. However, construction and decommissioning would involve the use of fuels, oils, and other hazardous materials. GGS could be affected if hazardous materials were released into aquatic habitats occupied by GGS. Potential direct effects resulting from hazardous materials would be avoided with implementation of AMMs.

Development of Distribution Line and Project Operation

Development of the distribution line is expected to occur during the GGS inactive and active period and the project operation period (compression and cycle testing) is expected to occur during the GGS active

period. The greatest potential for GGS to be affected by distribution line development would be from vehicle access and pole replacement activities. The greatest potential for GGS to be affected during project operation activities would be from light traffic leaving and entering the TSF pad, and from noise and light generated at the TSF pad.

During development of the distribution line, line trucks and other vehicles would be accessing the distribution line to install poles or re-conductor overhead lines. Effects could result from direct contact with vehicles, collapse of refugia in which snakes may take cover, or GGS avoidance of foraging habitat (e.g., irrigation ditches, ponds). Potential direct effects resulting from vehicle traffic or excavation would be avoided or minimized with implementation of AMMs.

Project personnel and service vehicle traffic are expected to decrease during the operation phase of the project (approximately April–August), which is within the active period for GGS (active period is May 1–October 1). Snakes are expected to be within, and immediately adjacent to, aquatic habitats during the active period. GGS foraging in the irrigation ditches and GGS basking on or near roadway surfaces (e.g., near the irrigation ditches) could be disturbed by vehicle traffic. Traffic entering and leaving the TSF pad could results in direct effects on GGS. Effects could result from direct contact with vehicles or avoidance of available foraging habitat in the irrigation ditches due to the increased level of disturbance. Potential direct effects resulting from vehicle traffic would be avoided or minimized with implementation of AMMs.

Operations at the TSF pad would generate noise by compression testing over a five-month period from April through August 2014. Noise generation would be concentrated at the TSF pad. There would be two testing phases, each expected to last 3 weeks. Injection and withdrawal would be alternated on repeating daily schedules for 4 to 5 days, followed by a short period to inject air and stabilize the reservoir. Daily withdrawal would be conducted from 5 to 10 hours depending on the rates being tested. The air release vent would be installed with a silencer and air withdrawal would not result in sudden high noise levels, but would ramp-up over a 10-minute period. With a silencer on air release vent, the compression testing would generate noise reaching 65 to 90 A-weighted sound pressure levels (dBA) adjacent to the TSF pad, attenuating to less than 60 dBA approximately 0.25 mile from the TSF pad (Figures 4a and 4b, Appendix A).

Although the noise levels that would be generated at the TSF pad are similar to ambient conditions (e.g., noise from farming equipment like diesel engines, generators, pumps, and power tools), the noise would be stationary and longer in duration. Given the stationary nature of the noise and the duration of the noise, GGS in close proximity to the TSF pad could be affected. Although snakes do not have external ears or an ear drum, they do have an inner ear that is connected to their jawbone. Snakes “hear” by sensing vibrations traveling through the ground (and possibly the air), which cause vibrations in the jawbone that are relayed to the brain via the inner ear. Effects on GGS from noise could result from avoidance of aquatic or upland habitats if noise vibrations interfere with foraging activities or are otherwise uncomfortable for the snake. Given the low potential for snakes to be present near the TSF pad, the attenuation of noise with increasing distance from the TSF pad, and the ability of snakes to move away from the area, noise effects from operations are not considered to be adverse.

Operation of the project would require night-time lighting at the TSF pad seven days a week for the duration of the project. The lighting would be focused on the TSF pad and would be shielded to minimize the illumination of areas outside the TSF pad. However, the segment of irrigation ditch

immediately west of the TSF pad and along the access road could be illuminated. If GGS utilize this segment of irrigation ditch, effects could result from avoidance of the area, changes in behavior, or reduced availability of prey. Given the low potential for snakes to be present near the TSF pad, the small area of potential habitat that would be affected, and the ability of snakes to move away from the area, effects from night-time lighting are not considered to be adverse.

Western Pond Turtle

The golf course ponds north of the distribution line in the eastern portion of the project area and associated uplands provide suitable habitat for western pond turtle (Figure 3h, Appendix A). Upland nesting habitat is also present adjacent to the golf course. Western pond turtles are documented to occur in the irrigation canal approximately 1.3 miles northwest of the portion of the distribution line along the southern boundary of the golf course (California Department of Fish and Wildlife 2013d). Because of the presence of habitat and occurrences within proximity of the golf course, this species has a moderate potential to occur in the project area.

Although ditches in the project area are perennial, and contain some fresh emergent vegetation, the banks are steep and do not contain available basking sites. Ditches are actively maintained which likely precludes occupation by pond turtles. Additionally, upland breeding sites are unavailable in the cropland habitat within the project area. Due to lack of basking habitat and upland breeding sites, pond turtles are not expected to occur in the agricultural portions of the project area near the TSF pad.

Project Effects

The project could have adverse effects on western pond turtle if an individual or a nest were crushed during the construction or operation phase of the project. The peak of construction activity would occur in the winter between January and March. Western pond turtles generally hibernate under water during colder periods (i.e., winter months) (Zeiner et al. 1988) and would not likely be encountered during construction activities. Pond turtles move overland during the spring and early summer and have been documented to move over 325 feet (Jennings and Hayes 1994). Installation of the distribution line would occur in the road shoulders, which is too compacted to provide nesting substrate for western pond turtles. It is expected that only adults could be encountered along roads during project implementation.

Because the duration of the project is approximately 10 months and turtles are generally restricted to aquatic habitats, long-term effects are not expected. Implementation of AMMs provided below would minimize the potential for adverse effects on western pond turtle. These measures include a preconstruction survey and stop work measures if a turtle is encountered.

Swainson's Hawk

Suitable nesting habitat (e.g., trees, power poles/towers) for Swainson's hawk occurs within 0.5 mile of the project area. Suitable nesting habitat within 0.25 mile of the project area is limited to one eucalyptus tree (*Eucalyptus* sp.), which is located approximately 700 feet north of the TSF pad, and trees located along King Island Road, north and south of Eight Mile Road west of Bishops Cut. Foraging habitat is abundant in the agricultural lands near the project area. However, walnut orchards currently within the proposed TSF pad do not provide foraging habitat (California Department of Fish and Game 1994). CNDDB records include one Swainson's hawk occurrence approximately 0.2 mile southeast of the PG&E Eight Mile Road Substation, one 2001 Swainson's hawk nest approximately 1 mile south of Eight Mile Road at Bishops Cut along Disappointment Slough, and Swainson's hawks nested in 2009 approximately 1 mile northeast of the TSF pad.

Surveys following the guidance provided in *Recommended Timing and Methodology for Swainson's Hawk Nesting Surveys in California's Central Valley* (Swainson's Hawk Technical Advisory Committee 2000) were conducted by NSR during the spring of 2013 within 0.5 mile of the project area. No Swainson's hawk nests were detected within 0.5 mile of the project area (North State Resources 2013). One Swainson's hawk pair exhibited nesting behavior during April 2013 approximately 1.5 miles north of the project area (North State Resources 2013).

Given that there is a general lack of nesting habitat within 0.25 mile of the project area, and that the 2013 surveys did not detect nesting Swainson's hawks within 0.5 mile of the project area, the potential for Swainson's hawks to nest within 0.5 mile of the project area during project activities is considered to be low.

Project Effects

Noise generated during construction and operation activities could affect Swainson's hawks if active nests are located within 0.25 mile of the project area (California Department of Fish and Game 1994). As discussed above, it is anticipated that construction of the TSF pad, well drilling, and installation of the distribution line would result in a high sound level of approximately 81 to 90 dB, which is similar to the ambient sound level generated by annual crop farming occurring year-round (e.g., tilling, planting spraying, pumping, harvesting); however, drilling would be stationary and of longer duration.

Construction of the TSF pad and drilling noise would be generated continuously for 3 months and is anticipated to occur between January and March 2014. Decommissioning would occur during September and October, thus construction and decommissioning would largely occur during the non-nesting season for Swainson's hawk (non-nesting season is October 1 to February 28). Given that construction and decommissioning would occur outside the Swainson's hawk nesting period, effects on Swainson's hawks is not expected.

Development of the distribution line would occur between August 2013 and March 2014. Initiation of the distribution line improvements would occur at the end, but completed before the start of the Swainson's hawk nesting period (March 1 through September 15). Activities associated with development of the distribution line (e.g., noise and line-of-sight disturbance) could result in effects on nesting Swainson's hawks (e.g., nest abandonment). However, work would occur after the post-fledgling period (June 10-July 30) (Swainson's Hawk Technical Advisory Committee 2000) and effects on young would not be expected for they would have likely have fledged by early August.

During the operation phase (compression testing), most noise generation would be concentrated within the TSF pad. Operation sound levels would be at a similar sound level as for the construction phase of the project (approximately 65-90 dbA with a silencer). With a silencer on the air release vent, the decibel rating at 0.25-mile would be less than 60 dBA, which is a low sound level (U.S. Fish and Wildlife Service 2006). Compression testing would occur during the nesting season for Swainson's hawk (nesting season is March 1–September 15). Noise generation during drilling and compression testing are similar in sound level and duration. These sound levels are comparable to ambient sound levels; however, noise would be stationary and continuous for a longer duration than farming activities.

Because the operation phase would occur during the nesting season for Swainson's hawk, effects on Swainson's hawk from noise could result in the incidental loss of fertile eggs, nestlings, or otherwise lead to nest abandonment, which could adversely affect the species. However, noise would be of similar level

and duration between the drilling and compression testing. If Swainson's hawks begin nesting after the commencement of drilling in January 2014 near the project area and compression testing follows drilling, effects are not expected.

Given that (1) the potential for Swainson's hawk to nest within 0.25 mile of the TSF pad is very low, (2) nest sites greater than 0.25 mile from the TSF pad would be subject less than 60 dBA, which is lower than ambient conditions, and (3) noise conditions are similar between drilling and compression testing, which would commence prior to the nesting season, impacts on nesting Swainson's hawks are considered low.

Both the construction and the operation phase of the project would require night-time lighting seven days a week during the drilling activities and compression testing, respectively. Because the low potential for Swainson's hawks to nest within 0.25 mile of the project area, lighting would be consistent from the onset of the nesting season, and operations would cease in the fall/winter of 2014, adverse lighting effects on nesting Swainson's hawks, if present, are not expected.

Project activities could adversely affect Swainson's hawk if the project starts at the end of the nesting season (e.g., distribution line) or does not start prior to the nesting season (e.g., construction and operation activities). Swainson's hawk surveys would be conducted to determine presence/absence if project activities begin during any time of the nesting season. If present, determination of buffers or a limited operating period may be required. If nesting occurs within 0.5 mile while construction/drilling or operation phases (compression testing) are in progress, nesting activity should be monitored to confirm noise or line-of-sight disturbance during construction or operation activities does not disrupt nesting success. Implementation of the AMMs provided below would minimize the potential for adverse effects on Swainson's hawks.

Other Special-Status Birds

Habitat for white-tailed kite, northern harrier, western burrowing owl, and loggerhead shrike is present in the project area. Nesting habitat for loggerhead shrike and white-tailed kite is present in the trees and shrubs in the project area. Open areas near ponds at the golf course may provide nesting habitat for northern harrier. Burrows and other structures (e.g., culverts) in annual grasslands and ruderal habitats along road shoulders, open areas, and levee berms provide habitat for burrowing owl. White-tailed kite is documented by the CNDDB to nest 2 miles northeast of the project area and burrowing owl is reported to occur within 3.8 miles southeast of the project area (California Department of Fish and Wildlife 2013d). Northern harrier was observed nesting 1.5 miles north of the project area during April 2013 (North State Resources 2013). Because of the presence of habitat and known occurrences near the project area, white-tailed kite, and loggerhead shrike have a low potential to occur in the TSF pad, and a moderate potential to occur along the distribution line; northern harrier has a moderate potential to occur near the golf course ponds along the distribution line; and western burrowing owl has a moderate potential to occur along the distribution line.

Project Effects

As described for the Swainson's hawk, construction and operation activities could affect nesting success for other special-status birds. Ground disturbing activities and vegetation removal could directly affect birds nesting on the ground or in trees slated for removal (e.g., mortality of young in nest). Direct effects (e.g., nest abandonment due to noise disturbance) on nesting birds may result if construction activities commence after the nesting season begins.

Construction of the distribution line occurs within non-nesting and nesting habitat for the burrowing owl. Burrowing owls occupy burrows throughout the year and effects on burrowing owl could occur during any time of year. Although no burrowing owls were observed during the field reconnaissance on April 3 and July 17 2013, burrowing owls could move into the area prior to construction. Habitat is limited to the distribution line and effects on owls would only be anticipated during installation of the distribution line.

Noise and lighting effects resulting from construction/decommissioning (January-March; September-October) and operation activities (April-August) would be the same as those described for the Swainson's hawk. Because high sound levels and ongoing night-time lighting would be present from the onset of potential nesting activity and operations would cease in the fall/winter of 2014, no effects on birds nesting near the TSF pad are expected. However, if construction phase does not start until after the nesting season begins, effects on nesting birds could be adverse if nests are located in or near the project area.

Implementation of the AMMs provided below would reduce the potential for adverse effects on special-status birds. These measures include preconstruction surveys for burrowing owl and, if work does not commence prior to the nesting season, preconstruction surveys for other nesting special-status birds.

Waters of the United States

An assessment for potential waters of the United States was conducted during the August 20, 2012, April 3, and July 17, 2013 field reconnaissance visits. Some of the irrigation ditches within the project area were observed to support a prevalence of hydrophytic vegetation, and some reaches of the irrigation ditches contained flowing or ponded water (Photographs 1 and 2). Water is generally pumped in or out of White Slough or Bishop Cut depending on need to irrigate farmland or to keep the area from flooding. The irrigation ditches within the project area are adjacent (separated by a levee) to White Slough or Bishop Cut, which qualify as waters of the United States. Given that the irrigation ditches support hydrophytic vegetation, are subject to extended inundation and/or saturation, and are adjacent to waters of the United States, the features are considered as potential waters of the United States. The project would not result in any physical disturbance of irrigation ditches or Bishop Cut, and would not result in direct impacts on potential waters of the United States. AMMs have been incorporated into the project to avoid indirect impacts to potential waters of the United States.

A small area (3 feet by 4 feet) south of Eight Mile Road adjacent to the subdivision is hydrated with nuisance water from landscape irrigation. Cattails (*Typha* sp.) and barnyard grass (*Echinochloa crusgalli*), which are both hydrophytic plants, have colonized the area at the interface of the paved road and adjacent soil (Photograph 13). Wetland plants thrive due to continued irrigation run-off. Because of the dominance of hydrophytic vegetation, sufficient hydrology augmented by irrigation, and soil saturation, the area would likely meet the USACE definition of a wetland (per 33 CFR 328.3).

The hydrology that supports this wetland would not likely persist if irrigation ceased. The area is nearly level and water collects at the slight rise in the topography where the pavement meets a gravel road that is perpendicular to the paved shoulder. The area is rehydrated and inundated with reoccurring landscape irrigation. Based on the depth of the ponded area (less than 2 inches), it is likely, during normal precipitation events, the area dries or percolates and would not be hydrated for a sufficient duration to support a prevalence of hydrophytic vegetation, and would revert to upland vegetation. Based on USACE guidance, the feature would not qualify as waters of the United States because the area is artificially irrigated and would likely revert to upland vegetation if irrigation was to cease (U.S. Army Corps of Engineers 2011). However, because this area would be used as an access route access and staging would

be limited to the gravel road and disturbed areas, this area will be avoided and no direct impacts on this feature are expected. Implementation of BMPs and AMMs incorporated into the project would avoid indirect effects on this feature.

One roadside ditch occurs adjacent to the golf course in the eastern portion of the project area. Vegetation in the ditch is dominated by upland and facultative upland plant species including ripgut brome and poison hemlock (Photograph 14). Because the duration of inundation is insufficient to support a dominance of hydrophytic vegetation and the ditch does not exhibit evidence of hydrology that supports long-duration saturation or inundation (e.g., lacks water marks, drift lines, sediment deposits) to support wetland vegetation, the ditch does not qualify as a federal jurisdictional wetland (per 33 CFR 328.3). Additionally, the ditch does not exhibit evidence of scour or sediment deposition, which indicates that it is not subject to frequent or high-velocity flows. It also gradually loses depth, and terminates west and east of the golf course entrance, which is evidence that it is not tributary to waters of the United States or other water body features. Based on lack of wetland hydrology and hydrophytic vegetation, these ditches may collect water during storm events, but water either percolates or evaporates quickly. The ditch is not considered to qualify as waters of the United States because it: (1) is not a natural stream that has been altered; (2) was not excavated in waters of the United States; (3) does not have relatively permanent flowing or standing water; (4) does not connect two or more jurisdictional waters of the United States; and (5) does not drain natural water bodies (including wetlands) into the tributary system of a traditional navigable or interstate water (U.S. Army Corps of Engineers 2011).Although the USFWS National Wetlands Inventory identifies the entire project area as farmed wetlands, the existing access roads, the existing well pad, and the proposed TSF pad do not appear to currently meet wetland criteria. The existing access roads and the existing well pad consist of compacted surfaces that are graded and unvegetated; and do not exhibit evidence of long-duration ponding or saturation, or exhibit other indications of wetland hydrology. The proposed TSF pad expansion area currently supports a leveled and routinely disked agricultural field that is planted with a young walnut orchard. Field inspection of this area did not identify the presence of hydrophytic vegetation or evidence of soil inundation/saturation unrelated to routine irrigation. Based on observation of the water level in ponded portions of the irrigation ditch, the surface of the agricultural field is several feet above the water table. Given the lack of hydrophytic vegetation and an absence of indications of a current wetland hydrology, the existing access roads, the existing well pad, and the TSF pad are not considered to qualify as waters of the United States.

It is important to note that the field assessment did not involve a formal delineation using USACE methodology and no detailed investigations for wetland hydrology were conducted. The entire project area was historically Sacramento–San Joaquin Delta marshland prior to dikes/draining and conversion to agricultural production. Areas of agricultural production that were formerly wetlands may still qualify as jurisdictional wetlands if hydrological characteristics remain to the extent that hydrophytic vegetation would return if the agricultural activities ceased and the levees were breached. All determinations provided in this document concerning waters of the United States should be considered preliminary and tentative unless verified in writing by the USACE.

Other Sensitive Biological Resources

Migratory birds and raptors (i.e., birds of prey) protected under the federal Migratory Bird Treaty Act and California Fish and Game Code may nest on open ground, vegetation, or structures within the project area. Multiple stick nests and mud nests were observed during the field visits. Cliff swallow (*Petrochelidon pyrrhonota*) nests were observed under the Eight Mile Road Bridge over Bishop Cut.

As described for the Swainson's hawk, construction and operation activities could have adverse effects on nesting success for birds nesting near the construction site. Implementation of AMMs provided below would reduce the potential for adverse effects on nesting migratory birds and raptors. If work does not commence prior to the nesting season, preconstruction surveys for nesting birds should be conducted.

The project also occurs within a PG&E designated raptor concentration zone. Birds that perch or build nests on utility poles may become electrocuted if they come in contact with live wires. Raptors and other migratory birds utilize power poles to perch and build nests. As discussed in the project description, the distribution line would be built or retrofitted to avian protection specifications.

Wildlife corridors connect habitat that is separated by human activities. Wildlife corridors are important as they increase available habitat by providing protective passage between suitable habitat. Nursery habitat provides habitat elements necessary to raise young to maturity (e.g., caves, rookeries, wetland, rivers). Bishop Cut provides migratory, spawning, and rearing habitat for several fish species. The project would not occur within Bishop Cut and would not interfere with the movement of any native resident or migratory fish or wildlife species, with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites.

Tree removal required for the project is limited to removal of approximately 90 sapling-sized walnut trees in a portion of a walnut orchard. The walnut orchard is not considered a sensitive biological resource and the tree removal would not require authorization under, or conflict with, a tree ordinance.

The project area occurs within the San Joaquin County Multispecies Habitat Conservation and Open Space Plan (SJMSCP) planning area. The proposed project is not subject to discretionary approval by San Joaquin County, and as such would not conflict with the SJMSCP.

Recommended Avoidance and Minimization Measures:

1. Prior to working on any phase of the project, all workers will be provided with Environmental Awareness Training by a qualified biologist. The training will address the identification and general ecology of giant garter snake, Swainson's hawk, nesting birds and other special-status species that have potential to occur in the project area, and the AMMS to be implemented in order to avoid impacts on these resources. Areas to be avoided will also be addressed in the training. Please contact PG&E project biologist two weeks prior to construction to schedule the training.

2. Prior to construction of any phase of the project, all work areas (e.g., vehicle access, parking, staging) needed to complete the project will be identified in coordination with the monitoring biologist. Due to the presence of sensitive resources, some work areas may need to be adjusted. All work areas will be limited to the minimum area necessary to complete work. Laydown and staging will be limited to the road shoulder or previously developed or disturbed areas along the golf course.

3. Prior to constructing the TSF pad, high visibility fencing will be erected 20 feet beyond the proposed TSF pad to contain personnel and equipment. The Construction Contractor will inspect fencing before the start of each workday and the fencing will be maintained by the Contractor until completion of the project.

4. Because construction of the TSF pad will occur within 200 feet of aquatic habitat for giant garter snake in the irrigation ditch along the gravel access road, exclusionary fencing will be installed along the irrigation ditch on the west side of the road a minimum of 200 feet from the TSF pad in both directions to prohibit snake entry. Exclusionary fencing will be placed during the active period between (May 1 and October 1), so that the fence is erected before snakes move to upland refugia that may occur in the TSF pad. Snake exclusionary fencing will be buried at least six inches below the ground to prevent snakes from attempting to move under the fence. If burrows are present along the ditch, methods to hold the exclusionary fencing flush with the ground (e.g., sand or rock bags, pins) will be employed as appropriate to avoid damage to burrows. The fencing will not contain any holes along the ground large enough for snakes to enter the construction site. Fencing can be as high as 12 to 24 inches above ground.

5. Due to the temporary nature of pole installation along the irrigation ditches along the gravel access road and Eight Mile Road, and near the golf course ponds, exclusionary fencing is not required for the distribution line. However, a biological monitor will be present during all distribution line activities conducted within 200 feet of GGS aquatic habitat (i.e., irrigation ditches and golf course ponds). PG&E proposes to construct the section of distribution line located along the irrigation ditch near the TSF pad during the GGS active period.

6. To ensure that wildlife does not become trapped or entangled, no wattles or other materials with plastic monofilament netting are permitted. Burlap or coconut wattles are appropriate substitutes.

7. If practicable, ground disturbing activity (e.g. vegetation removal, compaction, placement of gravel fill, new pole placement) will be conducted during the active season for giant garter snake (i.e., between May 1 and October 1). If ground-disturbing activity cannot be conducted during the active season, preconstruction surveys for potential wintering sites (e.g., burrows and soils crevices) within proposed disturbance areas will be conducted by a qualified biologist approved by the USFWS and CDFW. The preconstruction survey will be conducted no more than two weeks prior to construction activities. All burrows or potential refuge habitat will be flagged and avoided. If work is suspended for a period of five days or greater, than the project area must be resurveyed for giant garter snake. If it is determined that potential giant garter snake wintering habitat (e.g., burrows and crevices) is present within areas planned for ground disturbance, ground-disturbing activities will be postponed until the giant garter snake active season (i.e., between May 1 and October 1).

8. A biological monitor approved by the USFWS and CDFW will be on site during all phases of construction to direct traffic and construction work around irrigation ditches and other sensitive habitats capable of supporting giant garter snake. Full-time monitoring will be employed during construction activities that require increase vehicle traffic and ground disturbance (i.e., TSF pad construction, distribution line development, access road maintenance, and mobilization/demobilization to escort large equipment). Part-time monitoring (1-2 days per week) will be employed during project activities limited to the well pad with limited traffic (i.e., well drilling and compression testing). The purpose of the part time monitor is to ensure that AMMs are in place and to meet the crews monitoring needs. The purpose of the part time monitor is to ensure that AMMs are in place and to meet the crews monitoring needs (e.g., access road maintenance monitoring, environmental awareness training for new crew members, mobilization/demobilization of large equipment or other unforeseeable need for a monitor). The

biological monitor will coordinate closely with construction personnel to ensure monitors are present during key construction activities.

9. If any giant garter snakes are observed within the project area during work activities, work will cease and the on-site project manager will immediately contact the PG&E project biologist subsequently the USFWS and CDFW will be contacted before work proceeds. The biological monitor has the authority to stop construction to resolve any biological concerns.

10. Access to the TSF pad and distribution line will be confined to existing roads, road shoulders, and other compacted areas. Travel along roads will be restricted to the centerline. If placement of gravel or grading on access roads is necessary, the placement will be limited to the existing road surface. No gravel will be placed on ditch banks or other areas that may support burrows that could be used by giant garter snake. No grading will occur along segments of existing roads that may support burrows that could be used by giant garter snake.

11. The irrigation ditches, golf course ponds, and Bishop Cut will be designated as environmentally sensitive areas and physical disturbance to these features will be avoided during construction.

12. A qualified biologist approved by USFWS and CDFW will perform a general pre-construction survey for special-status species and other wildlife within 72 hours of the start of project construction.

13. Portable lighting would only be used during construction when absolutely necessary for worker safety, or as necessary to accomplish critical construction equipment maintenance or time-critical continuous process tasks that extend into nighttime hours. When in operation the temporary flood lighting will be directed towards the work area to minimize illumination of areas beyond the immediate work areas, and minimize reflected glare and illumination of the nighttime sky to the maximum extent practicable. When not in immediate use the temporary floodlights will be directed downward or turned off.

14. Reduce construction night lighting on sensitive habitats. Exterior lighting within the project area adjacent to preserved habitat will be of the lowest illumination allowed for human safety, selectively placed, shielded, and directed away from sensitive habitat to the maximum extent practicable.

15. Provide escape ramps at a 45 degree angle or less for any excavations that are greater than one foot that are left open overnight. For smaller holes, cover so that no gaps occur and inspect each morning for wildlife. Inspect prior to filling any trenches or holes. If wildlife becomes entrapped, work will stop and the PG&E project biologist will be notified immediately to determine next steps.

16. Prior to moving parked vehicles or equipment, construction personnel will visually check for snakes and other wildlife.

17. Ground disturbance and vegetation removal will be limited to the minimum amount necessary to complete work.

18. If a plant or animal is found at the work site and is believed to be a protected species, work must STOP and a biological monitor must be contacted for guidance. Care will be taken not to harm the plant or animal species. No wildlife or plant species will be handled and/or removed from the site by anyone except qualified biologists.

19. Construction equipment will be maintained to prevent leaks of fuels, lubricants or other pollutants into aquatic habitats.

20. Whenever possible, refueling and maintenance of vehicles will occur offsite. In cases when this is not practicable, refueling and maintenance of vehicles and equipment will be conducted over drip pans and at least 100 feet from any waterway.

21. Open ends of pipes, conduits or other materials stored onsite will be covered to exclude wildlife and will be inspected prior to use.

22. Vehicular speed within the project area will be limited to 10 miles per hour in order avoid impacts on wildlife that may be located on or near roadways. If ground disturbing activities, addition of gravel to roads, or movement of large equipment (May 1–October 1), a biological monitor will drive in front of heavy construction vehicles (e.g., dump trucks, drill rigs) on all gravel roads during entry/exit of project site. Biologist will lead vehicles at a speed of 10 mph or less, watch for signs of snakes, and stop and investigate the road if there are any concerns.

23. Watering of roads during dry season work will be performed as necessary in order to reduce potential dust resulting from project associated traffic.

24. All potential nesting substrate (e.g., shrubs and trees) that requires removal to construct the project should be removed before the onset of the nesting season (i.e., prior to February 15), if practicable. This will help preclude nesting and substantially decrease the likelihood of direct impacts on nesting birds. If this is not feasible then a nesting bird survey of potential nesting substrate will be performed 72 hours prior to its removal.

25. Surveys for nesting birds will be required if project construction is to occur during the nesting season. Surveys will be conducted by a qualified biologist approved by USFWS and CDFW.

    Surveys for Swainson's hawk will be conducted within a 0.5-mile radius between March 1 and September 15, and follow guidance provided by the Swainson's Hawk Technical Advisory Committee (see Appendix E).

    Surveys for burrowing owl within suitable habitat will be conducted within 72 hours of the start of construction.

    Surveys for other nesting birds will consist of performing an initial survey after February 15, 2013 or within a month of the start of project date if project is to begin later in the nesting bird season. A second nesting bird survey will be performed within 72 hours of the start of construction. Surveys will be completed within a 250-foot buffer of the project area. The surveys will be repeated if work is suspended for five days or more. Please contact PG&E project biologist two weeks prior to construction schedule surveys.

26. Caution will be used when handling and/or storing chemicals (fuel, hydraulic fluid, etc.). As part of standard PG&E Best Management Practices (BMPs), crews will have appropriate materials on site to provide secondary containment and prevent and manage spills. If groundwater is encountered, contact the PG&E Environmental Specialist.

27. Crews will implement all BMPs outlined in the project's NPDES Construction Storm Water Pollution Prevention Plan.

28. If the scope of work or project location changes, contact PG&E project biologist prior to commencing work. The PG&E project biologist or Land Planner will contact the USFWS Bay-Delta Fish & Wildlife Office ESA/Regulatory Division and the Dept. of Fish & Wildlife - Bay Delta Region upon notice of any such changes.

29. Remove construction related trash from the site daily and upon work completion and return site to near pre-construction contours and conditions upon project completion.

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Representative Photographs
Photographs taken on August 20, 2012 and April 3, 2013



Photograph 1. Irrigation ditch south of TSF pad. Photograph taken August 20, 2012.



Photograph 2. Irrigation ditch near the TSF pad. Photograph taken April 3, 2013.



Photograph 3. Walnut orchard adjacent to TSF pad. Photograph taken August 20, 2012.



Photograph 4. TSF pad and access road. Photograph taken April 3, 2013.



Photograph 5. Existing core drilling pad. Photograph taken April 3, 2013.



Photograph 6. King Island Road looking south. Bishop Cut is on the left. Photograph taken August 20, 2012.



Photograph 7. Western pull location and work area at the intersection of King Island Road and Eight Mile Road. Photograph taken April 3, 2013.



Photograph 8. Irrigation ditch and drainage located at the western pull location and work area at the intersection of King Island Road and Eight Mile Road. Photograph taken April 3, 2013.



Photograph 9. Bishop Cut at Eight Mile Road Bridge. Swallow nests are present under the bridge. Photograph taken April 3, 2013.



Photograph 10. Eastern pull location and work area at the intersection of King Island Road and Eight Mile Road. Photograph taken April 3, 2013.



Photograph 11. Representative intermittent irrigation ditch. Ditch located in the eastern pull location work area. Photograph taken April 3, 2013.



Photograph 12. Ruderal area between the PG&E Eight Mile Road Substation and the golf course in the eastern portion of the project area. Photograph taken April 3, 2013.



Photograph 13. Small wetland area created by nuisance irrigation water. Wetland would not likely qualify as waters of the United States. Photograph taken July 17, 2013.



Photograph 14. Annual grassland located at the golf course entrance. Roadside ditch (beneath vegetation, red arrow) does not qualify as a waters of the United States. Photograph taken April 3, 2013.



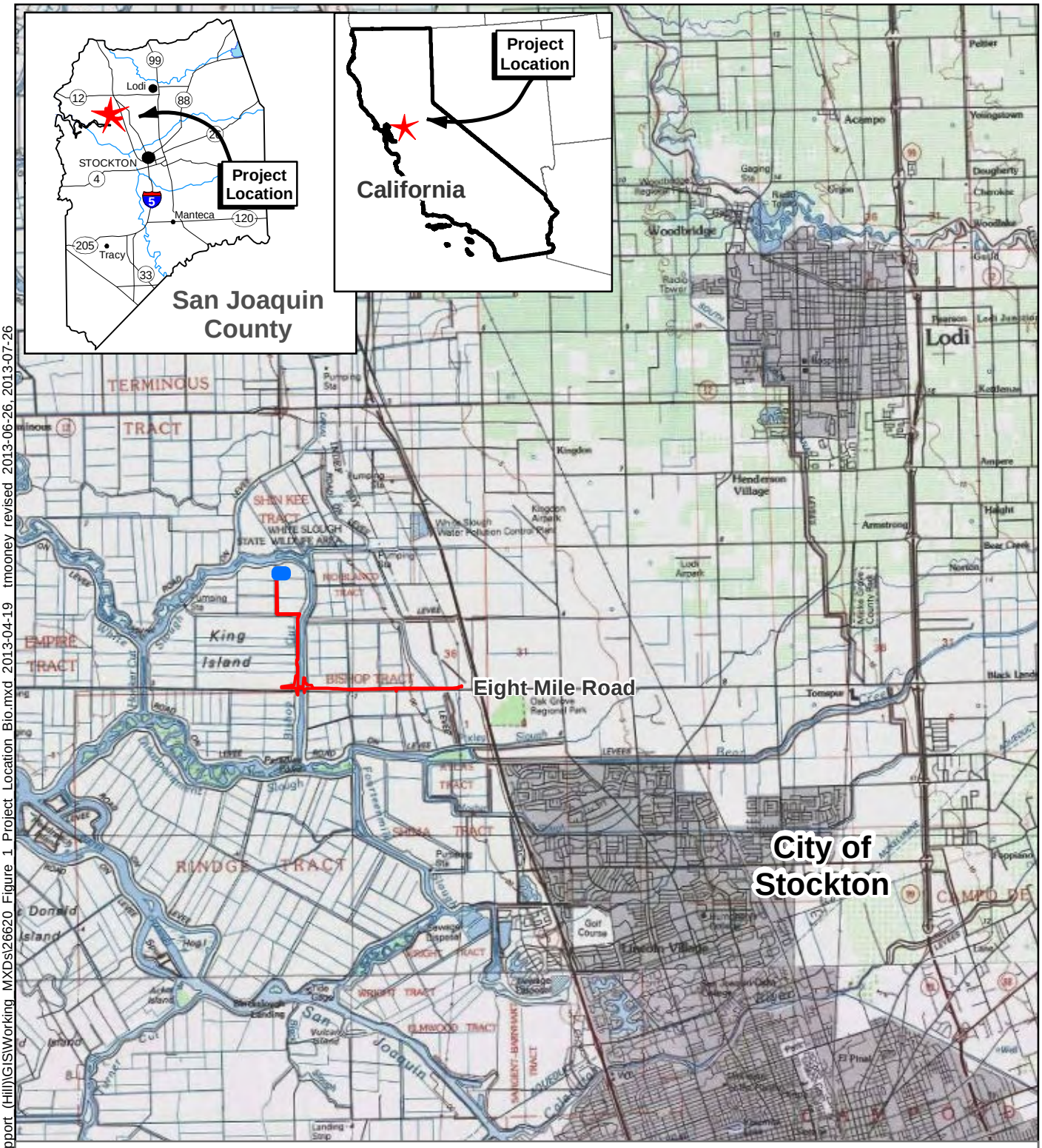
Photograph 15. Representative pond and berm on the golf course adjacent to the distribution corridor in the eastern portion of the project area. Photograph taken April 3, 2013.



Photograph 16. Representative irrigation ditch in the eastern portion of the project area along Eight Mile Road. Photograph taken April 3, 2013.

APPENDIX A

Figures



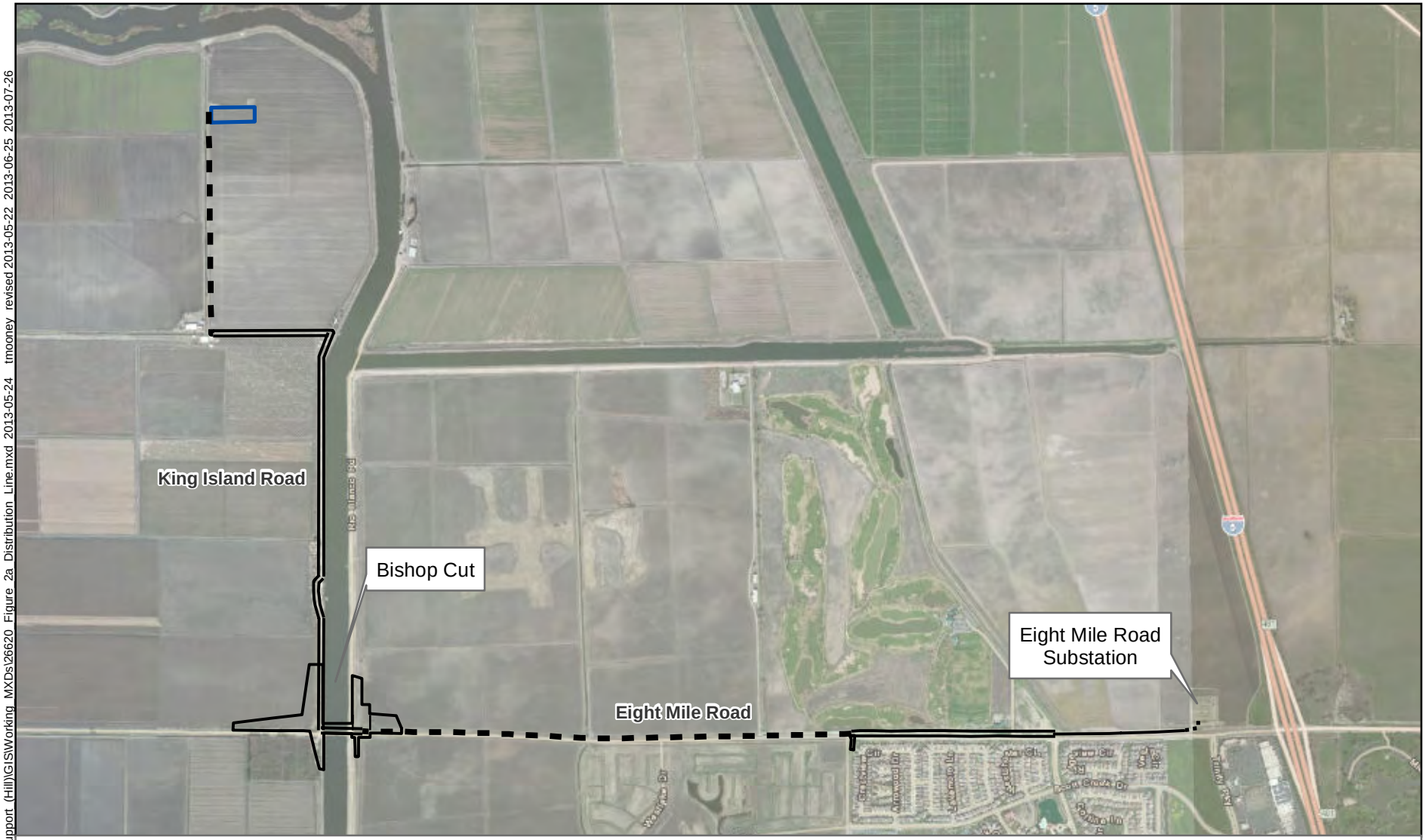
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USGS 7.5 Quad:
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PG&E CAES Project - King Island

Figure 1
Project Location

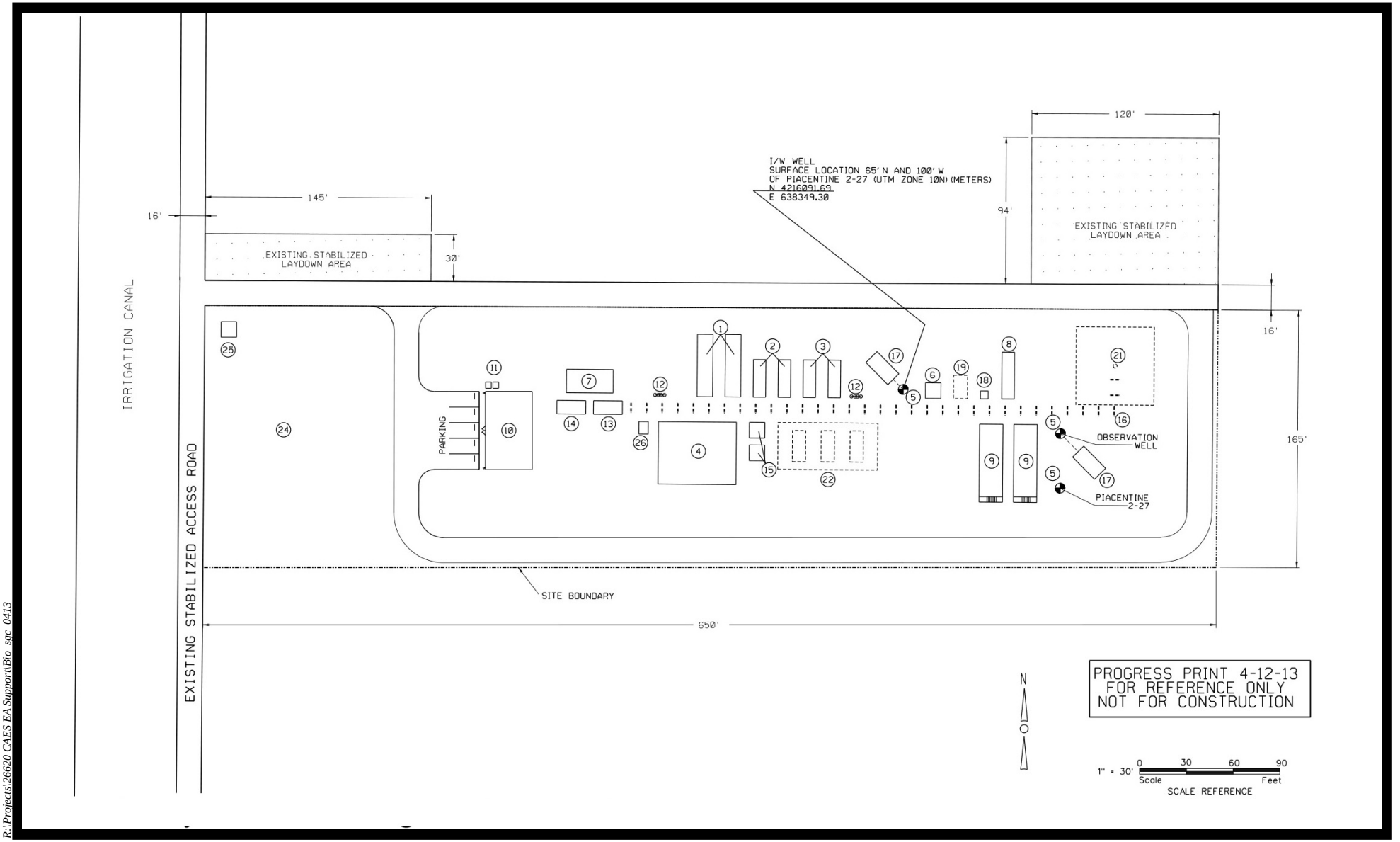


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PG&E CAES Project - King Island

Figure 2a
Distribution Line



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Figure 2b
Site Layout

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Gravel Access Road

White Slough

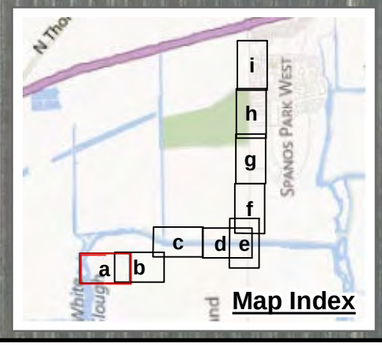
Study Area
Distribution Line
TSF Facility
Existing Well Pad
Culvert

Potential Waters of the U.S.
Irrigation Ditch
Perennial Stream

Vegetation Communities
Annual Grassland
Fresh Emergent Wetland
Orchard/Cropland
Riverine
Ruderal

200 0 200
Feet

N



Map Index

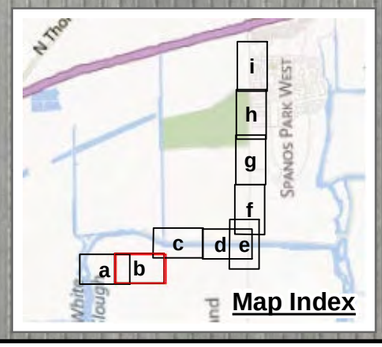
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PG&E CAES Project - King Island

Figure 3a
Survey Results
July 26, 2013

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Gravel Access Road



Study Area
Distribution Line
TSF Facility
Existing Well Pad
Culvert

Potential Waters of the U.S.
Irrigation Ditch
Perennial Stream

Vegetation Communities
Annual Grassland
Fresh Emergent Wetland
Orchard/Cropland
Riverine
Ruderal

200 0 200
Feet

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North State Resources, Inc.

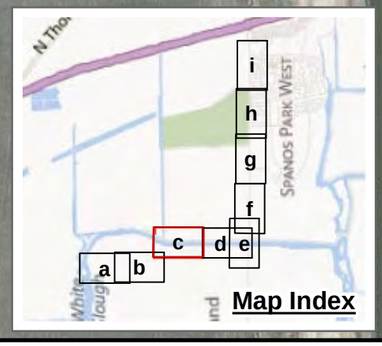
PG&E CAES Project - King Island

Figure 3b
Survey Results
July 26, 2013

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King Island Road

Bishop Cut



Study Area
Distribution Line
TSF Facility
Existing Well Pad
Culvert

Potential Waters of the U.S.
Irrigation Ditch
Perennial Stream

Vegetation Communities
Annual Grassland
Fresh Emergent Wetland
Orchard/Cropland
Riverine
Ruderal

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Feet

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North State Resources, Inc.

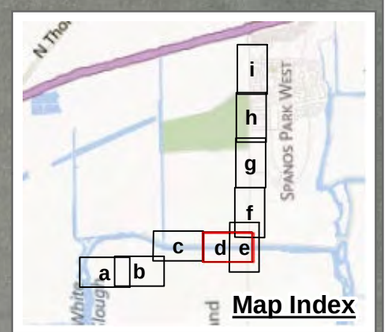
PG&E CAES Project - King Island

Figure 3c
Survey Results
July 26, 2013

King Island Road

Bishop Cut

Eight Mile Road



Study Area
Distribution Line
TSF Facility
Existing Well Pad
Culvert

Potential Waters of the U.S.
Irrigation Ditch
Perennial Stream

Vegetation Communities
Annual Grassland
Fresh Emergent Wetland
Orchard/Cropland
Riverine
Ruderal

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Feet

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PG&E CAES Project - King Island

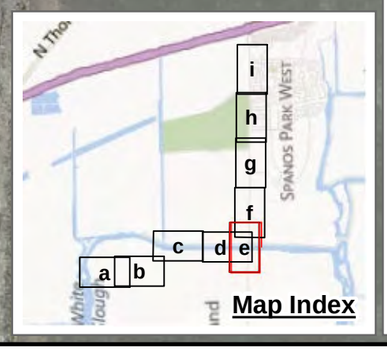
Figure 3d
Survey Results
July 26, 2013

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King Island Road

Eight Mile Road

Bishop Cut



Study Area
Distribution Line
TSF Facility
Existing Well Pad
Culvert

Potential Waters of the U.S.
Irrigation Ditch
Perennial Stream

Vegetation Communities
Annual Grassland
Fresh Emergent Wetland
Orchard/Cropland
Riverine
Ruderal

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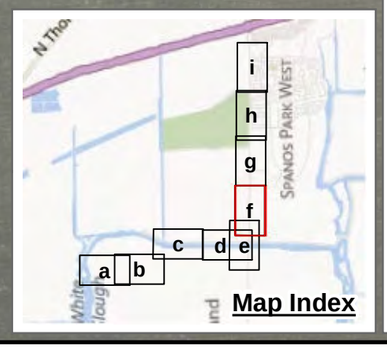
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PG&E CAES Project - King Island

Figure 3e
Survey Results
July 26, 2013

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Eight Mile Road



Study Area
Distribution Line
TSF Facility
Existing Well Pad
Culvert

Potential Waters of the U.S.
Irrigation Ditch
Perennial Stream

Vegetation Communities
Annual Grassland
Fresh Emergent Wetland
Orchard/Cropland
Riverine
Ruderal

200 0 200
Feet

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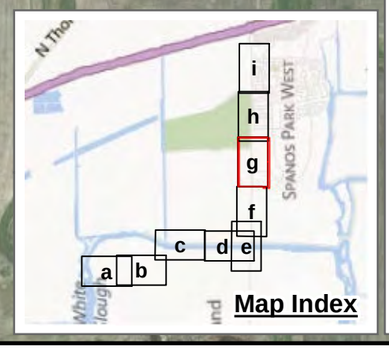
North State Resources, Inc.

PG&E CAES Project - King Island

Figure 3f
Survey Results
July 26, 2013

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Eight Mile Road



Study Area
Distribution Line
TSF Facility
Existing Well Pad
Culvert

Potential Waters of the U.S.
Irrigation Ditch
Perennial Stream

Vegetation Communities
Annual Grassland
Fresh Emergent Wetland
Orchard/Cropland
Riverine
Ruderal

200 0 200
Feet

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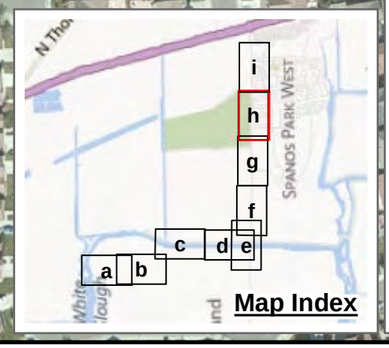
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PG&E CAES Project - King Island

Figure 3g
Survey Results
July 26, 2013

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Eight Mile Road



Study Area
Distribution Line
TSF Facility
Existing Well Pad
Culvert

Potential Waters of the U.S.
Irrigation Ditch
Perennial Stream

Vegetation Communities
Annual Grassland
Fresh Emergent Wetland
Orchard/Cropland
Riverine
Ruderal

200 0 200
Feet
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North State Resources, Inc.

PG&E CAES Project - King Island

Figure 3h
Survey Results
July 26, 2013

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PG&E Eight Mile Substation

Eight Mile Road

Map Index

Study Area
Distribution Line
TSF Facility
Existing Well Pad
Culvert

Potential Waters of the U.S.
Irrigation Ditch
Perennial Stream

Vegetation Communities
Annual Grassland
Fresh Emergent Wetland
Orchard/Cropland
Riverine
Ruderal

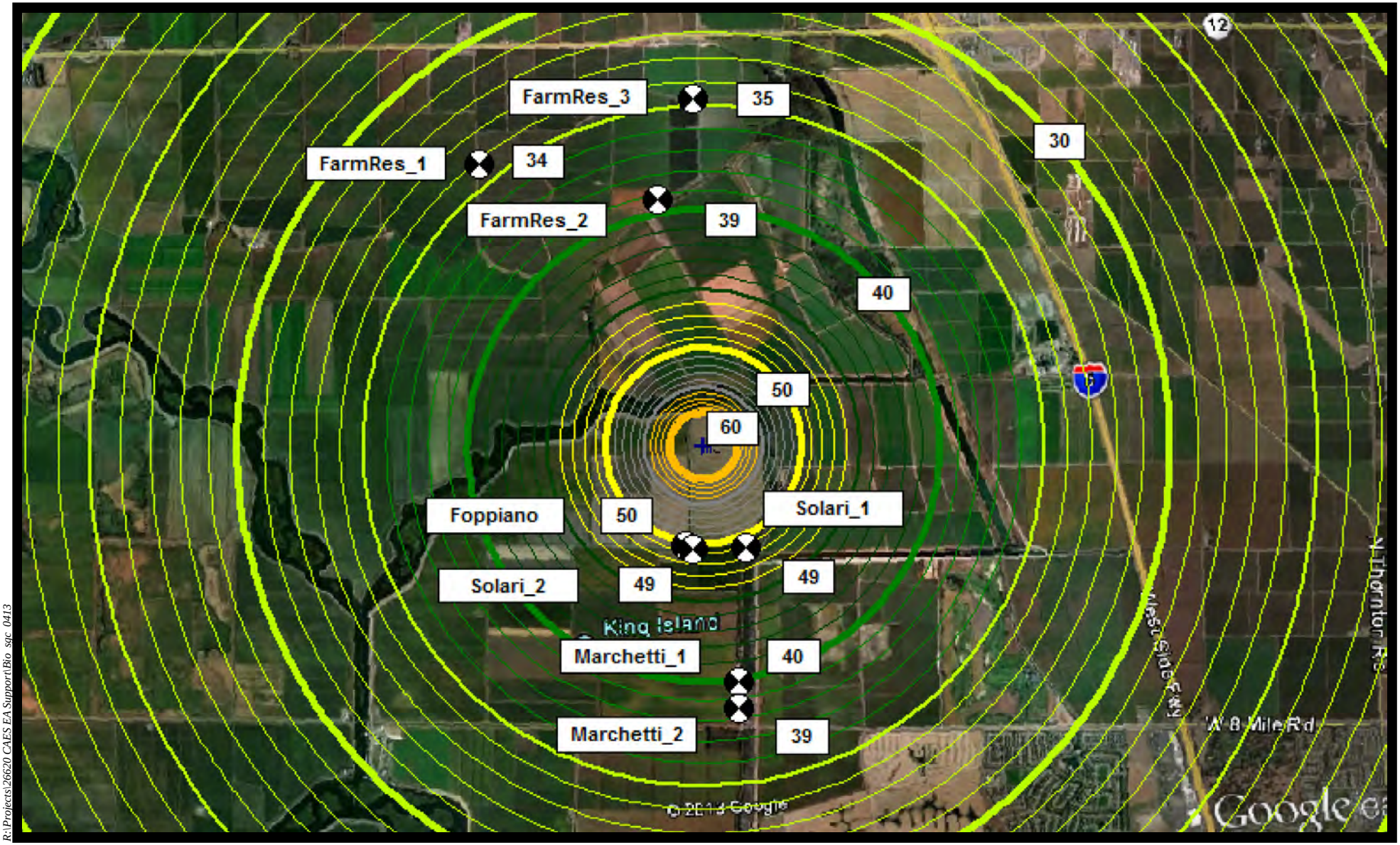
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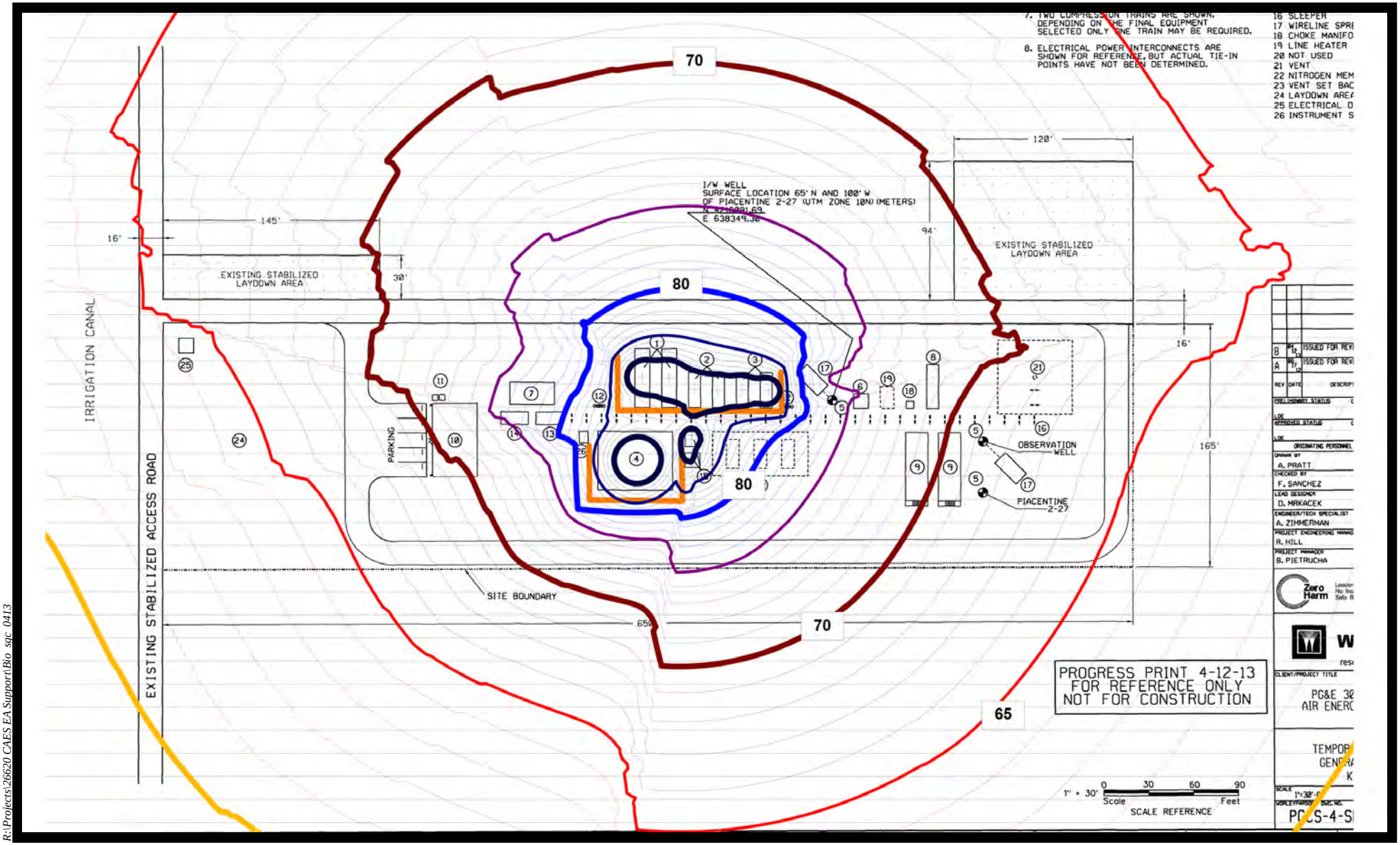
PG&E CAES Project - King Island

Figure 3i
Survey Results
July 26, 2013



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Figure 4a
Noise Contours with Mitigation



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Figure 4b
Noise Contours at TSF Pad with Mitigation

APPENDIX B

USFWS, CNDDB, and CNPS Queries

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825

April 19, 2013

Document Number: 130419063611

Heather L. Kelly
North State Resources
5000 Bechelli Lane Ste 203
Redding, ca 96002

Subject: Species List for CAES Project

Dear: Ms. Kelly

We are sending this official species list in response to your April 19, 2013 request for information about endangered and threatened species. The list covers the California counties and/or U.S. Geological Survey 7½ minute quad or quads you requested.

Our database was developed primarily to assist Federal agencies that are consulting with us. Therefore, our lists include all of the sensitive species that have been found in a certain area *and also ones that may be affected by projects in the area*. For example, a fish may be on the list for a quad if it lives somewhere downstream from that quad. Birds are included even if they only migrate through an area. In other words, we include all of the species we want people to consider when they do something that affects the environment.

Please read Important Information About Your Species List (below). It explains how we made the list and describes your responsibilities under the Endangered Species Act.

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be July 18, 2013.

Please contact us if your project may affect endangered or threatened species or if you have any questions about the attached list or your responsibilities under the Endangered Species Act. A list of Endangered Species Program contacts can be found here.

Endangered Species Division

TAKE PRIDE IN AMERICA

U.S. Fish & Wildlife Service

Sacramento Fish & Wildlife Office

Federal Endangered and Threatened Species that Occur in or may be Affected by Projects in the Counties and/or U.S.G.S. 7 1/2 Minute Quads you requested

Document Number: 130419063611

Database Last Updated: September 18, 2011

Quad Lists

Listed Species

Invertebrates

Branchinecta lynchi
vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus
valley elderberry longhorn beetle (T)

Lepidurus packardi
vernal pool tadpole shrimp (E)

Fish

Acipenser medirostris
green sturgeon (T) (NMFS)

Hypomesus transpacificus
Critical habitat, delta smelt (X)
delta smelt (T)

Oncorhynchus mykiss
Central Valley steelhead (T) (NMFS)
Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha
Central Valley spring-run chinook salmon (T) (NMFS)
winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Ambystoma californiense
California tiger salamander, central population (T)

Rana draytonii
California red-legged frog (T)

Reptiles

Thamnophis gigas
giant garter snake (T)

Mammals

Sylvilagus bachmani riparius
riparian brush rabbit (E)

Quads Containing Listed, Proposed or Candidate Species:

TERMINOUS (479C)

County Lists

No county species lists requested.

Key:

(E) *Endangered* - Listed as being in danger of extinction.

(T) *Threatened* - Listed as likely to become endangered within the foreseeable future.

(T) *Threatened* - Listed as likely to become endangered within the foreseeable future.
(P) *Proposed* - Officially proposed in the Federal Register for listing as endangered or threatened.
(NMFS) Species under the Jurisdiction of the National Oceanic & Atmospheric Administration Fisheries Service. Consult with them directly about these species.
Critical Habitat - Area essential to the conservation of a species.
(PX) *Proposed Critical Habitat* - The species is already listed. Critical habitat is being proposed for it.
(C) *Candidate* - Candidate to become a proposed species.
(V) Vacated by a court order. Not currently in effect. Being reviewed by the Service.
(X) *Critical Habitat* designated for this species

Important Information About Your Species List

How We Make Species Lists

We store information about endangered and threatened species lists by U.S. Geological Survey 7½ minute quads. The United States is divided into these quads, which are about the size of San Francisco.

The animals on your species list are ones that occur within, **or may be affected by** projects within, the quads covered by the list.

- Fish and other aquatic species appear on your list if they are in the same watershed as your quad or if water use in your quad might affect them.
- Amphibians will be on the list for a quad or county if pesticides applied in that area may be carried to their habitat by air currents.
- Birds are shown regardless of whether they are resident or migratory. Relevant birds on the county list should be considered regardless of whether they appear on a quad list.

Plants

Any plants on your list are ones that have actually been observed in the area covered by the list. Plants may exist in an area without ever having been detected there. You can find out what's in the surrounding quads through the California Native Plant Society's online Inventory of Rare and Endangered Plants.

Surveying

Some of the species on your list may not be affected by your project. A trained biologist and/or botanist, familiar with the habitat requirements of the species on your list, should determine whether they or habitats suitable for them may be affected by your project. We recommend that your surveys include any proposed and candidate species on your list. See our Protocol and Recovery Permits pages.

For plant surveys, we recommend using the Guidelines for Conducting and Reporting Botanical Inventories. The results of your surveys should be published in any environmental documents prepared for your project.

Your Responsibilities Under the Endangered Species Act

All animals identified as listed above are fully protected under the Endangered Species Act of 1973, as amended. Section 9 of the Act and its implementing regulations prohibit the take of a federally listed wildlife species. Take is defined by the Act as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" any such animal.

> Take may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or shelter (50 CFR §17.3).

Take incidental to an otherwise lawful activity may be authorized by one of two procedures:

- If a Federal agency is involved with the permitting, funding, or carrying out of a project that may result in take, then that agency must engage in a formal consultation with the Service.

  During formal consultation, the Federal agency, the applicant and the Service work together to avoid or minimize the impact on listed species and their habitat. Such consultation would result in a biological opinion by the Service addressing the anticipated effect of the project on listed and proposed species. The opinion may authorize a limited level of incidental take.

- If no Federal agency is involved with the project, and federally listed species may be taken as part of the project, then you, the applicant, should apply for an incidental take permit. The Service may issue such a permit if you submit a satisfactory conservation plan for the species that would be affected by your project.

  Should your survey determine that federally listed or proposed species occur in the area and are likely to be affected by the project, we recommend that you work with this office and the California Department of Fish and Game to develop a plan that minimizes the project's direct and indirect impacts to listed species and compensates for project-related loss of habitat. You should include the plan in any environmental documents you file.

Critical Habitat

When a species is listed as endangered or threatened, areas of habitat considered essential to its conservation may be designated as critical habitat. These areas may require special management considerations or protection. They provide needed space for growth and normal behavior; food, water, air, light, other nutritional or physiological requirements; cover or shelter; and sites for breeding, reproduction, rearing of offspring, germination or seed dispersal.

Although critical habitat may be designated on private or State lands, activities on these lands are not restricted unless there is Federal involvement in the activities or direct harm to listed wildlife.

If any species has proposed or designated critical habitat within a quad, there will be a separate line for this on the species list. Boundary descriptions of the critical habitat may be found in the Federal Register. The information is also reprinted in the Code of Federal Regulations (50 CFR 17.95). See our Map Room page.

Candidate Species

We recommend that you address impacts to candidate species. We put plants and animals on our candidate list when we have enough scientific information to eventually propose them for listing as threatened or endangered. By considering these species early in your planning process you may be able to avoid the problems that could develop if one of these candidates was listed before the end of your project.

Species of Concern

The Sacramento Fish & Wildlife Office no longer maintains a list of species of concern. However, various other agencies and organizations maintain lists of at-risk species. These lists provide essential information for land management planning and conservation efforts. More info

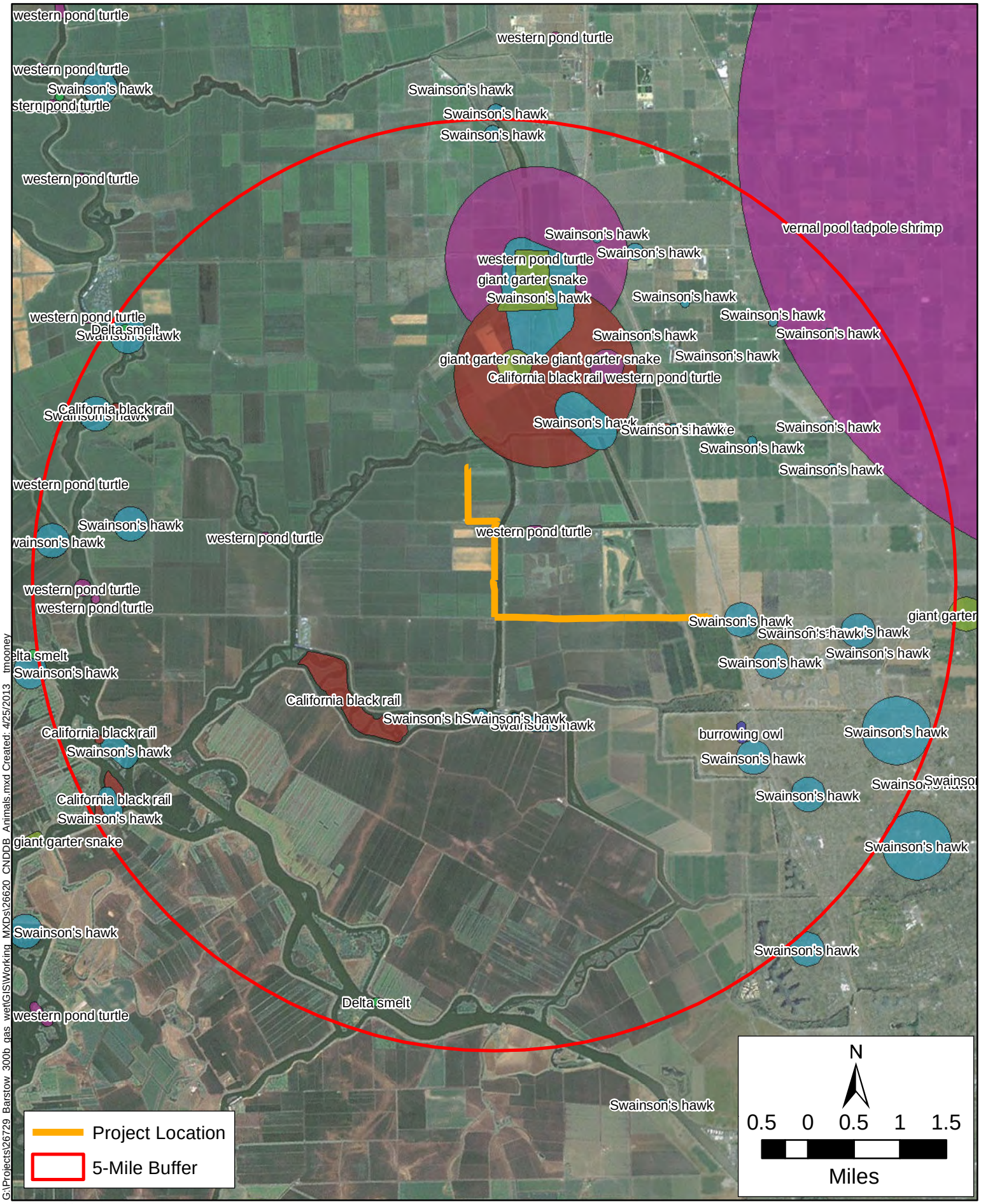
Wetlands

If your project will impact wetlands, riparian habitat, or other jurisdictional waters as defined by section 404 of the Clean Water Act and/or section 10 of the Rivers and Harbors Act, you will need to obtain a permit from the U.S. Army Corps of Engineers. Impacts to wetland

habitats require site specific mitigation and monitoring. For questions regarding wetlands, please contact Mark Littlefield of this office at (916) 414-6520.

Updates

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be July 18, 2013.

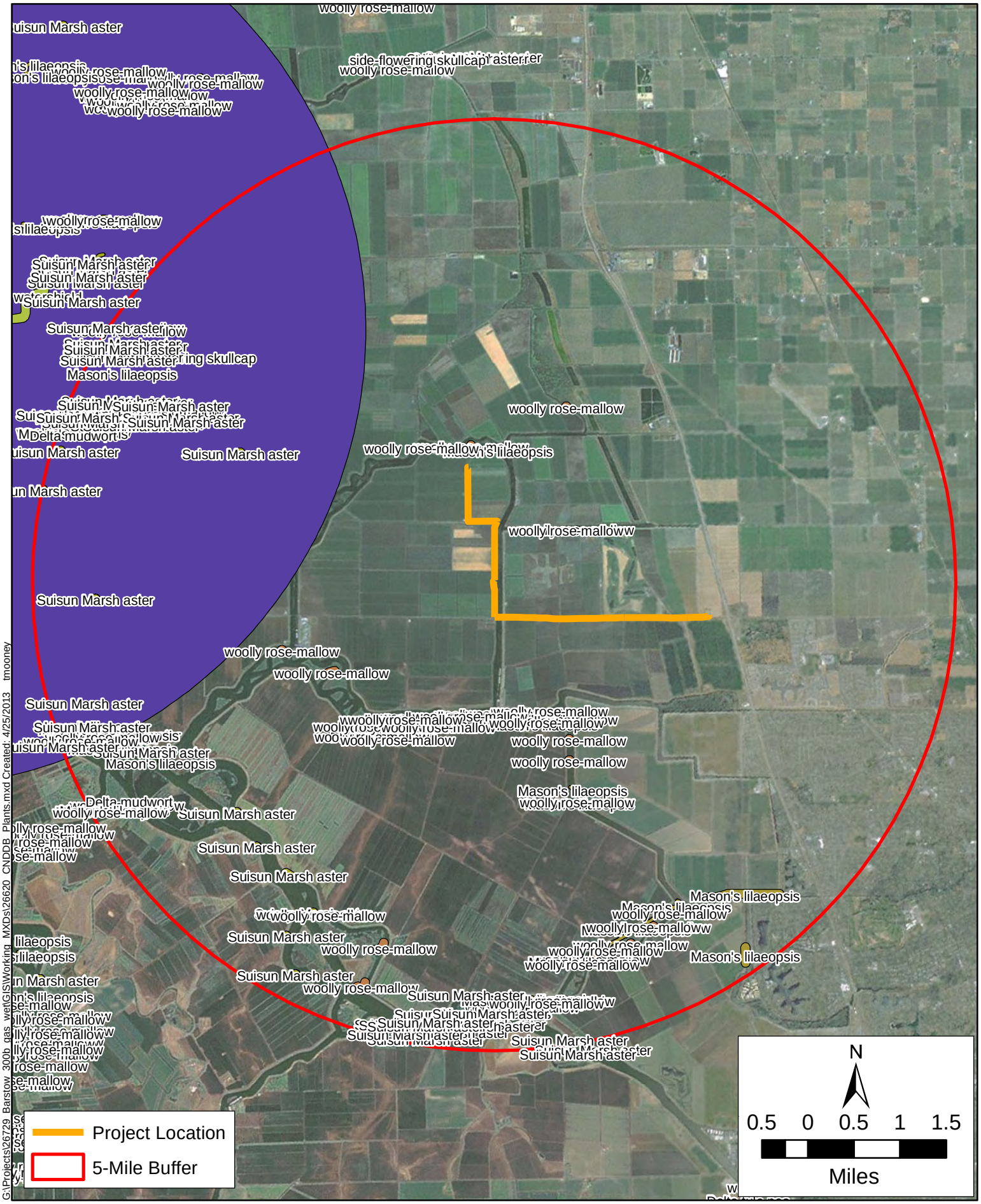


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North State Resources, Inc.

CAES PDEA - King Island

Animal CNDDB Results



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North State Resources, Inc.

CAES PDEA - King Island

Plants CNDDB Results

CNDDB 5-Mile Radius, April 23, 2013

SNAME	CNAME	FEDLIST	CALLIST	RPLANTRANK
Athene cunicularia	**burrowing owl**	None	**None**	
Buteo swainsoni	**Swainson's hawk**	None	**Threatened**	
Elanus leucurus	**white-tailed kite**	None	**None**	
Emys marmorata	**western pond turtle**	None	**None**	
Hibiscus lasiocarpos var. occidentalis	**woolly rose-mallow**	None	**None**	1B.2
Hypomesus transpacificus	**Delta smelt**	Threatened	**Endangered**	
Laterallus jamaicensis coturniculus	**California black rail**	None	**Threatened**	
Lathyrus jepsonii var. jepsonii	**Delta tule pea**	None	**None**	1B.2
Lepidurus packardi	**vernal pool tadpole shrimp**	Endangered	**None**	
Lilaeopsis masonii	**Mason's lilaeopsis**	None	**Rare**	1B.1
Limosella australis	**Delta mudwort**	None	**None**	2.1
Scutellaria lateriflora	**side-flowering skullcap**	None	**None**	2.2
Symphyotrichum lentum	**Suisun Marsh aster**	None	**None**	1B.2
Thamnophis gigas	**giant garter snake**	Threatened	**Threatened**	
Grand Total				

CNPS Inventory of Rare and Endangered Plants

Status: Plant Press Manager window with 25 items - Fri, Apr. 19, 2013 20:46 ET c

Reformat list as: Standard List - with Plant Press controls

ECOLOGICAL REPORT

scientific	family	life form	blooming	communities	elevation	CNPS
Astragalus tener var. tener	Fabaceae	annual herb	Mar-Jun	•Playas (Plyas) •Valley and foothill grassland (VFGrs) (adobe clay) •Vernal pools (VnPls)/alkaline	1 - 60 meters	List 1B.2
Atriplex cordulata var. cordulata	Chenopodiaceae	annual herb	Apr-Oct	•Chenopod scrub (ChScr) •Meadows and seeps (Medws) •Valley and foothill grassland (VFGrs) (sandy)/saline or alkaline	0 - 560 meters	List 1B.2
Atriplex joaquinana	Chenopodiaceae	annual herb	Apr-Oct	•Chenopod scrub (ChScr) •Meadows and seeps (Medws) •Playas (Plyas) •Valley and foothill grassland (VFGrs)/alkaline	1 - 835 meters	List 1B.2
Blepharizonia plumosa	Asteraceae	annual herb	Jul-Oct	•Valley and foothill grassland (VFGrs)/Usually clay.	30 - 505 meters	List 1B.1
Brasenia schreberi	Cabombaceae	perennial rhizomatous herb aquatic	Jun-Sep	•Marshes and swamps (MshSw)/freshwater	30 - 2200 meters	List 2.3
California macrophylla	Geraniaceae	annual herb	Mar-May	•Cismontane woodland (CmWld) •Valley and foothill grassland (VFGrs)/clay	15 - 1200 meters	List 1B.1
Carex comosa	Cyperaceae	perennial rhizomatous herb	May-Sep	•Coastal prairie (CoPrr) •Marshes and swamps (MshSw) (lake margins) •Valley and foothill grassland (VFGrs)	0 - 625 meters	List 2.1
Chloropyron palmatum	Orobanchaceae	annual herb hemiparasitic	May-Oct	•Chenopod scrub (ChScr) •Valley and foothill grassland (VFGrs)/alkaline	5 - 155 meters	List 1B.1
Cirsium	Asteraceae	annual/perennial	May-Aug	•Chenopod scrub (ChScr) •Marshes and	3 - 100	List

crassicaule	Asteraceae	herb	May-Aug	swamps (MshSw) (sloughs) •Riparian scrub (RpScr)	meters	1B.1
Delphinium recurvatum	Ranunculaceae	perennial herb	Mar-Jun	•Chenopod scrub (ChScr) •Cismontane woodland (CmWld) •Valley and foothill grassland (VFGrs)/alkaline	3 - 790 meters	List 1B.2
Downingia pusilla	Campanulaceae	annual herb	Mar-May	•Valley and foothill grassland (VFGrs) (mesic) •Vernal pools (VnPls)	1 - 445 meters	List 2.2
Eryngium racemosum	Apiaceae	annual/perennial herb	Jun-Oct	•Riparian scrub (RpScr)(vernally mesic clay depressions)	3 - 30 meters	List 1B.1
Eschscholzia rhombipetala	Papaveraceae	annual herb	Mar-Apr	•Valley and foothill grassland (VFGrs) (alkaline, clay)	0 - 975 meters	List 1B.1
Gratiola heterosepala	Plantaginaceae	annual herb	Apr-Aug	•Marshes and swamps (MshSw) (lake margins) •Vernal pools (VnPls)/clay	10 - 2375 meters	List 1B.2
Hibiscus lasiocarpos var. occidentalis	Malvaceae	perennial rhizomatous herb emergent	Jun-Sep	•Marshes and swamps (MshSw) (freshwater)	0 - 120 meters	List 1B.2
Lathyrus jepsonii var. jepsonii	Fabaceae	perennial herb	May-Jul(Sep), Months in parentheses are uncommon.	•Marshes and swamps (MshSw) (freshwater and brackish)	0 - 4 meters	List 1B.2
Lilaeopsis masonii	Apiaceae	perennial rhizomatous herb	Apr-Nov	•Marshes and swamps (MshSw) (brackish or freshwater) •Riparian scrub (RpScr)	0 - 10 meters	List 1B.1
Limosella australis	Scrophulariaceae	perennial stoloniferous herb	May-Aug	•Marshes and swamps (MshSw) (freshwater or brackish) •Riparian scrub (RpScr)/Usually mud banks	0 - 3 meters	List 2.1
Madia radiata	Asteraceae	annual herb	Mar-May	•Cismontane woodland (CmWld) •Valley and foothill grassland (VFGrs)	25 - 1215 meters	List 1B.1
Sagittaria sanfordii	Alismataceae	perennial rhizomatous herb emergent	May-Oct	•Marshes and swamps (MshSw) (assorted shallow freshwater)	0 - 650 meters	List 1B.2

				freshwater)		
Scutellaria galericulata	Lamiaceae	perennial rhizomatous herb	Jun-Sep	•Lower montane coniferous forest (LCFrs) •Meadows and seeps (Medws) (mesic) •Marshes and swamps (MshSw)	0 - 2100 meters	List 2.2
Scutellaria lateriflora	Lamiaceae	perennial rhizomatous herb	Jul-Sep	•Meadows and seeps (Medws) (mesic) •Marshes and swamps (MshSw)	0 - 500 meters	List 2.2
Symphyotrichum lentum	Asteraceae	perennial rhizomatous herb	May-Nov	•Marshes and swamps (MshSw) (brackish and freshwater)	0 - 3 meters	List 1B.2
Trichocoronis wrightii var. wrightii	Asteraceae	annual herb	May-Sep	•Meadows and seeps (Medws) •Marshes and swamps (MshSw) •Riparian forest (RpFrs) •Vernal pools (VnPls)/alkaline	5 - 435 meters	List 2.1
Tropidocarpum capparideum	Brassicaceae	annual herb	Mar-Apr	•Valley and foothill grassland (VFGrs) (alkaline hills)	1 - 455 meters	List 1B.1

APPENDIX C

Regional Special-Status Species Review

Table 1. Special-Status Species with Potential to Occur in the Project Area, Impacts Analysis, and Avoidance and Minimization Measures

Common Name Scientific Name	Listing Status[1] (Fed/State)	Habitat Requirements	Potential for Significant Impact	Avoidance and Minimization Measures
Delta smelt *Hypomesus transpacificus*	T/T	Estuarine systems in the Sacramento-San Joaquin Delta.	No. Bishop Cut provides spawning habitat for this species and is designated critical habitat. Because the road is paved, no additional roadwork on levee road is anticipated, and work areas used to span Bishop Cut would be 190 feet from surface water on the down-slope side opposite of Bishop Cut, effects from silting, fill or spills are not expected.	Water quality BMPs
Central Valley steelhead DPS *Oncorhynchus mykiss*	T/—	Spawns in cool, moderately fast flowing water with gravel bottom.	No. Bishop Cut provides migratory habitat for this species and is designated critical habitat. Because the road is paved, no additional roadwork on levee road is anticipated, and work areas used to span Bishop Cut would be 190 feet from surface water on the down-slope side opposite of Bishop Cut, effects from silting, fill or spills are not expected.	Water quality BMPs
Winter-run Chinook salmon ESU *Oncorhynchus tshawytscha*	E/E	Spawn and rear in main-stem Sacramento River. Require cool year-round water temperatures, since spawning occurs during the summer. Requires deep pools and riffles, and clean gravel and cobble substrate to spawn.	No. Bishop Cut provides migratory habitat for this species. Because the road is paved, no additional roadwork on levee road is anticipated, and work areas used to span Bishop Cut would be 190 feet from surface water on the down-slope side opposite of Bishop Cut, effects from silting, fill or spills are not expected.	Water quality BMPs

Table 1. Special-Status Species with Potential to Occur in the Project Area, Impacts Analysis, and Avoidance and Minimization Measures

Common Name Scientific Name	Listing Status[1] (Fed/State)	Habitat Requirements	Potential for Significant Impact	Avoidance and Minimization Measures
Central Valley spring-run Chinook salmon ESU *Oncorhynchus tshawytscha*	T/T	Cool streams that reach the ocean and that have shallow, partly shaded pools and clear-water depression pools.	No. Bishop Cut provides migratory habitat for this species. Because the road is paved, no additional roadwork on levee road is anticipated, and work areas used to span Bishop Cut would be 190 feet from surface water on the down-slope side opposite of Bishop Cut, effects from silting, fill or spills are not expected.	Water quality BMPs
Green sturgeon, southern DPS *Acipenser medirostris*	T/SC	DPS includes green sturgeon that spawn in rivers south of the Eel River and includes the Sacramento-San Joaquin Delta. Preferred spawning substrate is large cobble, but can range from clean sand to bedrock.	No. Bishop Cut provides migratory habitat for this species and is designated critical habitat. Because the road is paved, no additional roadwork on levee road is anticipated, and work areas used to span Bishop Cut would be 190 feet from surface water on the down-slope side opposite of Bishop Cut, effects from silting, fill or spills are not expected.	Water quality BMPs
Longfin smelt San Francisco Bay-Delta DPS *Spirinchus thaleichthys*	C/SC	Sloughs of Suisun Bay and Delta.	No. Bishop Cut provides spawning habitat for this species. Because the road is paved, no additional roadwork on levee road is anticipated, and work areas used to span Bishop Cut would be 190 feet from surface water on the down-slope side opposite of Bishop Cut, effects from silting, fill or spills are not expected.	Water quality BMPs

Table 1. Special-Status Species with Potential to Occur in the Project Area, Impacts Analysis, and Avoidance and Minimization Measures

Common Name Scientific Name	Listing Status[1] (Fed/State)	Habitat Requirements	Potential for Significant Impact	Avoidance and Minimization Measures
Central Valley fall/late fall-run Chinook salmon ESU *Oncorhynchus tshawytscha*	SC/SC	Spawn and rear in main-stem Sacramento River and suitable perennial tributaries. Spawn and rear in main-stem Sacramento River and suitable perennial tributaries. Requires cool water temperatures for spawning, egg-incubation and juvenile rearing. Spawn in riffles with gravel and cobble.	No. Bishop Cut provides migratory habitat for this species. Because the road is paved, no additional roadwork on levee road is anticipated, and work areas used to span Bishop Cut would be 190 feet from surface water on the down-slope side opposite of Bishop Cut, effects from silting, fill or spills are not expected.	Water quality BMPs
Sacramento splittail *Pogonichthys macrolepidotus*	—/SC	Shallow, dead-end sloughs with submerged vegetation.	No. Bishop Cut provides spawning habitat for this species. Because the road is paved, no additional roadwork on levee road is anticipated, and work areas used to span Bishop Cut would be 190 feet from surface water on the down-slope side opposite of Bishop Cut, effects from silting, fill or spills are not expected.	Water quality BMPs
River lamprey *Lampetra ayresi*	—/SC	Anadromous fish found in rivers from San Francisco Bay watershed north to Alaska. Spawn in similar habitat as salmon.	No. Bishop Cut provides migratory habitat for this species. Because the road is paved, no additional roadwork on levee road is anticipated, and work areas used to span Bishop Cut would be 190 feet from surface water on the down-slope side opposite of Bishop Cut, effects from silting, fill or spills are not expected.	Water quality BMPs

Table 1. Special-Status Species with Potential to Occur in the Project Area, Impacts Analysis, and Avoidance and Minimization Measures

Common Name Scientific Name	Listing Status[1] (Fed/State)	Habitat Requirements	Potential for Significant Impact	Avoidance and Minimization Measures
California red-legged frog *Rana draytonii*	T/SC	Require aquatic habitat for breeding, also uses a variety of other habitat types including riparian and upland areas. Adults prefer dense, shrubby or emergent vegetation associated with deep-water pools with fringes of cattails and dense stands of overhanging vegetation. This species also breeds in ephemeral ponds that support little or no vegetation.	No. The project is outside the current known range (CWHR) of this species and there are no CNDDB reports within 5 miles of the project area. Additionally, the California red-legged frog recovery plan concludes that CRLF is extirpated from the valley floor (U.S. Fish and Wildlife Service 2002). This species is not expected to occur in the project area.	None required.
Giant garter snake *Thamnophis gigas*	T/T	Freshwater marshes and low gradient streams with emergent vegetation. Adapted to drainage canals and irrigation ditches with mud substrate.	Low. Perennially inundated irrigation ditches, golf course ponds, and associated uplands within the project area provide potential habitat. An extant population occurs within the Coldani Marsh-White Slough area approximately 1.7 miles to the northeast of the TSF pad and 3.5 miles north of the distribution line along the southern portion of the golf course. This population is connected by a series of irrigation ditches and golf course ponds within the project area. Ground disturbance activities that disrupt burrows could adversely affect this species. Because giant garter snakes are absent from larger rivers, it is not anticipated that Bishop Cut would provide habitat for this species (Miller et al. 1999).	Pre-construction surveys Biological monitor Water quality BMPs Maintain speed limits less than 10 mph.

Table 1. Special-Status Species with Potential to Occur in the Project Area, Impacts Analysis, and Avoidance and Minimization Measures

Common Name Scientific Name	Listing Status[1] (Fed/State)	Habitat Requirements	Potential for Significant Impact	Avoidance and Minimization Measures
Western pond turtle *Emys marmorata*	—/SC	Slow water aquatic habitat with available basking sites. Hatchlings require shallow water with dense submergent or short emergent vegetation. Requires an upland oviposition site near the aquatic site.	Low. Perennially inundated irrigation ditches and the ponds at the golf course north of Eight Mile Road provide aquatic habitat. Pond habitat and adjacent uplands provide aquatic and upland nesting habitat. The nearest CNDDB record to suitable aquatic habitat is 1.2 miles northwest of the golf course ponds. Although ditches in the project area are perennial, and contain fresh emergent vegetation, the banks are steep and do not contain available basking sites. Ditches are actively maintained which likely precludes occupation by pond turtles. Additionally, upland breeding sites are unavailable in the cropland habitat. Due to lack of basking habitat and upland nesting sites, pond turtles are unlikely to occur in the agricultural portions of the project area.	Pre-construction surveys Avoidance measures Maintain speed limits below 10 mph
California black rail *Laterallus jamaicensis coturniculus*	—/T, FP	Coastal and inland marsh habitat.	No. Marsh habitat suitable for this species is absent from the project area and no impacts are expected.	None required
Swainson's hawk *Buteo swainsoni*	--/T	Breeds in stands with few trees in juniper-sage flats, riparian areas, and oak savannah; forages in adjacent livestock pasture, grassland or grain fields.	Low. Larger trees and stands of trees occurring within 0.5 mile of the project area provide potential nesting habitat for Swainson's hawk. There are sixteen recorded CNDDB occurrences of nesting Swainson's hawk within 5 miles of the project area with the nearest approximately 1 mile south of the project area. Surveys and monitoring associated with the CAES coring phase did not detect nesting during the 2013-nesting season (North State Resources 2013). Noise generated by project activities could disrupt nesting behavior and nest success if Swainson's hawks are nesting within 0.25 mile of the project area.	Pre-construction surveys if work is expected to occur during nesting season (March 1 to September 15)

Table 1. Special-Status Species with Potential to Occur in the Project Area, Impacts Analysis, and Avoidance and Minimization Measures

Common Name Scientific Name	Listing Status[1] (Fed/State)	Habitat Requirements	Potential for Significant Impact	Avoidance and Minimization Measures
White-tailed kite *Elanus leucurus*	—/FP	Nests in tall shrubs and trees, forages in grasslands, agricultural fields and marshes.	Low. Isolated trees and shrubs near proposed access roads and existing farm facilities provide potential nesting habitat for this species.	Pre-construction surveys if work is expected to occur during nesting season (February 15–August 31)
Northern harrier *Circus cyaneus*	—/SC	Forages in marshes, grasslands, and ruderal habitats; nests in extensive marshes and wet fields.	Low. Wet meadows and wetlands near the golf course may provide nesting habitat for northern harrier. Exposure to project activities would only be during installation of distribution lines. Potential nesting habitat is north of a bermed area, which would reduce effects on nesting birds, if present.	Pre-construction surveys if work is expected to occur during nesting season (February 15–August 31)
Western burrowing owl *Athene cunicularia*	—/SC	Grasslands and ruderal habitats.	Low. Annual grassland and ruderal habitat present along the distribution line provide habitat for this species. Ground squirrel burrows observed along the distribution line route. Grassland may grow too high to support burrowing owl foraging habits. No owls observed during the field reconnaissance; however, they could move into the area prior to construction.	Pre-construction surveys
Loggerhead shrike *Lanius ludovicianus*	—/SC	Nests in tall shrubs and dense trees, forages in grasslands, marshes, and ruderal habitats.	Low. Isolated trees and shrubs near proposed access roads and existing farm facilities provide potential nesting habitat for this species.	Pre-construction surveys if work is expected to occur during nesting season (February 15–August 31)

[1]Status Codes: : Federal and State Codes: Endangered; T = Threatened; C=Candidate; SC = Species of Concern (federal), Species of Special Concern (State), FP = Fully Protected (State)

APPENDIX D

Giant Garter Snake Impacts Review for the Pacific Gas and Electric Company (PG&E) Compressed Air Energy Storage Project-King Island Piacentine Well Pad Expansion and Core Drilling Project-January 2013

Eric C. Hansen
Consulting Environmental Biologist

4200 North Freeway Boulevard, Suite 4
Sacramento, CA
95834-1235

Phone 916-921-8281
Fax 916-921-8278
Mobile 916-214-7848

To: Catalina Reyes
Pacific Gas and Electric Co.
3401 Crow Canyon Road, Rm 150E
San Ramon, CA 94583

Re: Giant Garter Snake Impacts Review for the Pacific Gas and Electric Company (PG&E) Compressed Air Energy Storage Project— King Island Piacentine Well Pad Expansion and Core Well Drilling Project

Date: 23 January, 2013

Dear Ms. Reyes:

This letter/memorandum provides a brief review of environmental documents prepared by North State Resources, Inc. (NSR) in support of the Pacific Gas and Electric Company (PG&E) Compressed Air Energy Storage Project—King Island Piacentine Well Pad Expansion and Core Well Drilling Project. The King Island project area is located approximately 5 miles northwest of the city of Stockton in San Joaquin County at approximately Latitude 38.082284° , Longitude -121.421892. The project will require the expansion of the existing well pads and improvements of existing roads to access the project area.

Conducted in light of potential impacts to the giant garter snake (*Thamnophis gigas*, GGS), this review is based on the following documents:

1. Pacific Gas and Electric. 2012. *Pacific Gas and Electric Company Compressed Air Energy Storage Project— King Island Piacentine Well Pad Expansion and Core Well Drilling: Assessment of Effects on Federally Listed Species*. Prepared by North State Resources, Inc. Prepared for U.S. Department of Energy National Energy Technology Laboratory. October 12, 2012.

2. Pacific Gas and Electric. 2013. *Giant Garter Snake Burrow Baseline Surveys Results Summary—East Island and King Island Project Areas*. Technical Memorandum from Patrick Martin, North State Resources, Inc. to Catalina Reyes, Pacific Gas and Electric Company. January 9, 2013.

The purpose of this review is to provide a quality assurance assessment of the findings in the two PG&E documents prepared by NSR and an independent review and summary of potential risks to GGS. A site visit was also conducted for this purpose at the proposed King Island well pad site on 17 January, 2013. This memorandum includes a summary of the conclusions presented by NSR, a discussion of the site's suitability and impact potential for GGS, and provides broader context by providing a summary of Delta-wide GGS survey efforts to illustrate negative results that are not available in the California Natural Diversity Database (Appendix 1). Photographs illustrating the site's general character are provided in a separate photo appendix (Appendix 2).

The results of this review confirm what I feel is a thorough and accurate assessment by NSR, whose findings suggest that: 1) potential habitat on the project site is largely unsuitable due the canopy cover provided by the young walnut orchard comprising the entirety of the site; 2) overwintering opportunities are diminished or eliminated by annual intercropping of safflower between the walnut rows; and 3) that the distance and poor quality of aquatic habitat likely precludes access by GGS to the few burrows that could function as winter refugia.

As part of a thorough assessment, NSR has appropriately identified all features with even the most remote potential to support GGS. Based on the results of my site visit, my experience in the region, and my experience with the species as a whole, I concur that GGS are not likely to occur for the reasons stated above. Most noteworthy are the canopy cover, the annual intercropping of safflower, and the fact that the site falls more than 450 feet from the nearest potential aquatic habitat, all of which are factors that are generally incompatible with the life history of GGS. Only the very poor-quality drainage canal provides a potential source for GGS; however, even in the unlikely event that GGS should occupy the canal, there would no foreseeable incentive for them to move such a substantial distance over inhospitable terrain to overwinter, and very little chance of finding the few small burrows identified by NSR even if they did so.

Finally, I would emphasize that the density of GGS in the Delta is known to be extremely low, and that this further reduces the likelihood of GGS occurring in the sub-optimal landscape surrounding the project site. Historically, GGS occurred in both the south and north Delta regions (Hansen and Brode 1980; Hansen 1988; CNDDB 2012). However, the extent to which these historically occupied areas represent viable breeding populations is unclear, given agricultural conversion of much of the Delta. Nonetheless, survey efforts since the mid-1980s suggest that much of the Delta is unoccupied or supports few GGS.

To assess the likelihood of GGS occurring in the project vicinity, NSR's assessment necessarily relies heavily upon records reported in the California Natural Diversity Database (CNDDB). However, this approach tends to result in

very conservative assessments because: 1) the CNDDB does not provide negative survey results; and 2) because the gray literature/technical reports summarizing negative survey results are generally unavailable to the public. In order to supplement the material provided by NSR and to place the known GGS distribution within the Delta in better perspective, I am including a summary of Delta-wide GGS survey efforts illustrating negative survey results that are not available in the CNDDB. This summary, which details the historical and current survey work and occurrence information available in the Delta proper, is included as Appendix 1.

In closing, I believe that NSR has conducted a thorough and reasonable assessment of site conditions and has presented an appropriately conservative evaluation of potential impacts. I agree with NSR's conclusion that GGS are unlikely to occur on site due to the incompatibility of the existing aquatic habitat, land cover, and agricultural practices with GGS life history. I would emphasize that the low-quality aquatic habitat lies well beyond 200 feet boundary from linear bank margins that the USFWS generally considers as suitable upland for GGS when assessing a project's disturbance area (USFWS 1997, 2004). I would also emphasize the lack of positive survey data within this portion of the Delta when evaluating the likelihood that GGS might occur. In my professional opinion, this combination of factors eliminates virtually all likelihood that GGS occur on the project site. Finally, I agree with NSR that impacts to potential refugia occurring along access roads within 200 feet of aquatic habitat can be avoided and are not likely to be adversely impacted by project activities.

If you have questions regarding this review or any of the subsequent comments, please do not hesitate to contact me. I will gladly expand on any of these topics upon request.

Sincerely,



Eric C. Hansen
Consulting Environmental Biologist

Appendices:

1. Summary of Delta GGS Sampling Efforts
2. Photographs of relevant features
3. References

APPENDIX 1. SUMMARY OF DELTA GGS SAMPLING EFFORTS

Overview

Historically, giant garter snakes occurred in both the south and north Delta regions (Hansen and Brode, 1980; Hansen 1988; CNDDB 2012). Individuals have been observed in the north Delta region east of the Sacramento River at North Stone Lake, Beach Lake, and near Locke (CNDDB 2012). The species also was recorded on Sherman Island near the Antioch Bridge north of the City of Oakley (CNDDB 2012). Other documented occurrences are distributed around the periphery of the north and east Delta. The extent to which these historically occupied areas represent viable breeding populations is unclear, given agricultural conversion of much of the Delta. Nonetheless, survey efforts since the mid-1980s suggest that much of the Delta is unoccupied or supports few giant garter snakes.

Despite negative survey findings, Hansen (1988) reported that although the major permanent waterways of the Delta are apparently unsuitable for the giant garter snake, small backwater sloughs and toe drains support suitable habitat for, and thus could potentially support, small numbers of giant garter snakes.

The following describes the historical and current survey work and occurrence information in the Delta proper.

South Delta

During 1987 and 1988, live trapping and visual surveys were conducted at various locations in the California Department of Water Resources (DWR) South Delta Water Management Project area, including Trapper Slough, Salmon Slough, and along the irrigation canal at SR 4 near the Clifton Court Forebay expansion area. No giant garter snakes were observed during either year, although virtually all islands and channels contained some suitable habitat (ECOS 1990).

In 1994, surveys were conducted to determine the status of the giant garter snake in DWR's Interim South Delta Project area. The purpose of this study was to focus on particular areas containing the most suitable habitat and to conduct live trapping as well as additional ground surveys. Ground surveys for giant garter snakes were undertaken during previous work in the south Delta region in 1987, 1988, and 1993. Although no giant garter snakes were observed during any of these surveys, suitable habitat for the snake was present in some of the more remote sloughs and waterways in the project area (e.g., Tom Paine Slough, Salmon Slough, and Paradise Cut). Based on the presence of apparently suitable habitat, the potential for isolated populations of the giant garter snake was not ruled out (Miriam Green Associates 1995).

There are only two isolated records of giant garter snakes on the south side of the San Joaquin River in the northern aspect of the species' range. Although the historical and current distribution of giant garter snake in the Delta is poorly

understood, the south bank of the San Joaquin River lies within the apparent gap between the northern and southern populations (CNDDB 2012). The isolated records on Sherman Island represents the northern population's known southern extent in the Plan Area. The known southern terminus of the northern population outside of the Plan Area occurs north and east of the San Joaquin River in Duck Creek (CNDDB 2012). The nearest locality record to the south lies approximately 50 air miles distant in Merced County; no giant garter snakes are documented in Stanislaus County between the documented extremes of the Sacramento Valley and San Joaquin Valley populations.

North Delta

Surveys were also conducted to determine the status of giant garter snakes in DWR's Interim North Delta Program area (Miriam Green Associates 1996). The species was observed at scattered locations in the program area during 1994 surveys, but was not encountered in the major waterways of the North Delta. The species was observed in marsh and canal habitats along the Upland Canal from the confluence of Sycamore Slough and the Upland Canal south to the vicinity of White Slough on the Terminous and Shin Kee Tracts. Giant garter snakes also occur in the Upland Canal and the Coldani Marsh, north and east of Shin Kee Tract, respectively (Miriam Green Associates 1996).

Coldani Marsh/White Slough and Eastern Delta Fringe

Between 1974 and 1978, 13 rectangular borrow pits were excavated from 1 to 5 miles west of I-5 to provide fill for freeway construction (California Department of Water Resources 1995). The pits are fed by groundwater and periodic runoff from precipitation, irrigation, and high canal flows, creating a series of ponds characterized by vegetated sloping or vertical banks and open water with adjacent uplands and high ground. White Slough Wildlife Area encompasses ponds 7 through 13 along a roughly 14-mile (22.5-kilometer) stretch between Thornton and Stockton.

The White Slough Wildlife Area supports one of 13 extant giant garter snake populations recognized by USFWS (Coldani Marsh/White Slough population) (USFWS 1999). First identified on site in 1974 (CNDDB 2012), giant garter snakes were observed at the White Slough Wildlife Area from 1976 until the mid-1990s (Hansen and Brode 1980; Hansen 1988, 1996). Among sites supporting two giant garter snake populations recognized in San Joaquin County, the White Slough location is perhaps the only locality still supporting a viable snake population.

Most giant garter snake observations at White Slough Wildlife Area are concentrated at Pond 9, but surveys conducted by George Hansen in 1994 yielded additional sightings at Pond 7, Pond 11, and a site between Ponds 6 and 7

(California Department of Water Resources 1995; CNDDB 2012). Although channels and drainages including Telephone Cut, Sycamore Slough, Hog Slough, and Beaver Slough were surveyed, observations were made only at the ponds (M. Green, pers. comm.). Each of the ponds where snakes were observed are characterized by slow-moving water with mud banks and bottoms, vegetation cover, and access to high ground (California Department of Water Resources 1995).

In 2009 and 2010, under a grant provided by the Central Valley Project (CVP) Habitat Restoration Program, Hansen conducted rigorous trap and visual encounter sampling at Ponds 7–13 of the White Slough Wildlife Area to determine the current status and distribution of giant garter snake. Giant garter snakes were only confirmed within the emergent wetlands west of Pond 9 along the Upland Canal (Coldani Marsh), east of Guard Road and south of SR 12 (CNDDB 2012; Hansen 2011). In total, 27 snakes representing a normal age/size and gender distribution were captured. Surveys conducted in and near Lost Slough in 1996, 2004 and 2009 failed to detect giant garter snakes east of I-5 (Hansen 2004;Patterson, pers. comm.; Wylie pers. comm.

Antioch/Oakley and West Delta

Recent, intensive trapping surveys conducted within Contra Costa County independently by Eric Hansen and by Swaim Biological have failed to detect giant garter snakes. Likewise, Swaim Biological intensively trapped in regions northeast of Oakley in 2003 and 2005, including Marsh Creek, Big Break, and Contra Costa Canal, without success (Swaim Biological 2004; 2005a, b,c,d,e,f; 2006). With few exceptions, these surveys spanned 3 to 5 months of the species' active period. Swaim Biological also rigorously investigated bullfrog stomach contents to see if undetected giant garter snakes had been consumed; none was detected. While all of these surveys produced captures of common snake species, giant garter snakes were not detected, and, in all cases, it was determined that self-sustaining populations were unlikely to occur. Each report cited marginal habitat value as probable explanations for the species' absence. While the final disposition of Swaim Biological results and recommendations are unknown, USFWS concurred with Eric Hansen's findings that the species was unlikely to occur within the areas sampled.

Central Delta

In support of DWR's Delta Wetlands Project, Eric Hansen intensively trapped for giant garter snakes on Webb Tract and on Bacon Island in 2003 and 2004 without success (Patterson and Hansen, 2004; Patterson 2005.

All Delta

APPENDIX 1. SUMMARY OF DELTA GGS SAMPLING EFFORTS

In 2009, as part of the Delta Habitat Conservation and Conveyance Program, DWR biologists deployed 62, 50-trap traplines at White Slough Wildlife Area and throughout the Delta proper, resulting in approximately 42,700 accrued trap-days. Trap distribution ranged from the vicinity of Elk Grove to the north, I-5 to the east, Sherman Island to the west, and the vicinity of Clifton Court Forebay to the south. GGS were not detected during these surveys (Patterson pers. comm).

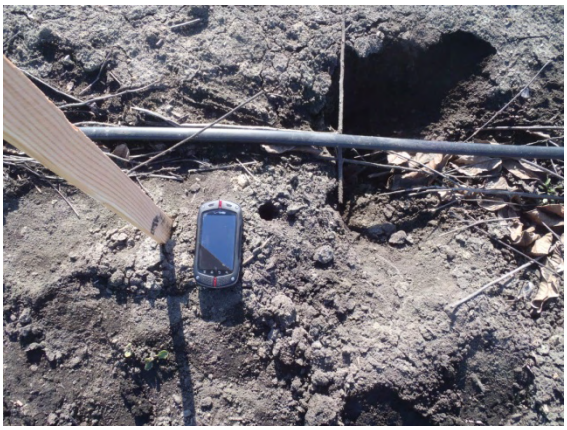
APPENDIX 2. PHOTOGRAPHS OF RELEVANT FEATURES



1. Margin in the transition zone between the existing well pad and proposed expansion



2. Example of inter-row vegetation



3. Example of the small string of burrows falling along only one row of the walnut orchard



4. Denuded ditch situated approximately 450 feet west of the project site

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APPENDIX E

Swainson's Hawk Survey Guidance

RECOMMENDED TIMING AND METHODOLOGY FOR SWAINSON'S HAWK NESTING SURVEYS IN CALIFORNIA'S CENTRAL VALLEY

Swainson's Hawk Technical Advisory Committee

May 31, 2000

This set of survey recommendations was developed by the Swainson's Hawk Technical Advisory Committee (TAC) to maximize the potential for locating nesting Swainson's hawks, and thus reducing the potential for nest failures as a result of project activities/disturbances. The combination of appropriate surveys, risk analysis, and monitoring has been determined to be very effective in reducing the potential for project-induced nest failures. As with most species, when the surveyor is in the right place at the right time, Swainson's hawks may be easy to observe; but some nest sites may be very difficult to locate, and even the most experienced surveyors have missed nests, nesting pairs, mis-identified a hawk in a nest, or believed incorrectly that a nest had failed. There is no substitute for specific Swainson's hawk survey experience and acquiring the correct search image.

METHODOLOGY

Surveys should be conducted in a manner that maximizes the potential to observe the adult Swainson's hawks, as well as the nest/chicks second. To meet the California Department of Fish and Game's (CDFG) recommendations for mitigation and protection of Swainson's hawks, surveys should be conducted for a ½ mile radius around all project activities, and if active nesting is identified within the ½ mile radius, consultation is required. In general, the TAC recommends this approach as well.

Minimum Equipment

Minimum survey equipment includes a high-quality pair of binoculars and a high quality spotting scope. Surveying even the smallest project area will take hours, and poor optics often result in eye-strain and difficulty distinguishing details in vegetation and subject birds. Other equipment includes good maps, GPS units, flagging, and notebooks.

Walking vs Driving

Driving (car or boat) or "windshield surveys" are usually preferred to walking if an adequate roadway is available through or around the project site. While driving, the observer can typically approach much closer to a hawk without causing it to fly. Although it might appear that a flying bird is more visible, they often fly away from the observer using trees as screens; and it is difficult to determine from where a flying bird came. Walking surveys are useful in locating a nest after a nest territory is identified, or when driving is not an option.

Angle and Distance to the Tree

Surveying subject trees from multiple angles will greatly increase the observer's chance of detecting a nest or hawk, especially after trees are fully leafed and when surveying multiple trees

in close proximity. When surveying from an access road, survey in both directions. Maintaining a distance of 50 meters to 200 meters from subject trees is optimal for observing perched and flying hawks without greatly reducing the chance of detecting a nest/young: Once a nesting territory is identified, a closer inspection may be required to locate the nest.

Speed
Travel at a speed that allows for a thorough inspection of a potential nest site. Survey speeds should not exceed 5 miles per hour to the greatest extent possible. If the surveyor must travel faster than 5 miles per hour, stop frequently to scan subject trees.

Visual and Aural Ques
Surveys will be focused on both observations and vocalizations. Observations of nests, perched adults, displaying adults, and chicks during the nesting season are all indicators of nesting Swainson's hawks. In addition, vocalizations are extremely helpful in locating nesting territories. Vocal communication between. hawks is frequent during territorial displays; during courtship and mating; through the nesting period as mates notify each other that food is available or that a threat exists; and as older chicks and fledglings beg for food.

Distractions
Minimize distractions while surveying. Although two pairs of eyes may be better than one pair at times, conversation may limit focus. Radios should be off, not only are they distracting, they may cover a hawk's call.

Notes and Species Observed
Take thorough field notes. Detailed notes and maps of the location of observed Swainson's hawk nests are essential for filling gaps in the Natural Diversity Data Base; please report all observed nest sites. Also document the occurrence of nesting great homed owls, red-tailed hawks, red-shouldered hawks and other potentially competitive species. These species will infrequently nest within 100 yards of each other, so the presence of one species will not necessarily exclude another.

TIMING

To meet **the minimum level** of protection for the species, surveys should be completed for **at least** the two survey periods immediately prior to a project's initiation. For example, if a project is scheduled to begin on June 20, you should complete 3 surveys in Period III and 3 surveys in Period V. However, it is always recommended that surveys be completed in Periods II, III and V. **Surveys should not be conducted in Period IV.**

The survey periods are defined by the timing of migration, courtship, and nesting in a "typical" year for the majority of Swainson's hawks from San Joaquin County to Northern Yolo County. Dates should be adjusted in consideration of early and late nesting seasons, and geographic differences (northern nesters tend to nest slightly later, etc). If you are not sure, contact a TAC member or CDFG biologist.

Survey dates **Justification and search image**	**Survey time**	**Number of Surveys**
I. *January-March 20 (recommended optional)*	*All day*	*1*

Prior to Swainson's hawks returning, it may be helpful to survey the project site to determine potential nest locations. Most nests are easily observed from relatively long distances, giving the surveyor the opportunity to identify potential nest sites, as well as becoming familiar with the project area. It also gives the surveyor the opportunity to locate and map competing species nest sites such as great homed owls from February on, and red-tailed hawks from March on. After March 1, surveyors are likely to observe Swainson's hawks staging in traditional nest territories.

II. *March 20 to April 5*	*Sunrise to 1000* *1600 to sunset*	*3*

Most Central Valley Swainson's hawks return by April 1, and immediately begin occupying their traditional nest territories. For those few that do not return by April 1, there are often hawks ("floaters") that act as place-holders in traditional nest sites; they are birds that do not have mates, but temporarily attach themselves to traditional territories and/or one of the site's "owners." Floaters are usually displaced by the territories' owner(s) if the owner returns.

Most trees are leafless and are relatively transparent; it is easy to observe old nests, staging birds, and competing species. The hawks are usually in their territories during the survey hours, but typically soaring and foraging in the mid-day hours. Swainson's hawks may often be observed involved in territorial and courtship displays, and circling the nest territory. Potential nest sites identified by the observation of staging Swainson's hawks will usually be active territories during that season, although the pair may not successfully nest/reproduce that year.

III. *April 5 to April 20*	*Sunrise to 1200* *1630 to Sunset*	***3***

Although trees are much less transparent at this time, 'activity at the nest site increases significantly. Both males and females are actively nest building, visiting their selected site frequently. Territorial and courtship displays are increased, as is copulation. The birds tend to vocalize often, and nest locations are most easily identified. This period may require a great deal of "sit and watch" surveying.

IV. *April 21 to June 10*	*Monitoring known nest sites only* ***Initiating Surveys is not recommended***	

Nests are extremely difficult to locate this time of year, and even the most experienced surveyor will miss them, especially if the previous surveys have not been done. During this phase of nesting, the female Swainson's hawk is in brood position, very low in the nest, laying eggs, incubating, or protecting the newly hatched and vulnerable chicks; her head may or may not be visible. Nests are often well-hidden, built into heavily vegetated sections of trees or in clumps of mistletoe, making them all but invisible. Trees are usually not viewable from all angles, which may make nest observation impossible.

Following the male to the nest may be the only method to locate it, and the male will spend hours away from the nest foraging, soaring, and will generally avoid drawing attention to the nest site. Even if the observer is fortunate enough to see a male returning with food for the female, if the female determines it is not safe she will not call the male in, and he will not approach the nest; this may happen if the observer, or others, are too close to the nest or if other threats, such as rival hawks, are apparent to the female or male.

V. ***June 10 to JuIy 30 (post-fledging)*** ***Sunrise to 1200*** ***3***
1600 to sunset

Young are active and visible, and relatively safe without parental protection. Both adults make numerous trips to the nest and are often soaring above, or perched near or on the nest tree. The location and construction of the nest may still limit visibility of the nest, young, ‘and adults.

DETERMINING A PROJECT'S POTENTIAL
FOR IMPACTING SWAINSON'S HAWKS

LEVEL OF RISK	REPRODUCTIVE SUCCESS (Individuals)	LONGTERM SURVIVABILITY (Population)	NORMAL SITE CHARACTERISTICS (Daily Average)	NEST MONI-TORING
HIGH	Direct physical contact with the nest tree while the birds are on eggs or protecting young. (Helicopters in close proximity)	Loss of available foraging area.	Little human-created noise, little human use: nest is well away from dwellings, equipment yards, human access areas, etc. *Do not include general cultivation practices in evaluation.*	**MORE**
		Loss of nest trees.		
	Loss of nest tree after nest building is begun prior to laying eggs.	Loss of potential nest trees.		
	Personnel within 50 yards of nest tree (out of vehicles) for extended periods while birds are on eggs or protecting young that are < 10 days old.	Cumulative: Multi-year, multi-site projects with substantial noise/personnel disturbance.		
	Initiating construction activities (machinery and personnel) within 200 yards of the nest after eggs are laid and before young are > 10 days old.	Cumulative: Single-season projects with substantial noise/personnel disturbance that is greater than or significantly different from the daily norm.		
	Heavy machinery only working within 50 yards of nest.		Substantial human-created noise and occurrence: nest is near roadways, well-used waterways, active airstrips, areas that have high human use. *Do not include general cultivation practices in evaluation.*	
	Initiating construction activities within 200 yards of nest before nest building begins or after young > 10 days old.	Cumulative: Single-season projects with activities that "blend" well with site's "normal' activities.		
LOW	All project activities (personnel and machinery) greater than 200 yards from nest.			**LESS**

APPENDIX D
SMART GRID DEMONSTRATIONS PROGRAM
ENVIRONMENTAL SYNOPSIS

This appendix contains a copy of the 2009 environmental synopsis for Smart Grid Demonstrations Program Area of Interest 2.

Environmental Synopsis of

Smart Grid Demonstrations Program
Area of Interest Two – Energy Storage

Funding Opportunity Announcement
DE-FOA-0000036

Prepared for

U.S. Department of Energy
National Energy Technology Laboratory
Morgantown, West Virginia

October 2009

Prepared by
Jason Associates Corporation
San Diego, California

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1. INTRODUCTION AND BACKGROUND

With funds made available by the *American Recovery and Reinvestment Act of 2009*, the U.S. Department of Energy (DOE or the Department) Office of Electricity Delivery and Energy Reliability issued a competitive Funding Opportunity Announcement (FOA) (DE-FOA-0000036), *Recovery Act – Smart Grid Demonstrations* (DOE 2009). Smart grid projects funded under the FOA would include regionally unique demonstrations to verify smart grid technology viability, quantify smart grid costs and benefits, and validate new smart grid business models, all at a scale that can be readily adapted and replicated around the country. These projects would demonstrate technologies that are widely available for use in the United States.

The goal of the FOA is to demonstrate technologies in regions across the states, districts, and U.S. territories that embody essential and salient characteristics of each region and present a suite of use cases for national implementation and replication. From these use cases, the goal is to collect and provide information necessary for customers, distributors, and generators to change their behavior in a way that reduces system demands and costs, increases energy efficiency, optimally allocates and matches demand and resources to meet that demand, and increases the reliability of the grid. The social benefits of a smart grid are reduced emissions, lower costs, increased reliability, and greater security and flexibility to accommodate new energy technologies, including renewable, intermittent, and distributed sources.

To reap the full benefits of smart grid technologies, advancements in grid-scale energy storage are also needed. Electric grid operators can utilize electricity storage devices to manage the amount of power required to supply customers at times when the need is greatest, which is during peak load. Electricity storage devices can also help make renewable energy resources, whose power output cannot be controlled by grid operators, more manageable. They can also balance microgrids to achieve a good match between generation and load. Storage devices can provide frequency regulation to maintain the balance between the network's load and power generated, increase asset utilization of both renewables and electric systems, defer technology and development investments, and achieve a more reliable power supply for high-tech industrial facilities.

The FOA included two program Areas of Interest (AOIs): (1) Smart Grid and (2) Energy Storage. This environmental synopsis addresses AOI-2; a separate synopsis has been prepared to address AOI-1.

The objective of the FOA under AOI-2 for energy storage is to support demonstration projects for major, utility-scale, energy storage installations. The projects will help to establish costs and benefits, verify technical performance, and validate system reliability and durability at scales that can be readily adapted and replicated across the United States. Energy storage systems include the following technologies: advanced battery systems (including flow batteries), ultra-capacitors, flywheels, and compressed air energy systems. Project areas include wind and photovoltaic integration with the grid, upgrade deferral of transmission and distribution assets,

congestion relief, and system regulation. Projects also include demonstrations of promising utility-scale storage technologies in order to rapidly advance their market readiness in the United States.

As a federal agency, DOE must comply with the *National Environmental Policy Act of 1969* (NEPA) (42 USC 4321 et seq.) by considering potential environmental issues associated with its actions prior to undertaking those actions. The NEPA environmental review of projects evaluated under the Smart Grid Demonstrations FOA will be prepared pursuant to Council on Environmental Quality (CEQ) regulations (40 CFR Parts 1500 – 1508), and the Department's NEPA implementing procedures (10 CFR Part 1021), which provide directions specific to procurement actions that DOE may undertake or fund before completing the NEPA process. Per these regulations, DOE has prepared an environmental critique and this environmental synopsis to support the procurement selection process.

The environmental critique prepared for AOI-2 evaluated nine proposals submitted for the Smart Grid Demonstrations AOI-2. The critique was developed to meet the DOE NEPA implementing procedures and, specifically, to meet the requirements in those procedures for environmental critiques of procurements, financial assistance, and joint ventures [10 CFR 1021.216(f) and (g)].

Only those proposals for which an environmental assessment or environmental impact statement could be required were evaluated. The critique did not address proposals submitted for the FOA that could be categorically excluded in accordance with Subpart D of 10 CFR Part 1021.

The environmental critique provided an evaluation and comparison of potential environmental impacts for each proposal deemed to be within the competitive range. DOE used the critique to evaluate appreciable differences in the potential environmental impacts from those proposals. As delineated in 10 CFR 1021.216(g), the environmental critique focused on environmental issues pertinent to a decision among the proposals and included a brief discussion of the purpose of the procurement and each proposed project, a discussion of the salient characteristics of each project, and a brief comparative evaluation of the environmental impacts of the projects. The critique represents one aspect of the formal process used to select among applicants for funding under the Smart Grid Demonstration AOI-2 FOA. As such, it is a procurement-sensitive document and subject to all associated restrictions.

This document is the environmental synopsis, which is a publicly available document corresponding to the environmental critique. The environmental synopsis documents the evaluation of potential environmental impacts associated with the proposals in the competitive range and does not contain procurement-sensitive information. The specific requirements for an environmental synopsis delineated in 10 CFR 1021.216(h) are as follows:

> *(h) DOE shall prepare a publicly available environmental synopsis, based on the environmental critique, to document the consideration given to environmental factors and to record that the relevant environmental consequences of reasonable alternatives have been evaluated in the selection process. The synopsis will not*

contain business, confidential, trade secret or other information that DOE otherwise would not disclose pursuant to 18 U.S.C. 1905, the confidentiality requirements of the competitive procurement process, 5 U.S.C. 552(b) and 41 U.S.C. 423. To assure compliance with this requirement, the synopsis will not contain data or other information that may in any way reveal the identity of offerors. After a selection has been made, the environmental synopsis shall be filed with EPA, shall be made publicly available, and shall be incorporated in any NEPA document prepared under paragraph (i) of this section.

To address the above requirements, this environmental synopsis includes: (1) a brief description of background information related to the Smart Grid Demonstration AOI-2, (2) a general description of the proposals received in response to the FOA and deemed to be within the competitive range, (3) a summary of the assessment approach used in the environmental critique to evaluate the potential environmental impacts associated with the proposals, and (4) a summary of the environmental impacts presented in the critique, focusing on potential differences among the proposals. Because of confidentiality concerns, the proposals and environmental impacts are discussed in general terms.

2. DESCRIPTION OF APPLICATIONS

The environmental critique evaluated nine projects under AOI-2. The projects evaluated are large- and small-scale energy storage demonstration projects, most of which include one or more of the following activities:

- Installation of new battery storage systems, generally to be integrated with new or existing photovoltaic or wind energy systems;
- Construction of new compressed air energy storage (CAES) systems connected to the grid and including use of caverns, mines, and aquifers for the air storage component; and
- Construction of flywheel energy storage systems.

The following are brief descriptions of the characteristics of the nine projects evaluated. The aspects of the projects that could result in environmental impacts, and that were considered in the Environmental Critique, are briefly described. All procurement sensitive information has been removed from the descriptions. Most projects include other activities that would result in minor or no impacts on the environment (for example, installing control equipment meters and running electric lines in the immediate area of the energy storage devices); such activities are not described.

1. Project 1

Period: 5.5 years
Location: Texas

This project would involve the construction of one of the largest CAES facilities in the United States, at about 130 megawatts. The project would make use of an existing storage cavern in a salt dome formation nearly 3,000 feet underground. The project would include a 30-acre construction site, discharge of non-contact cooling water to a nearby tributary, and injection of brine removed from the storage cavern.

2. Project 2

Period: 4 years
Location: New York

This project would design, build, test, commission, and operate a utility-scale, 20-megawatt flywheel energy storage frequency regulation plant and provide frequency regulation services to the grid operator. Project objectives include demonstrating to grid operators the technical, cost, and environmental advantages of fast-response flywheel-based frequency regulation; lowering the cost to build a 20-megawatt flywheel energy storage plant; speeding deployment of this technology to other grid operator regions; and stimulating international market demand for flywheel energy storage. The project includes construction of the facility in an industrial park and connecting to an adjacent grid transmission line.

3. Project 3

Period: 4 years
Location: Iowa

Many high-potential wind energy areas of the Midwest are located long distances from significant electrical load. This creates instability and over-capacity for the existing transmission system. In addition, most wind energy is generated during the off-peak hours, which does not match the demands of the electrical system. This project would demonstrate the benefits of a CAES plant to allow transmission systems to efficiently absorb vast amounts of wind energy in areas of high wind penetration and low load. In addition, the applicant would demonstrate and quantify the cost savings and benefits of using a CAES plant to optimize the existing generating assets of the utility systems receiving the wind energy. The applicant proposes to build a 270-megawatt CAES facility. Air would be stored in an underground aquifer.

The project would proceed in two phases:

- Phase 1 would involve air injection tests to demonstrate and prove the capability of the geologic formation to store and release the pressurized air at the desired rates.
- Phase 2 would involve the design, construction, and startup of the 270-megawatt CAES plant on approximately 20 acres of land.

4. Project 4

Period: 2 years
Location: Illinois

The applicant would design, build, test, commission, and operate a 20-megawatt flywheel energy storage frequency regulation plant and provide frequency regulation services to the grid operator. In addition, the applicant would collect critical data needed to measure the achievement of these project objectives and organize and disseminate that data to DOE, other grid operators, and the public in appropriately useful formats. The project site would be about 3.5 acres and involve the use of 200 high-energy flywheels.

5. Project 5

Period: 3 years
Location: Ohio

The applicant would install a compressed air power generating facility, which would be capable of 268 megawatts of power generation and would be located at a limestone mine. The project would include two power generation units designed specifically for the CAES application. The facility would be designed to operate on natural gas only. The project is already permitted for up to 800 Megawatts of power generation. Construction on the 92-acre site, which is previously disturbed and zoned for heavy industry, would include the power generation building, a control building, and a cooling tower.

6. Project 6

Period: 5 years
Location: California

The applicant would install a compressed air power generating facility using a saline porous rock formation as the storage reservoir. The project would take a phased approach to build and validate the design, performance, and reliability of an advanced underground CAES plant (300 megawatts with 10 hours of storage).

7. Project 7

Period: 4 years
Location: Hawaii

The project consists of the construction of a large battery enclosure and a substation, with a combined footprint of less than an acre. These facilities would be adjacent to existing wind energy facilities.

8. Project 8

Period: 5 years
Location: New York

The proposed project would include final design, layout, and construction of a 130-megawatt electric-peaking CAES plant. The plant would use electric-drive compressors during times of low electric demand to compress air into an existing salt cavern for subsequent use to generate electricity during times of high demand. A new 1.5-mile long electric transmission line and substation would be constructed to tie the new facility into the existing electric grid. The project site would be a leased 10-acre section of a much larger parcel. The tallest structure (stack) would be about 80 feet, and a building about 60 feet tall and 130 feet long would be constructed to house large equipment. New wells would likely be drilled into the cavern. Pumps and a water line (approximately 1,600 feet long) from a nearby recreational lake would be installed to provide access to fresh water for cooling towers.

9. Project 9

Period: 4 years
Location: New Mexico

This project would combine a 2.8-megawatt hour battery system with an existing 500-kilowatt solar photovoltaic installation. The goal is to employ the battery, along with a control system, to turn solar photovoltaic into a reliable, dispatchable, distributed generation resource. Data collection and analysis based on this design would produce information for a range of possible applications. The project would also yield computer-based modeling tools that would simulate the behavior of distribution feeders under varying loads, with and without distributed generation and storage attached. Construction would be on 5 acres within a currently undeveloped 27-acre site, and would include access roads, a pad for the battery system, and a 1,000-foot line to existing transmission lines.

3. ASSESSMENT APPROACH

Each of the applicants that provided a proposal in response to the Smart Grid Demonstrations FOA was required to submit an environmental questionnaire. The questionnaires included detailed information on the project including the following:

- Project Summary and objectives
- Work locations
- Materials used and produced (e.g., water, electricity, wastewater, air emissions)
- Proposed alternatives
- Land use changes

- Proximity to local, state, or national parks, forests, monuments, scenic waterways, wilderness, recreation facilities, or Tribal lands
- Potential impacts of construction activities
- Potential impacts to surface waters , floodplains, or wetlands
- Potential impacts to any vegetation and wildlife resources
- Changes that could result in socioeconomic or infrastructure conditions
- Potential impacts to historic or cultural resources
- Attainment status for the air quality conditions for the immediate project area
- Potential air emissions from the proposed project
- Potential amounts of solid and hazardous wastes produced
- Unique health and safety factors associated with the project
- Any required permitting or other regulatory compliance activities
- Potential for public controversy

For each project considered in the environmental critique, the potential direct and indirect effects, short-term and long-term effects, and unavoidable adverse effects were identified for 20 resource areas. These resource areas are included as the first 20 entries in Table 1 in Section 4. The critique also includes a summary of project activities, mitigation measures proposed by the applicant, areas where important environmental information is incomplete and unavailable, unresolved environmental issues, and practicable mitigation measures. Also included is a list of federal, tribal, state, and local government permits, licenses, and approvals identified by the applicants or known to be required for each project.

4. SUMMARY OF POTENTIAL ENVIRONMENTAL IMPACTS

This section provides a summary of potential impacts for each project. Table 1 identifies the resource areas that could be adversely or beneficially impacted for each of the nine projects. For each project, the potential direct and indirect, short-term and long-term, and unavoidable impacts were identified and classified into one of the following four color-coded categories:

- No impacts to a resource area are expected – blank
- Potential for minor adverse or beneficial impacts or unknown impacts of possible minor concern – black text or dot, no shading
- Potential for moderate adverse impacts or unknown impacts of possible moderate concern – light shading
- Potential for major adverse impacts or unknown impacts of possible major concern – darker shading

As summarized in Table 1, many of the projects have the potential to affect multiple aspects of the environment. Because of the nature of many of these projects (for example, construction of

new facilities, often with power-generating, or conversion, capabilities), many of the projects would have minor or moderate impacts on a range of environmental resource areas including aesthetics, air quality, human health and safety, land use, noise, waste and materials, transportation, and utilities. Some of the projects would also have minor or moderate impacts on cultural, biological, groundwater, and surface water resources. The geologic-based CAES are also identified as having the potential for moderate impacts on geology because of the unknowns associated with how the geologic features would respond to the repeated pressurization and release cycles. Most or all of the projects would have minor beneficial impacts on socioeconomic conditions (by increasing employment and the monetary infusion into the community) and utility operations (by improving the efficiency of the transmission system).

Many of the projects highlighted in Table 1 as having the potential for moderate adverse impacts are actually characterized in the environmental critique as having minor-to-moderate impacts. This characterization is often associated with unknowns with respect to some project quantity or the existing characteristics of the project site. The classification of these impacts may eventually be downgraded as the design of projects mature and more information becomes available.

Only one project was identified with the potential to have major adverse impacts. This was due to the projected amount of air emissions that would be involved, likely requiring a Prevention of Significant Deterioration permit for the project.

Table 1. Potential Impacts of Smart Grid Demonstration Projects Rollup – Area of Interest 2

Resource Areas	1	2	3	4	5	6	7	8	9
Aesthetics	•	•	•	•	•	•	•	•	•
Air Quality	•	•	■	•	•	•	•	•	
Biological Resources		•	•			•	•		•
Climate									
Community Services									
Cultural Resources			•					•	•
Environmental Justice									
Floodplains									
Geology	•				•	•		•	
Groundwater	•		•			•		•	
Human Health and Safety	•	•	•	•	•	•	•	•	•
Land use	•	•	•	•	•	•	•	•	•
Noise	•	•	•	•	•	•	•	•	
Wastes & Materials		•	•	•	•	•		•	•
Soils		•	•	•		•	•	•	•
Socioeconomics	•	•	•	•	•	•	•	•	•
Surface Water	•		•			•	•	•	•
Transportation/Traffic	•	•	•	•	•	•		•	•
Utilities	•	•	•	•	•	•	•	•	
Wetlands	•							•	
Public Controversy	•		•			•		•	•
Permits	•	•	•	•	•	•	•	•	•
Mitigation	•	•		•	•	•		•	•

(Blank) No impacts expected.
• Potential to be minor adverse or beneficial impacts or there are unknowns of possible minor concern.
• Potential to be moderate adverse impacts or there are unknowns of possible moderate concerns.
■ Potential to be major adverse impacts or there are unknowns of possible major concerns.

5. REFERENCES

DOE 2009 U.S. Department of Energy, National Energy Technology Laboratory, *Recovery Act – Smart Grid Demonstrations, Funding Opportunity Number: DE-FOA-0000036*, June 25, 2009.

A803: Finding of No Significant Impact

FINDING OF NO SIGNIFICANT IMPACT FOR THE PACIFIC GAS AND ELECTRIC COMPANY COMPRESSED AIR ENERGY STORAGE COMPRESSION TESTING PHASE PROJECT, SAN JOAQUIN COUNTY, CALIFORNIA

AGENCY: U.S. Department of Energy (DOE)

ACTION: Finding of No Significant Impact (FONSI)

SUMMARY: DOE completed the *Final Environmental Assessment for the Pacific Gas and Electric Company (PG&E) Compressed Air Energy Storage (CAES) Compression Testing Phase Project, San Joaquin County, California* (DOE/EA-1752). Based on the analysis in the environmental assessment (EA), DOE determined that its proposed action of providing up to $25 million in financial assistance to PG&E for construction and operation of a CAES compression testing phase project would not result in any significant adverse impacts. PG&E proposes construction, operation and decommissioning of an injection and withdrawal well, air compression equipment, and associated temporary site facilities required to conduct compression testing of a depleted natural gas field. The project would simulate operation of a CAES facility to confirm geological and engineering suitability for this use. The Mokelumne River geologic formation is located on King Island, San Joaquin County, California. The CAES compression testing project would create temporary construction jobs and further PG&E and DOE's understanding of CAES as a Smart Grid technology.

BACKGROUND: As part of the American Recovery and Reinvestment Act of 2009 (Recovery Act) (the Recovery Act; Public Law 111-5, 123 Stat. 115), DOE's National Energy Technology Laboratory (NETL), on behalf of the Office of Electricity Delivery and Energy Reliability's Smart Grid Demonstrations Program, is providing up to $435 million in financial assistance through competitively awarded grants for the deployment of Smart Grid Demonstration projects under Funding Opportunity Announcement DE-FOA-0000036. These projects verify technology viability, quantify costs, validate new business models at a scale that can be readily adapted and replicated around the country, and develop new and innovative forms of energy storage.

The federal proposed action of providing funding for these projects requires compliance with the *National Environmental Policy Act (NEPA) of 1969,* as amended (NEPA; 42 U.S.C. Section 4321 et seq.), Council of Environmental Quality regulations (40 CFR Parts 1500 to 1508), and DOE NEPA implementing regulations (10 CFR Part 1021). DOE prepared an EA to evaluate the potential environmental consequences of providing a grant for PG&E's proposed project under the Smart Grid Initiative.

PURPOSE AND NEED: The overall purpose and need for DOE's proposed action, pursuant to the Smart Grid Demonstration Program and the Recovery Act, is to accelerate the development and production of a smarter, more efficient, more resilient electrical grid. DOE believes PG&E's proposed project can meet these objectives because it would: (1) increase power quality and reliability in its service area; (2) reduce impacts associated with carbon emissions; (3) increase energy security through reduced fossil fuel consumption; and (4) further national knowledge and technology of new renewable energy-generating and peak-shifting systems.

DESCRIPTION OF THE PROPOSED ACTION: DOE's proposed action is to provide up to $25 million in financial assistance to PG&E, which has also received approval from the California Public Utilities Commission to obtain matching funds. PG&E proposes to use this financial assistance to fund construction of a temporary facility and conduct pressure testing of a depleted gas well field. Testing would consist of injecting air to build a subsurface bubble within the reservoir sands of the depleted King Island Gas Field, and then conducting a series of pressure tests to further confirm geologic suitability and to obtain more detailed information for project engineering. The cost of the pressure testing phase, which is the subject of this final EA, is estimated to be approximately $20 to $25M.

ALTERNATIVES CONSIDERED: DOE's alternatives to this project consisted of the 15 other technically acceptable applications it received in response to Funding Opportunity Announcement DE-FOA-0000036, *Recovery Act: Smart Grid Demonstrations*. Before selection DOE made preliminary determinations about the level of review under NEPA based on potentially significant impacts it identified during the review of technically acceptable applications. DOE conducted these preliminary reviews pursuant to 10 CFR 1021.216 and provided them to the selecting official who considered them during the selection process.

Because DOE's Proposed Action under the Smart Grid Demonstrations Program is limited to providing financial assistance in cost sharing arrangements to selected applicants in response to a competitive funding opportunity, DOE's decision is limited to either accepting or rejecting the project proposed by the proponent, including its proposed technology and selected sites. DOE's

consideration of reasonable alternatives is therefore limited to the technically acceptable applications and the No-Action Alternative for each selected project.

Under the No Action Alternative, DOE would not provide funds for the proposed project. For the purposes of the analyses in the EA, DOE assumed that the project would not proceed without federal funding. This assumption establishes a baseline against which the potential environmental impacts of the proposed project can be compared. For comparison purposes, it is assumed no impacts to the existing environment would occur, and the beneficial impacts discussed above would not be realized.

ENVIRONMENTAL CONSEQUENCES: DOE evaluated the potential environmental consequences of the proposed project and the No Action Alternative. DOE considered thirteen environmental resource areas in the EA; however, not all areas were evaluated at the same level of detail. A "sliding-scale" approach was used so that those actions with greater potential effect were evaluated in greater detail than those that have little potential for impact. To this end, those resource areas with the higher potential for impacts and greater potential need for mitigation measures were given more emphasis. For the resource categories land use/land resources; waste management; aesthetics and visual resources; utilities, energy, and minerals; and transportation, DOE determined there would be no impacts or the potential impacts would be small, temporary, or both, and therefore did not carry those forward for additional analysis.

The areas DOE evaluated in detail include: air quality; biological resources; noise and vibration; public and occupational health and safety; and water resources as well as those resource areas

that typically interest the public, such as socioeconomics and environmental justice and cultural, historic, and paleontological resources. For these resource areas, DOE determined there would not be significant environmental impacts during the construction and operation phases of the proposed project. The following paragraphs summarize the analyses.

During construction and operation, air emissions would include: (1) combustion emissions from vehicles, heavy-duty equipment, and drilling rig power supplies used to construct the test facilities; (2) fugitive dust from site preparation activities; and (3) emissions of volatile organic compounds including greenhouse gases from the injection and withdrawal well during test operations. These emissions would have minor but short-term impacts that are below the San Joaquin Valley Air Pollution Control District's recommended thresholds of significant impact or the General Conformity *de minimis* threshold values.

Irrigation ditches along roads and near the development site provide marginal- to moderate-quality habitat for the giant garter snake (*Thamnophis gigas*), which is federally listed as a threatened species. The irrigation ditches and ponds also provide habitat for the western pond turtle (*Emys marmorata*), a California species of special concern. Trees within 0.5 mile of the study area provide nesting habitat for Swainson's hawk (*Buteo swainsoni*) and the white-tailed kite (*Elanus leucurus*), which are listed as threatened by California. DOE consulted with the U.S. Fish and Wildlife Service (FWS). With the implementation of standard avoidance and minimization measures, DOE determined that the proposed project would not adversely affect these species. These measures include preconstruction surveys, exclusionary fencing, worker

environmental training, burrow avoidance, road shoulder avoidance, speed limits, and biological monitoring.

The project would involve the productive reuse of a depleted natural gas field. The project's potential to induce seismicity is extremely low, based on recent studies of this phenomenon that involve thousands of oil and gas wells and analysis of the geologic setting.

Well drilling and construction equipment would create noise during the installation phase, and compressors, the withdrawal well air release vent, and choke manifold would create noise during test operations. Detailed modeling of project noise sources and noise attenuation with distance shows that, with the application of an air release stack silencer and other measures, the project would meet San Joaquin County's noise standards at the nearest sensitive receptor.

No previously recorded historic or cultural resources of significance occur in the project's area of potential effects. As the project location is in a former marsh area of the Sacramento-San Joaquin Delta, the discovery of buried archaeological deposits during construction or operation is unlikely. If PG&E were to find cultural deposits during project activities, work would stop immediately and the Native American tribes and California State Historic Preservation Officer (SHPO) would be notified in accordance with the Unanticipated Discovery Plan. DOE has consulted with the California SHPO and interested Native American tribes and it was determined there would be no impacts to federally listed or eligible historic properties. The SHPO agreed with DOE's determination. The site is in an area of recent alluvial deposits of low paleontological sensitivity and there are no previously recorded vertebrate paleontological finds near the project site.

As a direct result of the Tribal consultation process, DOE is hereby requiring PG&E comply with the following conditions regarding cultural resources:

1. PG&E shall prepare an ethnographic study. The ethnographic study may be conducted concurrently with the project activities.

2. PG&E shall perform subsurface testing at the compression testing site. The subsurface testing will include up to 15 shovel pits (approximately 1.5'x3'x1.5-3' in depth). Material recovered from these test pits will be screened through one-quarter inch mesh, or suitable sized mesh acceptable for archeological investigation. PG&E shall require this work be performed by professionals meeting the requirements applicable in California.

3. PG&E shall maintain a copy of the Unanticipated Discovery Plan at the site during construction. The plan will be followed by all parties during sub-surface testing and ground disturbance activities.

The project would create indirect economic consequences because vendors and equipment suppliers would benefit from the orders for project components and support systems. The positive economic benefits would be small.

The evaluation of environmental justice impacts is conducted by determining if adverse effects from the proposed project would disproportionately affect low-income or minority populations. DOE determined that no adverse impacts would occur to any member of the community. Nonetheless, there would be no adverse impacts to any minority or low-income population.

Injected air would mix to some extent with residual natural gas contained in the reservoir sands. Work done to date suggests that the percentage of natural gas contained in air withdrawn from the reservoir should be relatively low; however, some uncertainty remains until preliminary findings can be verified through reservoir testing. It is thus possible that withdrawal air may contain methane in concentrations potentially posing a hazard for onsite workers. This potential hazard would be mitigated by modeling the reservoir behavior during injection and withdrawal testing to determine expected hydrocarbon concentrations, monitoring of the reservoir and withdrawal air for actual concentrations, operational controls to prevent hazardous mixtures from reaching the surface and, if needed, injection of air with a depleted molar oxygen concentration of five percent or less to reduce the hydrocarbon concentrations in the withdrawn air.

Site preparation and construction could result in storm water runoff and soil erosion. To reduce runoff and prevent sediments from entering surface waters, PG&E would use permeable materials to construct the drilling and operation pad. The pad design would direct runoff away from equipment. PG&E would prepare a Storm Water Pollution Prevention Plan in accordance with the National Pollutant Discharge Elimination System General Permit for Storm Water Discharges. The project would use an air-cooled closed-loop cooling system that would minimize the use of fresh water for project operation. Produced water from the compressed air

withdrawal would be stripped from the air stream, captured, and trucked offsite along with other wastewater to be disposed of properly at a certified commercial disposal facility.

PUBLIC AVAILABILITY: DOE issued the draft EA on November 26, 2013, and advertised its release in *The Record* (Stockton) and *News-Sentinel* (Lodi) on November 26, 27, and 28, 2013. In addition, DOE sent copies of the draft EA to the San Joaquin County Library in Stockton, California, for public review. DOE established a 35-day public comment period that began November 26, 2013, and ended December 31, 2013. DOE announced it would accept comments by mail, email, or fax. DOE distributed the draft EA to the applicable Federal, State, and local agencies, Native American tribes, and interested individuals.

On April 28, 2014, DOE sent a follow-up consultation letter and an updated Biological Effects Assessment to the FWS in accordance with the review requirements of Section 7 of the Endangered Species Act. The updated information detailed the necessary revised avoidance and mitigation measures as required by FWS to ensure that the proposed project is not likely to adversely affect threatened and endangered species. PG&E cannot proceed with additional construction beyond the original authorization as noted in the FWS letter dated August 2, 2013, until FWS issues an updated concurrence review. PG&E will comply with all avoidance and mitigation measures required by FWS.

On June 7, 2013, DOE sent a letter to the SHPO in accordance with the review requirements of Section 106 of the National Historic Preservation Act, as amended (16 U.S.C. 470 et seq.), and its implementing regulations at 36 CFR Part 800. The letter detailed DOE's investigation of

nearby historic properties and concluded that no historic properties would be affected by the proposed project. The SHPO responded on June 26, 2013, with a letter indicating its agreement with DOE's determination. On August 7, 2013, the SHPO responded with a letter of concurrence that the expanded area of potential effects still would not affect historic properties.

Notices of availability for the final EA and this FONSI were sent to stakeholders and resource agencies that provided comments or consultation, and the documents were made available at: http://www.netl.doe.gov/library/environmental-assessments. Copies of the final EA and FONSI can also be obtained by sending a request to:

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During the 35-day public comment period, which ended on December 31, 2013, DOE received one comment letter from the San Joaquin County Environmental Health Department. This letter indicated that this agency had reviewed the draft EA and had no substantive comments on it. DOE received and accepted comments on the draft EA on March 12, 2014, from the Buena Vista Rancheria of Me-Wuk Indians. These comments and DOE's responses are included in the final EA.

DETERMINATION: Based on the findings of this EA, and after careful consideration of all public and agency comments, DOE has determined that its proposed – action of providing up to

$25 million in the form of cost-shared federal funding – and PG&E's construction and operation of the Compressed Air Energy Storage Compression Testing Phase Project would not significantly affect the quality of the human environment. Therefore, preparation of an environmental impact statement is not required and DOE is issuing this FONSI.

Issued in Pittsburgh, PA, this 15th day of May 2014.

Scott M. Klara
Acting Director
National Energy Technology Laboratory

A804: KICP Appendix 5.3E – SWCA GeoTest 2012

Cultural Resource Survey for the PG&E CAES – King Island Project, San Joaquin County, California

Prepared for

Pacific Gas and Electric Company

Prepared by

SWCA Environmental Consultants

October 2012

CONFIDENTIAL – NOT FOR PUBLIC DISTRIBUTION

CULTURAL RESOURCE SURVEY FOR THE PG&E CAES – KING ISLAND PROJECT SAN JOAQUIN COUNTY, CALIFORNIA

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SWCA Project No. 23910
SWCA Cultural Resource Report No. 12-392

October 2012

Keywords: Cultural resource survey; 4 potential cultural resources; 41.4 acres; San Joaquin County; Terminous quadrangle; Township 3 North, and Range 5 East

Archaeological and other heritage resources can be damaged or destroyed through uncontrolled public disclosure of information regarding their location. This document contains sensitive information regarding the nature and location of archaeological sites which should not be disclosed to the general public or unauthorized persons.

Information regarding the location, character, or ownership of a cultural resource is exempt from the Freedom of Information Act pursuant to 16 USC 470w-3 (National Historic Preservation Act) and 16 USC Section 470(h) (Archaeological Resources Protection Act).

MANAGEMENT SUMMARY

Purpose and Scope: SWCA Environmental Consultants (SWCA) was retained by Pacific Gas and Electric Company (PG&E) to conduct a cultural resource study in support of the PG&E Compressed Air Energy Storage (CAES) – King Island Project (project). The study area consists of 16.75 hectares (41.4 acres) of land located approximately 14.25 kilometers (8.9 miles) southwest of the City of Lodi in San Joaquin County, California. The cultural resource study consisted of a cultural resource record and literature search, Native American consultation, cultural resource survey of the study area, and preparation of a cultural resource technical report documenting the results of the inventory and providing management recommendations.

Dates of Investigation: A search of the California Historical Resources Information System (CHRIS) was conducted by the Central California Information Center (CCIC) at California State University, Stanislaus in Turlock, California, and the results were received on August 28, 2012. Cultural resource specialists conducted an intensive-level cultural resource survey on August 28, 2012.

Findings of the Investigation: Seven prior cultural resource studies have been conducted within a 1.6-kilometer (1-mile) radius of the area of potential effects (APE), one of which included a portion of the APE. The records and literature search also indicates that five cultural resources have been previously recorded within a 1-mile radius of the APE, none of which are located in the study area. Three buildings (SWCA-KING-1, SWCA-KING-2, and SWCA-KING-3) were identified in the study area along one of the potential access roads (Alternate B). Visual observation and initial research of these buildings suggest that they may be older than 50 years and as such, could be potential cultural resources. SWCA archaeologists did not identify any other cultural resources in the APE.

Investigation Constraints: Ground visibility was generally poor throughout the study area due to obstruction by vegetative ground cover, pavement, and gravel. A portion of the study area along the eastern side of Alternate B was unable to be fully surveyed to the full 25-foot-wide buffer from the edge of the access road due to an adjacent waterway.

Recommendations Summary: SWCA cultural resource specialists identified three buildings and an irrigation canal along Alternate B as a result of the intensive-level survey (SWCA-KING-1, SWCA-KING-2, SWCA-KING-3, and SWCA-KING-4). Visual observation and initial research of these resources suggest that they may be potential cultural resources. Until these resources are formally recorded and evaluated, SWCA recommends that they be treated as though they are significant, and that the project avoid impacting them. Alternate A would not have direct or indirect effects on these buildings, and SWCA recommends that the project use this access route, while avoiding the use of Alternate B. If it becomes necessary to use Alternate B, SWCA recommends that SWCA-KING-1, SWCA-KING-2, SWCA-KING-3, SWCA-KING-4 be formally evaluated to determine their significance before the start of any construction activities.

However, in the event that cultural resources are discovered during construction grading, trenching, or excavation, project personnel should halt earth-moving activities in the immediate area and notify a qualified archaeologist to evaluate the resource. In the event of the discovery of human remains during project implementation, relevant state law shall be followed, beginning with a cessation of disturbance and the placing of a call to the county coroner.

Disposition of Data: This report will be on file with the following entities: the CCIC at California State University, Stanislaus; PG&E; and SWCA. All field notes and records related to the current project are on file at SWCA's Pasadena office. All geographical information systems data created during this study is on file at SWCA's Pasadena office and PG&E.

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INTRODUCTION

SWCA Environmental Consultants (SWCA) was retained by Pacific Gas and Electric Company (PG&E) to conduct a cultural resource study in support of the PG&E Compressed Air Energy Storage (CAES) – King Island Project (project). The study area consists of 16.75 hectares (41.4 acres) of land located approximately 14.25 kilometers (8.9 miles) southwest of the City of Lodi in San Joaquin County, California. The cultural resource study consisted of a cultural resource record and literature search, Native American consultation, cultural resource survey of the study area, and preparation of a cultural resource technical report documenting the results of the inventory and providing management recommendations.

Project Description

The project would use renewable energy from sources such as wind to inject compressed air into an underground reservoir and then use it to help power a turbine generator during peak periods when the energy is needed most. It would be implemented in three phases: site selection and feasibility analysis, licensing and permitting, and construction and operation.

The King Island reservoir site consists of the expansion of the existing Piacentine well pad to the west for a total area of 42 × 67 meters (m) (140 × 220 feet). The well pad will support a drilling rig and other equipment for the purpose of core drilling tests to determine whether the King Island reservoir is a viable candidate for the CAES project. Construction of the well pad will require importing non-native fill material (e.g., sand and gravel) to stabilize the site so that it can support a drilling rig. Access routes may also require grading prior to construction. Site preparation will include importing gravel and sand and performing grading and compaction, and will occur over a 1- to 2-week period starting as early as October 2012. Core drilling is planned to start as early as November 2012 following site preparation, and will consist of mobilizing a drill rig with supporting equipment, conducting core drilling to approximately 1,524 m (5,000 feet) below the surface.

Area of Potential Effects

An area of potential effects (APE) is defined as the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties (36 Code of Federal Regulations [CFR] 800.16(d)). The proposed project is located within unincorporated San Joaquin County in an area primarily characterized by agricultural land use. The archaeological or direct APE boundary represents portions of the study area that will be directly affected by the proposed undertaking, and includes areas where ground disturbance may result from the proposed project. Specifically, the direct APE consists of the construction footprint, or well pad site, and two potential access roads (Alternate A and Alternate B). The vertical APE extends to approximately 1,524 m (5,000 feet) below the existing ground surface, or the depth to which core drilling will be conducted. A study area was established to include both direct and indirect effects, and included an approximately 61-m (200-foot) buffer around the well pad site, and a 7.6-m (25-foot) buffer from the edges of each of the potential access roads (Figure 3).

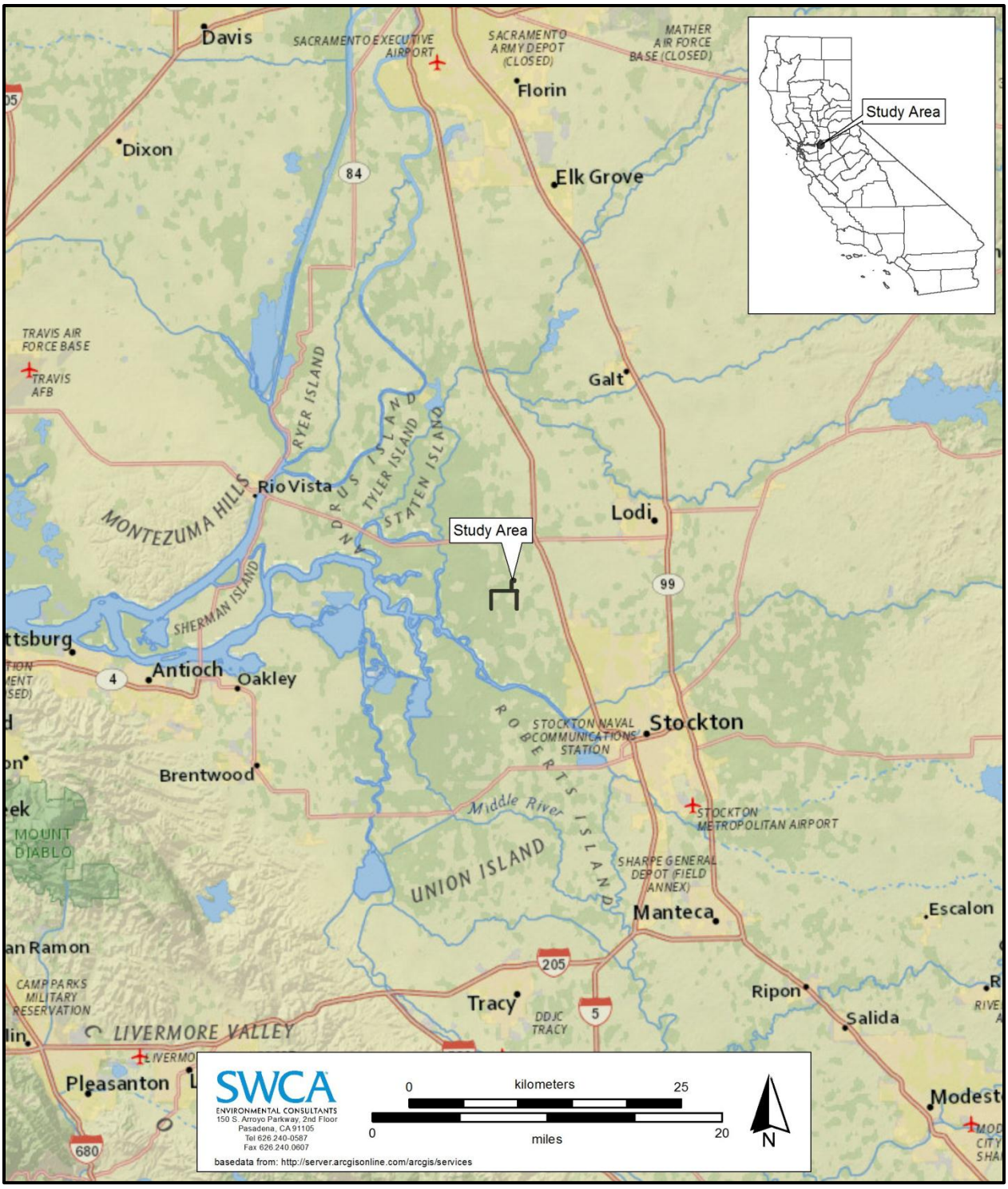


Figure 1. Location of the study area.

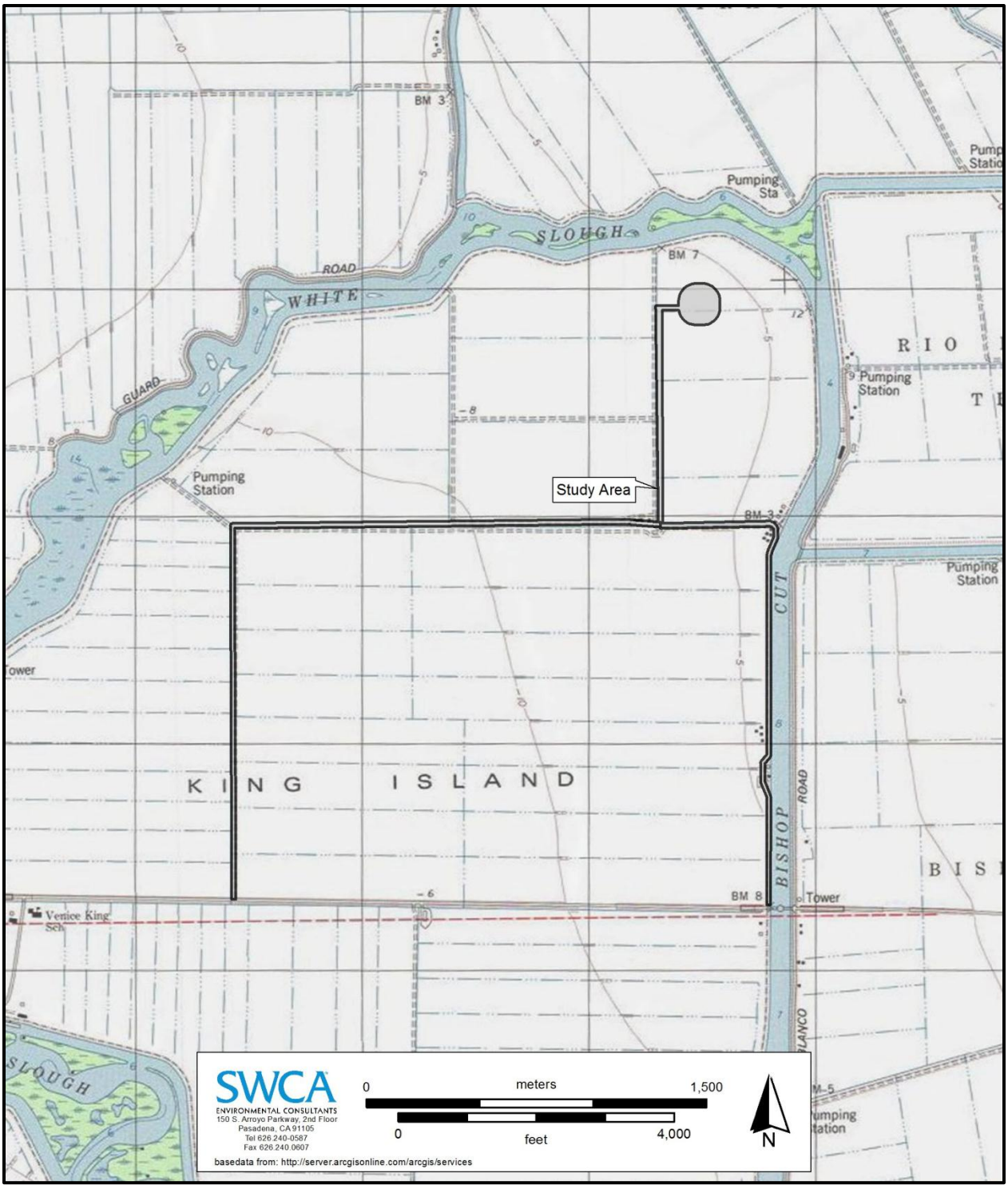


Figure 2. Detailed location of the study area.



Figure 3. The area of the potential effects in relation to Alternate A and B.

REGULATORY SETTING

This section identifies federal regulations, state legislation, and local statutes, ordinances, and guidelines that govern the identification and treatment of cultural resources and analysis of project-related effects on cultural resources. The lead agency must consider these requirements in making decisions on projects that may affect cultural resources. The current study was conducted in compliance with both federal and state laws, particularly Section 106 of the National Historic Preservation Act (NHPA) and the California Environmental Quality Act (CEQA).

Federal

National Historic Preservation Act

The current study was completed under the provisions of the NHPA of 1966, as amended (16 United States Code 470f). Cultural resources are considered during federal undertakings chiefly under Section 106 of the NHPA through one of its implementing regulations, 36 CFR 800 (Protection of Historic Properties), as well as the National Environmental Policy Act (NEPA). Properties of traditional religious and cultural importance to Native Americans are considered under Section 101(d)(6)(A) of the NHPA. Other relevant federal laws include the Archaeological Data Preservation Act of 1974, the American Indian Religious Freedom Act of 1978, the Archaeological Resources Protection Act of 1979, and the Native American Graves Protection and Repatriation Act of 1989.

Section 106 requires federal agencies to take into account the effects of their undertakings on any district, site, building, structure, or object that is included in or eligible for the National Register of Historic Places (NRHP) and to afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment on such undertakings (36 CFR 800.1). Under Section 106, cultural resources must be identified and evaluated; effects on historic properties are reduced to acceptable levels through mitigation measures or agreements among consulting and interested parties. Historic properties are those resources that are listed in or are eligible for the NRHP in accordance with the criteria listed below (36 CFR 60.4) (ACHP 2010).

The quality of *significance* in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess *integrity* of location, design, setting, materials, workmanship, feeling and association and that

(A) are associated with events that have made a significant contribution to the broad patterns of our history; or

(B) are associated with the lives of persons significant in our past; or

(C) embody the distinctive characteristics of a type, period, or method of installation, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

(D) have yielded, or may be likely to yield, information important in prehistory or history.

Impacts of a project to significant cultural resources that affect the characteristics of any resource that qualify it for the NRHP are considered a significant effect on the environment. Under 36 CFR 800.5(a)(2), adverse effects on historic properties include, but are not limited to

(i) physical destruction of or damage to all or part of the property;

(ii) alteration of a property;

(iii) removal of the property from its historic location;

(iv) change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance;

(v) introduction of visual, atmospheric or audible elements that diminish the integrity of the property's significant historic features;

(vi) neglect of a property which causes its deterioration;

(vii) transfer, lease, or sale of property out of federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance.

State

California Environmental Quality Act

CEQA requires a lead agency to determine whether a project may have a significant effect on historical resources (Section 21084.1). If it can be demonstrated that a project will cause damage to a unique archaeological resource, the lead agency may require that reasonable efforts be made to permit any or all of these resources to be preserved in place or left in an undisturbed state. To the extent that they cannot be left undisturbed, mitigation measures are required (Section 21083.2[a], [b], and [c]).

Section 21083.2(g) defines a *unique archaeological resource* as an archaeological artifact, object, or site about which it can be clearly demonstrated that without merely adding to the current body of knowledge, there is a high probability that it meets any of the following criteria:

(1) Contains information needed to answer important scientific research questions and that there is a demonstrable public interest in that information.

(2) Has a special and particular quality such as being the oldest of its type or the best available example of its type.

(3) Is directly associated with a scientifically recognized important prehistoric or historic event or person.

A *historical resource* is a resource listed in, or determined to be eligible for, the California Register of Historical Resources (CRHR) (Section 21084.1); a resource included in a local register of historical resources (Section 15064.5[a][2]); or any object, building, structure, site, area, place, record, or manuscript that a lead agency determines to be historically significant (Section 15064.5[a][3]).

Public Resources Code (PRC) Section 5024.1, Section 15064.5 of the CEQA Guidelines, and PRC Sections 21083.2 and 21084.1 were used as the basic guidelines for this cultural resource study. PRC Section 5024.1 requires an evaluation of historical resources to determine their eligibility for listing in the CRHR. The purpose of the register is to maintain listings of the state's historical resources and to indicate which properties are to be protected from substantial adverse change. The criteria for listing resources on the CRHR were expressly developed to be in accordance with previously established criteria developed for listing in the NRHP, enumerated below.

According to PRC Section 5024.1(c)(1–4), a resource is considered historically significant if it (i) retains "substantial integrity," and (ii) meets at least one of the following criteria:

(1) Is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage.

(2) Is associated with the lives of persons important in our past.

(3) Embodies the distinctive characteristics of a type, period, region, or method of installation, or represents the work of an important creative individual, or possesses high artistic values.

(4) Has yielded, or may be likely to yield, information important in prehistory or history.

Impacts to significant cultural resources that affect the characteristics of any resource that qualify it for the NRHP or adversely alter the significance of a resource listed on or eligible for the CRHR are considered a significant effect on the environment. These impacts could result from "physical demolition, destruction, relocation, or alteration of the resource or its immediate surroundings such that the significance of an historical resource would be materially impaired" (CEQA Guidelines, Section 15064.5 [b][1], 2000). Material impairment is defined as demolition or alteration "in an adverse manner [of] those characteristics of an historical resource that convey its historical significance and that justify its inclusion in, or eligibility for inclusion in, the California Register…" (CEQA Guidelines Section 15064.5[b][2][A]).

ENVIRONMENTAL SETTING

The study area is in the Sacramento-San Joaquin Delta region, an area in the California Central Valley lowlands that is defined by the confluence of the Sacramento, American, Mokelumne, and San Joaquin Rivers. The topography of the study area is virtually flat, with elevations ranging from approximately 0 to 3 meters (0 to 10 feet) above mean sea level (Figure 4). The region's climate is characterized by warm, dry summers, and mild, moist winters. Summer temperatures have highs around 32 degrees Celsius (90 degrees Fahrenheit), and winter temperatures have highs around 13 degrees Celsius (55 degrees Fahrenheit).



Figure 4. Overview of study area; view to the north.

Although current land uses in the APE include agricultural croplands, the area near the APE was characterized historically by vegetation communities that included freshwater marshland near permanent water in low-lying areas, seasonal wetlands and vernal pools within grasslands and woodlands, riparian scrub/forest along drainages, and grasslands and oak woodlands in valley foothill areas. With this mosaic of ecological communities, and in view of the ethnographic descriptions of the Plains Miwok (Kroeber 1925; Latta 1977; Wallace 1978) who historically occupied the area, it would appear that the study area and surround area would have provided a very productive environment for its prehistoric occupants, one well-suited to a hunting-gathering economy with a variety of fish, waterbirds, small and large mammals, and edible plant species.

CULTURAL SETTING

Prehistoric Overview

California prehistory is divided into three broad temporal periods that reflect similar cultural characteristics throughout the state: Paleoindian period (ca. 9000–6000 B.C.), Archaic period (6000 B.C.–A.D. 500), and Emergent period (A.D. 500–Historic Contact) (Fredrickson 1973, 1974, 1994a). The Archaic is divided further into Lower (6000–3000 B.C.), Middle (3000–1000 B.C.), and Upper (1000 B.C.– A.D. 500) periods, generally governed by climatic and environmental variables, such as the drying of pluvial lakes at the transition from the Paleoindian to the Lower Archaic.

The APE lies in what generally is described as the Delta subregion of the Central Valley Archaeological Region, which is one of eight arbitrary organizational divisions of the state (Moratto 1984). This archaeological subregion surrounds the Sacramento-San Joaquin Delta in the middle of the Central Valley and mainly includes portions of Contra Costa, Sacramento, San Joaquin, Solano, and Yolo Counties.

Occupation in the Sacramento-San Joaquin Delta region during the Prehistoric period is estimated to have occurred as early as 12,000 years ago, but only a few archaeological sites have been identified that predate 5,000 years ago. It is possible that Holocene alluvial deposits buried many prehistoric sites in this area, and Moratto (1984:214) estimates that as much as 10 m of sediment accumulated along the lower stretch of the Sacramento River drainage system during the last 5,000–6,000 years. CA-CCO-637 in eastern Contra Costa County, for example, is one of the few early Holocene-age sites in the region, with a record of human occupation as early as 8,500 years ago during the Lower Archaic (Meyer and Rosenthal 1998). The archaeological remains at that site were discovered approximately 2 m below the surface within an alluvial fan near Kellogg Creek.

Prehistoric material culture in central California subsequent to the Paleoindian and Lower Archaic periods has been categorized according to “horizons” or “patterns” that define broad technological, economic, social, and ideological elements over long periods of time and large areas. The taxonomic system historically used for central California is a tripartite classification scheme with Early, Middle, and Late Horizons. This Central California Taxonomic System (CCTS) was the result of efforts of a number of researchers (e.g., Beardsley 1954; Heizer 1949) and was developed further after the advent of radiocarbon dating (Fredrickson 1973, 1974; Heizer 1958; Ragir 1972).

Today, a series of generalized periods associated with regionally based “patterns” are typically used as part of the CCTS for the Sacramento Delta area, San Francisco Bay area, and North Coast ranges (Bennyhoff and Fredrickson 1969; Fredrickson 1973, 1974). Smaller units of patterns are referred to as “aspects” and “phases,” which emphasize more local features. Revisions of the widely accepted CCTS (Bennyhoff 1994; Fredrickson 1994a, 1994b) are found in a recent volume edited by Hughes (1994).

Fredrickson (1973, 1974) defined several regionally based patterns, three of which are specific to the prehistory of the APE. Referred to as the Windmiller Pattern, Berkeley Pattern, and Augustine Pattern, each represents a general pattern of resource exploitation, as identified between 2500 B.C. and the beginning of Euro-American contact in the early 1800s. The Windmiller Pattern was first identified at the Windmiller site (CA-SAC-107) near the Cosumnes River in Sacramento County; the Berkeley Pattern was initially identified at the West Berkeley site (CA-ALA-307) in Alameda County on the east side of the San Francisco Bay; and the Augustine Pattern was identified at the Augustine site (CA-SAC-127) in the Sacramento-San Joaquin Delta. These patterns are present within the following horizon sequences: Middle Archaic period/Windmiller Pattern (formerly Early Horizon), Upper Archaic period/Berkeley Pattern (formerly Middle Horizon), and Emergent period/Augustine Pattern (formerly Late Horizon).

Windmiller Pattern (2500–500 B.C.)

Clearly documented evidence for human occupation in the general area is found at sites characteristic of the Windmiller Pattern during the Middle Archaic period. These sites date to as early as 4,500 years ago and as late as 2,500 years ago (2500–500 B.C.). Such sites often contain manos and metates (grinding stones), as well as many mortar fragments, indicating that acorns and/or various seeds formed an important part of the diet (Moratto 1984:201).

In addition to plant foods, the subsistence system included many other food resources, such as deer, elk, pronghorn, rabbits, and waterfowl. Numerous faunal remains have been documented at Windmiller Pattern sites, along with large quantities of projectile points. Also, the presence of angling hooks and baked clay artifacts possibly used as net or line sinkers, along with the remains of sturgeon, salmon, and smaller fishes, indicates that fishing was an additional source of food (Fredrickson 1973; Heizer 1949; Ragir 1972). Items made of baked clay included net sinkers, pipes, and discoids, as well as cooking "stones." Ground and polished charmstones, impressions of twined basketry, shell beads, and bone tools also have been found at Windmiller Pattern sites. Some items, such as shell beads, obsidian tools, and quartz crystals, were obtained by trade.

The archaeological record during the Windmiller pattern indicates that people practiced a mixed procurement strategy of both game and wild plants, with the addition of acorns and/or seeds. The mixed exploitation of a wide range of natural resources ties into a seasonal foraging strategy. Populations likely occupied the lower elevations of the Sacramento Valley in the winter months and shifted to higher elevations during the summer (Moratto 1984:206). Mortuary practices included burials, accompanied by grave goods, in cemeteries that were separate from the habitation sites.

Berkeley Pattern (500 B.C.–A.D. 500)

Over a 1,000-year period, the Windmiller Pattern began to shift to the more specialized adaptive Berkeley Pattern during the Upper Archaic period. A shift to a greater reliance on acorns as a dietary staple is interpreted during the Berkeley Pattern from the increase in mortars and pestles, along with a decrease in manos and metates. Mortars and pestles are better suited to crushing and grinding acorns, whereas manos and metates were used primarily for grinding wild grass grains and seeds (Moratto 1984:209–210).

As demonstrated by the artifact assemblage, hunting remained an important aspect of food procurement during the Berkeley Pattern (Fredrickson 1973:125–126). The archaeological record, which consists of numerous large shell midden/mounds, also demonstrates that occupants at most Berkeley Pattern sites near water (both fresh and salt) made intensive use of aquatic resources.

The artifact assemblage also includes shell beads and ornaments, as well as numerous types of bone tools. Interment continues to dominate mortuary practices, but a few cremations are also found at Berkeley Pattern sites.

Artifact assemblages and radiocarbon dating of sites from this period suggest this subsistence pattern may have developed in the San Francisco Bay region and later spread to surrounding coastal locales and into central California. Moratto (1984:207–211) suggests that the pattern is related to the expansion of Eastern Miwok populations from the San Francisco Bay area to the Sacramento Valley and Sierra foothills.

Augustine Pattern (A.D. 500–historic contact)

The Augustine Pattern is evidenced by a number of changes in subsistence, foraging, and land-use patterns that begin to reflect the use pattern known from Historic period Native American groups in the area. A substantial increase in the intensity of subsistence exploitation (including fishing, hunting, and gathering [particularly the acorn]) evidenced in the archaeological record correlates directly with population growth (Moratto 1984:211–214).

Tools and cooking implements include shaped mortars and pestles, hopper mortars, bone awls used for producing coiled baskets, and the bow and arrow. Pottery vessels, known as Cosumnes Brownware, are found in some parts of the Central Valley and most likely developed during this period from the prior baked clay industry.

During this period, an increase in sedentism led to the development of social stratification, accompanied by a shift to elaborate ceremonial and social organization. Exchange networks, with the use of clamshell disk beads as currency, also developed during the Augustine Pattern. Mortuary practices during this pattern included flexed burials and pre-interment burning of offerings in a grave pit, as well as cremation of high-status individuals (Fredrickson 1973:127–129; Moratto 1984:211). Additional items of material culture include flanged tubular pipes, harpoons, and small Gunther barbed series projectile points. The Augustine Pattern may represent the southward expansion of Wintu populations (Moratto 1984: 211–214).

Ethnographic Overview

The APE is located in an area historically occupied by the Penutian-speaking Plains Miwok, a subgroup of the Eastern Miwok (Kroeber 1925; Levy 1978; Shipley 1978:84). The Plains Miwok historically occupied the lower Mokelumne River, Cosumnes River, and the Sacramento River from Rio Vista to Freeport (Levy 1978:398–399). Neighboring groups included the Nisenan to the north, Patwin and Bay Miwok to the west, Northern Valley Yokuts to the south, and the Washoe to the east.

Spanish mission records, diaries, and journals have provided the most comprehensive study of the Miwok, as well as some ethnographical studies done in the first half of the twentieth century (Bennyhoff 1977; Levy 1978:399). Much of the history of the Plains Miwok, however, is incomplete.

The villages of the Plains Miwok were divided into "tribelets," political units that were also structured by similarities in language and ethnicity. The tribelets averaged 300–500 persons, and each held claim to a designated portion of territory within the lands of the Plains Miwok, which also extended to the natural resources within each territory (Levy 1978:410). Each tribelet's territory contained a main village and smaller satellite villages. Within a tribelet's main village was an assembly or dance house, either a large semi-subterranean structure or a simpler circular brush structure (Kroeber 1925:447). Other structures included semi-subterranean or aboveground conical houses made with tule-matting, conical sweathouses,

winter grinding houses, and acorn granaries (Levy 1978:408–409). The Plains Miwok also practiced cremation (Kroeber 1925:452).

The rich resources of the Sacramento-San Joaquin Delta and surrounding areas provided the Plains Miwok with food and material needs. The primary food staple was the acorn, supplemented by waterfowl, fish, shellfish, and large and small mammals (Bennyhoff 1977; Levy 1978). The Miwok are best described as seasonally mobile hunter-gatherers with semi-permanent villages. The delta islands were also used regularly for hunting and fishing base camps. Permanent settlements of the Plains Miwok were located on high ridges or knolls near watercourses or on the sandy islands in the delta.

The Plains Miwok collected plant greens and roots in the spring; seeds and nuts in the spring, summer, and early fall; and acorns in the late fall/early winter (Levy 1978:402–403). Acorns, particularly from the prevalent valley oak (*Quercus lobata*) could be stored for some time in the conical-shaped granaries prior to processing. Tule elk, pronghorn antelope, and mule deer, as well as smaller mammals such as jackrabbits, cottontails, beaver, squirrels, and woodrats, were regularly hunted. Game birds included many types of waterfowl, mountain and valley quail, pigeons, jays, and woodpeckers. In addition to salmon, the Plains Miwok fished for sturgeon and lamprey (Levy 1978:402–403).

A wide array of tools, implements, and enclosures were used by the Plains Miwok for hunting and gathering of natural resources. Among those used for hunting land mammals and birds were the bow and arrow, traps and snares, nets, and enclosures/blinds. Communal hunting drives were employed for both large and small mammals. Many plants were collected using wooden tools: long poles for dislodging acorns and pinecones, fire-hardened digging sticks for roots, and beaters for dislodging seeds. Once collected, seeds, roots, and nuts were placed in burden baskets and transported for processing or storage (Levy 1978:403–404).

The Plains Miwok used a variety of tools to process food resources. These included portable stone mortars and pestles, bedrock mortars, anvils, woven strainers and winnowers, leaching and boiling baskets, woven drying trays, and knives. Unprocessed acorns were stored in conical granaries. Various foods were baked in earth ovens. Exotic items such as obsidian, steatite, and shell indicate they traded with coastal groups and mountain tribes (Levy 1978).

The Native American population in the Sacramento Valley came into contact with European culture beginning in the late 1700s, as a result of increased incursions into the area by the Spanish. Traditional lifeways were drastically altered during the early to mid-1800s as Spanish colonization and proselytization, Mexican land grants, and the American takeover and settlement pushed indigenous peoples into the rugged California interior and reduced their numbers through transport to the missions, disease, and slaughter. Beginning in the early 1800s, most of the Plains Miwok converts were transported to Mission San José (Levy 1978:400–402). Many resisted and tried to return to their villages in the delta. Plains Miwok fought the invaders in the 1820s and 1830s, and with neighboring Yokuts, they also attacked Mexican coastal settlements. The secularization of the missions followed, spurred in part by these activities. During the war with Mexico in the 1840s, the Miwoks aided the United States (Cook 1960, 1962).

The California Gold Rush of 1849 and the continuing influx of Euro-Americans into formerly remote regions of California was the final cultural blow for many California Indians, including the Miwok bands near the study area. With the loss of most of their traditional lands, as well as enslavement, slaughter, and disease, surviving Miwok labored for the growing lumber, ranching, farming, and mining industries (Levy 1978:401).

During the first half of the twentieth century, acquisitions of land by the federal government (from 2 acres to more than 300 acres) created a number of reservations, or *rancherias*, for the Plains Miwok, along with

the Northern and Central Sierra Miwok. Between 1934 and 1972, the U.S. Bureau of Indian Affairs then terminated relations with most of these rancherias, although since 1984, the status has been restored to most of the rancherias (Slagle 2005). Today, although there is no unified California Miwok tribal organization at a state or federal level, there are seven rancherias that have primarily or exclusively Eastern Miwok populations. These are the Buena Vista Rancheria (Plains Miwok/Amador County), the Chicken Ranch Rancheria (Central Sierra division of Eastern Miwok/Tuolumne County), the Ione Rancheria (Northern Sierra and Plains Miwok/Amador County), the Jackson Rancheria (Northern Sierra and Plains Miwok/Amador County), the Sheep Ranch Rancheria (Northern Sierra Miwok/Calaveras County), the Shingle Springs Rancheria (Plains Miwok/El Dorado County), and the Tuolumne Rancheria (Central Sierra Miwok/Tuolumne County) (Slagle 2005).

Historic Overview

Post-contact history for the state of California is generally divided into three periods: the Spanish period (1769–1822), the Mexican period (1822–1848), and the American period (1848–present). Although there were brief visits by Spanish, Russian, and British explorers from 1529 to 1769, the beginning of Spanish settlement in California occurred in 1769 with an establishment of Mission San Diego, one of the 21 missions established from 1769 to 1823. The Mexican period began when news of the successful revolution by Mexico against the Spanish crown reached California in 1822. This period is marked by an extensive era of land grants, most of which were in the interior of the state, and by exploration by American fur trappers west of the Sierra Nevada Mountains.

With the signing of the Treaty of Guadalupe Hidalgo in 1848, ending the Mexican-American War, California became a territory of the United States. The discovery of gold in 1848 at Sutter's Mill near Sacramento and the resulting Gold Rush era influenced the history of the state and the nation. The rush of tens of thousands of people to the gold fields also had a devastating impact on the lives of indigenous Californians, with the introduction and concentration of diseases; the loss of land and territory, including traditional hunting and gathering locales; violence; malnutrition; and starvation. Thousands of settlers and immigrants continued to pour into the state, particularly after the completion of the transcontinental railroad in 1869.

With continued growth, California continues to be a national leader in agriculture and poultry production, ranching (cattle and sheep), aerospace and communications industries, as well as the film and entertainment business. The wealth of California's natural resources (e.g., lumber, petroleum deposits, minerals, fish) also continues to contribute to its growth and development.

San Joaquin County

San Joaquin County was one of the original 27 counties of California, created in 1850 at the time of statehood (Hoover et al. 2002:369). The county's geographical location in the center of the state between the Sierra Nevada mountain range to the east and the San Francisco Bay to the west has made it a prime location for business and industry. The county is accessible from almost all parts of the state by means of the Port of Stockton, the interstate highway system, railroads, and airports. Captain Charles M. Weber was instrumental in developing the city of Stockton as the county seat and as a port of entry, where the two large rivers that drain the northern and southern halves of the great Central Valley meet at the Sacramento-San Joaquin Delta. Ships today still deliver cargo to the Port of Stockton via the Stockton Channel, the deep-water slough that leads into the San Joaquin River, next to which Captain Weber laid out the town of Tuleburg (now Stockton) in 1847.

Agriculture and livestock have defined San Joaquin County's past and continue to play an important role in the present and foreseeable future. The many rivers in the area, including the San Joaquin, Cosumnes,

Mokelumne, and Calaveras Rivers, form rich agricultural land as well as marshlands for abundant wildlife. In 1813, Lieutenant Gabriel Moraga led an expedition in the lower portion of California's Central Valley, giving the name San Joaquin to the large river that flows northward through the county (Hoover et al. 2002:369). Later immigrants were attracted to the abundance of wildlife within or along the rivers, including waterfowl, fish, and fur-bearing animals. In 1827, American explorer and trapper Jedediah Smith traveled through the San Joaquin Valley. Other trappers soon followed, including employees of the Hudson's Bay Company in 1832 (Hoover et al. 2002:370).

Irrigation is an important part of the history of the productive agricultural and livestock economy of the county. The Miller and Lux Company, a cattle company known across the west, had vast holdings in the San Joaquin Valley. Founded by German immigrant Henry Miller (formerly Heinrich Alfred Kaiser) and partner Charles Lux, their lands and herds could be found throughout the state of California. They built an empire by acquiring rancho property and driving cattle to market in San Francisco (Hoover et al. 2002:435). The Miller and Lux Company also pioneered irrigation projects in the San Joaquin Valley, beginning with completion of the San Joaquin Canal in the 1870s. This ambitious project began on the San Joaquin River near Fresno Slough, and then ran north through Merced County and into Stanislaus County. The company also controlled more than 50 miles of land along Kern River, which they were able to parlay into a system of canals to irrigate dry lands that then became productive agricultural fields (Beck and Haase 1974:76; Hoover et al. 2002:94).

The history of San Joaquin County would not be complete without mention of the Tidewater Southern Railway. Begun as an electric interurban railway, the line opened its initial 32 miles of mainline between Stockton and Modesto in October 1912 (Tidewater Southern Railway 2007). The railway connected on the north to the Central California Traction Company Railroad, which served the Central Valley from Stockton to Sacramento. The Tidewater Southern was a successful venture, with 24 trains operating daily between Stockton and Modesto by 1916. The same year, it extended the rails to Turlock and to Hilmar. The last tracks of the Tidewater Southern were added in 1918, a 6.6-mile-long north-south branch between Manteca and Manteca Junction. The previous year, most of the rolling stock had been purchased by the Western Pacific Railroad. The number of passengers declined with the onset of the Depression, and the last interurban ran in 1932. This decline was offset, however, by an increase in freight transport, particularly agricultural products. Diesel power entirely replaced the electrified type by the late 1940s, and the line was upgraded in the 1950s and 1960s. Today, the original Tidewater Southern line between Stockton and Turlock is served as part of the Union Pacific Railroad; the Western Pacific merged into the Union Pacific in 1982.

BACKGROUND RESEARCH

California Historical Resources Information System Records Search

On August 22, 2012, a search was requested of the California Historical Resources Information System (CHRIS) at the Central California Information Center (CCIC), located at California State University, Stanislaus in Turlock, California. The search included any previously recorded cultural resources and investigations within a 1.6-kilometer (1-mile) radius of the APE. The CHRIS search also included a review of the NRHP, the CRHR, the California Points of Historical Interest list, the California Historical Landmarks list, the Archaeological Determinations of Eligibility list, and the California State Historic Resources Inventory list. Additionally, the records search included a review of historic maps covering the APE. A letter dated August 23, 2012, from the CCIC summarizing the results of the records search and providing a bibliography of prior cultural resources studies is provided in Appendix A of this report.

Prior Cultural Resources Studies within 1 Mile of the APE

The records searches identified seven prior cultural resource studies within 1 mile of the APE (Table 1). Of this, one (SJ-00767) was conducted within a portion the APE; a brief summary of this study is provided in the paragraph that follows.

Table 1. Prior Cultural Resource Studies within 1 Mile of the APE

CCIC Report No.	Title of Study	Author	Year	Proximity to the APE
SJ-00727	Cultural Resources Evaluation for the Proposed Water Supply Pipeline and treatment Plant Locations for the City of Stockton, San Joaquin County, California	Chavez, David	1978	Outside
SJ-00767	Cultural Resource Investigations of the Eight Mile Road Bridge No. 1043 Over Bishop Cut, San Joaquin County, California	Napton, L. Kyle	1982	**Within**
SJ-05534	A Cultural and Paleontological Resources Study for the Paradise Village Development Project	Kelley, John and Susan Huster	2003	Outside
SJ-05985	Caltrans Historic Bridge Inventory Update: Metal Truss, Movable, and Steel Arch Bridges	McMorris, Christopher	2004	Outside
SJ-06331	Archaeological/Resources Presence/Absence Testing at P-39-004492 (Southern Bishop Tract Farm Site), Westlake Villages Project, Stockton, San Joaquin County, California	Longfellow, J.	2006	Outside
SJ-06410	A Cultural and Paleontological Resources Study for the Spanos Parcel Project	Kelley, John, Susan Huster, and Ben Matzen	2005	Outside
SJ-06843	Stockton Delta Project: Cultural Resources Inventory Report	ESA	2007	Outside

SJ-00767

In 1982, L. Kyle Napton prepared *Cultural Resource Investigations of the Eight Mile Road Bridge No. 1043 Over Bishop Cut San Joaquin County, California* for the County of San Joaquin, Department of Public Works. The cultural resource assessment preceded the proposed replacement of the Eight Mile Bridge No. 1043 over Bishop Cut, with a survey area that encircled the bridge by approximately 500 feet, and which includes small portion of the current APE. Methods of investigation included a review of ethnographic literature, the NRHP, and the California Register of Historic Sites, as well as search of records at the California Office of Historic Preservation. Additionally, a field survey of the study area was undertaken by professional archaeologists. No cultural resources were identified as a result of the study, and a finding of no significant impact upon cultural resources was determined.

Previously Recorded Cultural Resources within 1 Mile of the APE

The records searches identified five previously recorded cultural resources within 1 mile of the APE (Table 2). Of these five, none are located in the study area. Two resources (Bridge #29C-0114 and Bridge

#29C-0290) were not formally listed by the CCIC, but rather referenced in *Caltrans Structure Maintenance & Investigations, Historical Significance – Local Agency Bridge, San Joaquin County* (2012) as not eligible for the NRHP.

Table 2. Previously Recorded Cultural Resources within 1 Mile of the APE

Primary No.	Trinomial	Resource Description	NRHP Eligibility	Recorder and Year	Proximity to Study Area
P-39-004492	–	Southern Bishop Tract Farm	Not evaluated; updated records states buildings are no longer extant	Kelley, John, and Susan Huster, 2003; and Longfellow, Joy, 2006.	Outside
P-39-004540	–	Bridge #29C-0219 – White Slough	Ineligible	CDM/JMC, 2003	Outside
P-39-005038	–	Venice School	Not evaluated	San Joaquin County Superintendent of Schools	Outside
–	–	Bridge #29C-0114 – Bishop Canal	Ineligible	Caltrans	Outside
–	–	Bridge #29C-0290 – Telephone Cut	Ineligible	Caltrans	Outside

Historic Map Review

In addition to reviewing previously conducted studies and previously recorded site records, SWCA examined the study area on historic maps provided by the CCIC. Maps from the mid- to late-nineteenth century show the study area as largely undeveloped, describing it as "swamp and overflowed land." By 1939, a U.S. Geological Survey (USGS) map shows development of the levee system, with the present-day irrigation canal in place along the eastern portion of the study area, and initial roads encircling the interior of what is by then named "King Island." A USGS map from 1952 shows the development of the additional access roads and buildings, including what appear to be the three extant buildings in the current study area (SWCA-KING-1, SWCA-KING-2, and SWCA-KING-3).

Sacred Lands File Search and Initial Native American Coordination

Native American coordination was initiated for this project on August 24, 2012. As part of the process of identifying cultural resources in or near the APE, SWCA contacted the Native American Heritage Commission (NAHC) to request a review of the Sacred Lands File. The NAHC faxed a response on August 28, 2012 (Appendix B), and stated that Native American cultural resources were not identified within 0.5 mile of the APE, but noted that it is always possible for cultural resources to be unearthed during construction activities. The NAHC also provided a contact list of seven Native American individuals or tribal organizations that may have knowledge of cultural resources in or near the APE. Letters were prepared and mailed to each of the NAHC-listed contacts on September 4, 2012, requesting information regarding any Native American cultural resources in or adjacent to the APE.

One response has been received to date in regarding the coordination letters, and is included in Appendix B of this report. In an email dated September 8, 2012, Ms. Silvia Burley of the Miwok Tribe requested that she be contacted if artifacts or human remains associated with the Miwok Tribe were discovered during the course of the project.

No additional responses have been received to date. One follow-up phone call will be made to each Native American contact on September 18, 2012. The results of these efforts will be forwarded to the PG&E at that time. Table 3 provides a complete record of Native American coordination to date.

Table 3. Record of Native American Coordination Efforts

NAHC-Provided Contact	Coordination Efforts	Results of Coordination Efforts
Miwok 4305 39th Avenue Sacramento, California 95824 Contact: Randy Yonemura	**9/2/12:** Letter sent via U.S. Mail	To be determined
Miwok P.O. Box 84 Wilseyville, California 95987 Contact: Briana Creekmore	**9/2/12:** Letter sent via U.S. Mail	To be determined
Buena Vista Rancheria 1418 20th Street, Suite 200 Sacramento, California 95811 Contact: Rhonda Morningstar Pope, Chairperson	**9/2/12:** Letter sent via U.S. Mail	To be determined
California Valley Miwok Tribe 10601 North Escondido Place Stockton, California 95212 Contact: Silvia Burley, Chairperson	**9/2/12:** Letter sent via U.S. Mail **9/8/12:** Ms. Burley replied via email that she had no concerns regarding the project, but asked that she is notified if Miwok artifacts or human remains are discovered during the course of the project.	No further reaction required
Ione Band of Miwok Indians P.O. Box 699 Plymouth, California 95669 Contact: Yvonne Miller, Chairperson	**9/2/12:** Letter sent via U.S. Mail	To be determined
Ione Band of Miwok Indians Cultural Committee 604 Pringle Avenue #42 Galt, California 95632 Contact: Billie Blue, Chairperson	**9/2/12:** Letter sent via U.S. Mail	To be determined
Wilton Rancheria 9300 West Stockton, Suite 200 Elk Grove, California 95758 Contact: Andrew Franklin, Chairperson	**9/2/12:** Letter sent via U.S. Mail	To be determined.
Wilton Rancheria 9300 West Stockton, Suite 200 Elk Grove, California 95758 Contact: Steven Hutchason, Director of Cultural Preservation	9/2/12: Letter sent via U.S. Mail	To be determined.

METHODS

SWCA Cultural Resources Specialists Katie Martin and William Kendig conducted an intensive-level pedestrian survey to identify any archaeological or historic built environment resources (i.e., buildings, structures, and objects) that may occur in the study area. Ms. Martin and Mr. Kendig surveyed the entire study area by walking linear transects spaced no more than 15 m (49 feet) apart. The ground surface was examined for the presence of prehistoric artifacts (e.g., flaked stone tools, tool-making debris, stone milling tools), historic artifacts (e.g., metal, glass, ceramics), sediment discoloration that might indicate the presence of a cultural midden, and depressions and other features indicative of the former presence of structures or buildings (e.g., post holes, foundations). A Trimble global positioning system (GPS) receiver with sub-meter accuracy was used to maintain transect accuracy and to record the location of cultural resources in the study area.

Ms. Martin and Mr. Kendig documented their fieldwork using field forms, a digital camera, close-scale field maps, and aerial photographs. Copies of the field notes and digital photographs are on file at the SWCA Pasadena office.

RESULTS

During the intensive-level field survey for cultural resources, ground visibility was poor in the study area (approximately 0% in some areas) due to obstruction by vegetative ground cover. Other areas of the study area were heavily disturbed due the construction of the access roads and agricultural activities (Figures 5 and 6). A portion of the study area along the eastern side of Alternate B was unable to be fully surveyed to the full 25-foot-wide buffer from the edge of the access road due to an adjacent waterway (Figure 7).

Four potential cultural resources were identified in the study area as a result of the intensive-level survey and were recorded on California Department of Parks and Recreation 523 series forms (Appendix C). Three buildings, SWCA-KING-1, SWCA-KING-2, and SWCA-KING-3, and an irrigation canal, SWCA-KING-4, are situated within the 25-foot-wide buffer of the Alternate B access road (Figure 8). Visual observation and initial research using historic maps indicate SWCA-KING-1, SWCA-KING-2, and SWCA-KING-3 were constructed between 1939 and 1952. Each of the three buildings is rectangular in plan and feature gabled roofs, sheathed in corrugated metal sheets.

SWCA-KING-4 is a segment of an irrigation canal, which is commonly known as Bishop Cut. The canal, which historic topographic maps indicate was constructed by 1939, is approximately 330 feet wide and connects White Slough from the north to Disappointment Slough 2.75 miles to the south. The waterfront portion of the canal is composed of rip-rap along steep banks, and it is bound by Rio Blanco Road to the east and a private access road to the west. SWCA-KING-4 includes the 1 mile portion of the canal from the vicinity of Telephone Cut to Bridge #29C-0114 to the south.



Figure 5. Portion of the study area; view to the east.



Figure 6. Agricultural activities in the study area; view to the west.



Figure 7. Paved access road (Alternate B) and irrigation canal; view to the south.

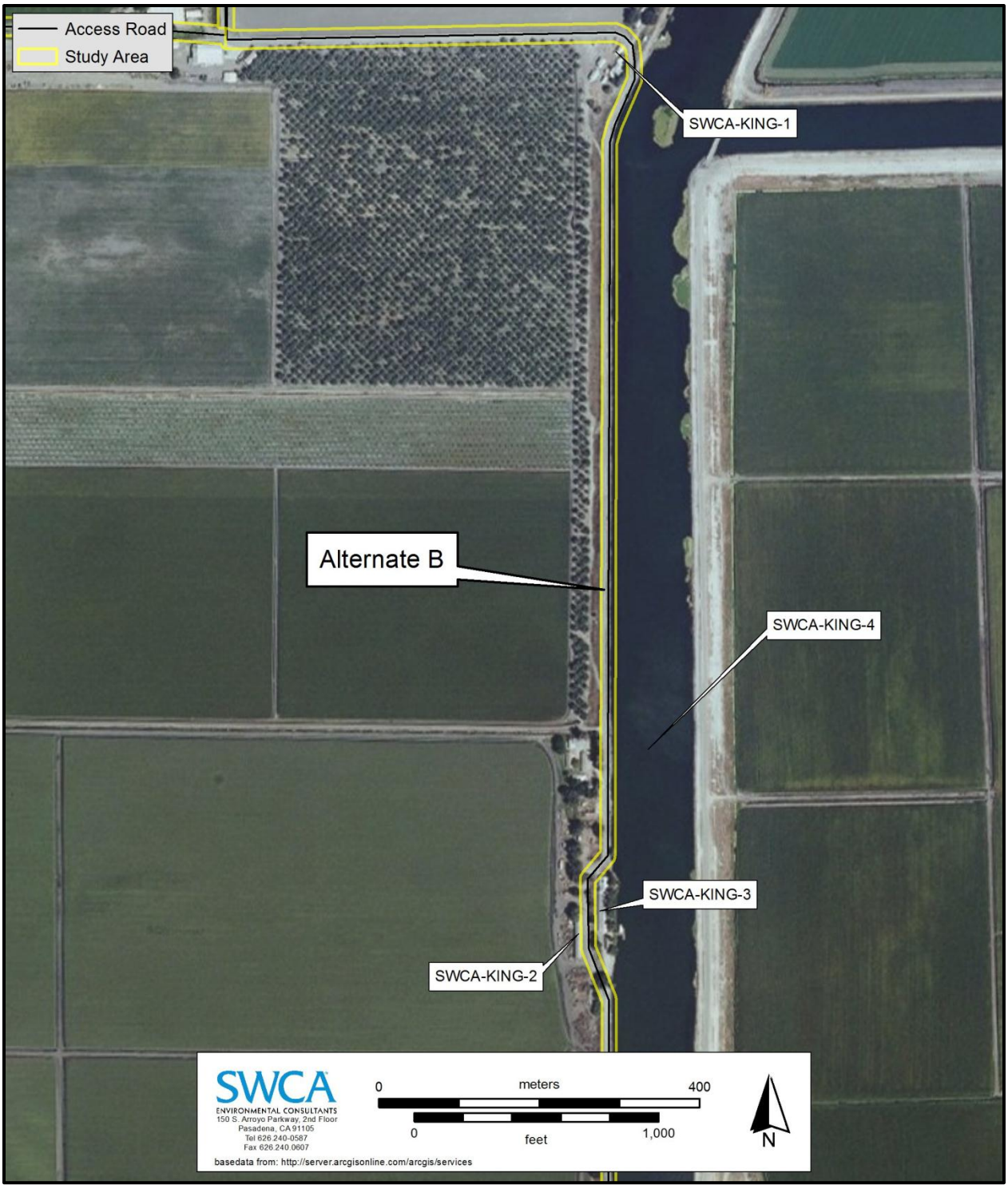


Figure 8. Potential cultural resources in relation to the study area.

DISCUSSION AND RECOMMENDATIONS

Discussion

The goal of this study is to identify cultural resources in the PG&E CAES King Island study area and provide management recommendations for those resources. The results of the records search indicate that a small portion of the study area was surveyed by qualified archaeologists in 1982. Although the records search also identified five previously recorded cultural resources within 1 mile of the APE, none were in the current study area or listed as eligible for the NRHP. Additionally, the NAHC Sacred Lands File search was negative for Native American cultural resources within 0.8 km (0.5 mile) of the APE.

SWCA cultural resources specialists identified four potential historic built resources as a result of the intensive-level survey (SWCA-KING-1, SWCA-KING-2, SWCA-KING-3, and SWCA-KING-4). They were not formally recorded or evaluated, and no determination of their significance was made at this time. However, visual inspection and initial research suggests that that they may be over 50 years old, and as a result, have the potential to be eligible for the NRHP.

Recommendations

The historical significance of the buildings and irrigation canal (SWCA-KING-1, SWCA-KING-2, SWCA-KING-3, and SWCA-KING-4), which are located along road Alternate B, was not determined as part of the current study. However, visual inspection and initial research using historic maps suggest they may be considered cultural resources. Until these resources are formally evaluated, SWCA recommends that they be treated as though they are significant, and that the project avoid impacting them. Alternate A would not have direct or indirect effects on these buildings or the canal, and SWCA recommends that the project use this access route, while avoiding the use of Alternate B. If it becomes necessary to use Alternate B, SWCA recommends that SWCA-KING-1, SWCA-KING-2, SWCA-KING-3, SWCA-KING-4 be formally evaluated to determine their significance before any construction activities begin.

Although SWCA did not identify any additional cultural resources, ground disturbance associated with the proposed project could impact previously unrecorded cultural resources. SWCA recommends that the following measures be taken to identify additional cultural resources in the study area to prevent or reduce the significance of project-related impacts to cultural resources and to satisfy the requirements of Section 106 and CEQA.

Inadvertent Discovery of Cultural Resources

In the event that cultural resources are exposed during ground-disturbing activities, construction activities (e.g., grading, grubbing, or vegetation clearing) should be halted in the immediate vicinity of the discovery. An archaeologist who meets the Secretary of the Interior's Professional Qualifications Standards (National Park Service 1983) should then be retained to evaluate the find's significance under CEQA. If the discovery proves to be significant, additional work, such as data recovery excavation, may be warranted and should be discussed in consultation with the lead agency.

Inadvertent Discovery of Human Remains

The discovery of human remains is always a possibility during ground disturbances; State of California Health and Safety Code Section 7050.5 addresses these findings. This code section states that no further disturbance shall occur until the county coroner has made a determination of origin and disposition

pursuant to PRC Section 5097.98. The coroner must be notified of the find immediately. If the human remains are determined to be prehistoric, the coroner will notify the NAHC, which will determine and notify a most likely descendant. The most likely descendant shall complete the inspection of the site within 48 hours of notification and may recommend scientific removal and nondestructive analysis of human remains and items associated with Native American burials.

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CULTURAL RESOURCES INVENTORY AND EVALUATION REPORT

Compressed Air Energy Storage Compression Testing Project
King Island, San Joaquin County, California



May 2013

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CONFIDENTIALITY STATEMENT

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Cultural Resources Inventory and Evaluation Report
Compressed Air Energy Storage Project
King Island, San Joaquin County, California

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Appendix A. CCIC Record Search Results
Appendix B. California Department of Parks and Recreation Site Forms
Appendix C. Native American Community Consultation

1. Introduction

On behalf of Pacific Gas and Electric Company (PG&E), North State Resources, Inc. (NSR) has completed a cultural resources investigation for the Compressed Air Energy Storage (CAES) Compression Testing Project, (the Project) situated on King Island, San Joaquin County, California (Figure 1). Compressed air energy storage involves using a porous underground rock formation (a depleted gas field on King Island) to store low-cost, low-emission energy in the form of compressed air during periods of low electric demand. This stored energy would then be utilized during periods of higher electric demand by releasing the compressed air to supplement a traditional gas turbine electric generator, improving the efficiency of energy distribution through the power grid. The Project would be co-funded by the United States Department of Energy (DOE), the California Public Utilities Commission (CPUC), and the California Energy Commission (CEC). Consequently, the Project is subject to the cultural resources identification and evaluation provisions of Section 106 of the National Historic Preservation Act (Section 106).

The Project Area of Potential Effects (APE) is located approximately 1.8 miles northwest of the City of Stockton's northern boundary at Eight Mile Road in northwestern San Joaquin County, California. Potential areas of ground disturbance within the APE include:

- A 2.5-acre (ac.) development site that is approximately 2.3 mi. west of Interstate 5;
- Un-paved access roads; and
- A 4.25-mi. electrical distribution alignment as an interrelated action.

The electrical distribution alignment runs west along Eight Mile Road from the Eight Mile Substation to Bishop Cut, spans Bishop Cut and then parallels Bishops Cut north along a paved levee road and veers west then north along two dirt roads to the development site (Figure 2). The APE, and the areas subjected to an intensive cultural resources survey by NSR, included the following:

- 200-foot (ft.) buffer around the 2.5-ac. development site;
- 20-ft. buffer on each side of the unpaved access roads shoulders; and
- 50-ft.-wide corridor along the 4.25-mi. electrical distribution alignment.

The vertical APE varies according to the nature of the various Project components. The vertical APE at the 2.5-acre development site is approximately 3 ft. below the present-day ground surface which accommodates proposed grading and tree removal. The vertical APE for the electric distribution line varies from a minimum of 9 ft. for a new underground circuit to a maximum of 15 ft. for the installation of new poles. The maximum vertical APE for the Project would be approximately 4,800 ft. which is the drilling depth necessary to access the depleted King Island Gas Field. Additional details regarding the vertical APE are presented below in the Project Description.

1.1 Project Description

The Project consists of development of a Temporary Site Facility (TSF) to conduct compression testing and evaluate the feasibility of development of a CAES project. Development of the TSF would include



TSF Facility

Distribution Line

N

0 250 500 1,000

Feet

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North State Resources, Inc.

CAES King Island TSF

Figure 2b
APE Map – TSF Site

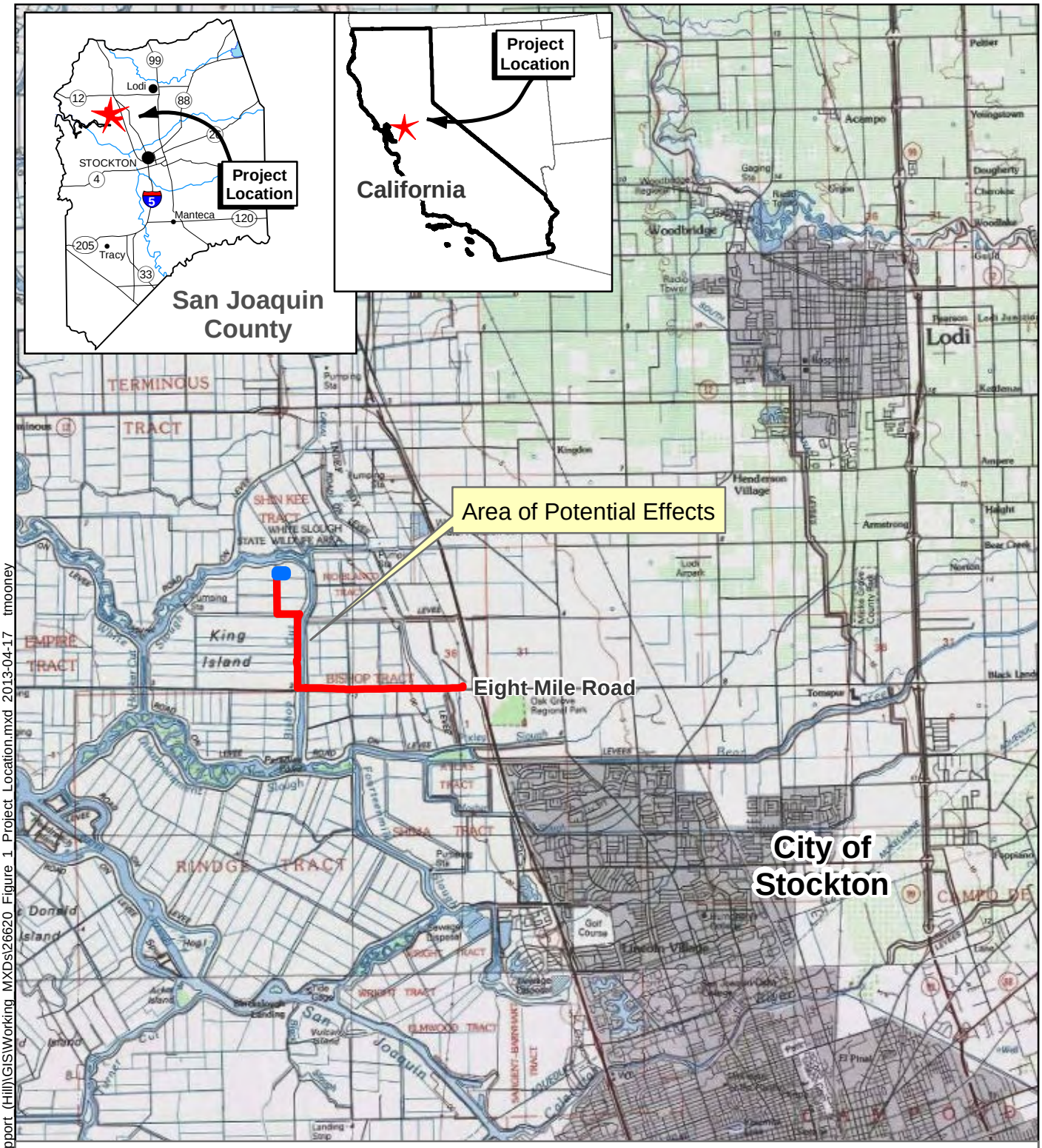


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North State Resources, Inc.

CAES - PDEA King Island

Figure 2a
APE Map-Distribution Lines and Roadways

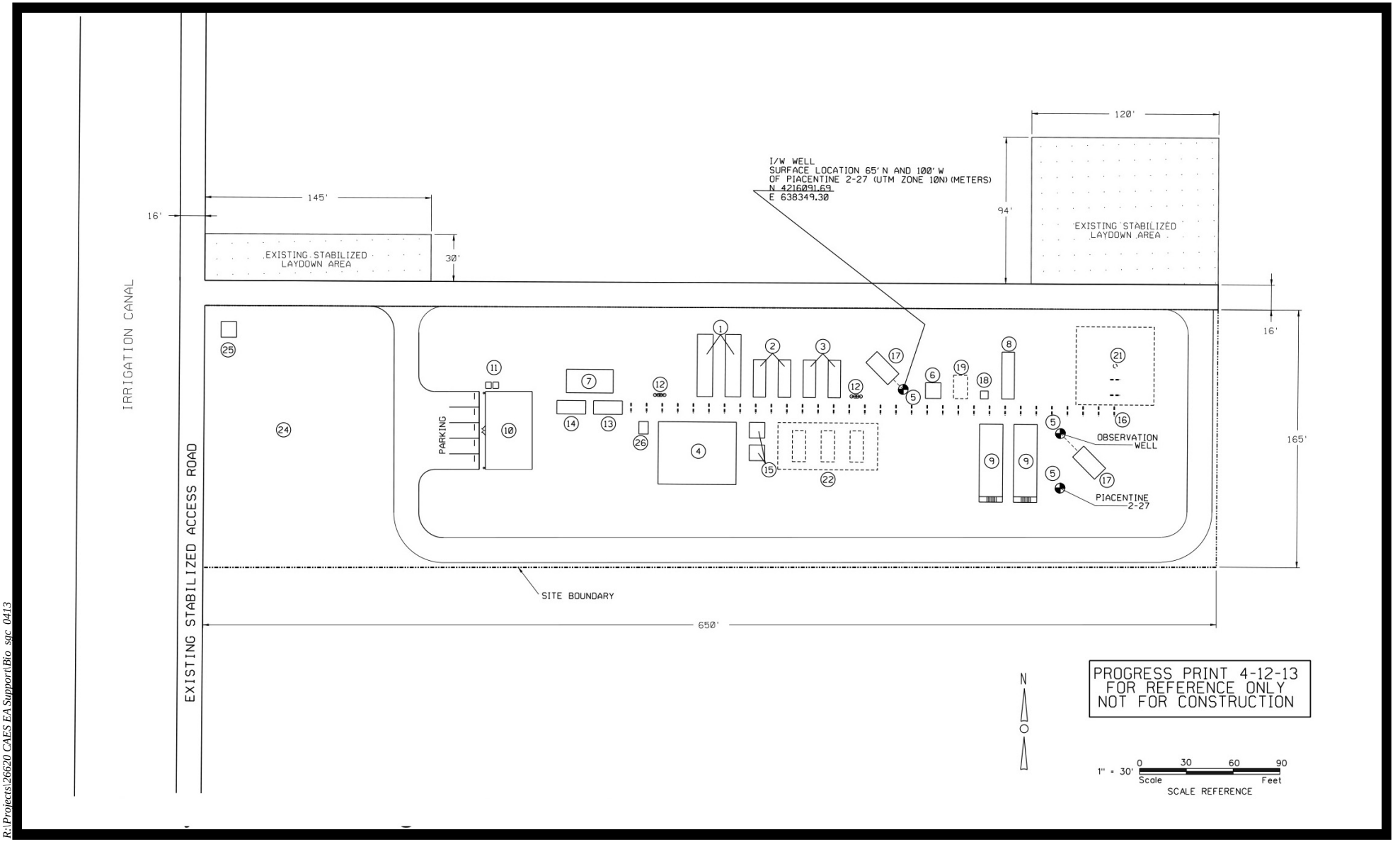


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North State Resources, Inc.

CAES PDEA - King Island

Figure 1
Project Location



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Figure 2c
Site Layout

limited maintenance to existing access roads. The DOE is co-funding the TSF project and is serving as the National Environmental Policy Act (NEPA) lead agency.

The development of an electric distribution line that would provide power to the TSF is considered an interrelated action. Development of the distribution line would involve reconductoring existing lines and construction of new lines. The DOE is the NEPA lead agency for development of the electric distribution line, which is being authorized separately from the TSF as an interim action.

A detailed description of the Project and the electric distribution line (interrelated action) is provided below.

1.2 DOE's Proposed Action

DOE's proposed action is to provide $25 million in financial assistance to PG&E, who has also received approval from the CPUC to obtain equal matching funds. The total cost of the overall CAES project would be approximately $50 million. The cost of the pressure testing phase is estimated to be approximately $20 to $25 million. The total project cost of full development of a commercial-scale CAES facility (i.e. 300 megawatt nominal output) over the full period of performance may be up to $356 million. This amount includes subsequent phases of the project leading to full implementation of a CAES facility, which are not currently funded and may or may not be realized.

1.3 Pacific Gas and Electric Company's Proposed Compressed Air Energy Storage Compression Testing Project

Project Overview

Renewable energy resources, such as wind and solar power, have the potential to reduce dependence on fossil fuels and greenhouse gas emissions in the electric sector. Concerns regarding climate change have spurred state regulation encouraging the integration of renewable resources into the power generating fleet. For example, under California's existing Renewable Portfolio Standard, utilities must supply 33 percent of all electricity retail sales from eligible renewable resources by the year 2020. Much of this new generation is expected to be derived from the addition of new solar and wind power generation[1]. Because wind and solar resources are by nature variable (*i.e.*, the sun does not always shine and wind does not always blow when power is actually needed), their addition to the power generating fleet poses challenges to the reliable operation of the power distribution grid and the cost of their integration. Energy storage has been identified as an important component of strategies to mitigate these effects and facilitate greater penetration of wind and solar power into the existing power generation and distribution system. CAES has been identified as a key enabling technology for expanding reliance on renewable resources for electricity production[2].

PG&E is currently studying the feasibility of using a porous underground rock formation (depleted natural gas field) in its service territory for a CAES project. CAES technology involves two major processes: (a) air compression and underground injection for storage and (b) air release for electricity generation. During the air compression and storage process, electric motor-driven compressors inject air

[1] *California ISO, 2010, Integration of Renewable Resources, Operational Requirements and Generation Fleet Capability at 20% RPS, August 31.*

[2] Denholm, Paul, E. Ela, B. Kirby, and M. Milligan, 2010, The Role of Energy Storage with Renewable Power Generation, NREL Technical Report NREL/TP-6A2-47187, January.

into a sealed and porous underground geological formation for storage under high pressure. During the air release phase, the high-pressure air is released from the underground reservoir, heated using natural gas (if necessary), and expanded through sequential turbines ("expanders"), which drive an electrical generator. The stored energy can be used during periods of higher electric demand, improving the efficiency of energy distribution through the power grid. Worldwide, two CAES plants using man-made caverns in salt formations—the McIntosh plant in Alabama and the Huntorf facility in Germany—have operated successfully for over 20 years.

The first phase of the feasibility study was completed in June 2013 and involved collection of core samples at a depleted natural gas field on King Island, San Joaquin County, California. The rock core samples were analyzed to determine whether the formation would support a CAES facility. The second phase, which is the subject of this cultural resources investigation, would be to conduct pressure testing of the formation. This would consist of injecting air to build a subsurface bubble within the reservoir sands of the depleted King Island Gas Field, and then conducting a series of pressure tests to further confirm the geologic suitability of the formation and provide more detailed information for project engineering. The permitting process includes the DOE's compliance with NEPA and the federal Environmental Protection Agency (EPA) Underground Injection Control (UIC) Program Class V Injection & Withdrawal Well. This study is being co-funded by the DOE, CPUC, and CEC.

Storage Reservoir Geology

The proposed compressed air storage reservoir consists of permeable sands of the Upper Cretaceous Mokelumne River Formation that occur at depths between approximately 4,675 ft. and 4,800 ft. below ground. The reservoir is an elliptically-shaped erosional remnant of approximately 235 ac. in horizontal area that is enclosed on all sides by shales of the Paleocene Meganos Gorge Fill and capped by the Eocene Capay Shale. This geological formation created an impermeable natural trap in which natural gas collected over geologic time and was stored under pressure for millions of years prior to extraction by natural gas production activities between 1980 and the present. As such, the reservoir may be suitable for storage and extraction of compressed air with its potential energy. Compressed air would be stored in the pores between particles of sand and the shale cap would hold the compressed air in place. The thickness of the storage reservoir is approximately 100 ft. at this location.

King Island Temporary Site Facilities

The proposed location of the King Island Temporary TSF is approximately 1.8 mi. northwest of the city of Stockton's northern boundary at Eight Mile Road in northwestern San Joaquin County, California (Figures 1, 2a, 2b). The TSF site would be situated on King Island about two miles north of West Eight Mile Road between White Slough and Bishop Cut, and can be accessed from Interstate 5 via West Eight Mile Road and King Island Road. The area surrounding the TSF site is generally level and ranges in elevation from approximately 5 to 10 ft. below sea level. Water levels in White Slough and Bishop Cut are slightly above sea level and are separated from King Island by a series of levees topped by paved and unpaved roads. The area surrounding the TSF is generally level and ranges in elevation from approximately 5 to 10 ft. below sea level. Water levels in White Slough and Bishop Cut are slightly above sea level and are separated from King Island by a series of levees topped by paved and unpaved roads. The area surrounding the test site is crossed by a series of dirt and gravel ranch roads that provide access to the various ranch fields and to the test site. Several agricultural residences are located

approximately 0.5 to 0.75 mi. south of the test site along the south side of an east-west-trending gravel road.

The TSF pad would be approximately 650 ft. by 165 ft., or 2.5 ac. in size, of which 0.7 ac. was previously created for the geological core drilling task associated with this project. The pad would be constructed at the locations shown on the site plan (Figure 2c). Construction activities associated with the project include access road maintenance, work pad construction, and well drilling, and would take approximately three months to complete.

The existing 0.7-ac. pad would be expanded by additional clearing, grubbing, scarifying, and compacting into an area that is currently planted with sapling-stage walnut trees, requiring the removal of approximately 90 small trees. The additional clearing would not extend below more than 3 ft. below the ground surface. Disturbances related to the removal of the trees would vary depending on their size although it is unlikely that any root balls would extend more than about 3 ft. below the surface. Geotextile material would be placed over the compacted work area, then up to 18 in. of sub-base material and Class II aggregate base would be placed and compacted. The work area would be crowned and sloped so that stormwater sheet-flows off the pad. PG&E would constrain all construction activities to the pad and a 10-ft. buffer area.

Once the TSF pad is constructed, a drilling rig and associated equipment would be moved onto the work pad. The primary equipment includes the drill rig, mud and water tanks and pumps, shaker tanks, electric generators, diesel fuel tanks, drill pipe racks and support trailers. Two wells would be drilled into the formation—one for injection and withdrawal of air (IW well), and the second well to monitor field pressures and responses to the injection and withdrawal process. The construction contractor would place all wastes, cuttings and drilling mud associated with well drilling in proper storage receptacles and transported them offsite to an authorized disposal facility.

Water for pad construction and well drilling would be trucked to the APE from off-site municipal water supply sources. All drilling activities would be completed in compliance with the County Gas and Oil Well Improvement Plan approval. Construction wastewater would be hauled offsite and disposed of in a permitted, commercial injection well in Rio Vista.

Access road and pad construction would involve approximately eight workers, five trucks, a road grader/maintainer, dozer (D-5 or equal), sheep's foot compactor, roller compactor, water truck, and similar construction equipment. Up to 5,000 cubic yards of road gravel and aggregate base would be required. Total duration of this task is approximately six weeks.

Drilling crew, engineers, temporary workers and site visitors would number an average of approximately 12 workers/people per shift, with three shifts per day during pad construction and drilling. A maximum of 20 workers may be present at one time during various operations. In addition to worker vehicles, service, equipment and material delivery vehicles would access the site during the drilling phase.

The well construction and installation would be followed by four to five months of compression and withdrawal cycling that simulates the operation of a CAES facility. During this period, approximately 12 workers would be onsite per day, staffing three eight-hour shifts. Before testing can begin, the compressors would create a subsurface air "bubble" of compressed air in the reservoir that is about one billion cubic feet in size. This would take approximately two months to complete.

After the bubble is created, a series of pressure tests would be conducted and data would be collected from the IW well, the observation well and possibly from additional existing nearby gas wells to assess the reservoir response. The testing protocols are still being developed and would include a series of sequential injection, pressure buildup, pressure fall off and possibly flow tests. The test would include periods of injection, typically from several hours to several days in length, followed by shut in periods from several hours to several days in length. Flow testing, if conducted, would consist of a series of sequential flow tests at increasing rates over a period of about a day. In addition, cyclical injection, shut in, and flow tests may be conducted to simulate daily reservoir cycling over a period several days to several weeks. The final compression testing plan would be developed to collect data that allows assessment of the reservoirs characteristics to support refinement of the computer reservoir model constructed for the project. During each cycle, daily injection would take place for several hours, followed by a short shut-in period and 5 to ten hours of withdrawal. The length of the injection and flow periods would depend on the testing rates.

The CAES compression test project would take place at reservoir pressures up to several hundred pounds per square inch above the original reservoir pressure in order to allow sufficient flow to build the bubble. Pressures would be highest near the injection well during injection and would dissipate rapidly with distance from the well Injection pressures would be maintained consistently below the fracture pressure of the geological cap formation, as determined for other nearby projects and as would be confirmed in advance by geomechanical testing. Pressure in the well would be monitored and observed throughout the test period. Operational pressure is expected to be somewhat below the original field pressure, under which natural gas was trapped in the reservoir for several million years.

Preliminary reservoir modeling indicates that air withdrawn from the reservoir is likely to produce some amount of residual natural gas in the extracted flow. The data suggest the concentrations of natural gas should be relatively low; however, model refinement is still in progress and modeling entails inherent uncertainties. Therefore, the possibility that testing the reservoir with ambient air has a potential for creating a combustible mixture cannot be ruled out for safety planning purposes. Engineering approaches to assure safety during conduct of the test include measures to automatically shut in the well before natural gas concentrations reach hazardous levels, use of air with its oxygen content depleted to a molar concentration of approximately 5 percent, and/or limiting the extent and duration of any flow testing.

During the above tests, regular pressure, temperature, injection rate, flow rate, water production and gas chemistry measurements would be collected and recorded using an automated data acquisition system. Additional measurements would be made in the field and selected process gas samples would be submitted for laboratory analysis.

Because compressing air generates heat, PG&E would use an air-cooled chiller system that consists of two separate closed-loop cooling water systems that includes chilled water and compressor cooling water. The chilled water system would have two chilled water pumps each capable of 3,500 gallons per minute (gpm), while the compressor cooling water system would have two cooling water pumps each capable of 2,500 gpm.

The closed-loop water systems would require about 4,800 gallons (gal.) for the chilled water portion and about 4,200 gal. for the compressor cooling portion. Nominal water loss is conservatively expected to be 25 gal. per day for evaporation from the open expansion tank; the closed-loop system would not have evaporative losses. The initial water requirements and this small quantity of evaporative loss would be

supplied by a municipal source and hauled to the site in a water truck. After compression testing is complete, the cooling and chiller water would be hauled offsite in trucks and disposed of in a permitted, commercial injection well.

Other than the IW wells themselves, the primary equipment used during the compression test would include the following:

- High-pressure compressor train capable of injecting the compressed air at flow rates up to 17 million standard cubic ft. per day and compressor outlet pressures up to a maximum of 2,700 pounds per square in.
- After-cooler to cool the compressed air to a temperature no higher than approximately 140 degrees Fahrenheit before injection
- If necessary for safety purposes, the air supply stream may include oxygen-depleted air generated using a portable membrane filtration system or similar equipment.
- Appurtenant equipment including a temporary electrical supply, a step-down transformer, a power distribution system, a compressor cooling system, high-pressure piping, and control circuitry
- Equipment to support withdrawal testing including high-pressure piping, a choke valve, a propane or electric line heater, a phase separator, one or more produced water storage tanks, and an air discharge vent
- Monitoring and measurement equipment including:
    - Wellhead pressure and temperature sensors at the wells
    - A sensor array along the discharge piping to measure flow, pressure, temperature, combustible gas concentrations, oxygen concentrations and relative humidity
    - A sensor array along the injection piping to measure flow, pressure, temperature, oxygen concentrations, and relative humidity

Pressure and temperature readings may be taken during compression testing using wireline gauges that are lowered into the IW well and observation well. In addition, wire logs (e.g. gamma and pulsed neutron spectrometry) of the observation well may be conducted to assess the size of the air bubble over time. Sampling ports would be provided along the injection and discharge lines near the wellhead so that gas samples can be collected for field testing and laboratory analysis.

Following completion of the compression testing, all of the drilling, compression, and other equipment would be removed from the site. If the compression testing has indicated the formation demonstrates appropriate characteristics for a compressed air energy project, the pad and wells may be left in place for use in development of the CAES energy storage facility. If the testing demonstrates otherwise, the wells would be plugged and abandoned per California Department of Conservation Division of Oil, Gas, and Geothermal Resources regulations and the requirements of the UIC permit issued by the EPA for the

project. If the project does not move forward, the well pad and associated wells would be transferred to the King Island Gas Storage as the owner of the subsurface rights.

Electric Distribution Line

PG&E would develop a 4.25-mi.-long electrical distribution line to provide power to the compression equipment separately from construction of the TSF. The distribution line would begin at PG&E's Eight Mile Road Substation and involve some use of existing lines with no improvements, reconductoring of existing lines to upgrade them to higher voltage capacity, and construction of new overhead and underground lines (Figure 2a). The line would head west from the substation for approximately 300 ft. as a new underground circuit to an existing riser pole. The maximum depth of disturbance for this new underground circuit would be no greater than approximately 9 ft. below the present-day ground surface. From this pole it would continue west along Eight Mile Road for a 0.9-mi. segment which is adequate for project service and would not require reconductoring. The route would then continue west to King Island Road along a 1.3-mi. segment that requires entirely new construction, and would cross Bishop Cut, a navigation channel, on tall structures required for vessel passage. The tops of the existing guyed mast structures may need to be extended to provide the necessary navigation clearance. After crossing Bishop Cut, the route would extend north along King Island Road, turning west and then north again on unnamed farm roads to the TSF. The first 1.4 mi. of this portion of the route would involve reconductoring, and the remaining 0.6-mi. segment to the TSF pad would require new construction. The segments along Eight Mile Road are in franchise and the remaining distribution line reconductoring would use existing easement rights along King Island Road. New easement rights would be required for the 0.6 mi. new construction segment to the TSF pad.

Distribution line construction would occur along existing public and private roads, and would not require construction of new access routes or roads. The line would be designed entirely raptor safe, utilizing perch guards, covers, insulated jumpers, or other equipment as needed. Except for the water at Bishop Cut, conductor support would consist of wooden poles with a span length of approximately 200 ft. Construction would occur within a 50-ft.-wide work area, centered on the line. New poles would require excavations no greater than approximately 15 ft. below the current ground surface. The crossing of Bishop Cut would likely involve renovation or extending the top of the existing steel structures to increase their strength to carry heavier conductors and maintain the necessary navigation clearance. Construction details such as staging areas, work areas at the pole sites, pull and tension sites, areas where special construction methods may need to be employed, areas where vegetation removal may occur, etc., would be provided to the construction contractor as the information becomes available. The Bishop Cut crossing upgrade would require a 100 x 200-ft. work area on each side of the water.

Electric distribution line construction would typically include up to two line crews (eight to ten workers total) over a period of approximately 12 weeks. Equipment would include line trucks with augers, bucket trucks, puller rig, conductor reel trailers, and crew trucks.

Access Roads

The preferred site access route during project construction and operation would be via the levee road extending northward along the west side of Bishop Cut from Eight Mile Road (King Island Road), and from there via improved, gravel agricultural access roads to the site. Passage across the levee road would

take place under conditions required under an encroachment permit from the local reclamation district responsible for maintenance of the levee (RD2044).

The gravel-surfaced roads are graded and well maintained and no new road construction or improvements would be necessary for the proposed project activities. The access roadways would be maintained as necessary during project construction and operation, and the following preventative measures would be implemented to protect the roadways from damage:

- Periodic dust control may be necessary and would be provided by wetting the road surface using a water truck. It is assumed that one daily application of water would be needed for the duration of the project.
- Steel plates may be placed over the irrigation siphons that penetrate beneath the levee road as a preventative measure to protect them from potential wheel loading.
- Potholes or cracks in the levee road may be filled with aggregate base, cold patch asphalt, or hot patch asphalt as needed to facilitate passage and prevent damage.
- Sections of gravel road may be re-leveled and re-compacted or resurfaced with imported aggregate base as needed to properly drain.
- Maintenance on the existing access roads would be limited to light graveling if determined to be necessary (e.g., if work were schedule to occur during the wet season) with the assumption that no additional grading would be required. If grading is required, it would be limited to the existing road and not extend beyond the compacted surface.
- Equipment used for road maintenance may include dump trucks, front end loaders, water trucks, graders, smooth drum rollers and other equipment as needed.

The project would obtain coverage under the General Construction Stormwater National Pollutant Discharge Elimination System permit, best management practices (BMP) would be deployed to prevent the potential release of sediment into adjacent waterways, including the placement of biodegradable fiber rolls, silt fences, sand bags, and other appropriate BMPs.

2. Regulatory Setting

Cultural resources in California are protected by a number of federal, state, and local regulations. Management of cultural resources within the State is guided in large part by the provisions of CEQA, with Section 106 becoming relevant when federal agencies are involved. However, a CEQA review is not required for this project. Section 106 and its implementing regulations require federal agencies to consider the effects of their actions, or those they fund or permit, on historic properties that may be eligible for listing or that are listed on the National Register of Historic Places (NRHP). To determine whether an undertaking could affect historic properties, cultural resources must be identified, inventoried, and evaluated for listing in the NRHP.

Prior to approving discretionary projects, State and local agencies must consider the potential significant impacts of those projects on archaeological and historical resources in accordance with CEQA (Public Resources Code Sections 21083.2 and 21084.1) and Section 15064.5 of the State CEQA Guidelines. Listing or eligibility for listing on the NRHP and/or the California Register of Historical Resources (CRHR) are the primary considerations in determining whether a cultural resource that may be affected by a project should be subjected to further research and documentation.

Assessing Significance under Section 106 – the NRHP

The NRHP is a register of districts, sites, buildings, structures, and objects of significance in American history, architecture, archaeology, engineering, and culture. The regulations provided in 36 CFR Part 60.4 describe the criteria to evaluate cultural resources for inclusion in the NRHP. Cultural resources can be significant on the national, state, or local level. Properties may be listed in the NRHP if they possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:

a) are associated with events that have made a significant contribution to the broad patterns of our history;

b) are associated with the lives of persons significant in our past;

c) embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess an artistic value, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

d) have yielded, or may be likely to yield, information important in prehistory or history.

Most prehistoric archaeological sites are evaluated with regard to Criterion d of the NRHP, which refers to site data potential. Such sites typically lack historical documentation that might otherwise adequately describe their important characteristics.

Assessing Significance under CEQA

CEQA states that if a project would have significant impacts on important cultural resources, then alternative plans or mitigation measures must be considered. However, only significant cultural resources (termed "historical resources") need to be addressed. The State CEQA Guidelines define a historical resource as "a resource listed or eligible for listing on the CRHR (Public Resources Code Section 5024.1). A resource may be eligible for inclusion in the CRHR if it:

a) is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage;

b) is associated with the lives of persons important in our past;

c) embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic values; or

d) has yielded, or may be likely to yield, information important in prehistory or history.

In addition to meeting one or more of the above criteria, resources eligible for listing in the CRHR (and the NRHP) must retain enough of their historic character or appearance to be recognizable as historical resources and to convey the reasons for their significance. Integrity is evaluated with regard to the retention of location, design, setting, materials, workmanship, feeling, and association (Office of Historic Preservation 1999: 69–70).

3. Cultural Setting

3.1 Prehistory

California prehistory is divided into three periods that reflect similar cultural characteristics throughout the state: Paleo-Indian period (ca. 12,000 years before the present [BP] – 8,000 BP), Archaic period (8,000 – 1,500 BP), and Emergent period (1,500 BP – Euro-American contact) (Fredrickson 1973, 1974). The Archaic is divided further into Lower (8,000 –5,000 BP), Middle (5,000 –3,000 BP), and Upper (3,000 BP – 1,500 BP) periods which are defined by dramatic environmental changes and variability in subsistence, settlement, and technological systems seen in the archaeological record.

Human occupation in the Sacramento-San Joaquin Delta region may have occurred as early as 12,000 years ago, but few archaeological sites pre-dating 5,000 years BP have actually been documented in the Delta or the broader Central Valley. It is possible that Holocene alluvial deposits buried many prehistoric sites and the dynamic nature of the Delta and Central Valley waterways have obscured and destroyed earlier sites. For example, Moratto (1984:214) estimates that as much as 10 meters of sediment accumulated along the lower stretch of the Sacramento River drainage system during the last 5,000–6,000 years. One of the few early sites in the region is CA-CCO-637 in eastern Contra Costa County which dates to approximately 8,500 BP and was found in an alluvial fan near present-day Kellogg Creek (Meyer and Rosenthal 1998).

Prehistoric material culture in central California subsequent to the Paleo-Indian and Lower Archaic periods has been categorized according to “horizons” or “patterns” that define broad technological, economic, social, and ideological elements over long periods of time and large areas. Fredrickson (1973, 1974) defined three regional patterns that are most relevant to the APE, three of which are specific to the prehistory of the APE. Referred to as the Windmiller, Berkeley, and Augustine patterns, each represents a general pattern of resource exploitation and cultural manifestations and occurred between about 4,500 BP and Euro-American contact around the year 1800.

Windmiller Pattern (4,500 – 2,500 BP)

Middle Archaic Windmiller Pattern sites date to as early as 4,500 BP and extend to and as late as 2,500 years ago. Windmiller sites appear to indicate an extensive reliance on plant foods although a wide variety of faunal remains have been noted as well. The presence of fish hooks and probable net and line sinkers along with the remains of sturgeon, salmon, and smaller species, indicate that fishing was an additional and important source of food (Fredrickson 1973; Heizer 1949; Ragir 1972). Items made of baked clay included net sinkers, pipes and manufactured cooking “stones” in an environment where suitable natural cobbles were generally scarce. Ground and polished charmstones, impressions of twined basketry, shell beads, and bone tools also have been found at Windmiller Pattern sites. Some items, such as shell beads, obsidian tools, and quartz crystals, were obtained by trade. Windmiller people appear to

have resided in the Sacramento Valley during the winter months but shifted to higher elevations during the summer (Moratto 1984:206). Mortuary practices included the frequent addition of grave goods in the interments and the deceased were buried in cemeteries that were separate from the habitation sites.

Berkeley Pattern (2,500 BP – 1,500 BP)

By around 2,500 BP the archaeological record begins to show changes to more specialized adaptive patterns characteristic of the Berkeley Pattern. Acorns become a significant dietary staple and this shift can be seen in a dramatic increase in the occurrence of mortars and pestles on sites as opposed to manos and metates which were far more common during the Windmiller. Mortars and pestles are better suited to crushing and grinding acorns, whereas manos and metates were used primarily for grinding wild grass grains and seeds (Moratto 1984:209–210). The archaeological record, however, clearly indicates that hunting continued to be an important source of food and useful materials (Fredrickson 1973:125–126). In addition, Berkeley Pattern sites adjacent to Bay and coastal shorelines often include significant shell mounds and middens indicating an intensive use of both fresh and salt water aquatic resources.

Artifact assemblages and radiocarbon dates from Berkeley Pattern sites suggest the subsistence and technological patterns characteristic of this time may have developed in the San Francisco Bay region and later spread into central California. Moratto (1984:207–211) suggests the pattern may be associated with an expansion of Eastern Miwok populations from the San Francisco Bay area to the Central Valley and into the Sierra foothills.

Augustine Pattern (A.D. 500–historic contact)

The Augustine Pattern is marked by shifts in subsistence and land-use patterns that begin to resemble those noted in ethnographic observations. Tools and cooking implements include shaped mortars and pestles, hopper mortars, bone awls used for producing coiled baskets, and the bow and arrow. A type of pottery, referred to as *Cosumnes Brownware*, appears in some parts of the Central Valley and have evolved from the baked clay industry so prominent during earlier times.

During this period, increased sedentism, social stratification, and the rise of elaborate ceremonies and social organizations can be seen. Exchange networks expanded and became more complex also developed during this time (see Fredrickson 1973; Moratto 1984). Distinctive artifacts including flanged tubular pipes, harpoons, and Gunther barbed series projectile points are found on these sites. Moratto (1984: 211–214) suggests that these occurrences accompanied by the other notable aspects of the Augustine Pattern may represent a southward expansion of Wintu populations and territory.

3.2 Ethnographic History

The APE and surrounding area are situated within an area traditionally occupied by the Native American group known as the Eastern Miwok and more specifically the Plains Miwok. During later prehistoric and early historic times, the Plains Miwok resided in the lower Sacramento River Valley from just north of the Cosumnes River to the south including the lower San Joaquin River drainage and the western ends of the Mokelumne River. This area is roughly bounded by present-day Sacramento on the north and the Stockton area to the south. However, the northern boundary may not have been as firm as indicated in some ethnographic sources since archaeological evidence along the Cosumnes River suggests that the Nisenan may have displaced the Miwok in this region during later prehistoric times (Deis 1996, Grantham 1993).

While the Plains Miwok shared a common language and cultural background, they consisted of a number of separate and politically independent nations or "tribelets" with the *Guayapemne* tribelet probably having inhabited the APE and surrounding early during the ethnographic era (see Kroeber 1925). Each tribelet was an independent and essentially sovereign nation being comprised of several lineages that were localized and named for specific geographical locations. Tribelets consisted of a number of permanently inhabited and seasonally occupied locales, with control of the natural subsistence and material resources contained within a bounded area (Levy 1978:398). Subsistence targeted a broad spectrum of flora and faunal resources. Of the plant species the valley oak was the most valued, with buckeye, laurel, and hazelnut also having been used. Wild oats and balsam root, several species of edible roots, and greens such as wild pea and miner's lettuce, berries, and a number of different mushroom varieties were consumed. Tule elk and pronghorn antelope were the most important faunal species exploited for food and materials and various species of rabbit were hunted in the summer. Waterfowl and fish, especially salmon, were also extremely important food sources for the Eastern Miwok (Aginsky 1943:397-398).

Spanish expeditions to the Sacramento-San Joaquin Valley in the latter eighteenth century had first contact with indigenous populations in the westernmost, delta portions of the Plains Miwok's territory. Several names of Native Americans appear in the Book of Baptisms of Mission San Jose in 1811, indicating that Spanish raids resulted in the capturing of native peoples. Unfortunately, the large-scale depopulation of native peoples from the Central Valley in the early nineteenth century led to a loss of cultural ways and geographical knowledge among the Plains Miwok and other groups during this time. However, in later years, Eastern Miwok tribelets became united and allied with Yokuts groups to the south in an attempt to resist incursion by the Spanish military (see Kroeber 1908, Merriam 1907).

A subsequent phase of Euro-American impacts to the Plains Miwok consisted of the rapid influx of fur trappers, would-be miners, and settlers following the establishment of the Mexican land-grant ranchos and the Gold Rush. Plains Miwok people adapted as best they could and many hired on to the newly-established ranches and farms as laborers. For example, members of the Ochehamne Plains Miwok tribelet were employed at Sutter's Fort (Forbes 1969). By the early twentieth century, most Eastern Miwok resided on small parcels or *rancherias* and were largely marginalized from the predominant Euro-American population. In general, despite some organized resistance during the early and middle decades of the nineteenth century most Eastern Miwok groups were no longer in existence as recognizable cultural and political entities. For example, Merriam apparently interviewed the last known Guayapemne individual in 1905 who was at the time living on Sherman Island in the Delta (Merriam 1966-1967).

Despite their near-disappearance by the late nineteenth and early twentieth centuries, many Eastern Miwok continued to maintain some of their traditional ways and identity. Many of the rancherias established during earlier years were disbanded in 1958 following enactment of the California Rancheria Act, which was part of a federal policy intended to further assimilate California native peoples. The Wilton Rancheria, home to many Plains and other Miwok peoples, was one of those that was subject to the policy. However, in 2009, the Wilton Rancheria Indian Tribe was re-recognized and they were re-formed as the Wilton Rancheria Miwok and the Me-Wuk Indian Community of the Wilton Rancheria.

3.3 History

The historic period in the Stockton area and in San Joaquin County essentially began in 1813 when Lieutenant Gabriel Moraga led an expedition in search of new mission sites into the lower portion of the Central Valley. During this expedition, Moraga christened the large river he travelled on the same San

Joaquin to the waterway (Hoover et al. 2002:369). Little in the way of sustained European contact with the Plains Miwok occurred during the earliest years of the twentieth century although later immigrants were attracted to the abundance of game and fur-bearing animals. In 1827, American explorer and trapper Jedediah Smith traveled through the San Joaquin Valley and others soon followed, including parties from the Hudson's Bay Company in 1832 (Hoover et al. 2002:370).

Just as the region was being settled in earnest, San Joaquin County was designated in 1850 as one of the original 27 counties established in California (Hoover et al. 2002:369). The county's location in the center of the state between the Sierra Nevada to the east and San Francisco to the west made it an important center for the early development of California's transportation infrastructure and the agricultural industry. "Captain" Charles M. Weber was instrumental in developing the City of Stockton as the county seat and as a major port of overland and marine entry. This was fostered by the presence of the confluence of the Sacramento and San Joaquin rivers that constitute the major drainages of the northern and southern portions of the Central Valley. Ships today still deliver cargo to the Port of Stockton via the Stockton Channel, the deep-water slough that leads into the San Joaquin River, next to which Captain Weber laid out the town of Tuleburg (now Stockton) in 1847.

Prior to establishing the town, Weber tried his hand at mining forming the Stockton Mining and Trading Company, but then realized that he could reap large rewards by establishing a town and supply center to cater to the miners. The town was resurveyed and the name was changed to Stockton, after Commodore Robert F. Stockton. With the Gold Rush the town developed rapidly with ships arriving with cargo and passengers bound for the southern gold fields. Roads were established linking the mining communities in Mariposa, Tuolumne, Calaveras, and Amador Counties. One of the first roads and probably the most important was the Mariposa Road (located north of the APE) established in 1851.

By the winter of 1850 the population of Stockton had increased to 5,000 (Marvin 1998). Following the Gold Rush, additional growth in the city and in San Joaquin County was spurred again by the arrival of rail transportation. The first train to arrive in Stockton was the Central Pacific's locomotive "Governor Stanford" in August of 1869. Subsequent lines built in the Stockton area included the San Francisco & San Joaquin Valley Railway Company, which began construction of a line from Stockton to Bakersfield in 1895. Today this line is located just over four miles east of the APE and is currently owned by Burlington Northern Santa Fe (Holterhoff 1914).

Other than transportation, the development of the agricultural and ranching industries has most defined the character of San Joaquin's economy since the Gold Rush period. In order to take full advantage of the fertile lands of the Central Valley and Delta region, water conveyance systems had to be constructed. One of the early and most notable proponents of irrigation was the Miller and Lux Company, a cattle company known across the western U.S. The company was founded by German immigrant Henry Miller (formerly Heinrich Alfred Kaiser) and partner Charles Lux. They started their ranching empire by first acquiring former rancho properties in California and bringing their cattle to market in San Francisco (Hoover et al. 2002:435). The Miller and Lux Company also pioneered irrigation projects in the San Joaquin Valley, beginning with the San Joaquin Canal which was completed in the 1870s. This massive conveyance project began on the San Joaquin River near Fresno Slough, and then ran north through Merced County and into Stanislaus County. The company also controlled more than 50 miles of land along Kern River, which they were able to parlay into a system of canals to irrigate dry lands that then became productive agricultural fields (Beck and Haase 1974:76; Hoover et al. 2002:94).

Although transportation and agriculture are still major components of the Stockton area character, the economy has continued to grow and diversify. Today, Stockton is a hub of rail, water, and highway transportation linking the rich agricultural industries to world markets. The continued need for agricultural workers in particular has led to the ethnically diverse population that is present today (Johnston et al. 1993).

4. Background Research

With the Project APE being largely the same as that addressed in an October 2012 SWCA (Treffers and Dietler 2012) report for the Project, NSR did not request a separate record search through the Central California Information Center (CCIC). The August 2012 record search included the entirety of the current APE within a one-mile radius (Appendix A). Consequently, information on previously-documented cultural resources within and near the current Project APE and previous cultural resources reports and investigations are up-to-date for the purposes of this study. However, in order to enhance the previous CCIC records search, NSR reviewed additional sources including, but not necessarily restricted to, the following:

- National Historical Topographic Map Collection (U.S. Geological Survey)
- Meriam Library Special Collections (California State University, Chico)
- University of Alabama Map Collections
- NRHP/CRHR updates
- NSR's in-house cultural resources library

According to the results of the CCIC record search presented in Treffers and Dietler (2012), a total of five cultural resources or features have been identified within the Project APE or in the vicinity (Table 1).

Table 1. Cultural Resources Situated within and near the APE

CCIC SITE NO.	ASSOCIATION	TYPE	LOCATION
P-39-004492	Historic-era	Southern Bishop Tract Farm	Outside APE
P-39-004540	Historic-era	Bridge 29C-0219	Outside APE
P-39-005038	Historic-era	Venice School	Outside APE
n/a	Historic-era	Bridge 29C-0290 over Telephone Cut	Outside APE
n/a	Historic-era	Bridge 29C-0114 over Bishop Cut	In APE
Source: CCIC and Treffers and Dietler 2012			

None of the resources identified by the CCIC within or outside of the Project APE are recommended as eligible for inclusion in the NRHP. This includes Bridge 29C-0114 over Bishop Cut which according to the Caltrans Local Agency Bridge significance rating sheet, was built in 1989 and has been recommended not eligible for NRHP listing. The other resources located within the vicinity of the APE remain unevaluated or have been recommended not eligible for NRHP/CRHR listing (see Treffers and Dietler 2012).

The results of additional research largely conform to the findings presented by Treffers and Dietler (2012). Prior to the early twentieth century, King Island did not exist as dry land and instead is noted only as "swamp and overflowed land" on maps of the period. Reclamation and the construction of levees, irrigation and drainage ditches, and access roads during the early decades of the twentieth century resulted in large areas of tillable land seen today. Other developments including three buildings immediately adjacent to/within the Project APE identified by Treffers and Dietler as SWCA-KING-1, SWCA-KING-2, and SWCA-KING-3 first appear on the 1952 *Terminous* USGS quad (see Appendix B).

In addition to a review of archival sources and maps, NSR also consulted with the on-line Web Soil Survey of the U.S. Department of Agriculture's National Resources Conservation Service (NRCS). Although map research makes it clear that the Project APE and surrounding area were swamp and/or frequently flooded "land" prior to the early decades of the twentieth century, some soil formations in the otherwise typically flooded Sacramento-San Joaquin Delta are known to be highly sensitive for exhibiting significant traces of prehistoric habitation. The "Piper series" soils represent relict dunes and higher-elevation landscapes that were heavily occupied. A review of the NRCS soil survey of the APE and surrounding area demonstrates that no such formations exist in these areas.

5. Native American Community Consultation

In order to determine if any cultural resources or properties of significance to the present-day Native American community were known to exist within or near the project area, SWCA (Treffers and Dietler 2012) contacted the Native American Heritage Commission (NAHC) and requested a search of the Sacred Lands File. SWCA also requested a list of appropriate Native American representatives and tribal organizations that might have an interest in or concerns with the project. The NAHC search did not note any culturally significant locations within the current Project APE or in the general area. SWCA and PG&E contacted the individuals and groups suggested by the NAHC and received a response from the Ms. Silvia Burley of the California Valley Miwok Tribe. Ms. Burley had no specific concerns regarding the APE but did request that she be notified in the event that any Miwok-associated materials or human interments were discovered during the course of ground-disturbing Project activities (Appendix C).

NSR is presently working with PG&E to continue and update consultation with the NAHC and appropriate Native American representatives and organizations. A new search of the Sacred Lands File and a request for an additional list of contacts is being sent to the NAHC and the consultation process under Section 106 is presently ongoing.

6. Field Methods and Survey Results

NSR cultural resources specialists surveyed the APE including the distribution line corridor, unpaved access roads, and the TSF site. The survey also included the buffers delineated around each of these APE elements (see Chapter 1). Due to the narrow configuration and heavily developed nature of much of the APE, the roadways and transmission line corridor surveys were accomplished using one or two pedestrian transects. The 2.5-acre TSF site and 200-ft. buffer was surveyed utilizing multiple transects spaces at approximately 15 meters or less. In order to obtain an overall view of the archaeological sensitivity of the landscape immediately surrounding the project in this area, road cuts, eroded slopes, rodent burrows, and

soils exposed through landscaping activities were examined whenever available. Ground surface visibility across the APE varied but was generally good; ranging from 50-100 percent, depending on the extent of vegetation cover, disturbances, and built environment features such as levees, roadways, and buildings.

Other than the historic-era features documented by Treffers and Dietler (2012), NSR did not identify any additional sites, features, or artifacts within or adjacent to the APE. The resources documented by SWCA within/immediately adjacent to the APE and revisited by NSR in 2013 consist of the following (Figure 3, Appendix C).

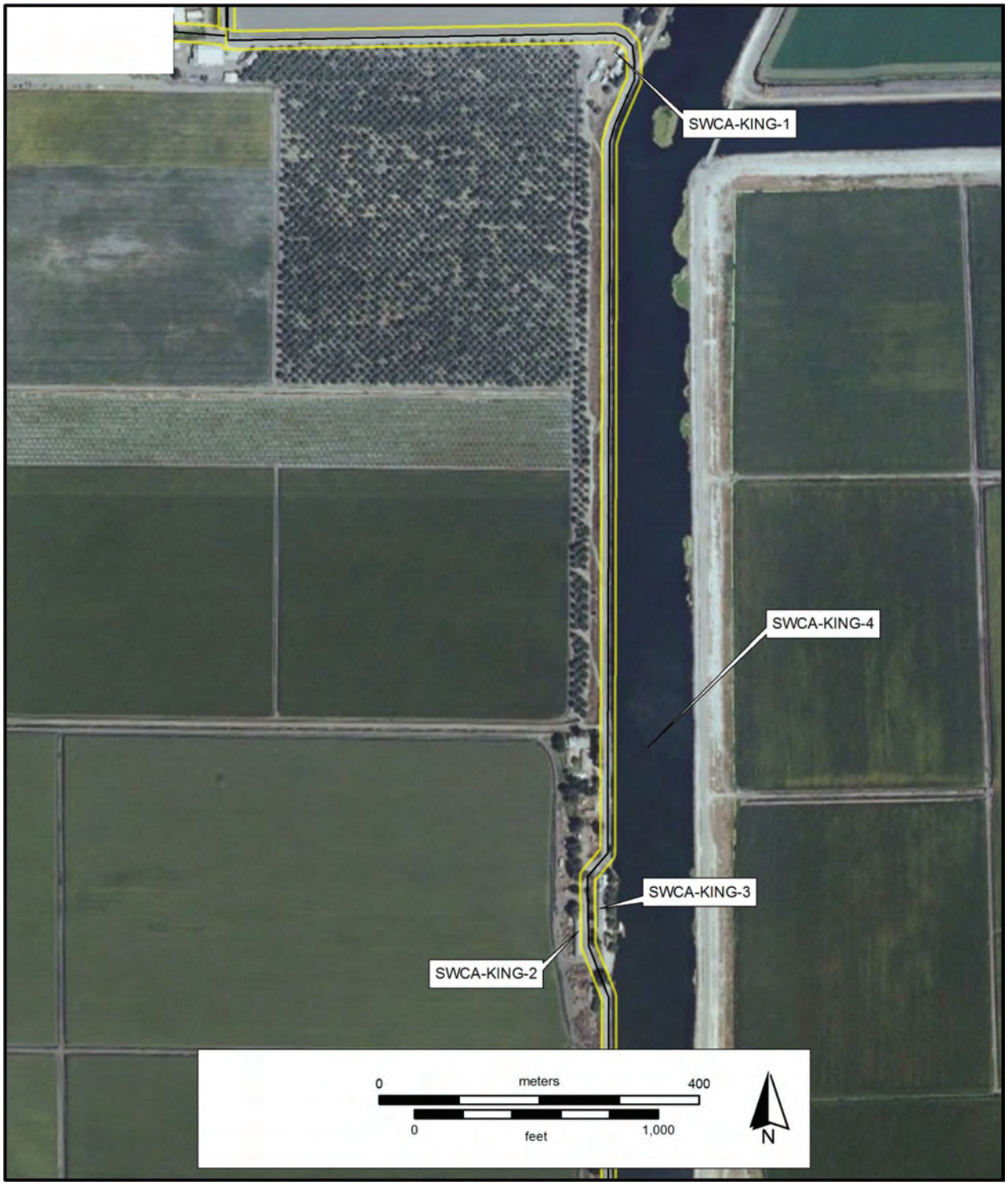
6.1 SWCA-KING-1

This resource consists of a small building that that historic topographic maps indicate was constructed sometime between 1939 and 1952. The building is situated on a northeast-southwest axis at the southwest corner of an access road named King Island and an unnamed street. The building measures approximately 40 ft. x 20 ft. and exhibits a gabled roof sheathed in corrugated galvanized sheet metal. A small shed roof extension is present at the southwest corner of the building. This building is part of a larger agricultural property consisting of 27 buildings and structures that is bounded by West Eight Mile Road to the south, White Slough to the north, and irrigation canals to the east and west. At the time of the 2012 documentation by Treffers and Dietler, no assessments as to the building's potential NRHP/CRHR significance was provided. However, NSR's 2013 survey showed that the building was in the same condition as when it was originally documented the previous year by SWCA. The building appears to be typical of the vernacular agricultural buildings commonly constructed in the Delta during the mid-twentieth century.

According to existing research, the building does not appear to be associated with any historically significant individual or event and as such is not eligible for NRHP listing under criteria A or B or for CRHR listing under criteria 1 or 2. In addition, farm buildings such as these are commonly encountered in the Central Valley and Delta and this example does not appear to be a particularly early or unusual example of its kind or the work of a noted master. As a result it does not appear to be eligible for NRHP/CRHR listing under Criterion C/3. Lastly, it is unlikely that further investigation would reveal information regarding this building that would render it significant and suitable for NRHP/CRHR listing. The data potential for this building has likely been realized through the SWCA documentation and as a result it does not appear to be eligible for NRHP/CRHR listing under Criterion D/4 (data potential).

6.2 SWCA-KING-2

This agricultural building, much like SWCA-KING-1, appears to have been built sometime between 1939 and 1952 per historic maps. This building is situated on a north-south axis and is located on the west side of an access road named King Island. The building measures approximately 160 ft. x 30 ft. and is sided with corrugated galvanized sheet steel. The building exhibits a gabled roof and minimal fenestration. The subject building is also part of the same agricultural property consisting of 27 buildings and structures noted above in the discussion regarding SWCA-KING-1.



R:\Projects\26620 CAES EA Support\ sgc 0413

Figure 3
Cultural Resources Site Location Map

According to existing research, the building does not appear to be associated with any historically significant individual or event and as such is not eligible for NRHP listing under criteria A or B or for CRHR listing under criteria 1 or 2. In addition, farm buildings such as these are commonly encountered in the Central Valley and Delta and this example does not appear to be a particularly early or unusual example of its kind or the work of a noted master. As a result it does not appear to be eligible for NRHP/CRHR listing under Criterion C/3. Lastly, it is unlikely that further investigation would reveal information regarding this building that would render it significant and suitable for NRHP/CRHR listing. The data potential for this building has likely been realized through the SWCA documentation and as a result it does not appear to be eligible for NRHP/CRHR listing under Criterion D/4 (data potential).

6.3 SWCA-KING-3

SWCA-KING-3 also appears to be an agricultural building that historic topographic maps indicate was constructed sometime between 1939 and 1952. The building is situated on a north-south axis and is located on the east side of an access road named King Island. This building measures about 220 ft. x 30 ft. and, like SWCA-KING-2, is sided with galvanized corrugated sheet steel. This building also exhibits a gabled roof and minimal fenestration. It is also part of a larger agricultural property that consists of 27 buildings and structures as noted above for SWCA-KING-2 and SWCA-KING-3.

According to existing research, the building does not appear to be associated with any historically significant individual or event and as such is not eligible for NRHP listing under criteria A or B or for CRHR listing under criteria 1 or 2. In addition, farm buildings such as these are commonly encountered in the Central Valley and Delta and this example does not appear to be a particularly early or unusual example of its kind or the work of a noted master. As a result it does not appear to be eligible for NRHP/CRHR listing under Criterion C/3. Lastly, it is unlikely that further investigation would reveal information regarding this building that would render it significant and suitable for NRHP/CRHR listing. The data potential for this building has likely been realized through the SWCA documentation and as a result it does not appear to be eligible for NRHP/CRHR listing under Criterion D/4 (data potential).

6.4 SWCA-KING-4

SWCA-KING-4 is a segment of an irrigation/navigation canal referred to as the Bishop Cut. The canal, which historic topographic maps indicate was constructed by 1939, is approximately 330 ft. wide and connects White Slough at the northernmost extent of King Island to Disappointment Slough in the south; a distance of approximately 2.75 miles. The waterfront portion of the canal is composed of rip-rap along steep banks, and it is bound by Rio Blanco Road to the east and a private access road to the west. SWCA-KING-4 includes the 1 mile portion of Bishop Cut from the vicinity of Telephone Cut to Bridge 29C-0114 to the south. Canals such as Bishop Cut are ubiquitous and defining features of the Delta region. They were constructed as part of the overall and long-term reclamation efforts that occurred in the Delta from the mid-nineteenth through mid-twentieth centuries.

As economic investment in the Delta lands increased, a great period of land reclamation began in the late 1860s and peaked between 1870 and 1880 when some 92,000 acres of Delta land were leveed and reclaimed. This number was not surpassed until the 1910-1920 period when an additional 94,000 acres were reclaimed. What led to the 1870s being such an active reclamation era were the establishment of large reclamation companies and technological advances in pumping and dredging. Two large companies, the Tide Land Reclamation Company, directed by George Roberts, and the Glasgow-California Land and Reclamation Company, directed and mostly owned by Morton Fischer, were formed

in the 1860s and dominated reclamation activities in the Delta well into the 1880s. Innovative dredges were used to build the initial Union Island levees and included the Tide Land Reclamation Company's dredge designed by A. A. von Schmidt. This dredge employed an auger to loosen river bottom sediments and a massive suction hose to relocate the spoils for use in levee construction. Later designs such as the Ferris-Smith dredge could move up to 125 cubic yards of soil an hour. Fisher's Glasgow-California company had 13 such dredges in constant operation in the Delta in 1880 and at their peak they were moving 25,000 cubic yards a day—amounts surpassed in their era only during the construction of the Suez and Panama canals (Thompson 1957:270).

According to SWCA and NSR research, Bishop Cut was not constructed during the most significant periods of Delta land reclamation (circa 1870-1880, 1910-1920) nor does it appear to be associated with any other historically significant individual, event, or series of events. As such, it does not appear to be eligible for NRHP listing under criteria A or B or for CRHR listing under criteria 1 or 2. In addition, features such as Bishop Cut essentially define the character of the Delta and are commonly encountered. Bishop Cut does not appear to be a particularly unusual example of its kind, it is certainly not one of the earliest, nor is there any evidence to suggest it's design or construction were accomplished by a noted builder. As a result it does not appear to be eligible for NRHP/CRHR listing under Criterion C/3. Lastly, it is unlikely that further investigation would reveal information regarding this canal that would render it significant and suitable for NRHP/CRHR listing. The data potential for this canal has been realized through the SWCA/NSR documentation and as a result it does not appear to be eligible for NRHP/CRHR listing under Criterion D/4 (data potential).

7. Conclusions and Recommendations

SWCA and NSR surveys (August 2012 and April 2013, respectively) did not result in the identification of any significant (per NRHP/CRHR criteria) within or immediately adjacent to the Project APE. A total of four historic-era resources were noted consisting of three mid-twentieth century vernacular buildings associated with agricultural activities, and the irrigation canal referred to as Bishop Cut. None of these resources appear to be eligible for NRHP listing and no potential Project effects would be considered adverse under Section 106.

7.1 Buried Site Sensitivity

Previous cultural resources investigations within and in the vicinity of the APE have documented several historic-era resources including three mid-twentieth century buildings and an irrigation canal constructed around the same time. However, neither the 2013 NSR survey nor SWCA's 2012 investigation identified any prehistoric sites or artifacts within the APE. Regarding prehistoric resources, given the former natural character of the landscape (swamp or otherwise frequently flooded) prior to early twentieth century reclamation, it is unlikely that any early Native American occupation occurred on King Island or that they engaged in activities that have left lasting and significant traces. In addition, it does not appear that any landforms conducive to prehistoric settlement (Piper Series soils) exist within the APE or in the general area. Consequently, there is little possibility that the Project would encounter any early Native American sites, features, artifacts, or human interments in surface or subsurface contexts.

Historic-era developments within and near the APE and on King Island appear to consist solely of those associated with twentieth century land reclamation, agriculture, and transportation. The levees, ditches,

and roadways within and adjacent to the APE have been well-documented through previous cultural resources investigations, Caltrans bridge assessments, and/or coincidental mapping and aerial photography since the land was reclaimed and initially tilled in the early-middle decades of the 1900s. As a result, it is unlikely that any potentially significant (per NRHP/CRHR criteria) historic-era buildings, structures, features, or artifacts would be located in or near the APE.

7.2 Recommendations

Although it appears that the APE and surrounding area is not sensitive for exhibiting traces of prehistoric or early historic-era occupation and activities, archival sources and surface surveys cannot always provide indications of subsurface archaeological occurrences. Consequently, the following recommendations are provided.

Unanticipated Discovery Protocol

If any new cultural resources are located during project activities, any ground-disturbing work in the vicinity of the find should cease and a qualified professional archaeologist should be consulted regarding their management. Prehistoric resources that may be identified include, but are not limited to, concentrations of stone tools and manufacturing debris made of obsidian, basalt and other stone materials, milling equipment such as bedrock mortars, portable mortars, and pestles and locally darkened soils (midden) that may contain dietary remains such as shell and bone, as well as human remains. Historic resources that may be identified include, but are not limited to small cemeteries or burial plots, structural foundations, cabin pads, cans with soldered seams or tops, and bottles or fragments of clear and colored glass.

Human Remains Protocol

Per Section 7050 of the California Health and Safety Code, it is a misdemeanor to knowingly disturb a human burial. If human remains are encountered during any Project-related activity, all work should halt in that vicinity immediately. A qualified cultural resources specialist should be contacted to evaluate the find before the San Joaquin County sheriff/coroner is contacted. If the human remains are of Native American origin, the coroner must notify the Native American Heritage Commission within 24 hours of such identification.

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APPENDIX A

CCIC Record Search Results

APPENDIX B

California Department of Parks and Recreation Site Forms

State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
PRIMARY RECORD

Primary #
HRI #
Trinomial
NRHP Status Code
Other Listings
Review Code | Reviewer | Date

 ***Resource Name or #:** SWCA-KING-1

P1. Other Identifier:

***P2. Location:** ☐ **Not for Publication** ☐ **Unrestricted** ***a. County:** San Joaquin

and (P2b and P2c or P2d. Attach a Location Map as necessary.)

***b. USGS 7.5' Quad:** Terminous **Date:** 2012 **T** 3N ; **R** 5E ; **¼ of ¼ of Sec ;** M.D. **B.M.**

c. Address: City: Zip:

d. UTM: Zone: 10 ; mE/ mN (G.P.S.)

e. Other Locational Data: (e.g., parcel #, directions to resource, elevation, etc., as appropriate) Elevation:

The subject property is accessed from a private access road named King Island, which is located on the north side of West 8 Mile Road, immediately west of Bridge #29C-0219.

***P3a. Description:** (Describe resource and its major elements. Include design, materials, condition, alterations, size, setting, and boundaries)

Located in unincorporated San Joaquin County, approximately 9 miles southwest of the City of Lodi, SWCA-KING-1 is a small building that that historic topographic maps indicate was constructed between 1939 and 1952. The subject building is situated on a northeast-southwest axis at the southwest corner of an access road named King Island and an unnamed street. Approximately 20 x 40 feet in plan, it features gabled roof sheathed in corrugated metal sheets and a small shed roof extension at the southwest corner of the building. The subject building is part of a larger agricultural property consisting of 27 buildings and structures that is bounded by West Eight Mile Road to the south, White Slough to the north, and irrigation canals to the east and west. The building was originally identified during an intensive-level survey, but was not adequately photographed and subsequent site visits were not possible due to safety concerns and additional access issues.

***P3b. Resource Attributes:** (List attributes and codes) HP1. Unknown

***P4. Resources Present:** ☒Building ☐Structure ☐Object ☐Site ☐District ☐Element of District ☐Other (Isolates, etc.)

P5a. Photo or Drawing (Photo required for buildings, structures, and objects.)



P5b. Description of Photo: (View, date, accession #) Aerial photo with SWCA-KING-1 identified.

***P6. Date Constructed/Age and Sources:** ☒Historic ☐Prehistoric ☐Both
1939-1952 (Lodi, CA, USGS Topographic Map 1:62,500, 1939; and Terminous, CA, USGS Topographic Map, 1:24,000, 1952).

***P7. Owner and Address:**
Unknown

***P8. Recorded by:** (Name, affiliation, and address)
Steven Treffers
SWCA Environmental Consultants
150 S. Arroyo Parkway, 2nd Floor
Pasadena, CA 91105

***P9. Date Recorded:** August 28, 2012

***P10. Survey Type:** (Describe)
Reconnaissance

***P11. Report Citation:** (Cite survey report and other sources, or enter "none.")
Cultural Resource Survey for the PG&E CAES – King Island Project.

***Attachments:** ☐NONE ☒Location Map ☐Sketch Map ☐Continuation Sheet ☐Building, Structure, and Object Record ☐Archaeological Record ☐District Record ☐Linear Feature Record ☐Milling Station Record ☐Rock Art Record ☐Artifact Record ☐Photograph Record ☐ Other (List):

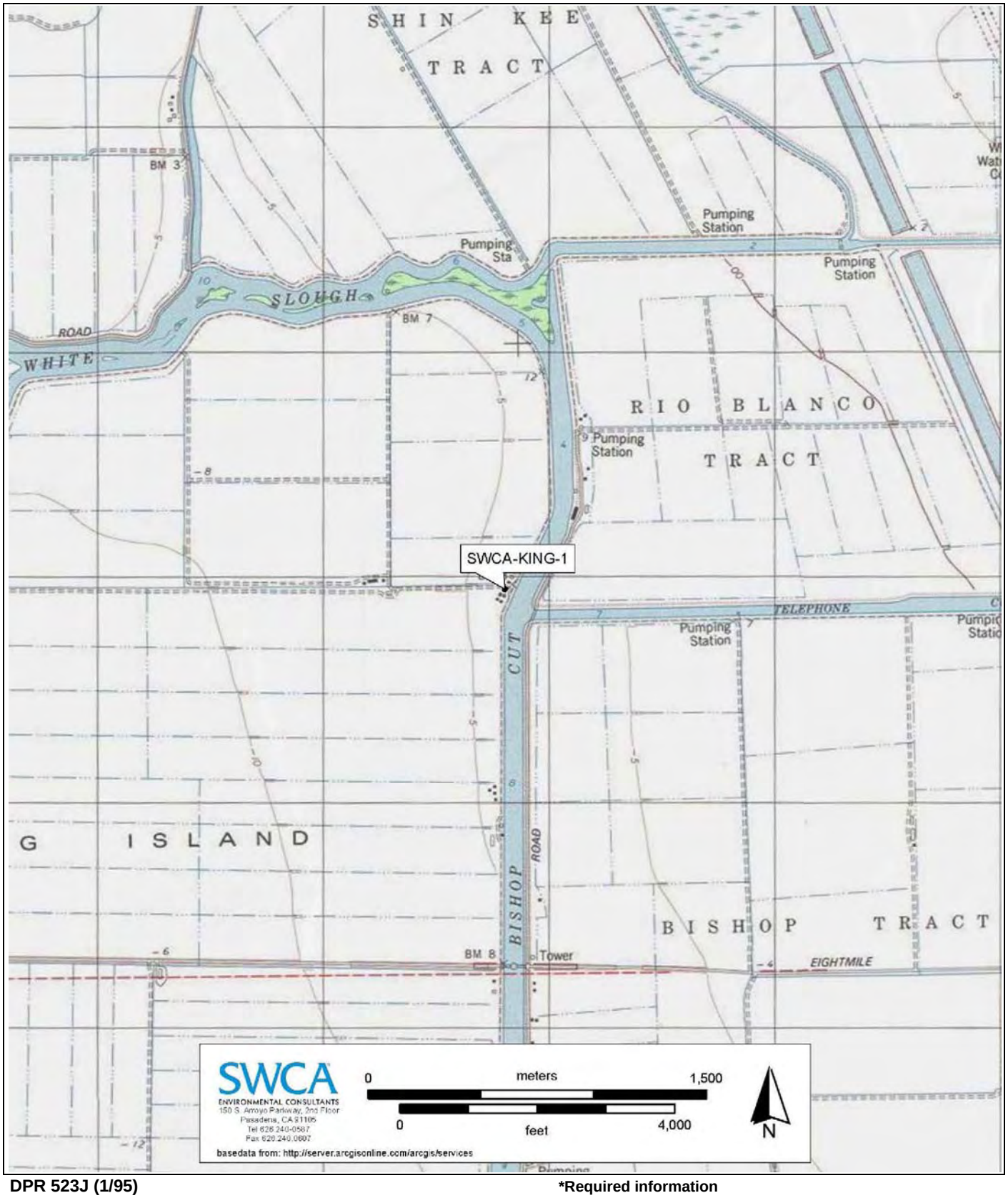
State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

LOCATION MAP

Primary #
HRI#
Trinomial

Page 2 **of** 2 ***Resource Name or #:** SWCA-KING-1

***Map Name:** Terminous, CA ***Scale:** 1:24,000 ***Date of Map:** 2012



DPR 523J (1/95)

*Required information

State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
PRIMARY RECORD

Primary #
HRI #
Trinomial
NRHP Status Code
Other Listings
Review Code | Reviewer | Date

 ***Resource Name or #:** SWCA-KING-2

P1. Other Identifier:

***P2. Location:** ☐ **Not for Publication** ☐ **Unrestricted** ***a. County:** San Joaquin

and (P2b and P2c or P2d. Attach a Location Map as necessary.)

***b. USGS 7.5' Quad:** Terminous **Date:** 2012 **T** 3N ; **R** 5E ; **¼ of ¼ of Sec** ; M.D. **B.M.**

c. Address: City: Zip:

d. UTM: Zone: 10 ; mE/ mN (G.P.S.)

e. Other Locational Data: (e.g., parcel #, directions to resource, elevation, etc., as appropriate) Elevation:

The subject property is accessed from a private access road named King Island, which is located on the north side of West 8 Mile Road, immediately west of Bridge #29C-0219.

***P3a. Description:** (Describe resource and its major elements. Include design, materials, condition, alterations, size, setting, and boundaries)

Located in unincorporated San Joaquin County, approximately 9 miles southwest of the City of Lodi, SWCA-KING-1 is an agricultural building that historic topographic maps indicate was constructed between 1939 and 1952. The subject building is situated on a north-south axis and is located on the west side of an access road named King Island. Approximately 30 x 160 feet in plan and sheathed in corrugated metal, it features a gabled roof and minimal fenestration. The subject building is part of a larger agricultural property consisting of 27 buildings and structures that is bounded by bounded by West Eight Mile Road to the south, White Slough to the north, and irrigation canals to the east and west. The building was originally identified during an intensive-level survey, but was not adequately photographed and subsequent site visits were not possible due to safety concerns and additional access issues.

***P3b. Resource Attributes:** (List attributes and codes) HP8. Industrial Building

***P4. Resources Present:** ☒Building ☐Structure ☐Object ☐Site ☐District ☐Element of District ☐Other (Isolates, etc.)

P5a. Photo or Drawing (Photo required for buildings, structures, and objects.)



P5b. Description of Photo: (View, date, accession #) Aerial photograph with SWCA-KING-2 identified.

***P6. Date Constructed/Age and Sources:** ☒Historic ☐Prehistoric ☐Both

1939-1952 (Lodi, CA, USGS Topographic Map 1:62,500, 1939; and Terminous, CA, USGS Topographic Map, 1:24,000, 1952).

***P7. Owner and Address:**

Unknown

***P8. Recorded by:** (Name, affiliation, and address)

Steven Treffers
SWCA Environmental Consultants
150 S. Arroyo Parkway, 2nd Floor
Pasadena, CA 91105

***P9. Date Recorded:** August 28, 2012

***P10. Survey Type:** (Describe)

Reconnaissance

***P11. Report Citation:** (Cite survey report and other sources, or enter "none.")

Cultural Resource Survey for the PG&E CAES – King Island Project.

***Attachments:** ☐NONE ☒Location Map ☐Sketch Map ☐Continuation Sheet ☐Building, Structure, and Object Record ☐Archaeological Record ☐District Record ☐Linear Feature Record ☐Milling Station Record ☐Rock Art Record ☐Artifact Record ☐Photograph Record ☐ Other (List):

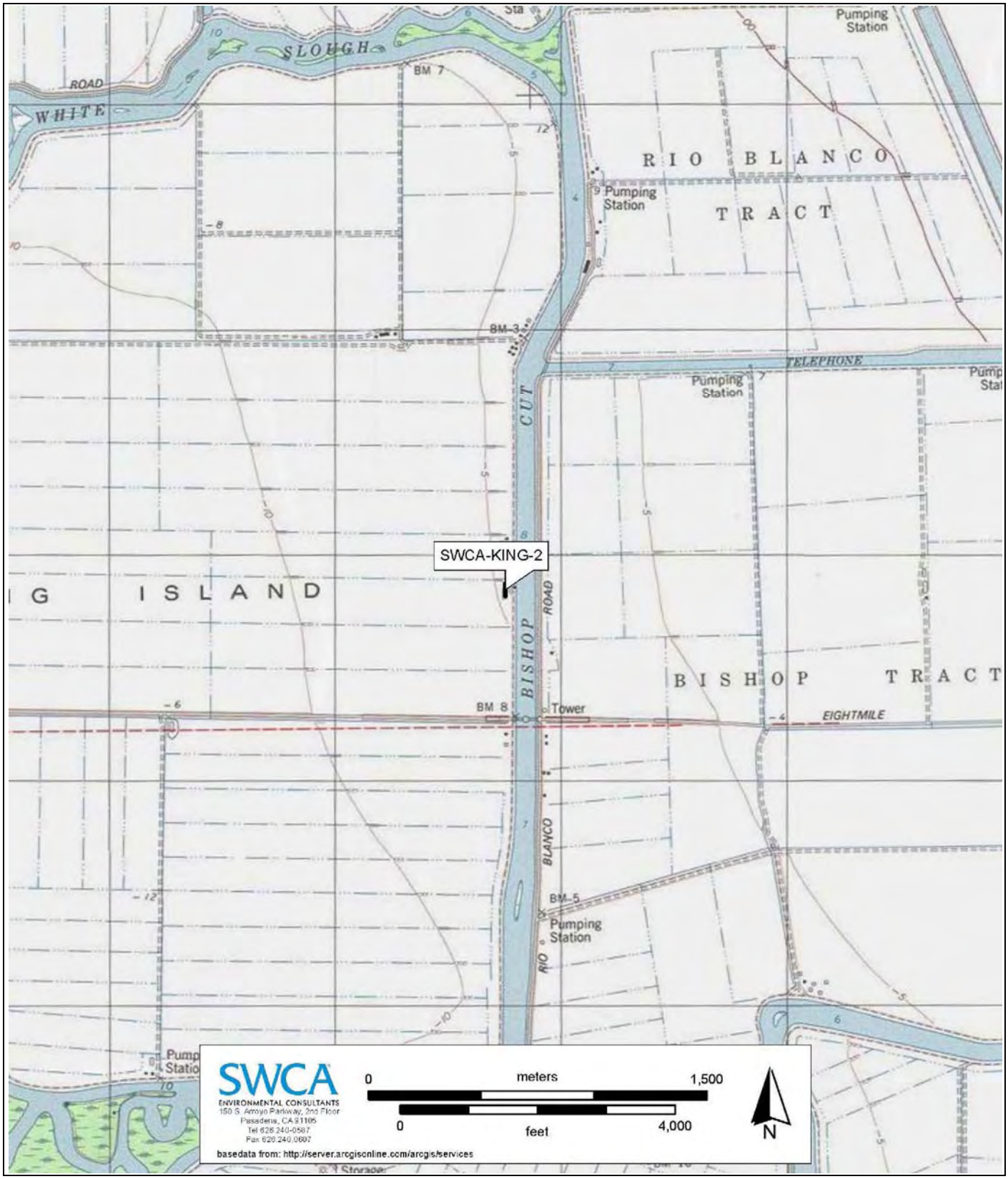
State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

LOCATION MAP

Primary #
HRI#
Trinomial

Page 2 **of** 2 ***Resource Name or #:** SWCA-KING-2

***Map Name:** Terminous, CA ***Scale:** 1:24,000 ***Date of Map:** 2012



DPR 523J (1/95)

*Required information

State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
PRIMARY RECORD

Primary #
HRI #
Trinomial
NRHP Status Code
Other Listings
Review Code | Reviewer | Date

 ***Resource Name or #:** SWCA-KING-3

P1. Other Identifier:

***P2. Location:** ☐ **Not for Publication** ☐ **Unrestricted** ***a. County:** San Joaquin

and (P2b and P2c or P2d. Attach a Location Map as necessary.)

***b. USGS 7.5' Quad:** Terminous **Date:** 2012 **T** 3N ; **R** 5E ; **¼ of** **¼ of Sec** ; M.D. **B.M.**

c. Address: City: Zip:

d. UTM: Zone: 10 ; mE/ mN (G.P.S.)

e. Other Locational Data: (e.g., parcel #, directions to resource, elevation, etc., as appropriate) Elevation:

The subject property is accessed from a private access road named King Island, which is located on the north side of West 8 Mile Road, immediately west of Bridge #29C-0219.

***P3a. Description:** (Describe resource and its major elements. Include design, materials, condition, alterations, size, setting, and boundaries)

Located in unincorporated San Joaquin County, approximately 9 miles southwest of the City of Lodi, SWCA-KING-3 is an agricultural building that historic topographic maps indicate was constructed between 1939 and 1952. The subject building is situated on a north south axis and is located on the east side of an access road named King Island. Approximately 30 x 220 feet in plan and sheathed in corrugated metal, it features a gabled roof and minimal fenestration. The subject building is part of a larger agricultural property that consists of 27 buildings and structures and is bounded by West Eight Mile Road to the south, White Slough to the north, and irrigation canals to the east and west. The building was originally identified during an intensive-level survey, but was not adequately photographed and subsequent site visits were not possible due to safety concerns and additional access issues.

***P3b. Resource Attributes:** (List attributes and codes) HP8. Industrial Building

***P4. Resources Present:** ☒Building ☐Structure ☐Object ☐Site ☐District ☐Element of District ☐Other (Isolates, etc.)

P5a. Photo or Drawing (Photo required for buildings, structures, and objects.)



P5b. Description of Photo: (View, date, accession #) Aerial photograph with SWCA-KING-3 identified.

***P6. Date Constructed/Age and Sources:** ☒Historic ☐Prehistoric ☐Both

1939-1952 (Lodi, CA, USGS Topographic Map 1:62,500, 1939; and Terminous, CA, USGS Topographic Map, 1:24,000, 1952).

***P7. Owner and Address:**

Unknown

***P8. Recorded by:** (Name, affiliation, and address)

Steven Treffers
SWCA Environmental Consultants
150 S. Arroyo Parkway, 2nd Floor
Pasadena, CA 91105

***P9. Date Recorded:** August 28, 2012

***P10. Survey Type:** (Describe)

Intensive

***P11. Report Citation:** (Cite survey report and other sources, or enter "none.")

Cultural Resource Survey for the PG&E CAES – King Island Project.

***Attachments:** ☐NONE ☒Location Map ☐Sketch Map ☐Continuation Sheet ☐Building, Structure, and Object Record ☐Archaeological Record ☐District Record ☐Linear Feature Record ☐Milling Station Record ☐Rock Art Record ☐Artifact Record ☐Photograph Record ☐ Other (List):

State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

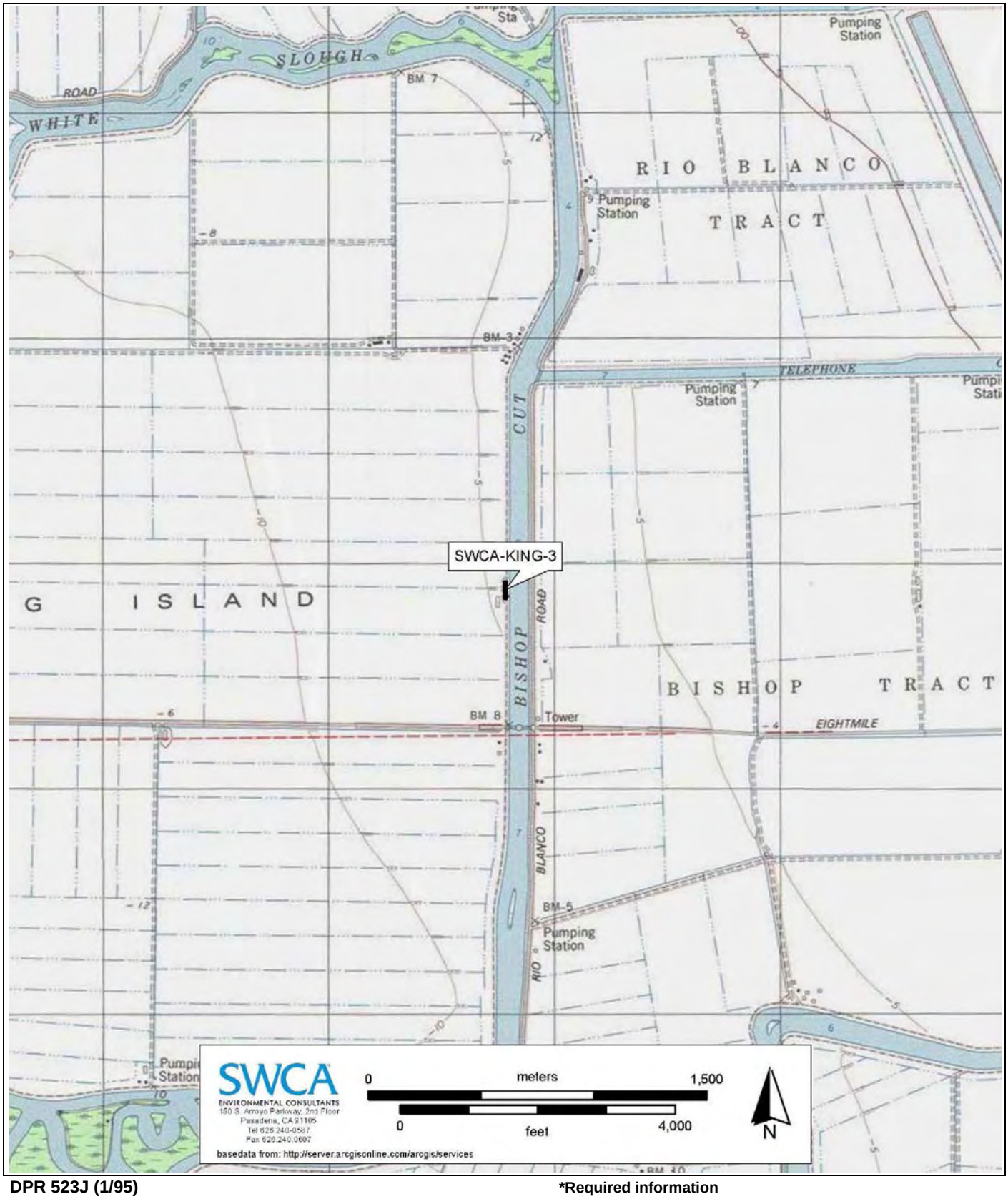
LOCATION MAP

Primary #
HRI#
Trinomial

***Resource Name or #:** SWCA-KING-3

***Map Name:** Terminous, CA

***Scale:** 1:24,000 ***Date of Map:** 2012



***Required information**

State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
PRIMARY RECORD

Primary #
HRI #
Trinomial
NRHP Status Code

Other Listings
Review Code | Reviewer | Date

 ***Resource Name or #:** SWCA-KING-4

P1. Other Identifier: Bishop Cut

***P2. Location:** ☐ **Not for Publication** ☐ **Unrestricted** ***a. County:** San Joaquin

and (P2b and P2c or P2d. Attach a Location Map as necessary.)

***b. USGS 7.5' Quad:** Terminous **Date:** 2012 **T** 3N ; **R** 5E ; **¼ of** **¼ of Sec** ; M.D. **B.M.**

c. Address: City: Zip:

d. UTM: Zone: 10 ; mE/ mN (G.P.S.)

e. Other Locational Data: (e.g., parcel #, directions to resource, elevation, etc., as appropriate) Elevation:

The subject property is located immediately north of Bridge #29C-0219.

***P3a. Description:** (Describe resource and its major elements. Include design, materials, condition, alterations, size, setting, and boundaries)

Located in unincorporated San Joaquin County, approximately 9 miles southwest from the City of Lodi, SWCA-KING-4 is a segment of an irrigation canal, which is commonly known as Bishop Cut. The canal, which historic topographic maps indicate was constructed by 1939, is approximately 330 feet wide and connects White Slough from the north to Disappointment Slough 2.75 miles to the south. The waterfront portion of the canal is composed of rip-rap along steep banks, and it is bound by Rio Blanco Road to the east and a private access road to the west. SWCA-KING-4 includes the 1 mile portion of the canal from the vicinity of Telephone Cut to Bridge #29C-0114 to the south. The segment fell within the 25-foot buffer of an intensive level survey that included the access road immediately to the west, which connects a larger agricultural property on King Island.

***P3b. Resource Attributes:** (List attributes and codes) HP20. Canal/aqueduct

***P4. Resources Present:** ☐Building ☒Structure ☐Object ☐Site ☐District ☐Element of District ☐Other (Isolates, etc.)

P5a. Photo or Drawing (Photo required for buildings, structures, and objects.)



P5b. Description of Photo: (View, date, accession #) SWCA-KING-4, view to the south, DSCN0348.jpg.

***P6. Date Constructed/Age and Sources:** ☒Historic ☐Prehistoric ☐Both
Pre-1939 (Lodi, CA, USGS Topographic Map 1:62,500, 1939).

***P7. Owner and Address:**
Unknown

***P8. Recorded by:** (Name, affiliation, and address)
Steven Treffers
SWCA Environmental Consultants
150 S. Arroyo Parkway, 2nd Floor
Pasadena, CA 91105

***P9. Date Recorded:** August 28, 2012

***P10. Survey Type:** (Describe)
Intensive

***P11. Report Citation:** (Cite survey report and other sources, or enter "none.") Cultural Resource Survey for the PG&E CAES – King Island Project.

***Attachments:** ☐NONE ☒Location Map ☐Sketch Map ☐Continuation Sheet ☐Building, Structure, and Object Record ☐Archaeological Record ☐District Record ☐Linear Feature Record ☐Milling Station Record ☐Rock Art Record ☐Artifact Record ☐Photograph Record ☐ Other (List):

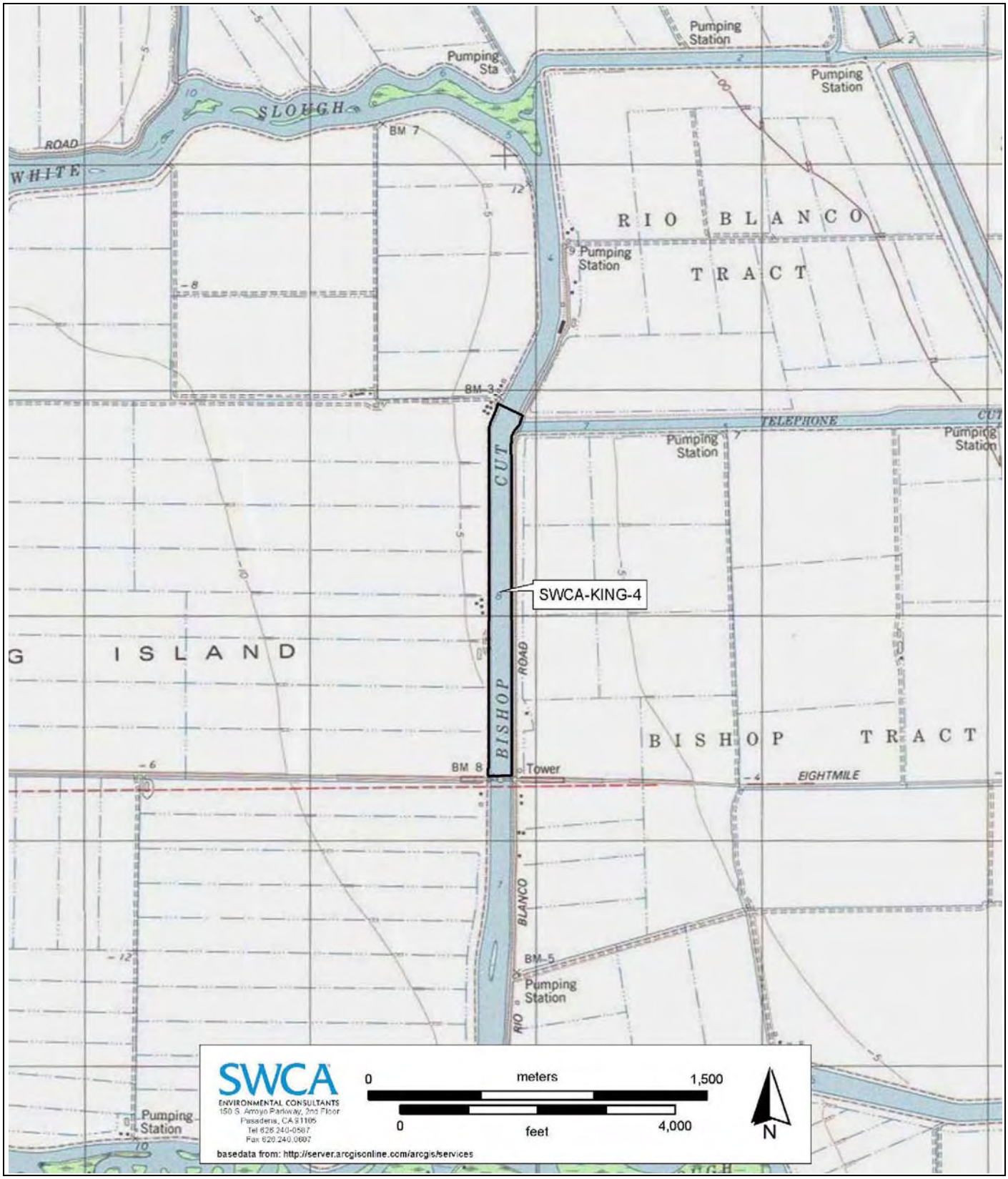
State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

LOCATION MAP

Primary #
HRI#
Trinomial

Page 2 **of** 2 ***Resource Name or #:** SWCA-KING-4

***Map Name:** Terminous, CA ***Scale:** 1:24,000 ***Date of Map:** 2012



DPR 523J (1/95)

*Required information

APPENDIX C

Native American Community Consultation

STATE OF CALIFORNIA Edmund G. Brown, Jr., Governor

NATIVE AMERICAN HERITAGE COMMISSION
915 CAPITOL MALL, ROOM 364
SACRAMENTO, CA 95814
(916) 653-6251
Fax (916) 657-5390

August 28, 2012

Steven Treffers
SWCA, Environmental Consultants
150 South Arroyo Parkway, Second Floor
Pasadena, CA 91105

Sent by Fax: 626-240-0607
Number of Pages: 2

Re: PG&E CAES—King Island Project, San Joaquin County.

Dear Mr. Treffers:

A record search of the sacred land file has failed to indicate the presence of Native American cultural resources in the immediate project area. The absence of specific site information in the sacred lands file does not indicate the absence of cultural resources in any project area. Other sources of cultural resources should also be contacted for information regarding known and recorded sites.

Enclosed is a list of Native Americans individuals/organizations who may have knowledge of cultural resources in the project area. The Commission makes no recommendation or preference of a single individual, or group over another. This list should provide a starting place in locating areas of potential adverse impact within the proposed project area. I suggest you contact all of those indicated, if they cannot supply information, they might recommend others with specific knowledge. By contacting all those listed, your organization will be better able to respond to claims of failure to consult with the appropriate tribe or group. If a response has not been received within two weeks of notification, the Commission requests that you follow-up with a telephone call to ensure that the project information has been received.

If you receive notification of change of addresses and phone numbers from any of these individuals or groups, please notify me. With your assistance we are able to assure that our lists contain current information. If you have any questions or need additional information, please contact me at (916) 653-4038.

Sincerely,

Debbie Pilas-Treadway
Environmental Specialist III

Native American Contacts
San Joaquin County
August 28, 2012

Randy Yonemura
4305 - 39th Avenue Miwok
Sacramento , CA 95824
honortraditions@mail.com
(916) 421-1600
(916) 601-4069-cell

Briana Creekmore
PO Box 84 Miwok
Wilseyville , CA 95257
209-298-7158

Buena Vista Rancheria
Rhonda Morningstar Pope, Chairperson
1418 20th Street, Suite 200 Me-Wuk / Miwok
Sacramento , CA 95811
rhonda@buenavistatribe.com
916 491-0011
916 491-0012 - fax

California Valley Miwok Tribe
Silvia Burley, Chairperson
10601 N Escondido PL Miwok
Stockton , CA 95212
office@cvmt.net
209-931-4567
209-931-4333

Ione Band of Miwok Indians
Yvonne Miller, Chairperson
PO Box 699 Miwok
Plymouth , CA 95669
(209) 274-6753
(209) 274-6636 Fax

Ione Band of Miwok Indians Cultural Committee
Ms Billie Blue, Chairperson
604 Pringle Ave, #42 Miwok
Galt , CA 95632
bebluesky@softcom.net
(209) 745-7112

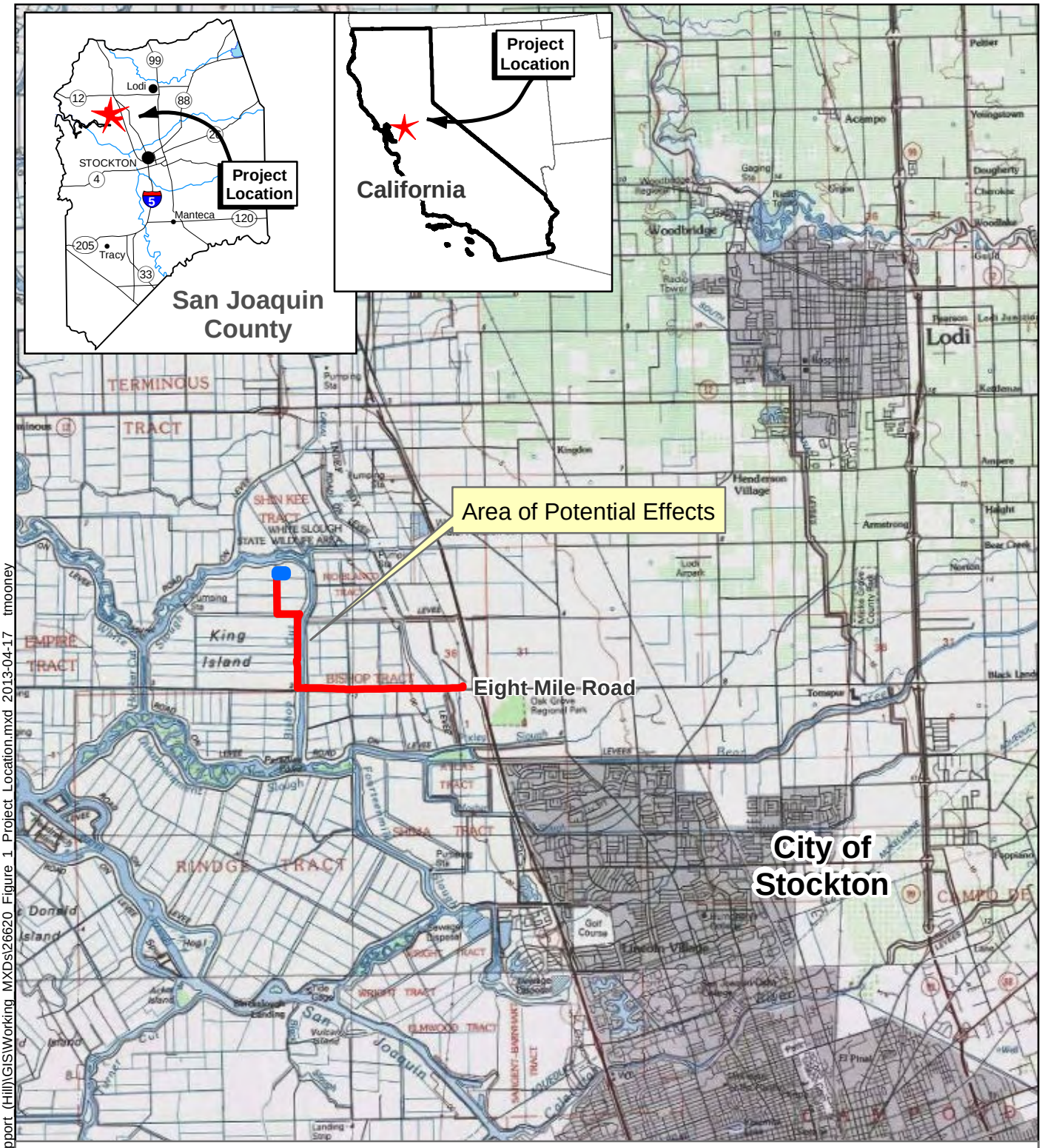
Wilton Rancheria
Andrew Franklin, Chairperson
9300 W. Stockton, Suite 200 Miwok
Elk Grove , CA 95758
916-683-6000
916-683-6015

Wilton Rancheria
Steven Hutchason, Director of Cultural Preservation
9300 W. Stockton, Suite 200 Miwok
Elk Grove , CA 95758
miwoksteve@gmail.com
916-683-6000
916-683-6015

This list is current only as of the date of this document.

Distribution of this list does not relieve any person of statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resources Code and Section 5097.98 of the Public Resources Code

This list is only applicable for contacting local Native Americans with regard to cultural resources for the proposed PGE CAES-King Island project, San Joaquin County



G:\Projects\26620_CAES_EA_Support_(Hill)\GIS\Working_MXDs\26620_Figure_1_Project_Location.mxd_2013-04-17_tmooney

North State Resources, Inc.

CAES PDEA - King Island

Figure 1
Project Location

Pacific Gas and Electric Company

Christophe Descantes, PhD
Sr. Cultural Resources Specialist
Land & Environmental Management

Mailing Address
245 Market Street — N10A
San Francisco, CA 94105
Tel: (415) 973.1177
Mobile: (925) 719.2740
Email: chd8@PGE.com

September 4, 2012

Ione Band of Miwok Indians Cultural Committee
Billie Blue, Chairperson
604 Pringle Ave #42
Galt, CA 95632

RE: Cultural Resources Survey for the PG&E CAES – King Island Project in San Joaquin County, California

Dear Ms. Blue:

Pacific Gas and Electric (PG&E) is conducting a cultural resources study for the PG&E CAES – King Island Project. All cultural resource work is being conducted in accordance with Section 106 of the National Historic Preservation Act (NHPA), the National Environmental Policy Act (NEPA), and the California Environmental Quality Act (CEQA). PG&E has retained SWCA Environmental Consultants, Inc., to assist with this effort.

The project area is located in unincorporated San Joaquin County near the City of Lodi and falls within the USGS 7.5-minute Terminous quadrangle map (see enclosed project location map). The proposed project would use renewable energy from sources such as wind to inject compressed air into an underground reservoir. The King Island reservoir site consists of the construction of a well pad measuring approximately 1 acre, which would support a drilling rig and other equipment for the purpose of core drilling tests to determine if the site is a viable candidate for the CAES project.

As part of the process of identifying cultural resources issues for this project, SWCA contacted the Native American Heritage Commission (NAHC) and requested a Sacred Lands File (SLF) search and a list of Native American individuals and/or tribal organizations that may have knowledge of cultural resources in or near the project area. The NAHC SLF search did not identify any Native American cultural resources within a one-half mile radius of the proposed project area. The NAHC recommended that we consult with you directly regarding your knowledge of the presence of cultural resources that may be impacted by this project.

If you have knowledge of any cultural resources that may exist within or near the project area, please contact Steven Treffers at (626) 240-0587, streffers@swca.com, at your earliest convenience.

Thank you for your attention to this matter.

Best regards,

Christophe Descantes
Sr. Cultural Resources Specialist
Enclosure: Project Location Map

Pacific Gas and Electric Company

Christophe Descantes, PhD
Sr. Cultural Resources Specialist
Land & Environmental Management

Mailing Address
245 Market Street — N10A
San Francisco, CA 94105
Tel: (415) 973.1177
Mobile: (925) 719.2740
Email: chd8@PGE.com

September 4, 2012

California Valley Miwok Tribe
Silvia Burley, Chairperson
10601 North Escondido Place
Stockton, CA 95212

RE: Cultural Resources Survey for the PG&E CAES – King Island Project in San Joaquin County, California

Dear Ms. Burley

Pacific Gas and Electric (PG&E) is conducting a cultural resources study for the PG&E CAES – King Island Project. All cultural resource work is being conducted in accordance with Section 106 of the National Historic Preservation Act (NHPA), the National Environmental Policy Act (NEPA), and the California Environmental Quality Act (CEQA). PG&E has retained SWCA Environmental Consultants, Inc., to assist with this effort.

The project area is located in unincorporated San Joaquin County near the City of Lodi and falls within the USGS 7.5-minute Terminous quadrangle map (see enclosed project location map). The proposed project would use renewable energy from sources such as wind to inject compressed air into an underground reservoir. The King Island reservoir site consists of the construction of a well pad measuring approximately 1 acre, which would support a drilling rig and other equipment for the purpose of core drilling tests to determine if the site is a viable candidate for the CAES project.

As part of the process of identifying cultural resources issues for this project, SWCA contacted the Native American Heritage Commission (NAHC) and requested a Sacred Lands File (SLF) search and a list of Native American individuals and/or tribal organizations that may have knowledge of cultural resources in or near the project area. The NAHC SLF search did not identify any Native American cultural resources within a one-half mile radius of the proposed project area. The NAHC recommended that we consult with you directly regarding your knowledge of the presence of cultural resources that may be impacted by this project.

If you have knowledge of any cultural resources that may exist within or near the project area, please contact Steven Treffers at (626) 240-0587, streffers@swca.com, at your earliest convenience.

Thank you for your attention to this matter.

Best regards,

Christophe Descantes
Sr. Cultural Resources Specialist
Enclosure: Project Location Map

From: Tribal Council [mailto:tribe@californiavalleymiwoktribe-nsn.gov]
Sent: Saturday, September 08, 2012 10:33 AM
To: Descantes, Christophe
Subject: Cultural Resources Survey for the PG&E CAES – King Island Project in San Joaquin Co. CA

9-8-2012

Mr. Christopher Descantes
Sr. Cultural Resources Specialist
Pacific Gas and Electric Company
245 Market Street – N10A
San Francisco, California 94105
Chd8@PGE.com

RE: Cultural Resources Survey for the PG&E CAES – King Island Project in San Joaquin County, California

Dear Mr. Descantes,

This letter is in response to your letter (dated 09/4/2012) regarding the proposed cultural resource survey for the PG&E CAES – King Island Project in San Joaquin County, California.

Project Description: The project is located in unincorporated San Joaquin County near the City of Lodi and falls within the USGS 7.5-minutes Terminous Quadrangle. The propose project would use renewable energy from sources such as wind to inject compressed air into an underground reservoir. The King Island reservoir site consists of the construction of a well pad measuring approximately 1 area, which would support a drilling rig and other equipment for the purpose of cored drilling tests to determine if the site is a viable candidate for the CAES project.

The California Valley Miwok Tribe's only concerns or issues with the proposed project located near the City of Lodi in unincorporated San Joaquin County, California, is since Miwok Indians regularly lived, hunted, gathered materials for basket making and traveled throughout the proposed area; there is a heightened possibility that Miwok artifacts and/or human remains may be discovered. Therefore, the "Tribe" is requesting that it be notified of Miwok artifacts or human remains if any are found at the proposed site location.

Sincerely,

/s/
Silvia Burley, Chairperson
s.burley@californiavalleymiwoktribe-nsn.gov

.....
Tribal Council
California Valley Miwok Tribe
Ph# 209.931.4567 / Fax# 209.931.4333
Office Email: office@cvmt.net
Tribal Council: tribe@californiavalleymiwoktribe-nsn.gov

http://www.californiavalleymiwoktribe-nsn.gov

Pacific Gas and Electric Company

Christophe Descantes, PhD
Sr. Cultural Resources Specialist
Land & Environmental Management

Mailing Address
245 Market Street — N10A
San Francisco, CA 94105
Tel: (415) 973.1177
Mobile: (925) 719.2740
Email: chd8@PGE.com

September 4, 2012

Briana Creekmore
P.O. Box 84
Wilswyville, CA 95606

RE: Cultural Resources Survey for the PG&E CAES – King Island Project in San Joaquin County, California

Dear Ms. Creekmore:

Pacific Gas and Electric (PG&E) is conducting a cultural resources study for the PG&E CAES – King Island Project. All cultural resource work is being conducted in accordance with Section 106 of the National Historic Preservation Act (NHPA), the National Environmental Policy Act (NEPA), and the California Environmental Quality Act (CEQA). PG&E has retained SWCA Environmental Consultants, Inc., to assist with this effort.

The project area is located in unincorporated San Joaquin County near the City of Lodi and falls within the USGS 7.5-minute Terminous quadrangle map (see enclosed project location map). The proposed project would use renewable energy from sources such as wind to inject compressed air into an underground reservoir. The King Island reservoir site consists of the construction of a well pad measuring approximately 1 acre, which would support a drilling rig and other equipment for the purpose of core drilling tests to determine if the site is a viable candidate for the CAES project.

As part of the process of identifying cultural resources issues for this project, SWCA contacted the Native American Heritage Commission (NAHC) and requested a Sacred Lands File (SLF) search and a list of Native American individuals and/or tribal organizations that may have knowledge of cultural resources in or near the project area. The NAHC SLF search did not identify any Native American cultural resources within a one-half mile radius of the proposed project area. The NAHC recommended that we consult with you directly regarding your knowledge of the presence of cultural resources that may be impacted by this project.

If you have knowledge of any cultural resources that may exist within or near the project area, please contact Steven Treffers at (626) 240-0587, streffers@swca.com, at your earliest convenience.

Thank you for your attention to this matter.

Best regards,

Christophe Descantes
Sr. Cultural Resources Specialist
Enclosure: Project Location Map

Pacific Gas and Electric Company

Christophe Descantes, PhD
Sr. Cultural Resources Specialist
Land & Environmental Management

Mailing Address
245 Market Street — N10A
San Francisco, CA 94105
Tel: (415) 973.1177
Mobile: (925) 719.2740
Email: chd8@PGE.com

September 4, 2012

Wilton Rancheria
Andrew Franklin, Chairperson
9300 West Stockton, Suite 200
Elk Grove, CA 95758

RE: Cultural Resources Survey for the PG&E CAES – King Island Project in San Joaquin County, California

Dear Mr. Franklin:

Pacific Gas and Electric (PG&E) is conducting a cultural resources study for the PG&E CAES – King Island Project. All cultural resource work is being conducted in accordance with Section 106 of the National Historic Preservation Act (NHPA), the National Environmental Policy Act (NEPA), and the California Environmental Quality Act (CEQA). PG&E has retained SWCA Environmental Consultants, Inc., to assist with this effort.

The project area is located in unincorporated San Joaquin County near the City of Lodi and falls within the USGS 7.5-minute Terminous quadrangle map (see enclosed project location map). The proposed project would use renewable energy from sources such as wind to inject compressed air into an underground reservoir. The King Island reservoir site consists of the construction of a well pad measuring approximately 1 acre, which would support a drilling rig and other equipment for the purpose of core drilling tests to determine if the site is a viable candidate for the CAES project.

As part of the process of identifying cultural resources issues for this project, SWCA contacted the Native American Heritage Commission (NAHC) and requested a Sacred Lands File (SLF) search and a list of Native American individuals and/or tribal organizations that may have knowledge of cultural resources in or near the project area. The NAHC SLF search did not identify any Native American cultural resources within a one-half mile radius of the proposed project area. The NAHC recommended that we consult with you directly regarding your knowledge of the presence of cultural resources that may be impacted by this project.

If you have knowledge of any cultural resources that may exist within or near the project area, please contact Steven Treffers at (626) 240-0587, streffers@swca.com, at your earliest convenience.

Thank you for your attention to this matter.

Best regards,

Christophe Descantes
Sr. Cultural Resources Specialist
Enclosure: Project Location Map

Pacific Gas and Electric Company

Christophe Descantes, PhD
Sr. Cultural Resources Specialist
Land & Environmental Management

Mailing Address
245 Market Street — N10A
San Francisco, CA 94105
Tel: (415) 973.1177
Mobile: (925) 719.2740
Email: chd8@PGE.com

September 4, 2012

Wilton Rancheria
Steven Hutchason, Director of Cultural Preservation
9300 West Stockton, Suite 200
Elk Grove, CA 95758

RE: Cultural Resources Survey for the PG&E CAES – King Island Project in San Joaquin County, California

Dear Mr. Hutchason:

Pacific Gas and Electric (PG&E) is conducting a cultural resources study for the PG&E CAES – King Island Project. All cultural resource work is being conducted in accordance with Section 106 of the National Historic Preservation Act (NHPA), the National Environmental Policy Act (NEPA), and the California Environmental Quality Act (CEQA). PG&E has retained SWCA Environmental Consultants, Inc., to assist with this effort.

The project area is located in unincorporated San Joaquin County near the City of Lodi and falls within the USGS 7.5-minute Terminous quadrangle map (see enclosed project location map). The proposed project would use renewable energy from sources such as wind to inject compressed air into an underground reservoir. The King Island reservoir site consists of the construction of a well pad measuring approximately 1 acre, which would support a drilling rig and other equipment for the purpose of core drilling tests to determine if the site is a viable candidate for the CAES project.

As part of the process of identifying cultural resources issues for this project, SWCA contacted the Native American Heritage Commission (NAHC) and requested a Sacred Lands File (SLF) search and a list of Native American individuals and/or tribal organizations that may have knowledge of cultural resources in or near the project area. The NAHC SLF search did not identify any Native American cultural resources within a one-half mile radius of the proposed project area. The NAHC recommended that we consult with you directly regarding your knowledge of the presence of cultural resources that may be impacted by this project.

If you have knowledge of any cultural resources that may exist within or near the project area, please contact Steven Treffers at (626) 240-0587, streffers@swca.com, at your earliest convenience.

Thank you for your attention to this matter.

Best regards,

Christophe Descantes
Sr. Cultural Resources Specialist
Enclosure: Project Location Map

Pacific Gas and Electric Company

Christophe Descantes, PhD
Sr. Cultural Resources Specialist
Land & Environmental Management

Mailing Address
245 Market Street — N10A
San Francisco, CA 94105
Tel: (415) 973.1177
Mobile: (925) 719.2740
Email: chd8@PGE.com

September 4, 2012

Ione Band of Miwok Indians
Yvonne Miller, Chairperson
P.O. Box 699
Plymouth, CA 95669

RE: Cultural Resources Survey for the PG&E CAES – King Island Project in San Joaquin County, California

Dear Ms. Miller:

Pacific Gas and Electric (PG&E) is conducting a cultural resources study for the PG&E CAES – King Island Project. All cultural resource work is being conducted in accordance with Section 106 of the National Historic Preservation Act (NHPA), the National Environmental Policy Act (NEPA), and the California Environmental Quality Act (CEQA). PG&E has retained SWCA Environmental Consultants, Inc., to assist with this effort.

The project area is located in unincorporated San Joaquin County near the City of Lodi and falls within the USGS 7.5-minute Terminous quadrangle map (see enclosed project location map). The proposed project would use renewable energy from sources such as wind to inject compressed air into an underground reservoir. The King Island reservoir site consists of the construction of a well pad measuring approximately 1 acre, which would support a drilling rig and other equipment for the purpose of core drilling tests to determine if the site is a viable candidate for the CAES project.

As part of the process of identifying cultural resources issues for this project, SWCA contacted the Native American Heritage Commission (NAHC) and requested a Sacred Lands File (SLF) search and a list of Native American individuals and/or tribal organizations that may have knowledge of cultural resources in or near the project area. The NAHC SLF search did not identify any Native American cultural resources within a one-half mile radius of the proposed project area. The NAHC recommended that we consult with you directly regarding your knowledge of the presence of cultural resources that may be impacted by this project.

If you have knowledge of any cultural resources that may exist within or near the project area, please contact Steven Treffers at (626) 240-0587, streffers@swca.com, at your earliest convenience.

Thank you for your attention to this matter.

Best regards,

Christophe Descantes
Sr. Cultural Resources Specialist
Enclosure: Project Location Map

Pacific Gas and Electric Company

Christophe Descantes, PhD
Sr. Cultural Resources Specialist
Land & Environmental Management

Mailing Address
245 Market Street — N10A
San Francisco, CA 94105
Tel: (415) 973.1177
Mobile: (925) 719.2740
Email: chd8@PGE.com

September 6, 2012

Buena Vista Ranceria
Rhonda Morningstar Pope, Chairperson
1418 20th Street, Suite 200
Sacramento, CA 95811

RE: Cultural Resources Survey for the PG&E CAES – East Island Project in San Joaquin County, California

Dear Ms. Morningstar Pope:

Pacific Gas and Electric (PG&E) is conducting a cultural resources study for the PG&E CAES – East Island Project. All cultural resource work is being conducted in accordance with Section 106 of the National Historic Preservation Act (NHPA), the National Environmental Policy Act (NEPA), and the California Environmental Quality Act (CEQA). PG&E has retained SWCA Environmental Consultants, Inc., to assist with this effort.

The project area is located in unincorporated San Joaquin County near the City of Lodi and falls within the USGS 7.5-minute Terminous quadrangle map (see enclosed project location map). The proposed project would use renewable energy from sources such as wind to inject compressed air into an underground reservoir. The East Island reservoir site consists of the construction of a well pad measuring approximately 1 acre, which would support a drilling rig and other equipment for the purpose of core drilling tests to determine if the site is a viable candidate for the CAES project.

As part of the process of identifying cultural resources issues for this project, SWCA contacted the Native American Heritage Commission (NAHC) and requested a Sacred Lands File (SLF) search and a list of Native American individuals and/or tribal organizations that may have knowledge of cultural resources in or near the project area. The NAHC SLF search did not identify any Native American cultural resources within a one-half mile radius of the proposed project area. The NAHC recommended that we consult with you directly regarding your knowledge of the presence of cultural resources that may be impacted by this project.

If you have knowledge of any cultural resources that may exist within or near the project area, please contact Steven Treffers at (626) 240-0587, streffers@swca.com, at your earliest convenience.

Thank you for your attention to this matter.

Best regards,

Christophe Descantes
Sr. Cultural Resources Specialist
Enclosure: Project Location Map

Pacific Gas and Electric Company

Christophe Descantes, PhD
Sr. Cultural Resources Specialist
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September 4, 2012

Randy Yonemura
4305 39th Avenue
Sacramento, CA 95824

RE: Cultural Resources Survey for the PG&E CAES – King Island Project in San Joaquin County, California

Dear Mr. Yonemura:

Pacific Gas and Electric (PG&E) is conducting a cultural resources study for the PG&E CAES – King Island Project. All cultural resource work is being conducted in accordance with Section 106 of the National Historic Preservation Act (NHPA), the National Environmental Policy Act (NEPA), and the California Environmental Quality Act (CEQA). PG&E has retained SWCA Environmental Consultants, Inc., to assist with this effort.

The project area is located in unincorporated San Joaquin County near the City of Lodi and falls within the USGS 7.5-minute Terminous quadrangle map (see enclosed project location map). The proposed project would use renewable energy from sources such as wind to inject compressed air into an underground reservoir. The King Island reservoir site consists of the construction of a well pad measuring approximately 1 acre, which would support a drilling rig and other equipment for the purpose of core drilling tests to determine if the site is a viable candidate for the CAES project.

As part of the process of identifying cultural resources issues for this project, SWCA contacted the Native American Heritage Commission (NAHC) and requested a Sacred Lands File (SLF) search and a list of Native American individuals and/or tribal organizations that may have knowledge of cultural resources in or near the project area. The NAHC SLF search did not identify any Native American cultural resources within a one-half mile radius of the proposed project area. The NAHC recommended that we consult with you directly regarding your knowledge of the presence of cultural resources that may be impacted by this project.

If you have knowledge of any cultural resources that may exist within or near the project area, please contact Steven Treffers at (626) 240-0587, streffers@swca.com, at your earliest convenience.

Thank you for your attention to this matter.

Best regards,

Christophe Descantes
Sr. Cultural Resources Specialist
Enclosure: Project Location Map

A806: KICP Appendix 5.3G – Subsurface Testing KICP Compression

Subsurface Identification Efforts for the CAES Compression Testing Project, King Island, San Joaquin County, California

By:
Sharon Waechter, M.A.
Kim Carpenter, M.A.

July 2014 FINAL



Submitted to:
Christophe Descantes, Ph.D.
Sr. Cultural Resources Specialist
Environmental Management – Transmission
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245 Market Street — N10A
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INTRODUCTION

Pacific Gas & Electric Company (PG&E) is considering the feasibility of using an existing underground formation (a depleted natural gas field) to store compressed-air energy during periods of low energy demand, to be released during periods of higher demand. The storage facility would be located on King Island in the Sacramento-San Joaquin Delta, just northwest of the city of Stockton (Figure 1). The lead reviewing agency would be the U.S. Department of Energy (DOE), making the project a federal undertaking and thus subject to compliance with the National Environmental Policy Act (NEPA) and the National Historic Preservation Act.

As part of their compliance with these regulations, PG&E hired SWCA Environmental Consultants to conduct a cultural resources inventory of the project APE. That survey was done on August 28, 2012 (Treffers and Dietler 2012). As part of that effort, SWCA recorded three standing structures built sometime between 1939 and 1952, and a segment of the Bishop Cut canal (pre-1940). They found no archaeological resources during their surveys. The following year, PG&E hired North State Resources, Inc., to do additional survey, as the project APE had been modified and expanded since the SWCA study (Ludwig 2013a). The second survey, conducted on April 3, 2013, found no additional cultural resources.

On September 5, 2013, members of the Wilton Rancheria and the Shingle Springs Band of Miwok Indians requested a supplemental study to determine the potential for buried cultural resources that might not be identified during a surface inventory. In that supplemental study, Ludwig (2013b) reviewed soils data and historical maps of the project vicinity and determined that King Island had been tule marshes and wetlands prior to the reclamation projects of the early twentieth century, at which time the project area was leveed, drained, and turned to agricultural uses. He also noted that a prisoner of war branch camp had been located on the island during World War II. Ludwig concluded that, in its natural state, the project area would not have been suitable for human occupation and thus had a "very low level of archaeological sensitivity" (2013b:5).

At the request of PG&E, Far Western Anthropological Research Group, Inc., (Far Western) recently completed a more detailed sensitivity study (Meyer 2014). This study determined that although Holocene aged soils are present in the study area, the potential for buried sites in the project area is estimated to be moderate because the entire project area is located more than 200 meters from the only known historic-era water source (Appendix A). While the position of White Slough, or other possible stream channels, has likely changed over the past several hundred years or more, the likelihood of there being a prehistoric archaeological deposit buried directly below the project area seems remote, especially because the project area is relatively small.

On May 15, 2014, the DOE issued a Finding of No Significant Impact (FONSI) for the project, with stipulations. Among these stipulations was the requirement that PG&E perform subsurface testing at the compression testing site, to include up to 15 shovel test pits (Figure 2). That testing study is the subject of this report.

PROJECT DESCRIPTION

The full project includes several elements, which are described in detail by Ludwig (2013a). The current study involves only the 2.5-acre well pad or TSF location (Figure 2). Project activities here will include staging, well drilling, compression, and cycling tests. The pad will be 650 feet east/west by 165 feet north/south. Once the pad is completed, a drilling rig and associated equipment (mud and water tanks, pumps, shaker tanks, electrical generators, diesel fuel tanks, and drill pipe racks) will be used to

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drill up to two wells to a maximum depth of 4,800 feet. This will be followed by installation of compression equipment, a closed-loop cooling system, a portable office trailer, a tank for drilling mud, and lighting.

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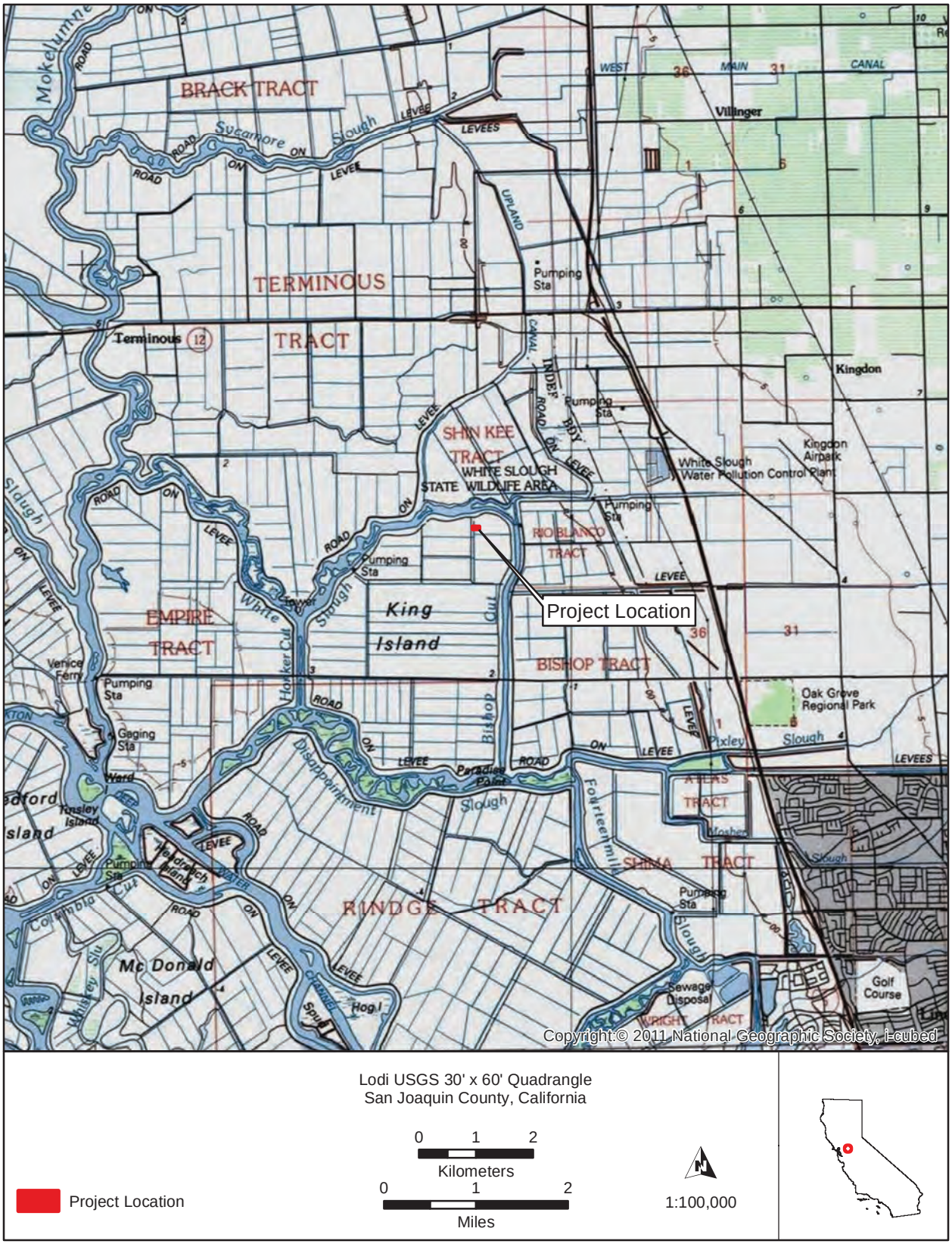


Figure 1. Project Location.

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Figure 2. Project Area.

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NATIVE AMERICAN COORDINATION

Native American consultation for the project is being carried out by the Department of Energy. Those efforts are summarized in the Final Environmental Assessment prepared for that project (USDOE 2014). This study is a direct result of those consultation efforts.

Four Tribes were invited to monitor the subsurface identification efforts including the Buena Vista Rancheria of Mi-Wuk Indians of California, the Ione Band of Miwok Indians, the Shingle Springs Band of Miwok Indians, and Wilton Rancheria. Representatives of three of these Tribes accepted the invitation (Buena Vista Rancheria of Mi-Wuk Indians of California, the Ione Band of Miwok Indians, and Wilton Rancheria). Monitoring logs documenting the observations of the Native American Monitors are presented in Appendix B.

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NATURAL AND CULTURAL CONTEXTS

The following sections, except for the *Non-Native History*, are adapted and abridged from Rosenthal and Whitaker (2009).

THE NATURAL ENVIRONMENT

The project is located on one of the reclaimed islands in the Sacramento-San Joaquin River Delta, immediately east of the confluence of California's two largest rivers. It lies at the junction of the Sacramento and San Joaquin valleys, the two alluvial basins that make up California's Great Central Valley. The nearest large city is Stockton (the county seat of San Joaquin County), roughly 10 miles to the southeast.

The Sacramento-San Joaquin Delta

The San Joaquin valley trough is partly filled by a sequence of alluvial deposits up to six miles thick; these range in age from late Mesozoic to Historic. Beginning in the late Mesozoic, the southern and west-central part of the valley was part of the Pacific Ocean. Marine sediments were deposited in the basin until it was eventually cut off from the sea by tectonic activity during the late Pliocene (Bartow 1991). By the early Pleistocene (1.8 million years ago), streams and rivers in the valley drained southward through an outlet in the Coast Ranges (Priest or Bitterwater valleys) and through the Salinas River Valley to the sea (Bartow 1991:32-33). The southern outlet was shut off by subsequent uplift of the Coast Ranges about 750,000 years ago, turning the valley into a closed drainage basin (Dupre et al. 1991). As a result, a series of lakes formed in the valley, with the largest and perhaps earliest of these being Corcoran Lake, which covered much of the San Joaquin Valley floor during the middle Pleistocene. The disappearance of Corcoran Lake around 600,000 years ago may mark the establishment of the current, northern drainage outlet through the Carquinez Straits (Bartow 1991:33).

Lowered sea levels during the late Pleistocene promoted channel incision and extremely low sedimentation rates in the northern San Joaquin Valley, as indicated by radiocarbon dates from "pre-Delta" deposits (Brown and Pasternack 2004, 2005). At that time, the region now occupied by the Delta was a broad inland valley crossed by numerous stream and river channels. As continental ice sheets melted at the end of the Pleistocene, the oceans of the world began to rise rapidly, causing the Pacific shoreline to migrate eastward. The lowest portions of the valley (now occupied by San Francisco Bay) were flooded between 11,000 and 8000 cal BP, with the Delta region beginning to be inundated between 7000 and 6000 cal BP (Atwater 1980, 1982; Goman and Wells 2000; Shlemon and Begg 1975; Wells and Goman 1995). The Delta was slowly covered by rising waters at an average rate of about 1.3 meters (4.3 feet) every 1,000 years or a total of eight meters (26.2 feet) over the past 6,000 years. This allowed sedimentation to keep pace with inundation, and permitted the formation of extensive tidal-marsh deposits during the middle Holocene (Atwater 1980, 1982; Atwater et al. 1977).

During the late Holocene, the Delta grew in size as marshlands expanded in response to higher sea levels and the decomposition, compaction, and subsidence of inter-tidal sediments. Due to historic land reclamation and agriculture, peat deposits that were once water-saturated now rapidly decomposed, causing subsidence of as much as 10 to 15 feet in some parts of the Delta. Historic-period and modern reclamation has resulted in the exhumation of some older floodplain and eolian deposits, which are now exposed at the surface in various locations throughout the Delta (Atwater 1982:8). Currently, an extensive network of man-made levees, canals, and drainage ditches controls most of the flooding and deposition in the Delta (Ingebritsen et al. 2000).

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Project Area Soils and Landscape Modifications (excerpted from Meyer 2014)

When viewed over the last several hundred (and thousands of years), it is clear that the local environment was not static, but was characterized by a great deal of change. The depositional history of the Delta region is closely tied to deglaciation and rising sea levels. At the height of the last glacial maximum some 22,000 to 19,000 years ago, worldwide sea levels were at least 125 meters (410 feet) lower than today (Atwater et al. 1977; Bard et al. 1996; Yokoyama et al. 2000). At that time, the Sacramento and San Joaquin rivers formed a single watercourse that flowed through the area now occupied by the San Francisco Bay, and across the continental shelf before entering the Pacific Ocean near the Farallon Islands (Atwater et al. 1977). The area that now makes up the Delta region was at that time a broad inland valley, crossed by numerous streams and rivers with incised channels that were graded to base levels significantly lower than today.

As the continental ice sheets melted, the world's oceans rose rapidly, causing the sea to migrate eastward across the continental shelf. Sometime between 7000 and 6000 cal BP, the rising waters began to inundate the lowermost parts of the ancestral Central Valley, resulting in the formation of extensive brackish and freshwater wetlands (Atwater 1980, 1982; Goman and Wells 2000; Shlemon 1972; Shlemon and Begg 1975; Wells and Goman 1995). Many of the wetlands, however, were relatively short-lived as sediment deposition began to equal or out-pace the rate of sea-level rise in the Delta (Atwater 1980, 1982; Atwater et al. 1977), totaling about five meters (16.4 feet) during the middle Holocene, between 7000 and 4000 cal BP. During the late Holocene (i.e., the past 4,000 years), the sea rose another five meters (16.4 feet) at a relatively slow average rate of 1.25 meters (4.1 feet) per 1,000 years.

As the sea progressed inland, the Delta expanded in response to the decomposition, compaction, and subsidence of wetland deposits. Even so, dry uplands, riparian forests, and freshwater wetlands occurred locally in and around the northern Delta until it "gradually came under tidal influence 3000-800 cal BP" (Brown and Pasternack 2005). The outermost portion of the present-day Delta, however, was probably not affected by tidal conditions until the past few thousand years or less. Together, these processes ultimately buried the terrestrial landscape that existed prior to the formation of the Delta (Brown and Pasternack 2004, 2005).

The formation and growth of the Delta had a profound influence on the paleohydrology and depositional history of the lower Sacramento Valley. The rising base level of the Delta caused the lower reaches of many channels to migrate laterally as they became filled with sediments (Brown and Pasternack 2004, 2005). The rivers entering the Delta responded by creating a wide floodplain belt that is now marked by numerous abandoned channel meander loops (i.e., oxbow lakes) and cut-off chutes, along with the active channel (Brice 1977; Robertson 1987). Many meander loops were partly or completely filled by sediments deposited from multiple large floods that occurred during the late Holocene (Sullivan 1982).

During major flood events in the valley, alluvium spilled over the channel banks and onto the surrounding fans and floodplains, sometimes forming prominent levee ridges (Atwater 1980:91, 93; Bryan 1923:28-29; Hinds 1952:147) such as those found along the lower Sacramento River, and smaller streams draining the valley. Once formed, the natural levees were flooded less frequently because they stood well above the surface of the surrounding flood basins. The presence of natural levees along existing channels and at the surface of alluvial fans graded to near-modern base lines suggests that most formed during the late Holocene. Two major episodes of alluvial levee deposition are recorded along the Sacramento River—one between 1550 and 1180 cal BP and the other between 750 and 650 cal BP (White 2003b:125)—and one or more large floods occurred along the South Fork American River between 1125 and 650 cal BP (Bureau of Reclamation 2002:34). Thus, a considerable amount of sediment was deposited in low-lying areas such as the Delta over the past few thousand years.

Historic-period Flooding and Deposition

During the height of the gold rush in the late 1800s, hydraulic mining in the northern Sierra Nevada generated nearly one billion cubic meters of sediment that was released into channels draining the western slope (Gilbert 1917). In some mining districts, these sediments were as much as 40 meters (~130 feet) thick in the late 1870s (Whitney 1880). During the winter of 1861-1862, a large volume of hydraulic mining deposits was transported to the valley floor (James 1989:573) when a series of storms delivered unusually heavy rainfall, creating a "great inland lake of ice-cold muddy water" that covered most of the Sacramento Valley (Engstrom 1996:143).

Intensive mining caused rapid channel aggradation in the lower reaches of the valley's drainages, which temporarily raised many channel beds 10 to 15 feet (3.0 to 4.5 meters) or more above their former elevations (Gilbert 1917; James 1989; Lindgren 1911; Olmstead and Davis 1961:20). Not surprisingly, this caused extensive flooding, channel migration, and widespread sediment deposition throughout the Sacramento-San Joaquin Delta (Thompson 1961). Large amounts of mining sediments are still stored in many of the region's floodplains, and continue to be reworked by active channels (James 1991, 1999).

Most of the flooding and deposition in the Delta is now controlled by an extensive network of man-made levees, canals, and drainage ditches (Ingebritsen et al. 2000). Agriculture and land reclamation efforts in the region have caused the rapid decomposition of the once water-saturated peat deposits, which has resulted in land subsidence of as much as 10 to 15 feet (3.0 to 4.6 meters; Atwater and Belknap 1980). Consequently, some older (pre-Delta?) and previously buried floodplain and eolian deposits are now exposed at the Delta's surface (Atwater 1982:8; Gilbert 1917). These man-made changes have fundamentally altered the drainage system and the transport, deposition, and storage of sediment within the Delta (Mount 1995; Thompson 1961).

San Joaquin Valley Marshes and Forests

The northwestern portion of the San Joaquin Valley is distinguished by the extensive wetlands of the Sacramento-San Joaquin Delta. This habitat provided abundant subsistence resource to the region's Native inhabitants, including plant foods, fish, waterfowl, and terrestrial animals. The freshwater tule marshes covered some 494,000 acres around the confluence of the Sacramento, San Joaquin, and Mokelumne rivers (Atwater 1980; Shlemon and Begg 1975; West 1977). Between about 1860 and 1920, construction of an extensive series of levees, dikes, and tidal gates drained much of the Delta wetlands and brought more than 50 reclaimed tracts and islands (including King Island) under intensive cultivation. By 1930, more than 441,000 acres of wetlands had been drained in the Delta (West 1977; West et al. 1999).

In its pre-developed state, the Delta consisted of a sinuous mosaic of interconnected sloughs, overflow lakes, natural levees, and subtidal islands covered by freshwater tule marsh. Often dominated by pure stands of *Scirpus* spp., the native freshwater marsh also contained cattails (*Typha* spp.), sedges (*Carex* spp.), rushes (*Juncus* spp.), and reeds (*Phragmites australis*). The "tulares" (a name given to the freshwater marshes of the San Joaquin Valley by early Spanish explorers) extended south from the Delta in a narrow strip along the San Joaquin River, then formed a broad tract surrounding the many sloughs and overflow channels of the low-lying basin near what is now Los Banos in central Merced County. Aquatic plants such as pondweed (*Potamogeton* spp.), knotweed (*Polygonum* spp.), and yellow pond lily (*Nuphar polycephalum*) grew in areas of deeper, permanent water, such as ox-bows in the Delta and along the San Joaquin River. On natural levees, willow (*Salix* spp.) and Fremont cottonwood (*Populus fremontii*) were common (West 1977). In the winter and spring, high river flows inundated much of the Delta with fresh water; during the late summer and fall, reduced freshwater flows commonly resulted in salt water intrusion as far inland as Stockton (Shlemon and Begg 1975; West 1977).

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The rivers feeding into the Delta were largely or partially flanked by broad gallery forests on either side of the waterway (Burcham 1982; Küchler 1977). Riparian forests found on natural levees and low terraces along the middle and lower reaches of these rivers often formed dense, multi-tiered canopies of primarily deciduous species. The overstory was dominated by cottonwood, valley oak (*Quercus lobata*), California sycamore (*Platanus racemosa*), Oregon ash (*Fraxinus latifolia*), and black walnut (*Juglans nigra*). The sub-canopy commonly included white alder (*Alnus rhombifolia*), box elder (*Acer negundo*), buckeye (*Aesculus californica*), big leaf maple (*Acer macrophyllum*), and elderberry (*Sambucus mexicana*), while the understory was composed of willow (*Salix* spp.), grape vine (*Vitis californica*), blackberry (*Rubus ursinus*), poison oak (*Toxicodendron diversilobum*), and numerous other shrubs and herbaceous species forming dense thickets (Burcham 1982; Thompson 1961; West 1977). On the levees and younger floodplains adjacent to the gallery forest, oak woodlands formed uniform tracts up to four miles wide, consisting almost exclusively of valley oaks.

Open channels and lentic habitats of the delta and river system each supported different types of fishes. In the open fast-moving waters of the rivers and larger streams were found Chinook salmon (*Oncorhynchus tshawytscha*), sturgeon (*Acipenser* spp.), steelhead (*Oncorhynchus mykiss*), and lamprays (*Lampetra lethophaga*), as well as resident hardhead (*Mylopharodon conocephalus*), and sculpins (*Cottus* spp.). Sacramento sucker (*Catostomus occidentalis*) and western pike-minnow (*Ptychocheilus grandis*) were common in both fast- and slow-water habitats, while the calmer waters of the delta and rivers were home to splittail (*Pogonichthys macrolepidotus*), hitch (*Lavinia exilicauda*), thicktail chub (*Gila crassicauda*), Sacramento blackfish (*Orthodon microlepidotus*), Sacramento perch (*Archoplites interruptus*), and tule perch (*Hysterocarpus traskii*). Aquatic environments also supported pond turtle (*Clemmys marmorata*) and populations of freshwater mussel including *Gonidea angulata* and *Anodonata californiensis*. Common terrestrial animals once included elk, pronghorn, black-tailed deer, and grizzy bear, along with a multitude of smaller species like bobcat, fox, beaver, skunk, and rabbit. Economically important waterfowl migrated in vast herds along the Pacific Flyway and would have provided the Native inhabitants of the region with ducks, geese, grebes, gulls, coots, and others.

PREHISTORY

This section describes, in general terms, broad patterns in the prehistory of the Central Valley, focusing on major environmental, technological, and adaptive changes evident in the archaeological record of this region.

Paleo-Indian Period (13,200-11,500 cal BP)

When humans first entered the central valley prior to about 13,000 years ago, glaciers had already receded from the Sierran crest, conifer forests were established at mid- to upper-elevations on the western slope and the Coast Ranges to the west were covered in a near continuous blanket of conifer forest where woodland and chaparral communities now prevail. The Sacramento and northern San Joaquin valleys included extensive grasslands and riparian forest, providing forage for a diverse array of large vertebrates, many of which would shortly become extinct. The extensive central California delta-estuary had not yet developed, and vegetation in the southern San Joaquin Valley resembled more the Great Basin than cismontane California.

Several significant and widespread episodes of fan and floodplain deposition during the Holocene have obscured evidence of the earliest people in the Central Valley. The few scattered archaeological remains known from the late Pleistocene and earliest Holocene are deeply buried following repeated cycles of fan and floodplain building during the middle and late Holocene, or come from ancient landforms that have survived periods of erosion and remained at the surface.

The earliest tangible clue of human occupation in the Central Valley comes from eccentric crescents and basally thinned and "fluted" projectile points found at scattered locations in the San Joaquin Valley. Most similar to Clovis points, these distinctive projectiles have been well-dated elsewhere in North America to a brief interval between about 13,500 and 11,500 cal BP (Fiedel 1999). A recent reconsideration of radiocarbon dates from Clovis sites has led Waters and Stafford (2007) to conclude that these projectile points may have been in use for a much shorter period—just 450 years—between 13,250 and 12,800 cal BP. They believe that the widespread distribution of Clovis points across much of North and South America was the result of technological diffusion, rather than cultural migration, suggesting that a pre-Clovis human population must have existed. This contention remains highly controversial, but is more widely accepted by archaeologists than ever before.

The first fluted-point reported from the Central Valley was collected in San Joaquin County near Tracy Lake on the eastern side of the modern Delta (Heizer 1938). An eccentric crescent was later discovered at this same locality (Beck 1971) on an isolated Pleistocene-age alluvial fan, dissected by the northward migration of the Mokelumne River. On the west side of the San Joaquin Valley near Hills Ferry, Peak and Weber (1978) identified two Clovis-like projectile points and an eccentric crescent at the Woolfsen Mound (MER-213), a site containing predominantly late Holocene material. This site too is situated on a late Pleistocene-age alluvial fan that extends basin-ward from the slopes of the Coast Ranges.

At the far southern end of the San Joaquin Valley in the Tulare Basin, Clovis-like points have been found in large numbers in and around the Witt site (KIN-32) between the 190- and 195-foot elevation on the southwestern shore of Tulare Lake (Hopkins and Garfinkel 2008; Riddell and Olsen 1969; Wallace and Riddell 1991). This locality has produced the largest collection of basally thinned concave-base points in California, with as many as 200 specimens reported (Dillon 2002; Hopkins 1991:34). Many of the ancient concave-base points at Tulare Lake are quite small, however, and are unlike classic Clovis points found elsewhere in North America (Hopkins 1991; Rondeau and Hopkins 2008). Many also lack well-defined "fluting" scars (Riddell and Olsen 1969). As these diminutive specimens remain undated, it is not known whether they represent a distinct "Western Clovis" tradition or perhaps relate to some other post-Clovis occupation, falling in the period between about 11,500 and 10,500 cal BP (Rondeau 2005). Such late Paleo-Indian manifestations are known from various places in North America (e.g., Folsom), and bridge a gap between Ice-age cultures and those that flourished in North America during the subsequent Archaic Period.

The recovery of isolated concave-base points adds little to our understanding of the overall economy and lifeway of the Central Valley's earliest documented inhabitants. We know from the context of these finds elsewhere in California that a diverse array of habitats was exploited, from the coastal terrace (Simons et al. 1985), across the Coast Ranges, to the western slope of the Sierra Nevada (Davis and Schutler 1969). Nevertheless, the great majority of fluted points from California are found in ancient lake basins (Davis 1978; Dillon 2002; Harrington 1948; Hopkins 1991). Most appear to have been surface or near-surface finds (but see La Jeunesse and Pryor 1996c), lacking other demonstrably associated artifacts and occupation debris. Similarly, with the exception of a few hydration readings from fluted points at Borax Lake, Lake County (White et al. 2002) and Tulare Lake, Kings County (Garfinkel et al. 2008), these specimens are not well dated in central California. Uranium Series (230Th) age estimates are reported from human bone fragments and Pleistocene faunal remains found on the shores of Tulare Lake. The human bone produced dates of 11,379, 11,380, and 15,802 years BP, while the fauna returned dates of 10,788, 15,696, and 17,745 years BP (West et al. 1991). Although two of the human bone dates are from specimens recovered in the same vicinity as ancient concave-base points, the relationship between these materials remains ill-defined (West et al. 1991).

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Lower Archaic (11,500-7000 cal BP)

Well-preserved Lower Archaic archaeological deposits are rare in the Central Valley. The first appearance of milling tools and diverse faunal and floral assemblages from Early Archaic deposits in adjacent regions, reflect broad-spectrum economies characteristic of Archaic adaptations throughout North America. Changes in California's climate resulted in the expansion of oak woodlands and grassland prairie at the expense of conifer forests. Alluvial fans and floodplains throughout the lowlands of central California responded with a significant period of deposition after about 11,000 cal BP. This episode of landscape evolution capped many late Pleistocene alluvial landforms and resulted in a clear stratigraphic boundary between the late Pleistocene and Holocene (Rosenthal and Meyer 2004b). In a similar manner, changes in climate at the beginning of the middle Holocene, around 7000 cal BP, provoked another cycle of fan and floodplain deposition. This latter event capped many of the earliest archaeological deposits known from central California (Rosenthal and Meyer 2004a, 2004b).

Perhaps the most significant characteristic of post-Pleistocene economies in cismontane California is a clear reliance on plant foods. Milling tools are one of the most commonly reported artifact classes from Lower Archaic sites on the fringes of the Central Valley (La Jeunesse and Pryor 1996d; Meyer and Rosenthal 1997; Peak and Crew 1990) and elsewhere in central California. Exclusive use of handstones and millingslabs along with a number of other cobble-based pounding, chopping, and scraping tools are characteristic of assemblages from this time period. Beginning as early as 10,500 cal BP, this assemblage of expedient tools becomes the predominant extractive and processing technology employed from coastal California to the uplands of the North Coast Ranges and Sierra Nevada (Fitzgerald and Hildebrandt 2001; Fitzgerald and Jones 1999; Hildebrandt 1983; Jones et al. 2002; La Jeunesse and Pryor 1996a, 1996c; Meyer and Rosenthal 1997; White et al. 2002).

Often characterized by dense accumulations of milling tools (i.e., handstones and millingslabs), these so-called "millingstone" sites appear to represent frequently re-used encampments, part of a mobile, yet seasonally structured settlement system (Basgall and True 1985; McGuire and Hildebrandt 1994; Moratto 2002; Rosenthal and McGuire 2004). In central California, nut crops associated with expanding woodlands may have been the primary focus of seasonal plant exploitation and not simply small seeds, as is commonly believed (c.f., Basgall 1987; McGuire and Hildebrandt 1994; Rosenthal and McGuire 2004). At least two deeply buried and stratified sites from the foothills adjacent to the northern San Joaquin Valley provide direct evidence for use of nut crops during the early Holocene (Meyer and Rosenthal 1997; Rosenthal and McGuire 2004). Charred remains of acorn are reported from the Kellogg paleosol at Los Vaqueros in the Diablo Range (Meyer and Rosenthal 1997), and acorn and grey pine from the black clay stratum at the Skyrocket site (CAL-629/630) in the Sierra foothills (Rosenthal and McGuire 2004).

The nature of plant use in the Central Valley remains unknown, as Lower Archaic sites in the valley proper have only rarely been discovered and milling tools are uncommon or absent in these contexts. Handstones and millingslabs are reported as isolated finds around the late Pleistocene and early Holocene shoreline of Tulare Lake (Siefken 1999), but like other artifacts from this region, their temporal affiliation is unclear. No milling tools were found at KER-116, the only reasonably well-documented Lower Archaic site from the Central Valley. This deeply buried deposit occupies the lowest stratum of the site and produced calibrated radiocarbon dates on freshwater mussel shell ranging between 9125 and 8400 cal BP. The sparse artifact assemblage from this buried soil includes three chipped stone crescents, a stemmed projectile point base, and one stone atlatl engaging hook, other small flaked stone implements, and a human parietal fragment. The deposit also included a very small yet diverse faunal assemblage. Sacramento perch is the principal fish species. Waterfowl is represented by stiff-tailed ducks, grebes, coots, and mergansers; the latter are only abundant in late fall through early spring (Hartzell 1992). The small terrestrial mammal assemblage included a few bone fragments of artiodactyl, jackrabbit, and pocket gopher.

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Lower Archaic assemblages from central California are also often found to contain large broad-stemmed projectile or spear points. These points tend to be moderately to heavily re-worked, with convex and flat to indented bases and broad stems, resembling Borax Lake points from the North Coast Ranges and those with names such as Lake Mojave, Silver Lake, and Pinto, typical of early Holocene assemblages found in the Great Basin (La Jeunesse and Pryor 1996c; Meyer and Rosenthal 1997; Peak and Crew 1990). This may not be surprising, as we know the crest of the Sierra was regularly crossed during the early Holocene by people who presumably lived both east and west of this imposing topographic divide. Shell beads from coastal California are found in early Holocene deposits in the western and central Great Basin (Bennyhoff and Hughes 1987; Fitzgerald et al. 2005), and obsidian from eastern Sierran quarries makes up a large portion of the non-local flaked stone tools and tool-making debris found in Early Archaic sites on both sides of the Central Valley, such as Clarks Flat (CAL-342), Skyrocket (CAL-629/630), and Los Vaqueros (CCO-696). Obsidian was not reported, however, from the basal stratum at KER-116 in the Buena Vista Lake Basin and is rare among the many stemmed points from the Tulare Basin (Wallace 1991).

Middle Archaic (7000-2500 cal BP)

The beginning of the Middle Archaic (ca. 7000 cal BP) in Central California is marked by a substantial change in climate with warmer and drier conditions prevailing throughout the region. Tulare Lake shrank in size and eventually desiccated, matching similar declines at Clear Lake in the North Coast Ranges and other lake basins in the Sierra Nevada. Oak woodlands expanded upslope in the Coast Ranges and conifer forests moved into alpine zones in the Sierra. Although conditions were generally arid, significant new wetland habitats were forming in the Central Valley as sea level rise was forcing development of the Sacramento-San Joaquin Delta and associated marshlands. Substantial changes also occurred in the geomorphic landscape. Following an initial period of upland erosion and lowland deposition about 7000 cal BP, fans and floodplains stabilized. This period of landscape stability is represented by middle Holocene-age buried soils found in alluvial landforms throughout central California. Many of the best documented Middle Archaic archaeological deposits are associated with these buried paleosols.

Like evidence for Early Archaic occupation, well substantiated cultural deposits assignable to the Middle Archaic (ca. 7000 to 3000 cal BP) are rare in the Central Valley. In the southern delta, the archetypical Middle Archaic tradition is that of the Windmiller culture, dated as early as 5000 cal BP. Sites ascribed to the Windmiller culture are unique in their abundance of westerly oriented, ventrally extended burials and elaborate material culture found primarily as burial offerings (Heizer 1949; Ragir 1972). Originally termed the "Early Horizon" (Heizer and Fenenga 1939), Windmiller deposits were first recognized from a handful of sites located at the confluence of the Mokelumne and Cosumnes rivers. No subsequent culture in central California provides the wealth of grave goods found among the handful of Windmiller sites in the eastern Delta. More than 80% of the interments contained funerary offerings (Heizer 1949). Diverse non-utilitarian items are found with these graves, including large numbers of well made "charmstones," some of the earliest *Olivella* wall-beads, *Haliotis* ornaments, quartz crystals, and abundant obsidian projectile points and large bifaces from the Coast Ranges and eastern Sierra (Heizer 1949; Meyer and Rosenthal 1997, 1998; Milliken et al. 1997; Peak and Crew 1990). These settlements are found on levee ridges adjacent to what would have been emerging freshwater marshes and well-watered riparian settings in the lowlands. Radiocarbon dates suggest the oldest of the Windmiller sites, the Blossom Mound (SJO-68), is a minimum of 5000 cal BP, although, most other classic Windmiller deposits date between 3500 and 2700 cal BP (Ragir 1972; Schulz 1981).

In addition to the original Early Horizon sites in the delta, ventrally extended burials ranging between 5,700 and 2,800 years old are now known from the margins of the northern Diablo Range and

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base of the Sierra Nevada (Johnson 1967; La Jeunesse and Pryor 1996f; Meyer 2006; Meyer and Rosenthal 1997; Wiberg and Clark 2004). Burials at these sites lack the frequency and richness of grave goods found at Windmiller sites in the eastern delta, perhaps suggesting some internal differentiation within this regional culture.

As early as 5000 cal BP, use of the mortar and pestle is first apparent in the lowlands of the Central Valley, particularly in marsh-side and riparian settings (Meyer and Rosenthal 1997; Ragir 1972; Rosenthal and McGuire 2004). On the fringes of the northern Diablo Range, mortars and pestles replaced handstones and millingslabs as early as 6800 cal BP, and remained the predominant or exclusive milling technology used throughout the Middle and Upper Archaic (Fredrickson 1966; Meyer and Rosenthal 1997). These early assemblages commonly include a distinctive type of highly polished pestle used with a wooden mortar.

Various lines of evidence suggest that the shift to mortars and pestles accompanied more intensive subsistence practices and increased residential stability (Basgall 1987). The Blossom Mound is the oldest of the Central Valley sites known to include large numbers of human graves. Extended residential occupation is reflected in the strict burial posture, refined and specialized tool assemblages, abundant trade objects, and a wide range of non-utilitarian artifacts (Ragir 1972; Schulz 1981). Extended seasonal occupation is also evident in the burial patterning. Schulz (1981:96-97) has pointed out that the orientation of Windmiller burials follows the position of the setting sun and thus monitors the season of death. Although directional patterns reveal that most deaths occurred during winter, there are numerous burials with appropriate orientation to conclude that the site was occupied over much of the year.

Residentially stable occupations in the Central Valley were probably facilitated by the convergence of habitats containing economically important plants, terrestrial animals, waterfowl, and fish, concentrated spatially, but dispersed seasonally (Jones 1991, 1997). These latter characteristics alleviated some of the scheduling conflicts that prevailed in environments such as the Sierra Nevada, where important resources are distributed more homogenously into distinct environmental zones (Rosenthal 2008). Fishing may have taken on new importance to Central Valley groups during the Middle Archaic, as fishing gear and abundant fish remains are first represented in assemblages dating to this time period (Broughton 1988; Meyer and Rosenthal 1997; Ragir 1972; White 2003a). Both resident and anadromous fishes were taken, apparently obtained with spears and line and hook (Heizer 1949; Ragir 1972). Heavy reliance on the emerging mosaic of marshes, riparian forests, and adjacent grasslands in the Central Valley is further indicated by the composition of faunal assemblages attributed to the late Middle Archaic. Tule elk, mule deer, and pronghorn are all represented, as are smaller rabbits and hares, cranes, geese, swans, ducks, Cormorant, turtle, river otter, beaver, coyote, and several other terrestrial carnivores, raptors, and rodents (Ragir 1972:159).

The transition in milling technologies and increasing sedentism evident in the delta region of central California during the Middle Archaic do not coincide with a wholesale shift to new plant foods. Instead, these changes appear to be related to an increasing focus on nut crops. Archaeobotanical assemblages from throughout central California indicate that acorn, pine nuts, and other nuts were important fall resources beginning in the Early Archaic (Wohlgemuth 2004), but may have become more significant in certain regions during the Middle Archaic with the advent of storage (Basgall 1987; Rosenthal and McGuire 2004; Wohlgemuth 2004).

The exchange of commodities such as obsidian, shell beads and ornaments, and perhaps other perishable items, was well established by the late Middle Archaic. People living in the Central Valley became important consumers of obsidian quarried on the east side of the Sierra Nevada. Stoneworkers at three main quarries—Bodie Hills, Casa Diablo, and Coso—manufactured bifacial blanks that were transported over the mountains to the western slope along well-defined, east-west travel corridors

(Jackson 1994; King et al. 2008). Windmiller sites in the eastern delta include predominantly eastern California glass types, although Napa Valley obsidian from the North Coast Ranges is also well represented, obtained from groups living to the north and west.

Upper Archaic (2500-930 cal BP)

Evidence for Upper Archaic human occupation in the Central Valley is extensive, particularly for the last 2,000 years. Holocene landscape evolution has greatly biased the archaeological record toward these younger deposits, adding to a perception of substantial human population increases during the Upper Archaic (Basgall 1987). Earlier sites are commonly buried by an episode of regional fan and floodplain deposition which occurred between about 2800 to 3000 cal BP (Banks et al. 1984; Rosenthal and Meyer 2004a, 2004b). Two subsequent depositional cycles, initiated around 1300 to 1000 cal BP and again about 650 cal BP (Meyer and Rosenthal 1997; Rosenthal and Meyer 2004a, 2004b; White 2003a, 2003b), also obscured some proportion of Upper Archaic sites, adding to the perceived over-representation of sites from the latest Holocene.

Perhaps as a result of greater temporal resolution and a much larger archaeological record, economic, technological, and socio-cultural developments are much better understood for the Upper Archaic than for preceding time periods. Cultural diversity first apparent in the Middle Archaic becomes much more pronounced in the Upper Archaic, as evidenced by a complex mosaic of distinct socio-political entities marked by contrasting burial postures, artifact styles, and other material culture elements (Bennyhoff and Fredrickson 1994; Rosenthal 1996). It was this diversity that Bennyhoff and Fredrickson (1994) were trying to accommodate in their Central California taxonomy.

In conjunction with increasing effective precipitation beginning around 2,700 years ago, large mounded villages developed in the Delta region of the San Joaquin Valley (e.g., Bouey 1995; Lillard et al. 1939; Ragir 1972; Schenck and Dawson 1929; Schulz 1981). These sites contain extensive accumulations of habitation debris, including robust faunal and floral assemblages, a variety of habitation features, and hundreds of human graves—all connoting long-term residential occupation (Bouey 1995). In the eastern delta, the Windmiller culture is replaced by people with a homeland to the west, from the Diablo Range or the North Bay (Gerow with Force 1968; Bennyhoff 1987). This cultural tradition was originally termed the "Middle Horizon" (Heizer and Fenenga 1939) and is identified by Fredrickson as the Berkeley Pattern (1973, 1974).

Descendants of the Windmiller culture, termed the Meganos tradition by Bennyhoff (1968, 1987), continued to occupy the San Joaquin Valley during the Upper Archaic. Their sites are found along the western and southern edges of the delta and along the side streams and axial marshes of Merced and San Joaquin counties until sometime around 1,000 years ago (Bennyhoff 1987; Delacorte 2001; Dougherty and Werner 1993; Fenenga 1973; Peak and Weber 1978; Pritchard 1970). In the foothill woodlands of the Sierra, these valley people may have periodically colonized well-watered and riparian habitats judging by clusters of extended Upper Archaic burials found at sites as far east as San Andreas, Copperopolis, and Buchannan Reservoir (La Jeunesse and Pryor 1996f; Milliken et al. 1997; Moratto 1972, 1984; Stewart and Gerike 1994). A period of cultural expansion out of the northern San Joaquin Valley is also evident in the interior of the northern Diablo Range beginning about 1,500 years ago. Referred to as the Meganos intrusion (Wiberg 1988), descendants of the Windmiller culture established settlements throughout the lowlands of the east bay, extending as far west as the Fremont plain by 1,100 years ago (Bennyhoff 1968, 1987; Hylkema 2002; Meyer and Rosenthal 1997; Wiberg 1988).

Throughout Central California, the Upper Archaic witnessed the development and proliferation of many specialized technologies, including new types of bone tools including harpoons, shaft wrenches, and awls. Mortars and pestles were predominantly or exclusively used in the lowlands of the Central

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Valley, in conjunction with an increased focus on processing acorns (Wohlgemuth 1996). Most residential sites dating to the Upper Archaic include large quantities of fish bone and fishing implements, as well as a diverse assortment of mammal and bird remains. Sites from the drier open grasslands of the San Joaquin Valley include primarily pronghorn and elk bone (Delacorte 2001; Dougherty and Werner 1993; Peak and Weber 1978), while those closer to the Delta and riparian habitats include mostly deer and elk bone (Pierce 1988; Schulz and Simons 1973; Schulz et al. 1976; Soule 1976).

Well-defined exchange relationships are evident throughout central California during the Upper Archaic. Large quantities of shell beads manufactured in southern California and along the central and northern California coast are found in residential sites throughout the Central Valley. *Olivella* wall-beads predominate through most of the Upper Archaic (Bennyhoff and Hughes 1987), along with various types of *Haliotis* ornaments and pendants. In the San Joaquin Valley, *tivela* spp. shell beads are also frequently found (e.g., Dougherty and Werner 1993; Olsen and Payen 1983), but appear to be rare in sites to the north and west. Obsidian from the eastern Sierra and North Coast Ranges is well represented in sites of this age, commonly found as large bifacial blades, often in burial contexts.

Strongly demarcated boundary zones are evident in the distribution of different obsidian sources. Bodie Hills obsidian makes up greater that 85% of all obsidian found at Upper Archaic sites in the foothills between the Tuolumne River on the south and American River on the north (King et al. 2008). Yet Napa Valley obsidian comprises a substantial proportion (greater than 50%) of all volcanic glass found at Upper Archaic sites in the adjacent northern San Joaquin Valley (Jackson 1974), suggesting that a significant socio-cultural boundary existed between the valley and foothills during the Upper Archaic (Ericson 1977; Jackson 1994; Jackson 1974; King et al. 2008). This continues a pattern first observed in the Middle Archaic, suggesting that separate culture groups likely occupied the valley versus the adjacent foothills. This pattern seems to characterize most of the Middle and Upper Archaic.

Emergent Period (930-150 cal BP)

A wholesale shift in material culture is evident after about 900 years ago, marking the beginning of the Emergent or Late Prehistoric Period in the San Joaquin Valley and southern Delta region. Two sub-periods are typically recognized within the Emergent: Phase 1 and Phase 2. The latter period represents the onset of cultural traditions most resembling those existing at the time of European contact. In addition to the distinctive big-head effigy ornaments and other decorative items (e.g., collared stone pipes, ear spools, and incised bird-bone whistles) introduced at the beginning of the Emergent Period, the most unique arrow point style in California developed in the northern San Joaquin Valley or adjacent regions to the west, known as the Stockton Serrated point. While other point styles found in the Sierra, Sacramento Valley, and North Coast Ranges have morphological similarities to arrow points in adjacent regions, and may have been adopted from neighboring groups, the Stockton Serrate style is clearly an independent invention. South of the Delta, in Merced County, there is little evidence for the first arrow-point types, but by at least 500 years ago, the Panoche Side-notched point, a variant of the Desert Side-notched, is in use on the west side of the San Joaquin Valley (Olsen and Payen 1983; Pritchard 1970). By Phase 2 of the Emergent Period, Desert Side-notched points are widely used, but do not completely replace the earlier Stockton Serrated form.

During the Emergent Period, large mound villages are established every few miles along the San Joaquin River and major tributaries. Several sites reported by Schenck and Dawson (1929), contained house depressions and other types of residential features, along with human graves (see also Hewes 1941). Although the practice of cremation became quite common in the northern and western Delta during the Emergent Period, it seems to have been rare in the southern Delta (Schenck and Dawson 1929:334). Burials from this time period commonly contain utilitarian items, such as mortars and pestles,

but also large quantities of decorative items such as shell beads and ornaments. By Phase 2, *Olivella* wall beads were replaced in popularity by clam shell disk beads obtained from production centers in the North Bay area and north of the Delta in the lower Sacramento Valley. Coiled basketry appears to have become more important during the Emergent period as basketry awls are more common in these sites, and burned coiled basketry and other perishables have occasionally been found (Pritchard 1970). Brownware pottery obtained from groups to the south, or possibly in the eastern Delta, is also first recovered in the northern San Joaquin Valley during the Emergent Period (Johnson 1990; Olsen and Payen 1968:55-56, Pritchard 1970:17).

Fishing may have become a significant component of the native economy during this time period, as fish bone and fishing equipment are common in these sites, including several types of spears and harpoons, bone fishhooks, and gorge hooks. Mortars and pestles were used almost exclusively during the Emergent Period, and there is substantial archaeobotanical evidence suggesting that small seeds, in addition to acorn, were among the primary plant foods. Most residential sites dating to this time period also include high quantities of large and small mammal bone, as well as abundant remains of water birds.

Sometime after about 800 years ago, a significant change in obsidian production and exchange is recognized throughout central California. In the Northern San Joaquin Valley, this change is identified through shifts in obsidian source frequencies. Napa Valley obsidian becomes the primary source material used in this region (Jackson 1974), supplanting material obtained from eastern quarries. Napa obsidian appears to have been traded in raw form to people living in the northern and western Delta region, based on high frequencies of Napa production debris and debitage with cortical remnants (Rosenthal et al. 2007). However, little is known about technological profiles of obsidian found in the northern San Joaquin Valley.

ETHNOHISTORY

Historically, the Central Valley was home to no fewer than seven Native California ethnic groups, all related to a single linguistic superfamily—Penutian. It has been estimated that slightly more than 100,000 people lived in the Central Valley when Europeans first ventured into the basin about AD 1772 (Cook 1955, 1976; Moratto 1984:171). If this projection is correct, the valley alone was home to almost one third of the entire state's estimated Native population (Cook 1955, 1976, 1978).

A comprehensive ethnographic study will be undertaken for the proposed project. The following constitutes only a brief summary of the readily available literature. The project area is mapped as having been occupied by the Northern Valley Yokuts at the time of European contact (Milliken 2006), though lands claimed by the Plains Miwok are just north of the project area (Milliken in Blount et al. 2008).

Yokuts

At least 50 separate Yokuts groups lived in the San Joaquin Valley and adjacent Sierra Nevada foothills, each having a distinct name, dialect, and territory (Latta 1949). As Moratto (1984:173) points out, the Yokuts may have been the largest ethnic group in pre-Contact California, with an estimated population approaching 41,000 people (Cook 1955). According to Milliken (2006), the immediate vicinity of King Island was home to the *Tauquimne* band—though Wallace (1978) attributes the entire region east of Stockton to the *Chulamni*.

Settlement and Political Organization

Due to early missionization and extended Euro-American contact beginning during the Gold Rush, very little information was recorded about Northern Valley Yokuts communities (Wallace 1978). As elsewhere in western California, the Yokuts probably were organized into small, independent political

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groups, each one controlled by a single headman. The group had a single principal settlement and occasionally smaller hamlets. It was the primary task of the headman to organize ceremonies, mediate disputes, mete out punishment for anti-social behavior, authorize exchange and food collecting expeditions, and assist the needy.

The principal village was home to the headman and as many as 250 to 300 others. These settlements were typically located on an elevated levee ridge in the valley bottom or along a major tributary stream outside the active floodplain of the San Joaquin River. Wallace (1978:463) suggests that most settlements were situated east of the river, as the arid plains fringing the Coast Ranges were relatively unproductive. However, the marshes, sloughs, and forests contained a variety of economically important plant foods, fish, waterfowl, and terrestrial animals (see above under *The Natural Environment*). Most settlements appear to have been permanent year-round villages, although people would disperse in the spring and early summer to collect seeds, bulbs, and other plant foods.

Houses were typically simple frame structures covered by tule mats. In the south, large communal houses were built in this manner, providing shelter to as many as 10 families; however, single-family dwellings appear to have been the norm among the Northern Valley groups (Wallace 1978). Sweat-houses were more substantial, semi-subterranean, earth-covered structures and were built in all principal villages. Simple shade structures were also constructed with a wooden framework covered by matting.

Social Organization and Religion

Although not recorded ethnographically, it is likely that the Northern Valley Yokuts were organized as totemic lineages with patrilineal descent, just as their Yokuts neighbors to the south and their Miwok neighbors to the north and west (Levy 1978; Wallace 1978). Families with similar totems formed an exogenous lineage, with no formal leader or rights of land ownership. Instead, the totemic lineage was a means of conveying positions of authority and carrying out specific ceremonial functions. The Northern Valley Yokuts also shared a number of religious and social characteristics with other Native groups to the east and south, distinguishing them from their valley neighbors to the north. For example, the Kuksu Cult, which reached its most elaborate form in the Lower Sacramento Valley, north of the Delta, was not known among the Yokuts. Instead, they practiced a simple form of the Tolache or Datura religion, which had a center of distribution in southern California and desert regions to the east (Kroeber 1939).

Subsistence and Technology

Fishing was an important economic activity carried out with nets and other devices, often from well-made tule boats. Salmon may have been among the most valued species captured by the Northern Valley Yokuts, but sturgeon and various resident fishes were probably as economically significant. Fish were often dried for later use, as was deer, elk, and pronghorn meat. Various water birds, which arrived in great abundance during the fall and winter, were also an important food source, probably second only to fish (Wallace 1978:464). These species were captured in nets, often with the help of decoys fashioned from tule stalks. Domestic dogs were kept by the Yokuts and probably also served as a source of food. Rabbits and pronghorn were hunted in communal drives, while deer and elk were hunted individually. Other small mammals were trapped or snared. Plant foods included acorns and other nut crops collected from dryer areas away from the river, as well as numerous types of small seeds, bulbs, roots, and greens. These foods were collected and stored in various kinds of baskets.

Historic-Period Disruption

The Northern Valley Yokuts were among the first native groups encountered by Spanish expeditions from the coast. As early as 1776, Lieutenant-Colonel Juan Bautista de Anza led a party from

Monterey Bay into the San Joaquin Valley after exploring the edges of San Francisco Bay. Anza's party followed the western edge of the Delta, until a point near modern day Altamont Pass, where they headed inland via the Livermore Valley (Schenck 1926). Between 1776 and 1796, the Spanish established mission outposts and military settlements throughout the Coast Range valleys as far north as San Francisco.

In 1811, when Franciscan missionaries explored the San Joaquin Delta by boat, they passed through the territory of the Tauquimne, among others. Over the next few years, native people from this area were baptized at Mission San Jose, and by 1836, most of the people of San Joaquin, Stanislaus, and Merced counties had moved to the missions, where their names are recorded in the registers of baptism (Eidsness and Milliken 2004:11).

Miwok (excerpted from Whitaker and Kaijankoski 2010)

Because of their geographic location at the northeastern edge of the missionized area and the western edge of the Mother Lode, the Plains Miwok were hit early and hard by over-zealous missionaries and later by eager gold-seekers and the diseases they brought. By the 1880s, few people survived who could remember life before these intrusions. For this reason, primary information on traditional Plains Miwok culture and lifeways is limited and often conflicting. Most of what we have comes from mission records, early explorers' journals, and the recollections of aged and displaced Indian informants, often members of neighboring tribes; some archaeological data also are available.

The Plains Miwok homeland includes much of the Sacramento River delta and adjacent plains, including the lower reaches of the Cosumnes and Mokelumne rivers and Dry Creek, a major tributary. This territory encompassed a wide range of micro-environments, including delta wetlands and marshes, lakes and sloughs, riparian forest, prairie grassland, and oak woodland/savanna. The people traditionally ate a wide variety of plants and animals, but acorns, salmon, and deer may have been their main staples. Women processed acorns on anvils and portable mortars, using pestles of stone or wood; they then leached the meal through sand and boiled it in baskets with hot stones or clay balls or baked it into a kind of "bread." The men trapped fish in nets or speared them with bone harpoons. The fish were either dried or smoked for storage, or eaten fresh. Deer were trapped by driving them into nets or snares, or were shot with bows and arrows, and the meat was divided between the hunters and their relatives.

The Miwok built several kinds of structures, among them conical dwellings (semi-subterranean or above ground), assembly or dance houses, sweat-houses, ceremonial structures (circular or rectangular), grinding booths, acorn granaries, and hunting blinds. Dwellings had a central fire pit and an earth oven, the latter perhaps 18 inches deep and a foot or more across. Some houses were covered with earth, others with a thatch of brush, grass, or tule, laid over a framework of poles. Large, semi-subterranean dance houses were built by erecting a roof of heavy beams, covered with earth and thatch, over a large pit and supported with four center posts and eight side posts. This structure also held a central fire pit, and the entrance could be on any side.

Miwok traditional hunting and gathering lifeways suffered severe impacts with the arrival of white explorers, missionaries, and subsequent waves of settlers. Epidemics, warfare, and missionization greatly reduced Native populations. Valley tribes fleeing missionization in the late 1770s and subsequently the malaria epidemic of 1833 sought refuge with their foothill neighbors. The 1848 discovery of gold in the adjacent foothills resulted in a devastating influx of white miners and even more settlers. Disease, as well as hostile and active persecution, swiftly destroyed the Native peoples' traditional culture. Today Miwok people live and work in the same towns and industries as their non-native neighbors, though they hold fast to many of their traditional practices and beliefs. These people are the living descendants of those who created the middens and mound sites along the Cosumnes River corridor, and they value these sites highly.

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NON-NATIVE HISTORY

The tule marshes and wetlands around what is now King Island were virtually uninhabitable until the second half of the nineteenth century. In 1850, the U.S. Congress passed the Swampland Act, which allowed title for wetlands to pass to private ownership, on the condition that the land be reclaimed. Some 500,000 acres of land in the Sacramento-San Joaquin Delta were partitioned under the Act. In 1861 the newly formed Board of Reclamation oversaw levee construction and the grouping of islands into reclamation districts. A ca. 1880 "Map of the Proposed Stockton Ship Chanel and Tule Land Reclamation District" shows the area as belonging to the "Tide Land Reclamation Company," but as late as 1910 the project area was still marshland (Figure 3; USGS 1910). Sometime between 1910 and 1939, the Bishop Cut canal was constructed, linking White and Disappointment Sloughs. This canal became the eastern edge of King Island. All of the farmable land in the Delta had been reclaimed by the 1920s (Prichard 1979).

Ludwig (2013b:5) notes that, during World War II, 251 German prisoners of war were housed at the King Island branch camp, associated with a larger facility—Camp Stockton—on nearby Rough and Ready Island. Neither he nor this author could find additional information on the branch camp or its exact location.

By the early 1950s, a series of parallel drainage/irrigation ditches covered King Island (Figure 4; USGS 1952). The only structures on the island at that time were the Venice School in the southwestern corner (at the location of the present-day King Island Resort) and a pump house and gas well in the northwest corner. Most of the land remains under cultivation today.

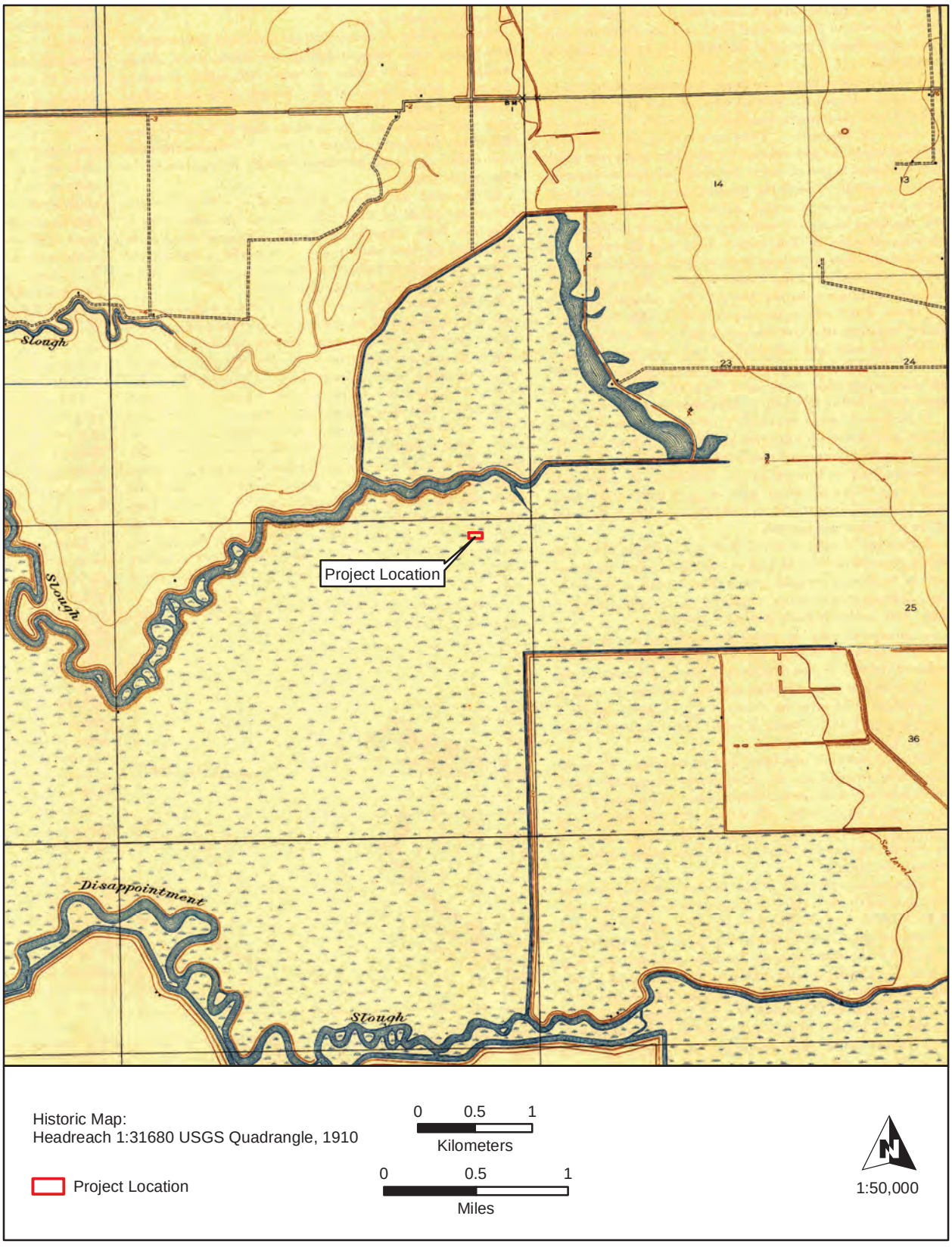


Figure 3. Historical 1910 Map showing Project Area.

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Figure 4. Historical 1952 Map showing Project Area.

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STUDY METHODS AND RESULTS

The study reported here includes the hand excavation of 15 Shovel Test Units (STUs) designed to determine whether or not archaeological remains are present in near-surface deposits at the location of the proposed TSF, Far Western did hand excavations across the entire area (Figure 5). This work was done between June 16 and 18, 2014. Far Western Principal Kimberley Carpenter served as Project Manager and Principal Investigator; archaeologists Michael Darcangelo and Tod Hildebrandt supervised the fieldwork. Four Native American groups (Buena Vista Rancheria of Me-Wuk Indians of California, Ione Band of Miwok Indians of California, Shingle Springs Band of Miwok Indians, and Wilton Rancheria) were contacted and offered the opportunity to monitor the subsurface excavations. Three of the groups—all except the Shingle Springs Band—agreed to participate. Native American monitors included Antonio Ruiz, Jr. (June 17-18 only), representing Wilton Rancheria, Anthony Burris and Andrew Ramey, representing the Ione Band, and Petee Ramirez, representing the Buena Vista Rancheria. Their monitoring logs are presented in Appendix B.

Testing included the excavation of 15 1.0-x-0.5-meter STUs, for a total of 5.0 cubic meters of sediment (Table 1). The STUs were excavated in 20-centimeter arbitrary levels to a maximum depth of 80 centimeters, and all excavated sediment was screened through 1/4-inch mesh. After hand excavations were completed, auger probes were placed in the bottom of 13 of the units. The probes reached a maximum depth of 160 centimeters, and all sediment from the probes was screen through 1/4-inch mesh.

A relatively simple stratigraphic profile was exposed in the STUs. The top 50 to 70 centimeters of deposit consisted of a very dark brown, fine-grained loam, underlain by fine-textured, clay-rich green wetland deposits (Figures 6 through 9). Those units near the access road included some gravels that likely represented road base. In STUs 12 and 13 fragments of decomposing sandstone were encountered at the 80- and 120-centimeter levels, respectively. Soil moisture increased with depth, and mud was encountered in several of the auger holes at 140 centimeters below the modern surface.

At the end of the excavation work, all units and probes were backfilled and their locations mapped using a Trimble GPS device with sub-meter accuracy. No cultural materials were found in any of the excavated sediments.

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Table 1. Excavation Summary.

Shovel Test Unit[a]	Depth (cm)	Volume (m^3)[b]	Auger Depth (cm)	Volume (m^3)[b]	Cultural Materials?
1	60	0.3	-	0.000	-
2	80	0.4	80-160	0.004	-
3	80	0.4	80-160	0.004	-
4	80	0.4	80-160	0.004	-
5	60	0.3	60-160	0.005	-
6	60	0.3	60-160	0.005	-
7	60	0.3	60-160	0.005	-
8	60	0.3	60-160	0.005	-
9	60	0.3	-	0.000	-
10	60	0.3	60-160	0.005	-
11	60	0.3	60-160	0.005	-
12	80	0.4	80-160	0.004	-
13	80	0.4	80-160	0.004	-
14	60	0.3	60-160	0.005	-
15	60	0.3	60-160	0.005	-
Total	**-**	**5.0**	**-**	**0.060**	**-**

Notes: [a] All shovel test units measured 1 meter long by 50 centimeters wide. [b] All soils were screened through 1/4-inch mesh window screen.



Figure 5. Shovel Trench Unit Locations.

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Figure 6. Overview of Native Soils Exposed in Drainage Ditch.



Figure 7. STU 9 East Wall Profile, 0-60 centimeters below surface.

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Figure 8. STU 2 North Wall Profile, 0-80 centimeters below surface.



Figure 9. STU 10 South Wall Profile, 0-60 centimeters below surface.

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SUMMARY AND RECOMMENDATIONS

Surface inventory, geotechnical coring, geoarchaeological sensitivity analysis, and hand excavations have indicated that no archaeological deposits or materials are likely to exist within the horizontal or vertical APE for the proposed TFS location. In the event of inadvertent discoveries during the course of project-related construction, the Unanticipated Discovery Plan developed for the project will be implemented (Appendix C). This plan provides measures for consideration and treatment of the find pursuant to regulation 36 CFR 800.13 (Post-Review Discoveries). Such measures include ceasing all ground-disturbing activities near the find, notifying PG&E's Cultural Resources Specialist, assessing the nature and extent of the resource (including its possible eligibility for listing in the National Register of Historic Places), and fully documenting the find. Per the Unanticipated Discovery plan, PG&E or its contractor will immediately notify all parties noted in the Plan contacts list by telephone and/or e-mail. PG&E shall also provide each contact with a brief description of the identified cultural resource and a location map.

In the event that human remains are encountered during the proposed project, the provisions outlined in Section 7050.5 of the California Health and Safety Code must be followed. Section 7050.5 of the California Health and Safety Code (CHSC) states that it is a misdemeanor to knowingly disturb a human burial. In keeping with the provisions provided in 7050.5 CHSC and Public Resource Code 5097.98 and if it is determined that NAGPRA applies, if human remains are encountered (or are suspected) during any project-related activity:

- Stop all work within 100 feet;
- Immediately contact the PG&E Cultural Resource Specialist (Christophe Descantes), who will notify all parties noted on the Unanticipated Discovery Plan contacts list within 24 hours by phone and/or e-mail; all expenses incurred will be covered by PG&E;
- If the remains are prehistoric, the county coroner shall notify the Native American Heritage Commission;
- Secure the location, but do not touch or remove remains and associated artifacts;
- Treat all human remains with appropriate respect and dignity;
- Do not remove associated spoils or pick through them;
- Record the location and keep notes of all calls and events; and
- Treat the find as confidential and do not publically disclose the location. Note: PG&E employees and its contractors are instructed to not disclose the location(s) of any cultural resources.

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APPENDIX A

BURIED SITE SENSITIVITY STUDY FOR CAES KING ISLAND (MEYER 2014)

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April 10, 2014

Christophe Descantes, Ph.D.
Senior Cultural Resource Specialist
Pacific Gas & Electric Company
245 Market Street—N10A
San Francisco, CA 9410

RE: CAES King Island

Dear Christophe,

Per your request, Far Western Anthropological Research Group, Inc. (Far Western), has reviewed buried site sensitivity for the Compressed Air Energy Storage (CAES) King Island TSP Facility. As part of this analysis, we reviewed the previous studies (Ludwig 2013, Mid Pacific Engineering 2013) and conducted an independent review and analysis of the potential for buried resources. The results of our study are provided below.

Geomorphic Setting and Depositional History

The proposed Temporary Site Facilities (TSF) Facility is situated on King Island along the east side of the Sacramento-San Joaquin Delta, about 1,000 feet south of White Slough, which is part of the lower Bear Creek drainage. At the time Europeans arrived in this region, this area was part of a vast natural marsh later known as the Delta. In its natural state, nearly 60% of the Delta was submerged by daily tides, and spring tides could submerge it entirely. Large areas were also subject to seasonal river flooding. Dominant vegetation included tules—marsh plants that live in fresh and brackish water. On higher ground, including the numerous natural levees formed by silt deposits, plant life consisted of coarse grasses; willows; blackberry and wild rose thickets; and galleries of oak, sycamore, alder, walnut, and cottonwood. Few traces of this earlier plant life remain since most have been cleared by land reclamation, agriculture, and urbanization (Thompson 1957; Thompson 1961).

When viewed over the last several hundred (and thousands of years), it is clear that the local environment was not static, but was characterized by a great deal of change. The depositional history of the Delta region is closely tied to deglaciation and rising sea levels. At the height of the last glacial maximum some 22,000 to 19,000 years ago, worldwide sea levels were at least 125 meters (410 feet) lower than today (Atwater et al. 1977; Bard et al. 1996; Yokoyama et al. 2000). At that time, the Sacramento and San Joaquin rivers formed a single watercourse that flowed through the area now occupied by the San Francisco Bay, and across the continental shelf before entering the Pacific Ocean near the Farallon Islands (Atwater et al. 1977). The area that now makes up the Delta region was at that time a broad inland valley, crossed by numerous streams and rivers with incised channels that were graded to base levels significantly lower than today.

As the continental ice sheets melted, the world's oceans rose rapidly, causing the sea to migrate eastward across the continental shelf. Sometime between 7000 and 6000 cal BP, the rising waters began to inundate the lowermost parts of the ancestral Central Valley, resulting in the formation of extensive brackish and freshwater wetlands (Atwater 1980, 1982; Goman and Wells 2000; Shlemon 1972; Shlemon and

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Begg 1975; Wells and Goman 1995). Many of the wetlands, however, were relatively short-lived as sediment deposition began to equal or out-pace the rate of sea-level rise in the Delta (Atwater 1980, 1982; Atwater et al. 1977), totaling about five meters (16.4 feet) during the middle Holocene, between 7000 and 4000 cal BP. During the late Holocene (i.e., the past 4,000 years), the sea rose another five meters (16.4 feet) at a relatively slow average rate of 1.25 meters (4.1 feet) per 1,000 years.

As the sea progressed inland, the Delta expanded in response to the decomposition, compaction, and subsidence of wetland deposits. Even so, dry uplands, riparian forests, and freshwater wetlands occurred locally in and around the northern Delta until it "gradually came under tidal influence 3000-800 cal BP" (Brown and Pasternack 2005). The outermost portion of the present-day Delta, however, was probably not affected by tidal conditions until the past few thousand years or less. Together, these processes ultimately buried the terrestrial landscape that existed prior to the formation of the Delta (Brown and Pasternack 2004, 2005).

The formation and growth of the Delta had a profound influence on the paleohydrology and depositional history of the lower Sacramento Valley. The rising base level of the Delta caused the lower reaches of many channels to migrate laterally as they became filled with sediments (Brown and Pasternack 2004, 2005). The rivers entering the Delta responded by creating a wide floodplain belt that is now marked by numerous abandoned channel meander loops (i.e., oxbow lakes) and cut-off chutes, along with the active channel (Brice 1977; Robertson 1987). Many meander loops were partly or completely filled by sediments deposited from multiple large floods that occurred during the late Holocene (Sullivan 1982).

During major flood events in the valley, alluvium spilled over the channel banks and onto the surrounding fans and floodplains, sometimes forming prominent levee ridges (Atwater 1980:91, 93; Bryan 1923:28-29; Hinds 1952:147) such as those found along the lower Sacramento River, and smaller streams draining the valley. Once formed, the natural levees were flooded less frequently because they stood well above the surface of the surrounding flood basins. The presence of natural levees along existing channels and at the surface of alluvial fans graded to near-modern base lines suggests that most formed during the late Holocene. Two major episodes of alluvial levee deposition are recorded along the Sacramento River—one between 1550 and 1180 cal BP and the other between 750 and 650 cal BP (White 2004:125)—and one or more large floods occurred along the South Fork American River between 1125 and 650 cal BP (Bureau of Reclamation 2002:34). Thus, a considerable amount of sediment was deposited in low-lying areas such as the Delta over the past few thousand years.

Historic-period Flooding and Deposition

During the height of the gold rush in the late 1800s, hydraulic mining in the northern Sierra Nevada generated nearly one billion cubic meters of sediment that was released into channels draining the western slope (Gilbert 1917). In some mining districts, these sediments were as much as 40 meters (~130 feet) thick in the late 1870s (Whitney 1880). During the winter of 1861-1862, a large volume of hydraulic mining deposits was transported to the valley floor (James 1989:573) when a series of storms delivered unusually heavy rainfall, creating a "great inland lake of ice-cold muddy water" that covered most of the Sacramento Valley (Engstrom 1996:143).

Intensive mining caused rapid channel aggradation in the lower reaches of the valley's drainages, which temporarily raised many channel beds 10 to 15 feet (3.0 to 4.5 meters) or more above their former elevations (Gilbert 1917; James 1989; Lindgren 1911; Olmstead and Davis 1961:20). Not surprisingly, this caused extensive flooding, channel migration, and widespread sediment deposition throughout the Sacramento-San Joaquin Delta (Thompson 1961). Large amounts of mining sediments are still stored in many of the region's floodplains, and continue to be reworked by active channels (James 1991, 1999).

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Most of the flooding and deposition in the Delta is now controlled by an extensive network of man-made levees, canals, and drainage ditches (Ingebritsen et al. 2000). Agriculture and land reclamation efforts in the region have caused the rapid decomposition of the once water-saturated peat deposits, which has resulted in land subsidence of as much as 10 to 15 feet (3.0 to 4.6 meters; Atwater and Belknap 1980). Consequently, some older (pre-Delta?) and previously buried floodplain and eolian deposits are now exposed at the Delta's surface (Atwater 1982:8; Gilbert 1917). These man-made changes have fundamentally altered the drainage system and the transport, deposition, and storage of sediment within the Delta (Mount 1995; Thompson 1957).

BURIED SITE SENSITIVITY ANALYSIS

Before buried sites can be avoided, sampled, or otherwise "managed," they must first be identified. The potential for buried archaeological sites is a practical problem for resource managers who must make a reasonable effort to identify archaeological deposits in a three-dimensional project area to ensure that potentially important resources are not affected by project activities. Early detection of buried archaeological deposits also avoids the potential for costly delays that may occur when unknown resources are discovered after project-related earth moving activities have begun and late discovery protocols are necessary. This is particularly important for any projects that can suffer significant delays and incur unexpected costs if a buried site is discovered as part of the project-related activities. Because of this, the potential for buried sites to occur within the TSF Facility project area assessed in the following sections.

Sensitivity Factors

Many Holocene-age alluvial deposits were formed after prehistoric people had occupied the region; therefore, deposits of this age have a general "geologic potential" to contain buried sites. Conversely, there is little or no potential for buried sites to occur in landforms that pre-date the Holocene because few, if any, people were present in the region at that time. Additionally, archaeological deposits are not distributed randomly throughout the landscape, but tend to occur in specific geo-environmental settings (Foster and Sandelin 2005:4; Hansen et al. 2004:5; Pilgram 1987; Rosenthal and Meyer 2004a). It is well known, for instance, that prehistoric occupation sites are most often associated with level or nearly level landforms that occur near perennial streams, especially near the confluence of one or more streams (Pilgram 1987:44-47).

Analysis of prehistoric sites in other parts of central California indicates the majority are located within 200 meters (656 feet) or less of a present or former water source, such as a spring, stream, or river channel (Rosenthal and Meyer 2004a). This means that many sites are located in settings that were subject to periodic flooding and sediment deposition due to the combination of low-lying topography and active water sources, such as those that prevailed in and near the TSF Facility. Thus, Holocene-age deposits located within 200 meters (656 feet) of a historic-era river or stream are generally considered to have an elevated (i.e., High or Highest) potential to contain buried sites.

Buried Site Assessment

The potential for buried prehistoric archaeological sites in the TSF Facility was estimated based on the age and distribution of surface deposits combined with the proximity to historic-era stream channels (i.e., distance to water). This method has proven useful in other predictive modeling efforts in central and northern California (e.g., Meyer and Rosenthal 2008; Rosenthal and Meyer 2004a, 2004b; Whitaker and Kaijankoski 2009).

Geologic mapping of the area shows most of the segment is underlain by Quaternary alluvium, variously composed of fan, floodplain, and stream deposits, which range from early Pleistocene to Historical in age (Harwood and Helley 1987). Because specific soils series are often associated with deposits

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and landforms of a particular age, they can generally be used to define the age and spatial extent of different-age landforms, which have been used successfully to estimate the potential for buried archaeological deposits throughout much of northern California (Meyer 2013; Meyer and Rosenthal 2008; Meyer et al. 2010; Rosenthal and Meyer 2004a, 2004b).

The surface soils in the project area are mapped as Kingile muck (partially drained, 0 to 2% slopes), which "consists of very deep, very poorly drained soils formed in highly decomposed organic material underlain by fine textured alluvium" (SSURGO database, NRCS 2014). These soils are considered to be historical to modern in age (<100 cal BP) because they were still actively forming before reclamation of the Delta. As shown in Table 1, there are at least seven radiocarbon dates from peat or terrestrial alluvial deposits that occur below the Kingle muck, all from nearby Terminous Tract. While these dates range from about 2430 to 14,263 cal BP, most date to the middle Holocene period (8200-4200 cal BP) and come from depths ranging between about two feet to 11 feet below the surface. Since the Kingle soils are associated with depositional landforms formed during the period of prehistoric human occupation, it is possible that buried archaeological deposits may lie beneath them. The results of the soil-age and sensitivity analysis are summarized below.

Table 1. Radiocarbon Dates from Deposits below the Kingle Muck Surface Soil.[a]

Provenience	Material	Average Depth (cmbs)	^{14}C Age BP	± Error	cal BP (med. prob.)	Lab Number	Source
Trench 10, upper 3Ob below disturbed peat	Peat	97	2390	40	2428	Beta-246540	Meyer in Tanksley 2008
Terminus Island (UCD 14); near former Western Pacific R.R. tracks	Peat	336	3315	145	3563	GX-02581	Shlemon and Begg 1975
Trench 10, lower 3Ob bedded peat above levee alluvium and burial	Peat	133	3980	40	4463	Beta-246541	Meyer in Tanksley 2008
Trench 3, 4Ab on soil formed in alluvium below peat and above burial	Charcoal	55	4350	40	4921	Beta-246536	Meyer in Tanksley 2008
Trench 5, 2Cu above alluvial flood event	Peat	113	4500	60	5152	Beta-246537	Meyer in Tanksley 2008
Trench 5, 3Ab soil formed in alluvium below alluvial flood event	Plant	125	4900	50	5636	Beta-246538	Meyer in Tanksley 2008
Trench 6, 3ABtkb terrestrial soil below alluvial flood event	Soil, SOC	220	12,310	50	14,263	Beta-246539	Meyer in Tanksley 2008

Notes: All data points are from the Delta and Terminus Tract in San Joaquin County.

Based on these factors, the potential for buried sites in the project area is estimated to be Moderate because the entire project area is located more than 200 meters from the only known historic-era water source, which is White Slough (Figure 1). While the position of White Slough, or other possible stream channels, has likely changed over the past several hundred years or more, the likelihood of there being a prehistoric archaeological deposit buried directly below the project area seem remote, especially since it is relatively small in size.

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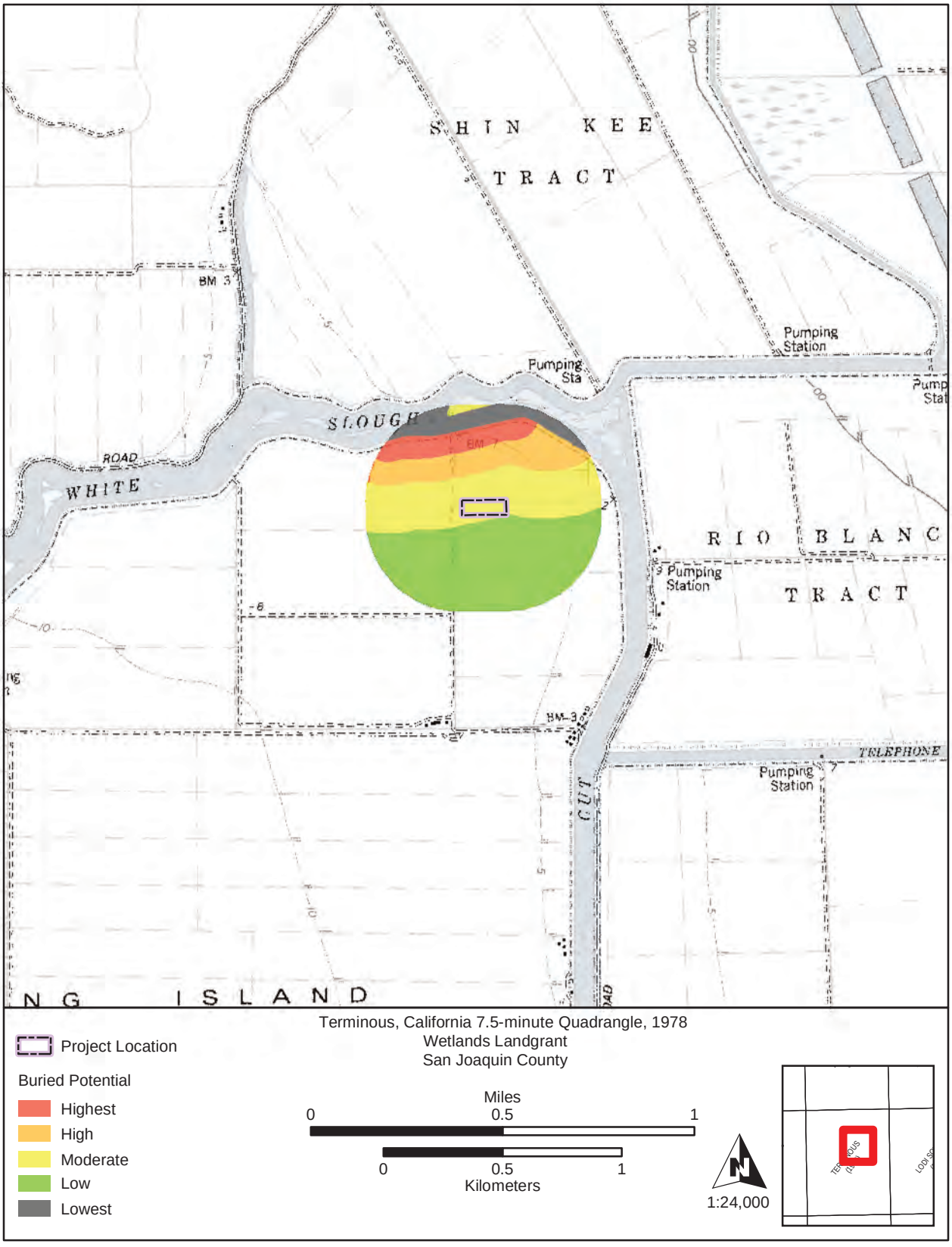


Figure 1. Buried Site Sensitivity along the TSF Facility.

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An examination of a 1939 USGS topographic map indicates that a drainage ditch or irrigation canal was once located in or very near the north side of the project area. Since the depth of this previous disturbance was probably at four to six feet below surface, and the upper two to three feet has been turned over by agricultural cultivation, then it follows that some archaeological materials would be visible if a prehistoric site was located at or near the present ground surface. Thus, the chances of a prehistoric archaeological site to occur at depths of three to five feet appear to be very low within the project area. Further, geotechnical borings indicate the project site is underlain by about 10 to 15 feet of fine-grained sediments (Mid Pacific Engineering 2013:5) that appear to represent wetland deposits. Below this is a deposit of silty clay with brown and gray mottles that may have formed on a terrestrial deposit (i.e., land surface) before the development of the Delta wetlands. Based on this, the potential for encountering a prehistoric site within 10 to 15 feet (3.0 to 4.6 meters) below the present ground surface is extremely low.

Recommendations

Based on the results of this assessment, no further archaeological study or identification efforts are recommended for the project area as currently defined and proposed.

Please do not hesitate to contact me if you have any questions.

Sincerely,



Jack Meyer, M.A., Geoarchaeologist

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APPENDIX B

MONITORING LOGS

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FAR WESTERN ANTHROPOLOGICAL RESEARCH GROUP

NATIVE AMERICAN MONITOR
DAILY LOG

PROJECT/SITE PG&E (CAES) King Island DATE 6·17·14

MONITOR'S NAME Antonio Ruiz Jr

STARTING TIME 7:30am ENDING TIME 4pm

TYPE OF PROJECT

☐ Survey ☑ Test Excavation ☐ Data Recovery ☐ Other STU's

LOCATION OF PROJECT
King Island, Stockton, CA

FINDINGS (note whether items found on surface, in disturbed backfill, in formal unit, etc.)

☐ Flaked stone artifact(s) ☐ Ground/battered stone artifact(s) ☐ Animal bone

☐ Shell ☐ Feature(s) -- describe ☐ Human remains

Other (describe) ☑

- piece of Black plastic - Roots
- piece of Brown glass

NOTES STU's 14 was Dug on 6·16·14 but finished 6·17·14 core sample 60-160cmbs
STU #4 0-40cmbs found some disturbance of black plastic @40cmbs @60cmbs came across a black stripe thought to be from a Rodent or tree Root its at the bottom of the Floor level.
STU # 12 take it to a depth of 80cmbs with a core sample with the hand ogger to a depth of 140cmbs because they hit a Rock and cant get through.
STU # 10 was being Dug and taken to 160cmbs
STU # 2 was being Dug by mikes crew and taken down to 160cmbs
STU # 7 Todds crew goes and digs STU #7
STU # 5 mike crew goes to dig the STU

Rich Soil Rich in Nutrients Soil a Dark black Loam

Signature

6·24·14
Date

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FAR WESTERN ANTHROPOLOGICAL RESEARCH GROUP

NATIVE AMERICAN MONITOR
DAILY LOG

PROJECT/SITE PG&E(CAES) King Island DATE 6·18·14

MONITOR'S NAME Antonio Ruiz Jr

STARTING TIME 7:30am ENDING TIME 4pm

TYPE OF PROJECT

☐ Survey ☑ Test Excavation ☐ Data Recovery ☐ Other STU's

LOCATION OF PROJECT

King Island Stockton, CA

FINDINGS (note whether items found on surface, in disturbed backfill, in formal unit, etc.)

☐ Flaked stone artifact(s) ☐ Ground/battered stone artifact(s) ☐ Animal bone

☐ Shell ☐ Feature(s) -- describe ☐ Human remains

Other (describe) ☑

- Piece of brown glass - Roots
- corn cobb

NOTES Stu unit #5 40cmbs Came across some clay Stops at 60cmbs and oggers the rest of the way 60 - 160cmbs 140-160cmbs hit the water table.
Stu unit #7 Finishing up the paperwork clay from 50-60cmbs Terminated @ 60cmbs because they hit clay 60-80cmbs Auger holed us down to 160cm gray clay Down to 100 cmbs then increase in sand content. hit water table.
Stu unit #8 - we see the same pattern in most of the units here in the orchard field on King Island pad
Stu unit #3 clays to a depth of 80 cmbs and begging to ogger to a depth of 160 cmbs. brown sandy clay loam
Stu unit #13 compact brown to sandy loam, minor Roots.
Stu unit # 11 dark brown silty loam to a light Brown clay pockets of gray oggered to 160cmbs
Stu unit # 15 dark brown to black compacted loam to a sandy loam 60-80cmbs decomposing sandstone @ 80cmbs oggered to a maximum depth of 160cmbs 140-160 - Brown sandy clay mud

Signature 6·24·14 Date

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FAR WESTERN ANTHROPOLOGICAL RESEARCH GROUP

NATIVE AMERICAN MONITOR
DAILY LOG

PROJECT/SITE PG+E KI Ethno Test DATE 6/16/14

MONITOR'S NAME Anthony Burris

STARTING TIME 10^30 am ENDING TIME 4pm

TYPE OF PROJECT

☐ Survey ☒ Test Excavation ☐ Data Recovery ☐ Other _____

LOCATION OF PROJECT

Kings Island

FINDINGS (note whether items found on surface, in disturbed backfill, in formal unit, etc.)

☐ Flaked stone artifact(s) ☐ Ground/battered stone artifact(s) ☐ Animal bone

☐ Shell ☐ Feature(s) -- describe ☐ Human remains

Other (describe) ☐

none

NOTES

4 Test Units were excavated, no Native American Cultural material was recovered

Signature _____ Date 6/16/14

FAR WESTERN ANTHROPOLOGICAL RESEARCH GROUP

NATIVE AMERICAN MONITOR
DAILY LOG

PROJECT/SITE PG+E KI Ethno Test DATE 6/17/14

MONITOR'S NAME Anthony Burris

STARTING TIME 7:30 am ENDING TIME 4pm

TYPE OF PROJECT

☐ Survey ☒ Test Excavation ☐ Data Recovery ☐ Other _____

LOCATION OF PROJECT

Kings Island

FINDINGS (note whether items found on surface, in disturbed backfill, in formal unit, etc.)

☐ Flaked stone artifact(s) ☐ Ground/battered stone artifact(s) ☐ Animal bone

☐ Shell ☐ Feature(s) -- describe ☐ Human remains

Other (describe) ☐

none

NOTES 6 Test Units were excavated, no Native American cultural material was recovered

Signature _____ Date 6/17/14

FAR WESTERN ANTHROPOLOGICAL RESEARCH GROUP

NATIVE AMERICAN MONITOR
DAILY LOG

PROJECT/SITE PG+E KI Ethno Test DATE 6/18/14

MONITOR'S NAME Anthony Burris

STARTING TIME 730 am ENDING TIME 4pm

TYPE OF PROJECT

☐ Survey ☒ Test Excavation ☐ Data Recovery ☐ Other _____

LOCATION OF PROJECT

Kings Island

FINDINGS (note whether items found on surface, in disturbed backfill, in formal unit, etc.)

☐ Flaked stone artifact(s) ☐ Ground/battered stone artifact(s) ☐ Animal bone

☐ Shell ☐ Feature(s) -- describe ☐ Human remains

Other (describe) ☐

none

NOTES

5 Test Units were excavated, no Native American cultural material was recovered

Signature _____ Date 6/18/14

BUENA VISTA RANCHERIA

BVR
1418 20th Street
Sacramento, CA 95811

Telephone: (916) 491-0011
Fax: (916) 491-0012

Daily Cultural Resources Monitoring Form

Project name: PG&E King island

Location and address of project: _____

Cultural monitors name and phone number: Petee Ramirez 688-6848

Date of monitoring: June 16 2014

General summary of activities monitored (list equipment being used, areas and depths of soils removed, color of soil etc:
Unit 1 - Vegitation on top Dark soil

Were any cultural or archeological materials found? YES_____ NO_____
If YES, describe, counts etc

Comments:

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Were any photos taken? YES_____ NO_____

PHOTO NUMBER	PHOTO DESCRIPTION

Cultural Monitor Signature and Date

Petee Ramirez June 16 2014

RJS 7/16/2014

Environmental Resource Director and Date

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BUENA VISTA RANCHERIA

DAILY MONITORING LOG

NAME OF MONITOR: Petee Ramirez

DATE: June 16 2014

TIME	ACTIVITY	COMMENTS
AM 10:30	SAFty Meeting-orientation Meet and greet	MIKE is Lead monitor
AM 11:30	UNIT 1 monitoring	SUN out Light clouds wind from the west
PM 12:30	Taking a 30 Min Lunch	everything is far Need to Bring a Lunch
PM 1:30	UNIT 1 almost complete	soil is the same for UNIT 1 & 9
PM 2:30	UNIT 14	UNITS going fast moving smoothly

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BUENA VISTA RANCHERIA

BVR
1418 20th Street
Sacramento, CA 95811

Telephone: (916) 491-0011
Fax: (916) 491-0012

Daily Cultural Resources Monitoring Form

Project name: PG&E Kings Island

Location and address of project: _____

Cultural monitors name and phone number: Petee Ramirez

Date of monitoring: June 17 2014

General summary of activities monitored (list equipment being used, areas and depths of soils removed, color of soil etc:
STU are dug shovel to bucket. They are going To 80cm then Augering to 140cm. The ground has been Highly disturbed with orchards.

Were any cultural or archeological materials found? YES_____ NO X
If YES, describe, counts etc

Comments:

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Were any photos taken? YES_____ NO_X_____

PHOTO NUMBER	PHOTO DESCRIPTION

Cultural Monitor Signature and Date

Peter Ramirez 6-17-2014

[signature] 6/29/2014

Environmental Resource Director and Date

BUENA VISTA RANCHERIA

DAILY MONITORING LOG

NAME OF MONITOR: Pete Ramirez

DATE: 6-17-2014

TIME	ACTIVITY	COMMENTS
8:00 AM	Stu #12 & #4	
9:00 AM	Stu #12 & #4	
10:00 AM	Stu #12 & #4	
11:00 AM	Stu #12 & #10	
12:00 AM	LUNCH	
1:00 pm	Stu #10 & #2	
2:00 pm	Stu #5 & #7	
3:00 pm	Stu #7 & #5	

BUENA VISTA RANCHERIA

BVR
1418 20th Street
Sacramento, CA 95811

Telephone: (916) 491-0011
Fax: (916) 491-0012

Daily Cultural Resources Monitoring Form

Project name: Kings Island CAES - PG&E - far west

Location and address of project: Kings Island Stockton CA

Cultural monitors name and phone number: Petee Ramirez 209-688-6848

Date of monitoring: June 18 2014

General summary of activities monitored (list equipment being used, areas and depths of soils removed, color of soil etc:
Soils seem to be consistant with other units

Were any cultural or archeological materials found? YES _____ NO ✓
If YES, describe, counts etc

Comments:
The site is located in a walnut orchard for several years with a lot of ground disturbance

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Were any photos taken? YES_____ NO__X__

PHOTO NUMBER	PHOTO DESCRIPTION

Cultural Monitor Signature and Date

Peter Ramirez June 18 2014

RDG 7/10/2014

Environmental Resource Director and Date

BUENA VISTA RANCHERIA

DAILY MONITORING LOG

NAME OF MONITOR: Petee Ramirez EM# 35

DATE: June 18 2014

TIME	ACTIVITY	COMMENTS
7:30 AM	Start UNIT #3 continue UNIT #5	SUNNY 60°
8:30 AM	Monitoring UNIT #5 almost Done	Augering down to 160cm
9:30 AM	monitoring UNIT #8 & 5	#8 = 40-60cm #5 = 40-60 cm
10:30 AM	finishing both UNITS	wind is fluctuating Heat is Rising
11:30 AM	switching from UNIT 11 to 13	going between Both units
12:30 PM	UNIT 13 - 40-60cm UNIT 11 - augering	one more Level and Done. almost Done
1:30 PM	UNIT 13 - 60-80cm UNIT 15 - 0-20	more compacted than previous UNITS Last UNIT

APPENDIX C

UNANTICIPATED DISCOVERY PLAN

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Unanticipated Discovery Plan

This unanticipated discovery plan is for the Pacific Gas & Electric Company (PG&E) project called Compressed Air Energy Storage Compression Testing Project (CAES) located on private property, King Island, San Joaquin County, which is being partially funded by the Department of Energy (DOE).

This plan outlines procedures for the treatment and disposition of human remains, funerary objects, objects of cultural patrimony, ceremonial items and any cultural artifacts, in the event that any are found in conjunction with ground disturbance activities. The plan described herein is consistent with 36 CFR 800.13 Section 106 of the National Historic Preservation Act, Section 7050.5 of the California Health and Safety Code, California Public Resources Code sections 5097.98 and 21083.2, and State CEQA Guidelines Section 15064.5 (e).

Cultural Resource Discoveries

Adhering to 36 CFR 800.13 on Post-Review discoveries:

(b) *Discoveries without prior planning* (3) If the agency official has approved the undertaking and construction has commenced, determine actions that the agency official can take to resolve adverse effects, and notify the SHPO/THPO, any Indian tribe or Native Hawaiian organization that might attach religious and cultural significance to the affected property, and the Council within 48 hours of the discovery. The notification shall describe the agency official's assessment of National Register eligibility of the property and proposed actions to resolve the adverse effects. The SHPO/THPO, the Indian tribe or Native Hawaiian organization and the Council shall respond within 48 hours of the notification. The agency official shall take into account their recommendations regarding National Register eligibility and proposed actions, and then carry out appropriate actions. The agency official shall provide the SHPO/THPO, the Indian tribe or Native Hawaiian organization and the Council a report of the actions when they are completed.

Pursuant to the above, if any potentially significant cultural resources are identified during project activities, all work shall be stopped in the vicinity of the discovery. Dr. Christophe Descantes, PG&E's Cultural Resource Specialist, must be notified immediately by e-mail at chd8@pge.com and by phone at 415-973-1177 or 925-719-2740. In turn, PG&E or its contractor will immediately notify all parties noted on the attached contacts list by telephone and/or e-mail. PG&E shall also provide each contact with a brief description of the identified cultural resource and a location map.

Cultural resources in the region may include:

- *Archaeological materials*: Examples may include, but are not limited to, flaked stone tools (projectile point, biface, scraper, etc.) and debitage (flakes) made of chert, obsidian, shell, etc., groundstone milling tools and fragments (mortar, pestle, handstone, millingstone, etc.), faunal bones, fire-affected rock, dark middens, ceremonial, habitation, and other pit depressions, and human interments, funerary objects, and objects of cultural patrimony.

- *Historic-era resources*: may include, but are not limited to, small cemeteries or burial plots, cut (square) nails, containers or miscellaneous hardware, glass fragments, cans with soldered seams or tops, ceramic or stoneware objects or fragments, milled or split lumber, earthworks, feature or structure remains and trash dumps; artifacts made of glass such as flakes, projectile points, etc. and habitation and ceremonial structures.

Human Remains

The term "human remains" encompasses the physical remains of a body. Funerary objects are those artifacts associated with any human remains. These items, and the soil in an area encompassing up to two (2) feet in diameter around the burial, and other funerary remnants and their ashes, are to be treated in the same manner as the physical remains and fragments of physical remains.

Section 7050.5 of the California Health and Safety Code (CHSC) states that it is a misdemeanor to knowingly disturb a human burial. In keeping with the provisions provided in 7050.5 CHSC and Public Resource Code 5097.98 and if it is determined that NAGPRA applies, if human remains are encountered (or are suspected) during any project-related activity:

- Stop all work within 100 feet;
- Immediately contact a PG&E Cultural Resource Specialist (Christophe Descantes), who will notify all parties noted on the attached contacts list within 24 hours by phone and/or e-mail; all expenses incurred will be covered by PG&E;
- If the remains are prehistoric, the county coroner shall notify the Native American Heritage Commission;
- Secure location, but do not touch or remove remains and associated artifacts;
- Treat all human remains with appropriate respect and dignity;
- Do not remove associated spoils or pick through them;
- Record the location and keep notes of all calls and events; and
- Treat the find as confidential and do not publically disclose the location. Note: PG&E employees and its contractors are instructed to not disclose the location(s) of any cultural resources.

All construction personnel shall follow the attached flow chart that outlines procedures for addressing cultural resource discoveries. Participating Tribes will have monitors on-site to assist with identifying materials that may have spiritual or cultural significance to the Tribes. On-site monitor(s) can provide guidance on appropriate respect and dignity in the treatment of human remains from the Indian perspective, if they so choose.

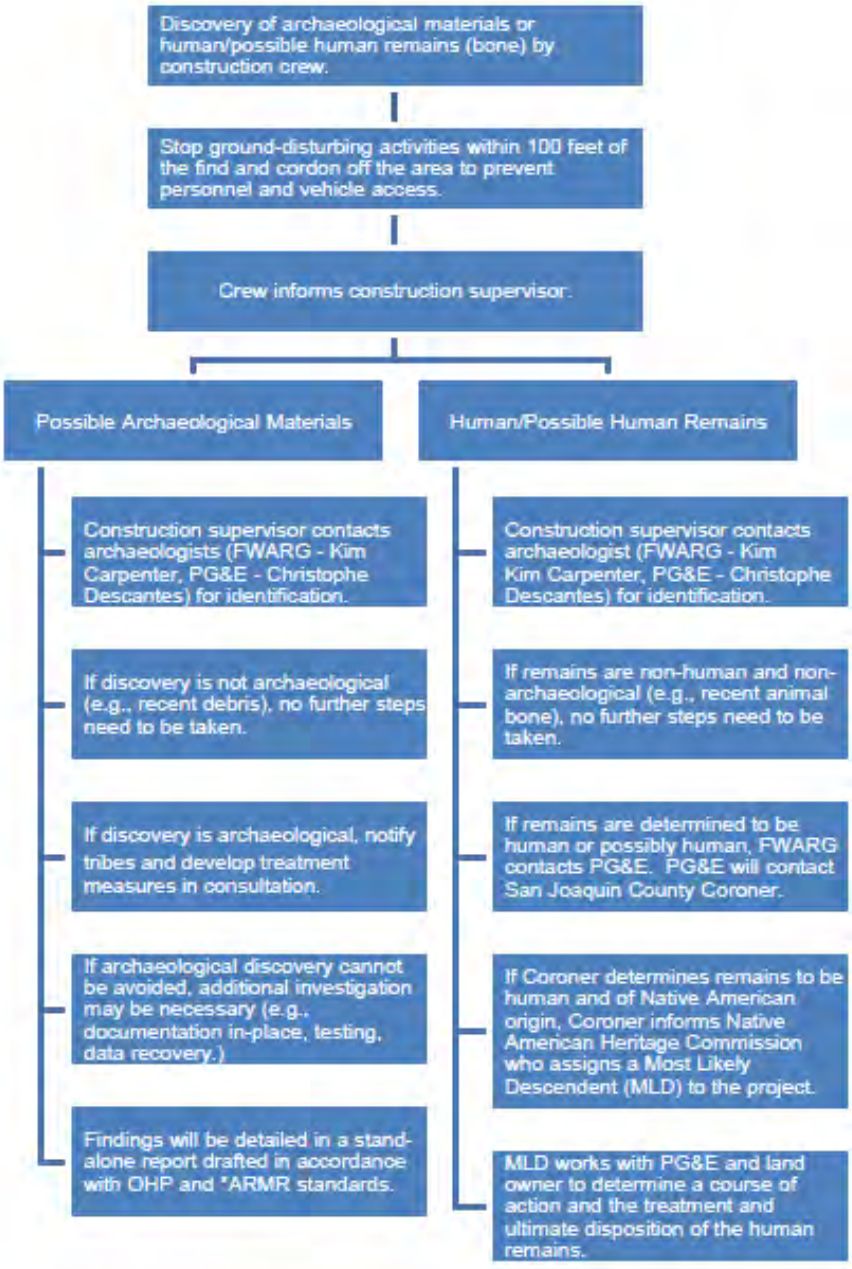
The treatment and reburial of human remains and associated items shall be accomplished in compliance with the California Public Resources Code sections 5097.98 and 21083.2 and State CEQA Guidelines Section 15064.5 (e). If it is determined that NAGPRA applies to the treatment or burial of discovered human remains and associated items, regulations 43 Part 10.13 will be followed from that point in time.

Most Likely Descendant: When an Indian Tribe is designated the Most Likely Descendent (MLD) by the Native American Heritage Commission (NAHC) under California Public Resources Code section 5097.98 for any Human Remains, Associated Funerary Objects and Artifacts found within the boundaries of the Project Area, they shall make recommendations on the treatment and disposition of those remains. The MLD shall complete its inspection within forty-eight (48) hours of receiving notification from either the DOE or PG&E as required by California Public Resources Code section 5069.98 (a). The Parties agree to discuss, in good faith, what constitutes "appropriate dignity" as the term is used in the applicable statutes.

Name	Title	Agency/Tribe	Phone	Address	Email
Roselynn Lwenya, PhD	Environmental Resources Director/THPO	Buena Vista Rancheria of Me-Wuk Indians of California	916-491-0011	1418 20th Street, Suite 200 Sacramento, CA 95811	roselynn@buenavistatribe.com
Rhonda Morningstar Pope	Chairperson	Buena Vista Rancheria of Me-Wuk Indians of California	916-491-0011	1418 20th Street, Suite 200 Sacramento, CA 95811	Rhonda@buenavistatribe.com
Silvia Burley	Chairperson	California Valley Miwok Tribe of California	209-931-4567	10601 N. Escondido Place Stockton, CA 95212	s.burley@californiavalleymiwoktribe-nsn.gov
Anthony Burris	Chairman of Cultural Committee	Ione Band of Miwok Indians	916-455-6808	PO Box 699 Plymouth, CA 95699	anthonyhburris@gmail.com
Randy Yonemura	Member of Cultural Committee	Ione Band of Miwok Indians	916-601-4069	4305 39th Avenue Sacramento, CA 95824	randy_yonemura@yahoo.com
Andrew Godsey	Assistant Director	Shingle Springs Band of Miwok Indians	530-698-1403 530-391-7091	Cultural Resources Department P.O. Box 1340 Shingle Springs, CA 95682	agodsey@ssband.org
Steven Hutchason	Director of Cultural Preservation	Wilton Rancheria	916-683-6000 Ext. 2006	9300 W. Stockton Suite 200 Elk Grove, CA 95758	shutchason@wiltonrancheria-nsn.gov
Ed Carrol	Historian	Office of Historic Preservation (SHPO)	916-445-7006	Dept. of Parks & Recreation 1725 23rd St., Suite 100 Sacramento, CA 95816-7100	Ed.Carroll@parks.ca.gov
Sgt. T. Farnsworth	County Coroner	San Joaquin County Sherriff's Office	209-468-4300	700 Michael N. Canlis Blvd. French Camp, CA 95231	t.farnsworth@sjgov.org
Christophe Descantes, PhD	Cultural Resource Specialist	Pacific Gas & Electric Company	415-973-1177 925-719-2740	245 Market Street -N10A San Francisco, CA 94105	chd8@pge.com
Kim Carpenter	Cultural Program Manager	Far Western Anthropological Research Group	530-756-3941 530-908-3364	2727 Del Rio Place Davis, CA 95618	kim@farwestern.com
Kimberly Nuhfer	Project Manager	Department of Energy	304-285-6544	National Energy Technology Laboratory 3610 Collins Ferry Rd P.O. Box 880 Morgantown, WV 26507-0880	kimberly.nuhfer@netl.doe.gov

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CAES Cultural Resources Discovery Procedures



*Archaeological Resources Management Report

A807: KICP ESLPA FINAL-Volume 1 – Document

Pacific Gas and Electric Company™

PG&E King Island
Compressed Air Energy Storage Project

Volume I: Environmental Siting, Licensing, and Permitting Analysis



May 2015

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Acronyms and Abbreviations

µg/m^3	micrograms per cubic meter
°F	degrees Fahrenheit
3-D	three-dimensional
AB	Assembly Bill
AC	alternating current
ADT	Average Daily Traffic
AERMIC	American Meteorological Society/Environmental Protection Agency Regulatory Model Improvement Committee
AFC	Application for Certification
afy	acre-feet per year
AGC	automatic generation control
AGL	above ground level
ALUC	Airport Land Use Commission
ALUCP	Airport Land Use Compatibility Plan
ALUP	Airport Land Use Plan
ANSI/ASME	American National Standards Institute/American Society of Mechanical Engineers
APCDs	air pollution control districts
APCO	Air Pollution Control Officer
APE	area of potential effect
APN	Assessor's Parcel Number
AQMDs	air quality management districts
ASME	American Society of Mechanical Engineers
AST	aboveground storage tank
BAAQMD	Bay Area Air Quality Management District
BACT	best available control technology
Basin Plan	San Francisco Bay Basin Water Quality Control Plan
BOP	Balance of Plant
BMPs	Best Management Practices
BPIP	Building Profile Input Program
Bscfd	Billion standard cubic feet per day

Btu	British thermal units
Btu/kWh	British thermal units per kilowatt hour
CAA	Clean Air Act
CAES	Compressed Air Energy Storage
CAISO	California Independent System Operator
Cal/OSHA	California Division of Occupational Safety and Health
CalARP	California Accidental Release Program
Cal-OSHA	California Occupational Safety and Health Administration
Caltrans	California Department of Transportation
CARB	California Air Resources Board
CAS	Chemical Abstract Service
CBC	California Building Code
CCR	California Code of Regulations
CCTC	Central California Traction Company
CDC	California Department of Conservation
CDFG	California Department of Fish and Game
CDOGGR	California Division of Oil, Gas and Geothermal Resources
CDPD	Cellular Digital Pocket Data
CEC	California Energy Commission
CEDD	California Employment Development Department
CEMS	continuous emission monitoring system
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
CHP	California Highway Patrol
CHRIS	California Historical Resources Information System
CHWMP	County Hazardous Waste Management Plan
CIWMB	California Integrated Waste Management Board
CNDDB	California Natural Diversity Data Base
CNEL	Community Noise Equivalent Level
CNPS	California Native Plant Society
CO	carbon monoxide
CPM	compliance project manager
CPUC	California Public Utilities Commission

CRS	Cultural Resource Specialists
CTG	combustion turbine-generator
CTG1	Combustion Turbine Project Number 1
CUPA	Certified Unified Program Agency
CVC	California Vehicle Code
CVWS	Central Valley Waste Services
CWA	Clean Water Act
dB	decibels
dBA	A-weighted decibels
DC	direct current
DCS	distributed control system
DEM	Digital Elevation Model
DESCP	drainage, erosion, and sediment control plan
DFM	distribution main feeder
DOF	California Department of Finance
DPM	Diesel particulate matter
DTSC	Department of Toxic Substances Control
DWR	Department of Water Resources
EAF	equivalent availability factor
ECF	Energy Conversion Facility
EJ	Environmental Justice
EMF	electromagnetic field
EPA	U.S. Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act of 1986
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FAR	Federal Acquisition Regulations
FDOC	Final Determination of Compliance
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FMMP	Farmland Mapping and Monitoring Program
FY	fiscal year
GEP	Good Engineering Practices
GHG	greenhouse gas

GO 95	General Order 95
gpm	gallons per minute
GSU	generator step-up
H&SC	Health & Safety Code
HAPs	hazardous air pollutants
HARP	Hotspots Analysis and Reporting Program
HCM	*Highway Capacity Manual*
HHV	higher heat value
HMBP	Hazardous Material Business Plan
HP	high pressure
HPU	hydraulic power unit
HRSG	heat recovery steam generator
HSP	Health and Safety Plan
HWCL	Hazardous Waste Control Law
Hz	hertz
I/O	input/output
I-5	Interstate 5
IFAS	Interconnection Facilities Study
IFR	Instrument Flight Rules
IP	intermediate pressure
ISIS	Interconnection System Impact Study
I/W	Injection/withdrawal
KICP	King Island Compressed Air Energy Storage Project
KOPs	Key Observation Points
kV	kilovolt
L_{dn} or DNL	Day-Night Sound Level
LEA	Local Enforcement Agency
LEC	Lodi Energy Center
LEPC	local emergency planning committee
L_{eq}	equivalent sound pressure level
LGIP	Large Generation Interconnection Procedures
LO/TO	lock-out/tag-out
LORS	laws, ordinances, regulations and standards
LOS	level of service

LP	low pressure
MCCs	motor control centers
MCE	maximum credible earthquake
MEGS	Modesto Electric Generation Station
MEI	maximum exposed individual
MEIR	Maximally Exposed Individual Resident
MEIW	Maximally Exposed Individual Worker
MICR	Maximum Incremental Cancer Risk
MID	Modesto Irrigation District
MMBtu/hr	million British thermal units per hour
MRF	Materials Recovery Facility
MSA	Metropolitan Statistical Area
MSDS	Material Safety Data Sheets
MSHCP	Multi-Species Habitat Conservation and Open Space Plan
MW	megawatts
NAAQS	national ambient air quality standards
NAHC	Native American Heritage Commission
NCPA	Northern California Power Agency
NEC	national electrical code
NEPA	National Environmental Policy Act
NESHAPS	National Emission Standards for Hazardous Air Pollutants
NFPA	National Fire Protection Association
ng/m^3	nanograms per cubic meter
NHPA	National Historic Preservation Act
NHRP	National Register of Historic Places
NIEHS	National Institute of Environmental Health Sciences
NO	nitric oxide
NO_2	nitrogen dioxide
NOI	Notice of Intent
NO_x	nitrogen oxide
NPDES	National Pollutant Discharge Elimination System
NRC	National Response Center
NRCS	Natural Resources Conservation Service
NSPS	Standards of Performance for New Stationary Sources

NSR	New Source Review
O&M	operations and maintenance
OEHHA	Office of Environmental Health Hazard Assessment
OPR	California Office of Planning and Research
OSHA	Occupational Safety and Health Act of 1970
PA	Participating Agency
PAHs	polycyclic aromatic hydrocarbons
PBA	peak bedrock acceleration
PCBs	polychlorinated biphenyls
PCE	Passenger Car Equivalent
PeMS	Freeway Performance Measurement System
PG&E	Pacific Gas and Electric Company
PM_{10}	particulate matter with a diameter less than 10 microns
$PM_{2.5}$	particulate matter with a diameter less than 2.5 microns
PMI	Point of Maximum Impact
ppbv	parts per billion by volume
PPE	Personal Protective Equipment
ppm	parts per million
ppmvd	parts per million by volume, dry basis
PRC	Public Resources Code
PSD	Prevention of Significant Deterioration
psi	pounds per square inch
psig	pounds per square inch gauge
PSMP	Process Safety Management Plan
PTE	potential to emit
Pub. L.	Public Law
RCRA	Resource Conservation and Recovery Act
REL	Reference Exposure Level
Ripon WWTP	City of Ripon Wastewater Treatment Plant
RI-TVI	Radio Interference and Television Interference
RMP	Risk Management Plan
RO	reverse osmosis
RQ	reportable quantities
RTP	Regional Transportation Plan

RWQCB	Regional Water Quality Control Board
S&HC	Street and Highways Code
SARA	Superfund Amendments and Reauthorization Act
SB	Senate Bill
SCADA	Supervisory Control and Data Acquisition
scf	standard cubic feet
SCGT	simple-cycle gas turbine
SCR	selective catalytic reduction
SDWA	Safe Drinking Water Act
SERC	state emergency response commission
SIP	State Implementation Plan
SJCOG	San Joaquin County Council of Governments
SJSO	San Joaquin Sheriff's Office
SJVAPCD	San Joaquin Valley Air Pollution Control District
SO_2	sulfur dioxide
SPCC	Spill Prevention Control and Countermeasures
SPRR	Southern Pacific Railroad
SR 160	State Route 160
SR 4	State Route 4
SR 12	State Route 12
STG	steam turbine generator
STIG plant	NCPA Combustion Turbine Project #2
SVAPCD	San Joaquin Valley Air Pollution Control District
SVP	Society of Vertebrate Paleontology
SWPPP	Stormwater Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TAC	toxic air contaminant
T-BACT	Toxics Best Available Control Technology
TCE	trichloroethylene
TDS	total dissolved solids
TMDL	total maximum daily loads
TMP	Transportation Management Plan
TPQs	threshold planning quantities
TQ	threshold quantity

TSD	treatment, storage, and disposal
TSP	total suspended particulates
UCMP	University of California Museum of Paleontology at Berkeley
UIC	Underground Injection Control
UIW	underground injection well
UPRR	Union Pacific Railroad
UPS	uninterruptible power supply
USACE	U.S. Army Corps of Engineers
USC	United States Code
USDW	Underground source of drinking water
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geologic Survey
VFD	variable frequency drive
VFR	Visual Flight Rules
VHP	very high pressure
VOC	volatile organic compound
WFPD	Woodbridge Fire Protection District
WPCF	Water Pollution Control Facility
WPRR	Western Pacific Railroad
WSWA	White Slough Wildlife Area
ZLD	zero liquid discharge

Preface

This document reviews and discusses the environmental and permitting considerations associated with the construction and operation of a planned King Island Compressed Air Energy Storage Project (KICP). It was prepared to form the basis for the environmental permitting portion of Pacific Gas and Electric Company's (PG&E's) final report to the U.S. Department of Energy, California Public Utilities Commission (CPUC), and California Energy Commission (CEC) which are sources of funding for Phase I of PG&E's CAES feasibility study. In format and content, this document closely follows the requirements for an Application for Certification (AFC) that would be filed by a project developer with the CEC to obtain a site certificate or license to construct and operate the KICP facility. For non-federal permitting, the CEC has sole jurisdiction to license thermal process power plants with nominal generating capacity greater than 50 megawatts in California.

However, this document is not an AFC, does not meet all of the requirements of an AFC, and is not suitable for filing as an AFC as it is. Certain studies and analyses required for an AFC have not been conducted as part of the effort to prepare this document. This is, in part, because some field studies and analyses would be out of date by the time a project developer were selected to license and construct the project. In addition, a future developer may choose to change some of the base case design and/or siting elements for their final project configuration.

For example, emissions inventory/analysis is included in this document, but air dispersion modeling analysis and human health risk assessment based on meteorological data are not, because the modeling data are continually updated and the air dispersion analysis results are highly dependent upon specific design elements such as stack location and height. Also, although biological surveys have been conducted for all project elements, it may be necessary to redo some or all of these studies, assuming that final project development and license application takes place more than one year after the studies reported here were conducted, because some of the studies would not be accepted by the CEC and regulatory agencies if they are more than a year old. It will be the responsibility of the project developer to prepare a complete and data-adequate AFC based on updated studies and analyses and the developer's final project design at the time the AFC is filed in order to obtain a CEC license to construct and operate the facility.

The project development scope described in this document represents PG&E's base case project developed as part of its feasibility study, encapsulating assumptions and design elements considered by PG&E and its consultants to be the most feasible project. Those assumptions are identified and referenced in various companion documents. It is understood that potential project developers will have their own assumptions and preferences for design elements, and may use this document as a starting point in conducting their due diligence. This document discusses potential or likely environmental effects, mitigation measures, and permits required if PG&E's base case project was implemented, and includes discussion of the permitting impacts associated with selected departures to those assumptions.

Further, the focus of this document is to identify and assess environmental and socioeconomic permitting aspects of the KICP. Separate documents provide information about the geology of the air reservoir and the modeling studies of reservoir behavior, engineering design considerations, geotechnical investigations, information needed for permitting the underground injection wells, and related matters. In addition, although this document includes a narrative project description and selected engineering drawings, the engineering design documents take precedence over the narrative for engineering matters. Though this document may be useful for future due diligence by interested parties, it is the responsibility of the user to verify the information provided here for use in preparing a future AFC and related permitting documents.

Executive Summary

Pacific Gas and Electric Company (PG&E) has developed a preliminary design and acquired various land rights for a compressed air energy storage (CAES) facility, the King Island CAES Project (KICP), at a location near Stockton, San Joaquin County, California. The KICP would provide the capability to store energy in the form of compressed air and to later retrieve the energy for power generation from an energy conversion facility (ECF) rated at a gross nominal generating capacity of up to 316 megawatts (MW)[1]. Compressed air would be piped from the ECF and stored in a depleted natural gas reservoir until it is needed.

This Environmental Siting, Licensing, and Permitting Analysis (ESLPA) includes a description of the KICP as currently designed and sited. It also includes analyses of the project design in relation to the 16 sociological and environmental disciplines that are covered in a standard Application for Certification (AFC) before the California Energy Commission (CEC) to license a thermal power plant with a nominal generating capacity of more than 50 MW. The ESLPA also includes a summary report (Appendix 2A) analyzing the United States Environmental Protection Agency (EPA) Underground Injection Control (UIC) Permit process/requirements applicable to injection of fluids into underground porous rock formations for storage or disposal.

Project Objectives

CAES is potentially a very important and useful energy storage technology because, if technically and economically viable, it would allow for a relatively large amount of energy capacity to be stored and released and does so relatively efficiently. Storage makes good use of renewable, and other power generated at times when it may not be needed to serve customer loads (for example, wind power generated during the nighttime). The stored energy can be used for grid support while also preventing the curtailment of renewable energy resource production during periods of low customer load. CAES can also provide operational flexibility in the form of ancillary services to the grid because it is capable of starting quickly (full load within 10 minutes of a notification to start), ramping up and down rapidly, and operating at part load with low efficiency loss. For these reasons, CAES is a very promising technology as a modern grid management tool to meet the increasing demands of changing grid operations.

The federal Department of Energy (DOE) funding was provided to PG&E's CAES program through the DOE National Energy Technology Laboratory's (NETL) Smart Grid Initiative. The goal of this program is to accelerate the transition of the electrical grid system in the U.S. to an updated, secure, and efficient system using a variety of technologies, including energy storage. Funding was also provided by the California Public Utilities Commission (CPUC) and the CEC.

The key objective of the KICP is to provide up to approximately 300 MW and 3,000 MWH/day of energy storage capacity and ancillary services support capability to the electrical grid controlled by the California Independent System Operator (CAISO). An important and unique part of this objective is to demonstrate understanding and experience with the CAES technology using a depleted natural gas field as an air storage reservoir.

[1] Targeted facility output with both expansion turbines operating at 100% load at International Standards Organization (ISO) conditions (15° C, 65% relative humidity, and ambient pressure at sea level).

Project Location

The KICP ECF would be located in unincorporated, rural San Joaquin County, California, on a 20.3-acre site (the ECF site) owned by the City of Lodi and located within the Lodi city limits. The ECF site is presently an irrigated agricultural field near the intersection of Interstate 5 (I-5) and North Thornton Road, north of the City of Lodi's White Slough Water Pollution Control Facility (WPCF). Existing surrounding land uses include the City of Lodi's wastewater treatment ponds and the Northern California Power Agency's (NCPA) Lodi Energy Center (LEC), a combined-cycle power plant to the south and Steam Turbine Injection Gas Turbine facility (STIG), a simple-cycle, power plant adjacent to the LEC; agricultural fields to the west and north and, about 0.6 mile to the west, a unit of the California Department of Fish and Wildlife's (CDFW) White Slough Wildlife Area, which is used for hunting and habitat preservation. The nearest urban/suburban areas are Stockton, about 2.5 miles to the south, and Lodi, about 4.9 miles to the east and northeast.

The compressed air energy storage reservoir is a nearly depleted gas field located on King Island, San Joaquin County, about 2 miles southwest of the ECF site, at a depth of about 4,700 feet below surface. King Island consists of agricultural land, surrounded by levees, in the Sacramento-San Joaquin Delta area. Originally a marshy area between sloughs, it was reclaimed into an island by the excavation and construction of levees to create Bishop Cut on the east and Honker Cut on the west, navigation channels that connect White and Disappointment sloughs.

Project Description Summary

The KICP would store energy in the form of compressed air for later release to generate electricity. The project would use electric-powered compressors to compress air and move the air through a pipeline to the underground air storage reservoir in the King Island natural gas field. When additional power or ancillary services are needed to meet the CAISO system needs, air would be released from the reservoir, heated via natural-gas-fired combustors, and used to drive turbo-expander units coupled to a generator to generate electricity for grid use.

Principal elements of the PG&E base case project include the following design features:

- ECF/power island site for the turbo-machinery including air compressors, natural gas compression, turbo-expanders, generators, switchyard, and cooling equipment; 20 acres
- Underground storage injection and withdrawal (I/W) wells and equipment at two well pads, hydrocarbon monitoring/control equipment, control building, and water storage tank
  - West well pad, 6 acres, 20 to 25 air I/W wells, 2 water withdrawal wells, up to 1 water injection well
  - East well pad, 4 acres, 5 to 10 air I/W wells, 2 water withdrawal wells, 1 water injection well
- Underground compressed air pipeline, ECF to east well pad; 2.6 miles
- Air collection pipeline (east well pad to west well pad); 0.3 mile
- Natural gas pipeline to convey fuel to the ECF from a PG&E distribution feeder main (DFM); 1.4 miles
- Generator tie-line connecting the ECF to the existing Gold Hill-Eight Mile 230 kV transmission line circuit; 270 feet
- Recycled cooling water supply pipeline from the City of Lodi's WPCF; 0.3 mile

Process Description – ECF/Power Island

For the compressed air storage mode of operation, the KICP would use two Dresser-Rand CAES compression trains, each consisting of a multi-stage compressor section driven by a dedicated 137 MW (nominal rating) electric motor. Each compression train would be capable of producing approximately 400 pounds per second of air at a compressor outlet pressure of up to 2,720 pounds per square inch absolute (psia).

For the generation mode of operation, the plant would consist of two turbo-expander-generator trains, each rated at 158.3 MW. At maximum compression load, the facility would consume up to 274 MW of energy, while at maximum generator output the facility would produce approximately 316 MW gross.

During periods of low power demand, excess or low-cost energy supplied to the grid by base-load facilities, renewable energy sources (wind or solar), or other resources would be used to drive the compressor trains, pumping compressed air into the reservoir for storage. The compressor trains are intercooled to reduce power-consumption requirements and after-cooled to reduce the compressed air's temperature prior to injection into the underground storage reservoir, using a standard, 10-cell mechanical draft cooling tower.

The KICP reservoir would operate over a wellhead pressure range of approximately 1,900 to 2,830 psia (static pressure range). When fully charged, the reservoir could support approximately 5 weekdays at 10 hours of generation per day at full rated output with recharging for 6 hours daily on weekdays and 20 hours on weekends; alternately, the reservoir has the capacity to support 7 days/week of generation at full rated output if the reservoir is charged for approximately 10 hours/day.

During periods of peak/intermediate power demand, the stored, compressed air would be released from the reservoir, preheated in a recuperator, and then expanded through the reheat-turbo-expander train. At maximum generator output, approximately 400 pounds per second of air per train from the reservoir header would pass through the recuperator, where the air would be preheated to a temperature of 630°F. The recuperator would reclaim the low pressure expander's exhaust heat, reducing the generation heat rate by approximately one third. A very high pressure (VHP or HHP) expander would be used as a topping turbine to provide power above what the LP and HP expanders can provide and to provide a mechanism to extract energy while reducing pressure to the inlet design point of the HP expander.

Process Description – Storage Reservoir and I/W Well Field

The compressed air storage reservoir is an underground geological structure located approximately 4,700 feet below the surface of King Island, approximately 2.5 miles southwest of the ECF site. The reservoir is a nearly depleted natural gas field that has been used for gas production from October 1985 to the present. All gas production from this field would have ceased prior to KICP commissioning, making the structure available for CAES. The project design includes two well pads, 6 and 4 acres in area, respectively. Each well pad would also have a control building, hydrocarbon monitoring and control system to manage residual natural gas return from the I/W wells, and a produced water storage tank. Under base case assumptions, the west well pad would be 6 acres in size, have 20-25 air I/W wells, 2 water withdrawal wells, and up to one wastewater injection well. The east well pad would be 4 acres in size, have 5-10 air I/W wells, 2 water withdrawal wells, and one wastewater injection well.

Compressed air pumped through the air pipeline from the ECF would be injected into the storage reservoir at the well pads. When needed for energy production, air would be released from the reservoir, stripped of produced water, and monitored for excess hydrocarbons, in route to the ECF through the pipeline.

Venting, purging, and cleaning systems will be installed for the air-pipeline for use during normal operations.

In addition to various other federal, state and local permitting processes discussed below, injection of both wastewater and air into the reservoir would be subject to UIC regulation by the United States Environmental Protection Agency (EPA) to support the operation of the KICP. These permits would not come under direct CEC jurisdiction because they would be federal permits, but any significant environmental issues raised in the UIC permitting process will likely be examined through the AFC process and the KICP CEC license would likely include a requirement to obtain the UIC permits and provide copies to the CEC.

Water Withdrawal and Disposal

Modeling runs and related development analysis have shown that building an 8 to 10 Bcf bubble in approximately one year would be feasible. Building the bubble in this time frame would require the physical removal of some water from the reservoir. The removed water would be re-injected into EPA-permitted injection wells completed to zones deeper than potable underground sources of drinking water (USDW) and the air storage reservoir. In the vicinity of King Island, the Starkey formation is deeper than the USDW and would not interfere with the air storage operations in the Mokelumne River formation. Disposal of produced waters into the Starkey formation would require disposal wells, tankage for temporary storage, properly sized pumps for this purpose, and the interconnecting piping between the equipment location and the disposal well site at each well pad.

In addition to the need to dispose of water withdrawn from the storage reservoir during the bubble build period, it will be necessary to dispose of waters produced during normal operations. Reservoir modeling has indicated an estimated 5,000 Bbl/day of water could be produced and separated from the air flow stream during normal withdrawal operations (and up to 2.5 times that amount during the first 6 months of operation). This produced water would, along with any ECF wastewater, be disposed of in the wastewater injection wells as described above. Appendix 2A is a permitting analysis for the UIC Permit and discusses produced water in greater detail.

Compressed Air Pipeline

A 30-inch-outside-diameter bi-directional pipeline would be constructed to convey compressed air from the ECF compressors to the well field/reservoir and back from the well field to the ECF turbo-expander/ generation equipment. The air pipeline design would include cathodic protection, blow-down valves that would be silenced as necessary, condensate traps/drains to manage water dropout as the air cools in the pipeline, and pipeline “pigging” equipment for maintenance.

Major Electrical Equipment and Systems

The bulk of the electric power produced by the facility would be transmitted to the electrical grid through a 230-kV connection to PG&E’s 230 kV Gold Hill-Eight Mile Road transmission line. Power from the facility would flow through a 230-kV generator tie-line from the facility switchyard to the transmission line. Electric power would be used onsite mainly to drive the compressors, but also for minor uses to power auxiliaries such as pumps and fans, control systems, and general facility loads including lighting, heating, and air conditioning.

Environmental Considerations

This document addresses sixteen areas of possible environmental effects of the project, pursuant to the requirements set forth in existing environmental laws and the CEC's regulations. Detailed descriptions and analyses of these areas are presented in Sections 5.1 through 5.16. This executive summary highlights, by discipline, the most important environmental licensing and permitting issues that have come to the foreground during an environmental effects analysis of the project.

Air Quality

The KICP project is located in the San Joaquin Valley Air Basin (SJVAB), for which the air quality permitting authority is the San Joaquin Valley Air Pollution Control District. The SJVAB is in attainment of the National Ambient Air Quality Standards except for 8-hour ozone (extreme) and annual and 24-hour PM_{10} (moderate). The basin is in attainment of the California Ambient Air Quality Standards except for 1-hour and 8-hour ozone, annual and 24-hour PM_{10} and annual $PM_{2.5}$.

The KICP would be required to apply for an Authority to Construct (ATC) permit in accordance with SJVAPCD Rule 2010. A complete application for an ATC would be filed with the SJVAPCD prior to submittal of the complete AFC to the CEC. The permit application would include meteorological modeling of emissions from the proposed KICP using meteorological data from existing monitoring stations certified by the SJVAPCD. Suitable data for most of the criteria pollutants is available for the KICP's location from the monitoring station located at 1593 East Hazelton Avenue in Stockton. The nearest monitoring station for SO_2 is the Bethel Island monitoring station, located at 5551 Bethel Island Road in Bethel Island.

Criteria pollutant and greenhouse gas (GHG) emission rates were calculated for the operational phase of the project, evaluating turbo-expander performance at International Organization for Standardization (ISO) and off-ISO conditions. Potential to Emit (PTE) maximum annual emissions of VOC, NO_x, CO, SO_2, PM_{10}, and $PM_{2.5}$ were estimated, based on expected operations, excluding startups, shutdowns, and commissioning, assuming an operation schedule of 5 days per week, 10 hours per day.

The emissions analysis showed that the KICP would be required to provide emission offsets for NO_x emissions, based on its projected annual emissions of 12 tons per year (tpy), compared with the offset threshold of 10 tpy. Emission offsets would be provided at an offset ratio of between 1 and 1.5 to 1, depending upon the distance between the source and the offset location. The SJVAPCD's offset bank currently appears to hold sufficient credits for NOx and other pollutants for future growth. Approximately 31 tons of NOx credits are currently available at prices of $40,000 to $50,000 per ton. For Clean Air Act permitting, offsets would not be required for other pollutants.

Note that the quantity of offsets required is likely to change based on the incorporation of KICP startup, shutdown, and commissioning emissions estimates. Therefore, a full offsets analysis would be required during the CEC licensing process. In addition, offset pricing may change from current levels.

Greenhouse gas (GHG) emissions for normal facility operations were calculated based on the maximum fuel use predicted for the KICP. GHG emissions would be required to be offset at the state level through CARB's GHG auction mechanism.

Based on the SJVAPCD's rules, a Best Available Control Technology (BACT) analysis is required for the uncontrolled emissions of NO_x, VOC, CO, SO_2, PM_{10}, and $PM_{2.5}$. The proposed BACTs for these pollutants are as follows:

- NO_x – Use of low NO_x combustors with water injection and SCR to control NO_x emissions to 2 ppmvdc (1-hour average)
- CO – Best combustion design and the installation of an oxidation catalyst system to control CO emissions to 2 ppmvdc (1-hour average)
- VOC – Best combustion design and the installation of an oxidation catalyst system to control VOC emissions to 1 ppmvdc (1-hour average)
- $PM_{10}/PM_{2.5}$ – Best combustion practice, use of pipeline-quality natural gas, and use of inlet air filtration to control $PM_{10}/PM_{2.5}$ emissions to 2.0 pound(s) per hour (lb/hr)
- SO_2 – Exclusive use of pipeline-quality natural gas with a fuel sulfur content of less than 0.75 grain per 100 scf

It is expected that the KICP emissions would not interfere with the attainment or maintenance of the applicable air quality standards; however, this would be confirmed through modeling performed as part of the licensing process. Because the SJVAB is currently a non-attainment area for state PM_{10} and state and federal $PM_{2.5}$ ambient air quality standards, any increase in PM_{10} or $PM_{2.5}$ emissions has the potential to exacerbate existing violations. The project owner would provide PM_{10} and $PM_{2.5}$ offsets to mitigate the impact of the emissions increase. Based on the expected project emissions and the ERC requirements of the SJVAPCD, it is expected that the project ERC cost would be in the range of $30,000 to $120,000 at current market prices, based on information publicly available through the SJVAPCD.

Biological Resources

The project area is located within the "Delta Islands," subarea of the Sacramento-San Joaquin Delta area. These are areas of former marshlands of the Sacramento–San Joaquin Delta that were historically reclaimed for agricultural use by the construction of levees/dikes and draining. The majority of the land is in agricultural production. Land not in active cultivation is used for irrigated pasture for livestock production. Vegetation communities within the project area include annual grassland, fresh emergent wetland, orchard/vineyard, open water, ruderal, and valley foothill riparian.

Field Surveys

Biological field surveys to identify sensitive biological resources within the KICP project area focused on potential special-status plant and animal species and their habitats. Evidence of sensitive wildlife species observed during the surveys included cliff swallow, Swainson's hawk (nests) and western pond turtle.

Botanical surveys of the project area were conducted during the spring during the appropriate blooming period for special-status plant species with potential to occur in the project area. Botanical surveys did not detect any special-status plant species and these species are not expected to occur within the project area.

A reconnaissance-level survey for potential waters of the United States within the project area was also conducted. Potential waters of the United States occur as irrigation canal, open water, riparian wetland, vegetated ditch, wetland swale, and non-vegetated ditch.

Special-Status Species

Twenty-one special-status wildlife species have the potential to occur in the project area.

Fish—Most of the nine special-status fish species present near KICP would not be affected by day-to-day operation of the project but could be impacted by construction activities that involve horizontal directional

drilling (HDD) under major water bodies such as Bishop Cut and White Slough and therefore raise the possibility of 'frac-out' or leakage of bentonite drilling mud into the water body during drilling.

This potential for impacts on special-status fish due to HDD frac-out would be temporary and would only be a threat during drilling activities under the water bodies. Implementation of avoidance and minimization measures including development of a HDD Fluid Release Contingency Plan would mitigate these potential effects. No operational impacts are anticipated.

Reptiles—Project construction and operation activities have some potential to adversely impact the federal- and state-threatened giant garter snake (*Thamnophis gigas*). The potential for impact is also seasonal and depends on the giant garter snake activity period in which the work would be conducted. Giant garter snakes are typically limited to aquatic habitat with some basking on the banks during the active period (May 1 through October 1). During the inactive period (October 2 through April 30), giant garter snakes seek refuge in upland cover types such as rodent burrows, debris piles, riprap, and other types of refugia generally within 200 feet of aquatic habitat.

Fresh emergent wetlands associated with White Slough Wildlife Area and irrigation ditches and canals present throughout the project area generally provide low to moderate quality habitat for giant garter snake.

Impacts from construction activities in proximity to giant garter snake aquatic habitat are anticipated to occur over one construction season, less than one year. Potential construction impacts on this species could be avoided by adopting avoidance and mitigation measures that involve fencing of sensitive areas, seasonal avoidance measures, and monitoring. No operational impacts are anticipated.

Amphibians—Project construction and operation activities have the potential to impact the western pond turtle (*Emys marmorata*), a state species of concern. Western pond turtles have been observed in White Slough and near the ECF site. White Slough, Bishop Cut, wetted irrigation ditches and canals provide aquatic habitat. Uplands adjacent to aquatic habitat provide upland nesting habitat. During field surveys, western pond turtles were observed in White Slough outside the northwest portion of the project area and in an irrigation ditch on the east side of the project area. Potential impacts to this species could be avoided by adopting avoidance and monitoring mitigation measures.

Birds—Five special-status avian species have a moderate to high likelihood to occur in the project area. Swainson's hawk nesting and foraging habitat is present within and adjacent to the project area. Isolated trees may provide nesting habitat and agricultural land cultivated in annual or perennial low growing crops provide foraging habitat. Two potential nests were observed during the reconnaissance surveys relatively near project facilities and a nesting pair was observed near King Island during the compression testing phase.

Noise generated during construction could affect Swainson's hawks if active nests are located within 0.25 mile of the survey area. The project would convert farmland (i.e., that provides foraging habitat) to industrial use, which would result in the permanent loss of approximately 20 acres of crop land foraging habitat at the ECF site. Regulatory agencies would require compensation for the foraging habitat. Measures to avoid impacts on Swainson's hawks include preconstruction survey, construction buffers, habitat avoidance, and monitoring.

Measures to avoid impacts on Swainson's hawks include removal of vegetation outside the nesting season, preconstruction survey (CDFW may require protocol-level surveys), construction buffers and/or limited operating periods.

The potential to impact the other species would be relatively low, would be similar to that of the Swainson's hawk, and the mitigation measures would be the same as or similar to those applicable for the Swainson's hawk.

Mammals—Western red bat (*Lasiurus blossevillii*) has moderate potential to occur in riparian habitat in the White Slough wildlife area. This species would not be affected by construction or operation of the project as long as removal of roost trees is avoided.

Rare Plants—As stated above, special-status plants were not identified during botanical surveys.

Wetlands and Waters of the United States

Field surveys indicate that wetlands and waters of the United States are not present at the ECF site or its laydown areas. Potential waters of the United States are present between the West and East Well pads, Bishop Cut, and the White Slough WA. Using jack and bore, and HDD construction techniques, the air pipelines connecting the ECF with the well pads could avoid wetlands and waters of the United States.

San Joaquin County Multi-Species Habitat Conservation Plan (SJMSCP)

Although the CEC would be lead agency for the project, the project owner may seek coverage under the SJMSCP for most of the state-or federal-listed species. The SJMSCP provides coverage for effects on federally and state-listed species with implementation of certain prescribed avoidance and minimization measures and mitigation fees are assessed for habitat loss on a per-acre basis.

The SJMSCP would not cover the anadromous fish species under jurisdiction of the National Marine Fisheries Service (NMFS) and also may not cover the giant garter snake, due to the proximity of the project to White Slough Wildlife Area. Any effects on these species would need to be addressed through separate processes, such as Federal Endangered Species Act Section 7 consultation and the California Department of Fish and Wildlife Section 2081 Incidental Take Permit process.

Cultural Resources

PG&E conducted a literature search of the KICP project vicinity and intensive pedestrian survey of the project footprint. According to the results of the record search at the California Historical Resources Information System and other sources, a total of eight cultural resources features have been identified within the project area or in the vicinity. The waterway known as Bishop Cut is the only previously documented cultural resource located within the project area. This feature does not meet the criteria for listing in the National Register of Historic Places or California Register of Historical Resources. Archaeological sensitivity of the ECF and linears is considered moderately low and sensitivity of the well pad sites is considered low.

PG&E conducted an intensive archaeological survey of the project area, recording five isolated artifact finds, one 1960s era livestock corral, and a recent (20th Century) refuse dump. None of these properties appear to meet the criteria for listing in the National Register of Historic Places or California Register of Historical Resources. Similar negative results were noted during surveys conducted in conjunction with the core well drilling and compression testing phases of the project. The project would therefore not affect known significant archaeological or historic resources.

Geological Hazards and Resources

The project site is in an area of relatively flat topography typical of the California Central Valley and gently slopes to the west. Surficial geology at the project site consists of Quaternary Modesto Formation deposits

of undifferentiated alluvium and dune sand, forming a toe of Mokelumne alluvial fan, generally covered by Holocene intertidal deposits. The ECF site has been mapped as being underlain by the undivided lower member of the Modesto Formation, and the well pad area has been mapped as Modesto Formation, undivided. Groundwater at the ECF has been detected at depths ranging from approximately 7 to 9 feet below ground surface. Groundwater at the well pad sites is maintained at a level of approximately six to eight feet below surface by a system of agricultural drains.

Active faults (within Holocene time) within 50 miles of the KICP site include Concord-Green Valley, Greenville, Los Positas, Calaveras, and Hayward. These faults are capable of generating maximum credible earthquake (MCE) moment magnitudes up to 7.3. These fault zones represent a significant seismic hazard to the project site. No active faults have been mapped crossing the project site and the site is not within an Alquist-Priolo Special Studies Zone.

Geologic hazards are rated as follows for the project facilities:

- **Seismicity**—If a large earthquake were to cause a rupture to the buried compressed air pipeline, the public could be exposed to hazards associated with sudden release of highly compressed air.
- **Liquefaction**—Hazard of liquefaction is considered moderate, based on the soils present at the ECF and wellpads and the risk of a major earthquake.
- **Mass wasting**—Because the site is relatively flat and no significant excavation is planned during site construction, the potential for direct impact from mass wasting at the site is considered low to negligible.
- **Subsidence**—The potential for subsidence as a hazard that could affect the project site is considered low.
- **Expansive Soils**—The KICP site lies in an area where the potential for expansive soils to be present is high.
- **Flooding**—The potential for a 100-year flood event to impact the ECF site is medium to high. Although the King Island gas field is protected by levees, it is possible that the levees would fail during catastrophic storm, flood, or seismic conditions.

There are no known geologic resources of recreational or scientific value at the project site or in the project vicinity. Two active producing gas wells are located on King Island (Citizen Green 1 and Piacentine 1-27). Although numerous wells have been drilled within 2 miles of the KICP, most are now labeled as “plugged and abandoned – dry hole” according to the California Division of Oil, Gas and Geothermal Resources (CDOGGR) maps.

Hazardous Materials Handling

The KICP would use hazardous materials both during construction and during project operation. Most of the hazardous materials that would be used for the project are required for facility operations such as air pollution control, and maintenance, such as lubrication of equipment, or would be contained within transformers and electrical switches. The only regulated substance that would be used for the project at quantities larger than the federal Threshold Quantity is aqueous ammonia.

The KICP facility would use aqueous ammonia, stored in a single stationary aboveground storage tank. The tank would be surrounded by a secondary containment structure capable of holding the full contents of the tank and accumulated precipitation. The aqueous ammonia storage tank would be equipped with a

continuous tank level monitor, automated leak detection system, temperature and pressure monitors and alarms, and emergency block valves.

If the aqueous ammonia solution were to leak or be released without proper controls, the ammonia in solution could escape or evaporate as a gas into the atmosphere. Ammonia gas can be toxic to humans at sufficient concentrations. The CEC licensing process requires an off-site consequences modeling analysis demonstrating that in the event of a catastrophic release of ammonia at the site, concentrations in air of ammonia would not exceed 75 ppm at the facility fence line.

Compressed air will be withdrawn from a depleted gas field. As a result, it is possible that, during the early operation period of the facility's lifecycle, small quantities of native natural gas may be entrained with the compressed air. The gas concentrations in the withdrawal air will be continuously monitored at each well and the gathering pipe. The levels will be limited to a concentration determined by formal HAZOP analysis to be performed during the detailed engineering and design effort. Predictive modeling has indicated this level would peak at approximately 3.0 percent in year one and reduce to below 1.5 percent by year 3. The results of the air injection test and the measured levels of gas detected in the air withdrawal stream will be available later in 2015. Continuous gas monitoring will take place along the compressed air pipeline and at the ECF site. As a precautionary measure the air pipeline will be designed with the ability to be purged prior to start-up of the turbo-expansion system. In addition, venting from the I/W wells may occur annually for testing. Based on these design precautions, there would be no significant hazards posed to the public or KICP workforce from any entrained gas.

Land Use

The KICP ECF site is currently agricultural land and open space. The ECF and staging area west of the ECF are currently corn fields, and the well pads are located within orchards. The area in the project vicinity is developed primarily into agricultural land uses with rural residences, I-5 and local roadways, and irrigation canals. There are no schools, churches, child care/day centers, parks and recreation centers, or historic areas within one mile of the proposed site.

The ECF site is located on lands designated as Unique Farmland. The well pads, air collection pipeline, and 12-kV service line are in locations designated as Prime Farmland. The main ECF site and east well pad are not under Williamson Act (agricultural tax preserve) contract. The west well pad is located on a parcel under Williamson Act contract. While natural gas extraction activities are considered a permitted use of properties under Williamson Act contract, it is uncertain how the proposed project facilities will be considered by San Joaquin County. If contract cancellation by the County is required for the 6-acre well pad area, mitigation may be required for the conversion from agricultural to non-agricultural use.

The zoning designation for the ECF site is Community Facility. A power plant and its linears are allowable uses in the City of Lodi's Public and Community Facility (PF) zoning designation. Therefore, the project would be consistent with the City of Lodi Zoning designations for the project. In licensing the LEC, the CEC found that "The PF zoning district applies to areas suitable for public land uses, and allows power plants and gas pipelines under the category of 'Utility Facility.'"

The well pads and linears are located within unincorporated San Joaquin County in areas that are designated in the General Plan for General Agriculture. The permanent well pads are allowable on General Agricultural designated land as long as they satisfy the San Joaquin County General Plan's criteria for the preservation of agricultural lands and compatible uses. The County zoning designation for these areas is

also General Agriculture. Minor utility services are a permitted use in the General Agriculture zone; major utility uses are permitted subject to site approval (conditional use permit) in the General Agriculture zone.

Noise

The KICP main sources of noise will be the equipment at the ECF. Sources of noise at the ECF site will include the air compressors, turbo-expanders, natural gas compressor, cooling tower fans, and pumps. Some equipment noise would be taking place most times of the day, with air compression and injection taking place potentially during the off-peak nighttime and early morning hours and air withdrawal and turbo-expander power generation potentially during the on-peak morning, afternoon, and evening hours. Actual operation of the equipment will depend upon system conditions and needs.

There are three residences located approximately 0.5 mile to the north of the power plant site on the opposite side of I-5; these are the closest sensitive noise receptors. There are approximately a dozen residences located further north along West Kingdon Rd. between 0.75 mile and 1 mile from the project site.

The City of Lodi's noise ordinance is nuisance-based and prohibits noise which increases the local noise more than 5 dBA over ambient between 10 pm and 7 am at the property line of any residential property. The San Joaquin County Development Regulations establish daytime (7 am to 10 pm) hourly average and maximum limits of 50 and 70 dBA respectively and nighttime (10 pm to 7 am) hourly and maximum levels are 45 and 65 dBA respectively.

The CEC noise impact analysis process generally starts with the ambient noise level during the four quietest nighttime hours at the nearest sensitive receptor. An increase over this level of less than 5 dBA attributable to the project would not be considered significant and an increase of greater than 10 dBA would be considered significant. An increase of 5 to 10 dBA may or may not be significant, depending on the circumstances. The CEC will require a 25-hour ambient noise survey at nearby sensitive receptors and a modeling analysis to determine the levels of attenuation required, if any, to meet this noise standard. Ambient noise monitoring was not done for this study. Based on preliminary attenuated equipment noise data, plant general arrangement, and preliminary acoustic modeling using certain fundamental assumptions regarding noise attenuation measures that could be applied (such as enclosure of compressors and expanders), an increase of more than 5 dBA at the nearest receptor is unlikely. Thus, noise contributions from the KICP project would not be considered significant.

Paleontological Resources

A literature search of the paleontological databases yielded very few records from the portion of the Great Valley at low elevations immediately adjacent to the Delta as at the project site facilities. In the area within one mile of the project, surficial geology consists of different facies of the Modesto Formation and overlying disturbed sediment, and no paleontological localities have been recorded within a mile of the site. Furthermore, no paleontological localities are known from the Modesto Formation in San Joaquin County and the Modesto Formation in this area is assigned low paleontological sensitivity.

Public Health

In the AFC, this section presents the methodology and results of a human health risk assessment performed to assess potential impacts and public exposure associated with airborne emissions from the construction and operation of the facility. For the KICP, this feasibility study has not included this analysis, as it would need to be redone with project-specific information for the actual AFC license application. Consequently

this section omits the risk assessment results, and concentrates on other aspects of the public health analysis normally found in this section.

Air will be the dominant pathway for potential public exposure to non-criteria pollutants released by the KICP. Emissions to the air will consist primarily of combustion by-products produced by the turbo-expander units. Potential health risks from combustion emissions will occur almost entirely by direct inhalation. To be conservative, additional pathways for dermal absorption, soil ingestion, home-grown vegetable consumption and mother's milk ingestion would be included in the health risk modeling. The health risk assessment would be conducted in accordance with guidance established by the California Office of Environmental Health Hazard Assessment (OEHHA), the California Air Resources Board (CARB), and the SJVAPCD.

Health and safety hazards due to use of hazardous materials (including aqueous ammonia and native natural gas entrained in the withdrawal air stream) are discussed in Section 5.5 (Hazardous Materials) and 5.16 (Worker Health & Safety).

Socioeconomics

Between 2010 and 2013, employment in San Joaquin County or the Stockton Metropolitan Statistical Area (MSA) increased by 9,300 jobs, or about 5 percent. This 5 percent increase is lower than California's net increase (about 7 percent) during the same period. On a percentage basis, the construction sector experienced the largest increase in employment, followed by the transportation, warehousing and utilities. Based on the MSA's prevailing unemployment rate, there would likely be adequate labor to fulfill KICP's construction labor requirements. Therefore, CAES construction will likely not place an undue burden on the local workforce. In 2013, the construction workforce was estimated at 8,700 workers.

It is anticipated that most of the construction workforce would be drawn from San Joaquin, County. Construction workforce could also be drawn from other nearby counties, especially those in the San Francisco Bay Area, or from out of state, if necessary. Thus, it is unlikely that the project will result in an increase in the population of the area.

The construction workforce will most likely commute daily to the project site; however, if needed, there are numerous hotels/motels in San Joaquin County that could accommodate workers who may choose to commute to the project site on a workweek basis. Additionally, housing supply is more than adequate within the County for any construction workers who may choose to rent. Since the proposed project site is close to the Bay Area, some of the workers could choose to seek accommodation in the Bay Area. As a result, construction of the proposed project is not expected to increase the demand for housing.

More than 50 percent of the census tracts within 6 miles of the ECF site have more than 50 percent minority population. Therefore, an environmental justice issue could exist if the project created high and adverse impacts that would fall disproportionately on minority members of the local area after all mitigation measures have been implemented. None of the census tracts contains a poverty population. A final determination of the potential for high and adverse human health and environmental impact to occur cannot be made at this time since the project's environmental impacts have not been completely analyzed (for example, public health impact of air emissions). Based on information developed thus far and experience with similar projects, it is unlikely that the KICP would pose high, significant, and unmitigated adverse impacts and, therefore, it is unlikely that an environmental justice issue will be present in connection with the KICP. While the above information is temporal, it is not expected to change significantly prior to the preparation of the actual AFC license application.

Soils

The soils found in the proposed KICP area are nearly level, with an estimated average slope of less than two percent. Soils are medium to fine textured, with a high concentration of organic material. The erosion potential of these soils would vary based on the wetness of the soil, soil compaction, sizes of soil particles, and other site-specific properties. Based on the soil survey information, the soils in the proposed KICP project area are expected to have a slight water erosion potential and a slight to high wind erosion potential.

An important characteristic of the proposed Kings Island CAES project area is the potential for soils with moderate to high shrink-swell potential. The majority of the mapped soils in the general area are of soil map unit 233 (Ryde-Peltier complex) having a moderate to high shrink-swell potential. The presence of expansive clays in the soil may affect the suitability of the soil as a bearing surface for foundations and pipelines because expansive clays have the potential to shrink or swell in volume with changing moisture content.

The organic nature of the soils at the well pad sites and along portions of the compressed air pipeline have the potential for subsidence when drained and subsequent oxidation occurs. Standard engineering designs and BMPs would address all soil issues.

Traffic and Transportation

This document does not include a standard AFC traffic impact analysis for construction and operation effects on Level Of Service (LOS) at key intersections and roadway segments)since detailed construction design information is not available (personnel by month), the exact dates of construction are not certain, and construction could begin several years in the future. Traffic density and LOS could significantly change by the time a project owner submits the final AFC for the KICP.

The following is a summary of the key findings of the existing traffic conditions analysis:

- All of the local roadways in the study area are operating at an acceptable level of service (LOS), based on Caltrans, County and the City of Lodi traffic impact thresholds
- All of the nearby intersections (where data was available) are operating at LOS C or better
- Several segments of State Route 4 and I-5 currently operate at LOS E or F during at least one peak hour. As a result, construction traffic travelling on these roads would likely be required to arrive and depart outside of peak hours.
- I-5, between March Lane and Benjamin Holt Drive (6.4 miles south of the project site in the City of Stockton) is currently operating at LOS E on a daily basis (which includes hours in addition to the standard peak hours).

The imaginary surface extending at a 100:1 slope from the nearest point of the Kingdon Airport runway intersects the location of the 100-foot-tall KICP exhaust stacks at an elevation of 75 feet above ground surface. Therefore, the project owner would be required to file form 7460a *Notice of Proposed Construction or Alteration* with the Federal Aviation Administration for an analysis of hazard to air navigation The ECF stacks would not be likely to pose structural hazard to air navigation.

In some recent cases before the CEC (Blythe II, Russell City, Mariposa), pilots have raised concerns about thermal exhaust plumes from power plant stacks sited near airport runways posing a possible air turbulence hazard to small aircraft. This is an issue that must be evaluated on a case-by-case basis,

depending on the distance from the runway, location in relationship to the takeoff and landing approaches, power plant technology and exhaust gas velocity, and local meteorology and is a potentially critical issue for permitting the KICP. This issue was not considered in detail during the LEC licensing process.

Visual Resources

The KICP project vicinity is agricultural in character, with row/field crops, grazing, orchards, dairies, vineyards and sod farms. The well pad locations on King Island are currently planted with young walnut orchards. King Island is nearly entirely agricultural, with orchards and row crops predominant. Residences and associated agricultural facilities are intermittently present along King Island Road, which extends along the perimeter of the island.

Population density in the region is low and fewer than ten residences are present within 1 mile of the proposed ECF site. The nearest residences to the ECF are concentrated in the land to the northeast, with a cluster of 3 homes associated with the Hilmar Cheese dairy farm within 0.5 miles of the ECF site, just east of, and on the opposite side of I-5 from the ECF. Two farm residences are approximately 1500 feet just south of the west well pad and are screened from the well pad by the walnut orchard.

The tallest elements within the ECF site are the turbo-expander stacks (two total), which would be approximately 100 feet in height, and the 100-foot-tall towers associated with the 270-foot-long generator tie-line connecting the ECF to the existing Gold Hill-Eight Mile 230-kV transmission line circuit. As means of comparison, the exhaust stack at the nearby LEC is approximately 150 feet in height. The tallest element in the well field would be the communication antenna for the well field control building, which would be approximately 50 feet in height. Young walnut trees in the immediate area surrounding the well pads are currently between 10 and 15 feet in height, but can be expected to grow to 30 to 50 feet tall at maturity.

The ECF site is expected to be visible from locations throughout the surrounding area, as evidenced by the general visibility of the existing and adjacent LEC and STIG plants. Along with the existing LEC, STIG plant, City of Lodi WPCF, and large-scale agricultural uses, three separate 230-kV transmission tower lines pass adjacent to the ECF. The well pad facilities are likely to be visible from unpaved farm roads adjacent to each of the sites and in longer, elevated views from the levee along the perimeter of King Island (a private, yet publicly accessible, road for use by adjacent property owners).

The project would likely be visible in views from various key observation points (KOPs) but would be unlikely to have a significant and adverse effect on project area visual resources. Visibility of the project would be determined by preparing simulated views of the final project design from the KOPs as part of the CEC licensing process and further analysis. A preliminary simulated view is included in Section 5.13.

Because of the character of the area and the presence of other plumes from other nearby sources, including the existing LEC facility, cooling tower vapor plumes that would occur at the EFC would not be likely to result in a significant impact on the visual character of the area. Plumes emitted from the proposed plant would not significantly detract from views of the area.

Waste Management

A Phase I Environmental Site Assessment and Limited Soil Investigation was conducted of the ECF site. These studies, which included literature/database research, interviews of people familiar with the property, a field visit, and collection and analysis of subsurface soils at four locations, did not identify any controlled recognized environmental condition, as defined in ASTM E 1527-13. The site assessment and soil analysis reports concluded that the potential presence of any residual agricultural chemicals in soil or groundwater

at the site from historical agricultural operations would represent a *de minimis* condition, and soil pesticide and herbicide levels were not detected above the laboratory reporting limits.

An examination of the California Department of Toxic Substances Control (DTSC) Hazardous Waste and Substances Site List (Cortese List) shows Guild Cleaners at 17 South Church Street, Lodi, California, at over 6 miles from the ECF, is the closest Corteste-listed property. The KICP site is not located on a Cortese-listed site and is not affected by the Guild Cleaners site, or any of the other listed sites.

Project construction and operation would generate both liquid and solid hazardous and non-hazardous wastes. Solid non-hazardous wastes would include metal, wood, paper, plastics, and glass. Facility operations and maintenance activities wastes would include rags, air filters, metal and machine parts, defective or broken electrical materials, empty containers, typical refuse generated by workers and small office operations, and other miscellaneous solid wastes. This waste would add to the total waste generated in San Joaquin County and in California. However, there is adequate recycling and landfill capacity in San Joaquin County to recycle and dispose of the waste generated by the KICP.

Water from washdown, sample drains, equipment leakage, and drainage from facility equipment would be collected in a system of floor drains, hub drains, sumps, and piping, and would be routed to the facility's oil/water separator. If contamination is present, the water would be trucked off site for disposal at an approved wastewater disposal facility. If sampling results show no contamination, the water would be discharged, and the oily sludge would be shipped to an appropriate disposal facility.

Non-hazardous wastewater would come from the I/W wells as native water entrained in the withdrawal stream and also as condensed vapor resulting from expansion of the compressed air on withdrawal. This water would be captured at the wellhead and reinjected into a non-potable aquifer situated geologically below the air reservoir using the injection wells at the well pad site(s) and/or ECF Site.

Hazardous waste generated would include waste lubricating oil, used oil filters, and chemical cleaning wastes. Chemical cleaning wastes, consisting of alkaline and acidic cleaning solutions, may be generated from periodic cleaning of the piping. These wastes may contain high concentrations of heavy metals and would be collected for offsite disposal.

The waste oil would be recycled. Hazardous waste treatment and disposal capacity in California is more than adequate. Therefore, the effect of the KICP on hazardous waste recycling, treatment, and disposal capability would not be significant.

Water Resources

The KICP is on the eastern edge of the Sacramento-San Joaquin River Delta (Delta). In the Delta region, the Sacramento and San Joaquin rivers converge with tidal action to produce an estuarine environment. Over time, the Delta has been highly modified by channelization and water diversions for municipal, industrial, and agricultural uses, creating a regional patchwork of islands and tracts surrounded by natural and man-made channels and sloughs.

The KICP ECF and well pad sites are located on agricultural lands, which are drained by small, unnamed drainage features. At the ECF and immediate surroundings all surface drainage is collected and returned to the Lodi WPCF. The air pipeline route and well pads are below sea level, so collected runoff is pumped over the levees into the adjacent sloughs which flow to the west of the project site and continue to the San Joaquin River.

Potable water would be used for domestic uses, such as drinking, washing, eye-wash stations, and sanitary facilities. The KICP would obtain potable water from a new onsite groundwater well at the ECF, using an estimated 0.8 acre-feet of water per year on average. Wastewater from these uses would be collected and disposed of in the ECF on-site septic system.

Process water would be recycled water from the adjacent City of Lodi White Slough WPCF. Approximately 1000 acre feet per year of recycled water would be used for cooling, as well as for NOx control and other industrial purposes based on base case plant design and load forecasts. Due to the high level of reliability of water from WPCF, no backup water supply is planned for the project at this time.

Wastewater from KICP ECF power generation and compressor cooling would be discharged directly to a Class I underground injection well that would be constructed on the ECF site and/or piped to injection wells located at the well pads. The KICP would discharge up to an average of 282 gallons per minute of process wastewater that would be injected into the wells. A Class I UIC well permit package would be submitted to the U.S. Environmental Protection Agency (EPA) Region IX, Water Department. Class I permits allow the injection of hazardous and nonhazardous fluids (industrial and municipal wastes) into isolated formations beneath the lowermost underground source of drinking water. This application/process would also need to incorporate UIC permitting of I/W wells as discussed below.

Wastewater would also come from the I/W wells as native water entrained in the withdrawal stream and also as condensed vapor resulting from expansion of the compressed air on withdrawal. This water would be captured at the wellhead and reinjected into a non-potable aquifer situated geologically below the air reservoir using one or more injection wells at the well pad and/or ECF sites.

The plant wash water from the equipment drains would pass through an oil-water separator and wastewater sump before it is discharged to the atmosphere through evaporation in the cooling tower. The oil and sludge removed from the washwater would be disposed of offsite. Wastewater from the safety showers and eye wash would be discharged to the on-site septic system.

The KICP site is in the 100-year flood plain (Zone AE) as defined by FEMA. The potential for a 100-year flood event to impact the site is medium to high. The KICP site is on the eastern edge of the Delta and is protected from the Delta by a system of levees. The well pads are located on King Island in unincorporated San Joaquin County also within the 100-year floodplain, designated by the County as Special Flood Hazard Areas (SFHA). King Island is hydrologically isolated and surrounded by levees, but the wellpads could be inundated in the event of a levee breach. For this reason, critical equipment at the wellpads would be located on platforms elevated above the flood level and all equipment would be designed to cease operation safely in the event of a flood, per San Joaquin County Development Title for SFHAs and good engineering safety practices.

Worker Health and Safety

Workers will be exposed to construction and plant operation safety hazards. Hazard analysis identifies the hazards anticipated during construction and operation, and indicates which safety programs should be developed and implemented to mitigate and appropriately manage those hazards. Programs are overall plans that set forth the method or methods that will be followed to achieve particular health and safety objectives corresponding to the hazards likely to be present as determined through the hazards analysis. For example, the Fire Protection and Prevention Program will describe what has to be done to protect against and prevent fires. The Emergency Action Program/Plan will describe escape procedures, rescue and medical procedures, alarm and communication systems, and response procedures for every hazardous

material that can migrate, such as ammonia. The programs or plans are set forth in written documents that are usually kept at specific locations within the facility.

Each program or plan will contain training requirements translated into detailed training courses. These courses are taught to plant construction and operating personnel, as needed. For example, all plant operating personnel will receive training in escape procedures under the Emergency Action Program/Plan, but only those working with flammables will receive training under the Fire Protection and Prevention Program.

Hazards that present themselves differently at KICP than traditional gas-fired power plant include the following:

- Native natural gas may be entrained in the air withdrawal stream in concentrations that may be hazardous to those working around the wellpads and pipeline. This hazard will be controlled by instrument monitoring to measure the concentrations at the wellhead and controlling or stopping the withdrawal at that wellhead as necessary if concentrations approach hazardous levels.
- The compressed air pipeline will carry a high-pressure air stream that would be hazardous to workers in the event of a pipe system breach.
- There are four fire stations in the Woodbridge Fire Protection District system. Fire Station #4, at 6365 W. Capitol St. Lodi, California 95242, is the closest fire station to the project site; approximately 1.25 miles to the north of the project site. Approximate response time from Fire Station #4 to the project site would be 7 to 10 minutes. Mutual aid response would come from the other three Woodbridge stations, as well as the City of Lodi and City of Stockton fire stations, depending on situation and need.

Alternatives

Alternatives to the PG&E base case project as sited and designed were considered, in comparison with the proposed project and project objectives. The key objective of the KICP is to provide approximately 300 megawatts (MW) of energy storage capacity and grid support ancillary services capability to the CAISO-controlled grid. An important part of this objective is to demonstrate understanding and experience with the CAES technology using a depleted natural gas field as an air storage reservoir.

In choosing the King Island gas field as a preferred site for the air storage reservoir, 148 depleted gas fields were initially considered. Based on public information and records, the following criteria were used to develop a priority list of reservoirs for further evaluation and study:

- Reservoir cumulative gas production sufficiently large to support a 300 MW, 10 hours of storage project objective
- Minor/moderate water drive mechanism in the reservoir
- Porosity greater than 15 percent
- Permeability greater than 400 millidarcys (400 mD)
- Reservoir with a net sand thickness of 20 feet or more

Using these criteria, a priority list of 20 reservoirs was selected for further technical and environmental evaluation to determine whether specific sites had fatal flaws that would eliminate them from consideration. As a result, the list was reduced to 12 priority sites for further economic and environmental study. Additional evaluation identified 7 high priority sites for site control discussions. Based on the

progress of the site control discussions and further refinement of the geological, environmental and economic information, 3 sites were chosen as finalists for site control efforts. Site control was achieved at 2 locations, where core drilling and additional analysis were conducted.

Initial geological testing, modeling, engineering analysis and other evaluation factors for the two sites led to the choice of the King Island reservoir as the preferred site for air injection testing and further KICP development. Both sites have geological properties that exceed minimum permeability, minimum porosity and other thresholds initially developed for the project; however, the King Island reservoir is larger and better positioned to support the project objective of 300 MW of energy storage for 10 hours.

In responding to and addressing the need for environmentally responsible, cost-effective, and operationally flexible and efficient power generation capacity in northern California, the project includes the following project site selection objectives:

- Power block/ECF site near the King Island natural gas field
- ECF adjacent to or near 230-kV high-voltage electrical transmission lines
- ECF adjacent to or near high-pressure natural gas transmission lines
- ECF adjacent to or near a CEC preferred cooling water make-up source (e.g., Title 22 [tertiary treatment] water source with available water)
- ECF and well pad areas large enough to accommodate the site equipment, including construction laydown

The proposed KICP meets all the project siting objectives.

With the choice of the King Island site, PG&E also considered alternatives sites within 5 miles of the King Island well field as potential alternative ECF Sites. The alternative site chosen for comparison is located near the junction of I-5 and State Route 12, approximately 1.3 miles north of the proposed site. This site (referred to as the SR-12 site) is also located near a high pressure natural gas pipeline and adjacent to the Gold Hill-Eight Mile Road 230-kV transmission line.

The proposed site best meets the project objectives. The SR-12 site would likely be more difficult to permit, because it is prime agricultural land that is zoned for general agriculture. In addition, the alternative site is adjacent to a wildlife preserve, which could pose land use and biological resources concerns.

Alternative compressed air and natural gas pipeline routes were also considered and found to be similar to the proposed routes in terms of cost and environmental impact. Alternative generator tie-line routes were not considered because the ECF is located adjacent to the Gold Hill-Eight Mile Road 230 kV transmission line.

Zero liquid discharge (ZLD) was considered as an alternative cooling technology; the use of recycled water, with injection of the waste water into EPA-permitted water injection wells, was selected because of the nearby available and reliable source as well as the “re-claimed” nature of the supply.

SECTION 1.0

Introduction

Pacific Gas and Electric Company (PG&E) has studied the feasibility, conducted subsurface testing, secured site control and developed a preliminary design for a compressed air energy storage (CAES) facility, the King Island CAES Project (KICP), for a location near Stockton, San Joaquin County, California. The KICP would provide the capability to store energy in the form of compressed air and to later retrieve the energy for power generation as part of an energy conversion and electrical generating facility rated at a gross nominal generating capacity of up to 316 megawatts (MW)[1]. Compressed air would be piped from the Energy Conversion Facility (ECF) for storage in a depleted natural gas reservoir until it is needed for conversion at the ECF to generate power.

PG&E has conducted this study and preliminary design in cooperation with the U.S. Department of Energy (DOE), the California Public Utilities Commission (CPUC) and the California Energy Commission (CEC). Specific efforts included geological testing and compressed air cycling tests in the proposed storage reservoir (DOE 2014), obtaining site control for the proposed gas field-storage reservoir area, air and natural gas pipelines, and ECF site, and development of a preliminary project design. PG&E will issue a Request for Offers (RFO) for independent power producers (IPPs) and related entities. If the RFO results in a project that is technically and economically viable and approved by PG&E senior management, the project would be subject to various regulatory approvals to allow the successful bidder to acquire control of the project, complete its development and construction, and operate the project as a facility available to provide power and ancillary services to PG&E and to the California Independent System Operator (CAISO) - controlled electrical grid.

This Environmental Siting, Licensing, and Permitting Analysis (ESLPA) includes a description of the PG&E KICP project as currently designed. It also includes analyses of the project design in relation to the 16 sociological and environmental disciplines that are covered in a standard Application for Certification (AFC) before the California Energy Commission (CEC) to license a thermal power plant with a nominal generating capacity of more than 50 MW. In addition, it also includes a permitting analysis of the Underground Injection Control (UIC) permits likely to be required by the United States Environmental Protection Agency (EPA). The purpose of the document is to identify for interested parties the key environmental siting, licensing, and permitting issues that may be associated with the future full development of the project. This document is not an AFC or other license or permit application and meets only some of the CEC's AFC Data Adequacy requirements (Title 20 California Code of Regulations, section 1704, Appendix B). It is instead intended to provide a permitting plan and schedule for project build-out, recognizing that the project may change, build-out would occur several years in the future, and the eventual project owner would be required to prepare a full AFC and other permit applications, based on a final project design, in order to permit the project and begin construction.

[1] Approximate facility gross output with both turbo expander trains operating at 100% load at International Standards Organization (ISO) conditions (15° C, 65% relative humidity, ambient pressure at sea level) and maximum reservoir supply pressure. Net output would be approximately 6 MW less.

1.1 Project Objectives

Technologies for energy storage have become increasingly important to electrical grid operation due to the increased use of renewable power from sources such as wind and solar energy that tend to be intermittent. In California, the legislature and California Public Utilities Commission (CPUC) have required that public utilities provide 33 percent of their retail electricity from renewable resources by 2020. According to the California Independent System Operator (CAISO 2014) "…in times of low load and high renewable generation, as much as 60 percent of the energy production [in California] would come from renewable generators that displace conventional generation and frequency response capability." Such resources are intermittent, tend to be operated at full output, and may not be required to include automated frequency response capability. For these reasons, the significant increase in renewable power may require the addition of power services, such as energy storage resources, that facilitate better control and smoother operation of the grid.

CAES is potentially a very important and useful energy resource in this regard because it allows for a relatively large amount of energy to be stored and released and does so relatively efficiently. Storage makes good use of renewable and other power that is generated during times of low load (for example, wind power generated during the nighttime or solar generated during mid-morning) when it may not be needed to serve customer loads, and can be used to prevent the curtailment of renewable energy resource production that might otherwise need to occur. To the extent this power can be utilized for charging the CAES reservoir, it typically produces much lower emissions per MWh generated than the alternative of running fossil-fired peaking plants to meet the increasing flexible demand needs of the grid. CAES can also provide flexibility in ancillary services to the grid, because it is capable of starting quickly (within 10 minutes of a notice, it can be at full load), ramping up and down rapidly, and operating at part load at relatively high efficiency. For these reasons, CAES is a very promising technology as a modern grid management tool to meet the increasing demands of changing grid operations.

Recognizing the need to add energy storage resources to California's grid operation to help meet the challenges of intermittent renewable generation, the legislature passed AB 2514, signed in 2010, directing the CPUC to begin rulemaking procedures to set policy for California utilities and load-serving entities requiring procurement of energy storage systems. In October 2013, the CPUC adopted an energy storage procurement framework and established an energy storage procurement target of 1,325 megawatts for the three major California investor-owned utilities (PG&E, Southern California Edison, and San Diego Gas and Electric) by 2020 (with installation by 2024).

CAES is a technology for utility-scale energy storage that has been operational, both in the U.S. and in Europe for more than 20 years. Using a depleted natural gas reservoir as the storage medium, as studied during this project, is a new concept for CAES and could have wide commercial applicability. It is a high priority of the DOE, CPUC, CEC, and PG&E to develop a better understanding of CAES and other power storage technologies in terms of their technical requirements, operational characteristics, permitting and economics in order to modernize the grid and provide more efficient and reliable electrical service for consumers. The most important objective of the KICP is therefore to move the technological, operational, and economic understanding of CAES using a depleted natural gas reservoir as the storage medium forward, if feasible, as a utility-scale, grid-connected operating facility. As a full-scale CAES project, the KICP may have significant potential to provide comprehensive information about CAES that would benefit power developers and utilities around the globe as well as providing needed energy storage and ancillary services to the CAISO-controlled grid.

Currently, there are only two utility-scale CAES facilities operating in the world and both use salt domes as a storage reservoir. Due to geological conditions, however, salt domes are generally not available in California nor in many other locations in the U.S. Porous rock reservoirs in the form of depleted natural gas fields are available in the Central Valley of California and elsewhere and may also have suitable geologic properties to function as CAES reservoirs. As part of this feasibility study, PG&E began investigating the feasibility of using a porous rock reservoir for CAES in February 2011 (see Section 1.3, below), culminating in the development plan for a full-scale CAES facility that is described in this document. PG&E has continued working to demonstrate the feasibility of CAES using a porous rock reservoir such as the depleted gas field in King Island, San Joaquin County, California.

DOE funding was provided to PG&E's CAES program through the DOE National Energy Technology Laboratory's (NETL's) Smart Grid Initiative. The stated goal of this program is to accelerate the transition of the electrical grid system in the U.S. to an updated, secure, and efficient system using a variety of technologies, including energy storage, to do so. PG&E's project was one of 16 projects funded under DOE's Funding Opportunity Announcement DE-FOA-000036) "Recovery Act: Smart Grid Demonstrations", Area of Interest 2, Energy Storage, for "demonstration projects for major, utility-scale energy storage installations to help establish costs and benefits, to verify technical performance, and validate system reliability and durability at scales that can be readily adapted and replicated across the United States."

In general, energy storage may be a key technology for improving and modernizing grid operation in California and throughout the nation and the KICP provides an important and perhaps even unique opportunity to gain essential and valuable operating experience to further the development and use of this technology.

1.2 Project Location

The ECF facility would be located in unincorporated, rural San Joaquin County, California, on a 20.3-acre site (the ECF site) that is owned by the City of Lodi. The ECF site is located in an agricultural field near the intersection of Interstate 5 (I-5) and North Thornton Road and north of the City of Lodi's White Slough Water Pollution Control Facility. Existing surrounding land uses include the City of Lodi's wastewater treatment ponds and the Northern California Power Agency's Lodi Energy Center, a combined-cycle power plant; agricultural fields and, about 0.6 mile to the west, a unit of the California Department of Fish and Wildlife's (CDFW) White Slough Wildlife Area, which is used for hunting and habitat preservation. The nearest urban/suburban areas are Stockton, about 2.5 miles to the south and Lodi, about 5 miles to the east and northeast.

The energy storage reservoir is a nearly depleted gas field located on King Island, San Joaquin County, about two miles southwest of the ECF site. King Island consists of agricultural land, surrounded by levees, in the Sacramento-San Joaquin Delta area. Originally a marshy area between sloughs, it was changed into an island by the excavation of Bishop Cut on the east and Honker Cut on the west, navigation channels that connected White and Disappointment Sloughs.

The ECF would be located in the northeastern quarter of Section 23, Township 3 North, Range 5 East, Mount Diablo Base and Meridian (38° 5.71' North, 121° 23.36' West). The well pads would be located on King Island (Sections 27 and 28 of the same township) at approximately 38° 4.92' North, 121° 25.33' West.

Figure 1.2-1 is a map of the project vicinity, Figure 1.2-2 shows the project location and locations of the well field and linear appurtenances. Various siting alternatives are discussed in more detail in Section 6.0, Alternatives.

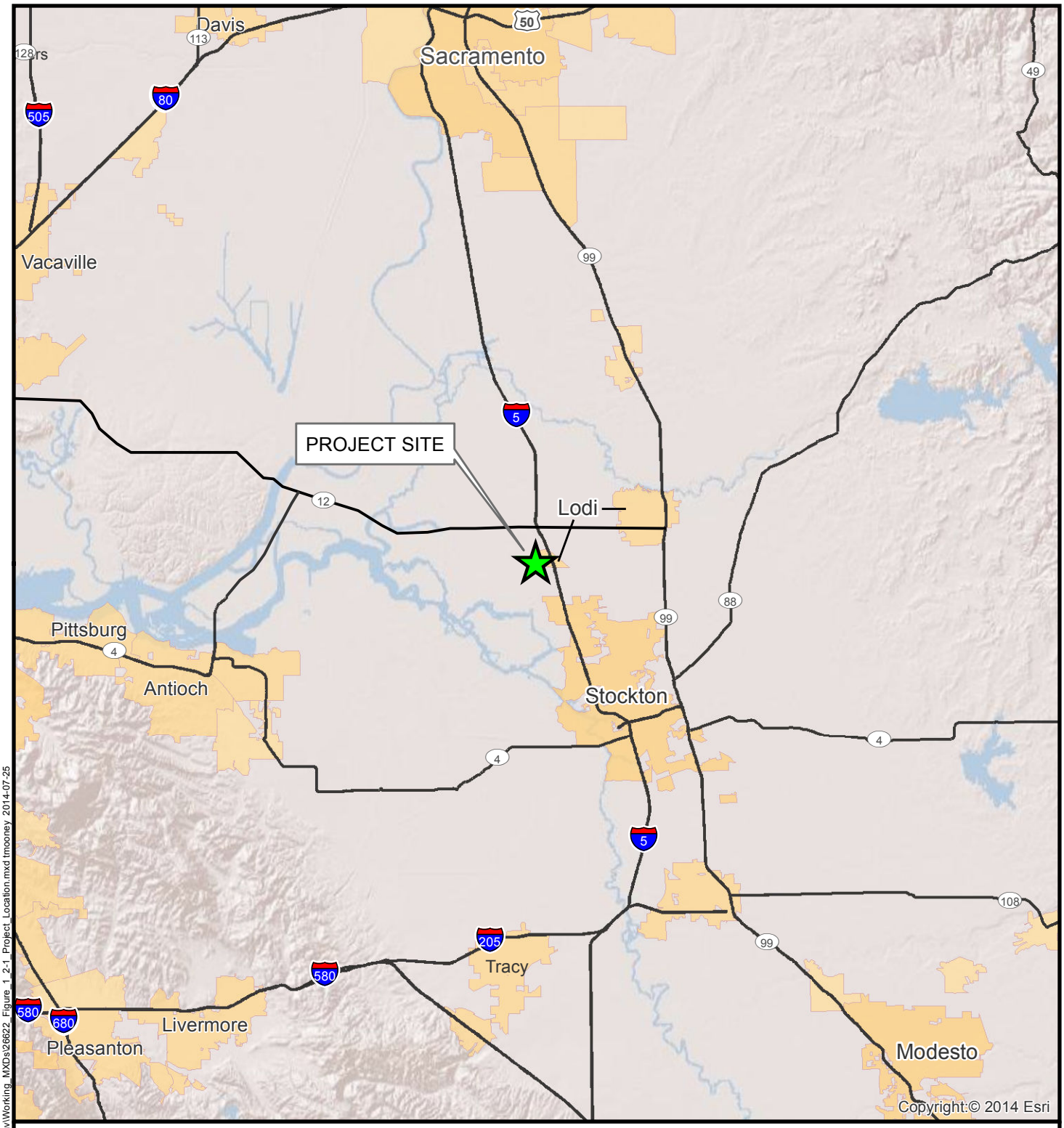
1.3 Previous Studies

As stated above, PG&E began investigating the feasibility of a CAES project in February of 2011. First steps involved identifying suitable air storage reservoirs from among depleted gas fields in California. From approximately 148 potential gas field sites initially identified, 20 were selected for further technical evaluation. Detailed cost and environmental information was developed for 12 sites and 7 sites were selected for landowner outreach and site control efforts; those efforts resulted in three site finalists. Site control efforts were ultimately completed at two of these sites. Core drilling and geotechnical investigations at these two sites occurred in 2013. Additional environmental and technical studies led to the final selection of the King Island site as the preferred site. PG&E conducted a compression testing and evaluation program at King Island beginning in 2015. The DOE conducted a review of the compression testing program under the National Environmental Policy Act and published its Environmental Assessment and Finding of No Significant Impact in May of 2014 (DOE, 2014).

1.4 References Cited

California Independent System Operator (CAISO). 2014. Fast Facts: What the Duck Curve Tells Us About Managing a Green Grid. California Independent System Operator. Available online at: http://www.caiso.com/documents/flexibleresourceshelprenewables_fastfacts.pdf

U.S. Department of Energy. 2014. Final Environmental Assessment for the Pacific Gas and Electric Company (PG&E) Compressed Air Energy Storage (CAES) Compression Testing Phase Project, San Joaquin County, California. (DOE/EA/1752D). Available online at: http://energy.gov/nepa/ea-1752-pacific-gas-electric-company-pge-compressed-air-energy-storage-caes-compression-testing

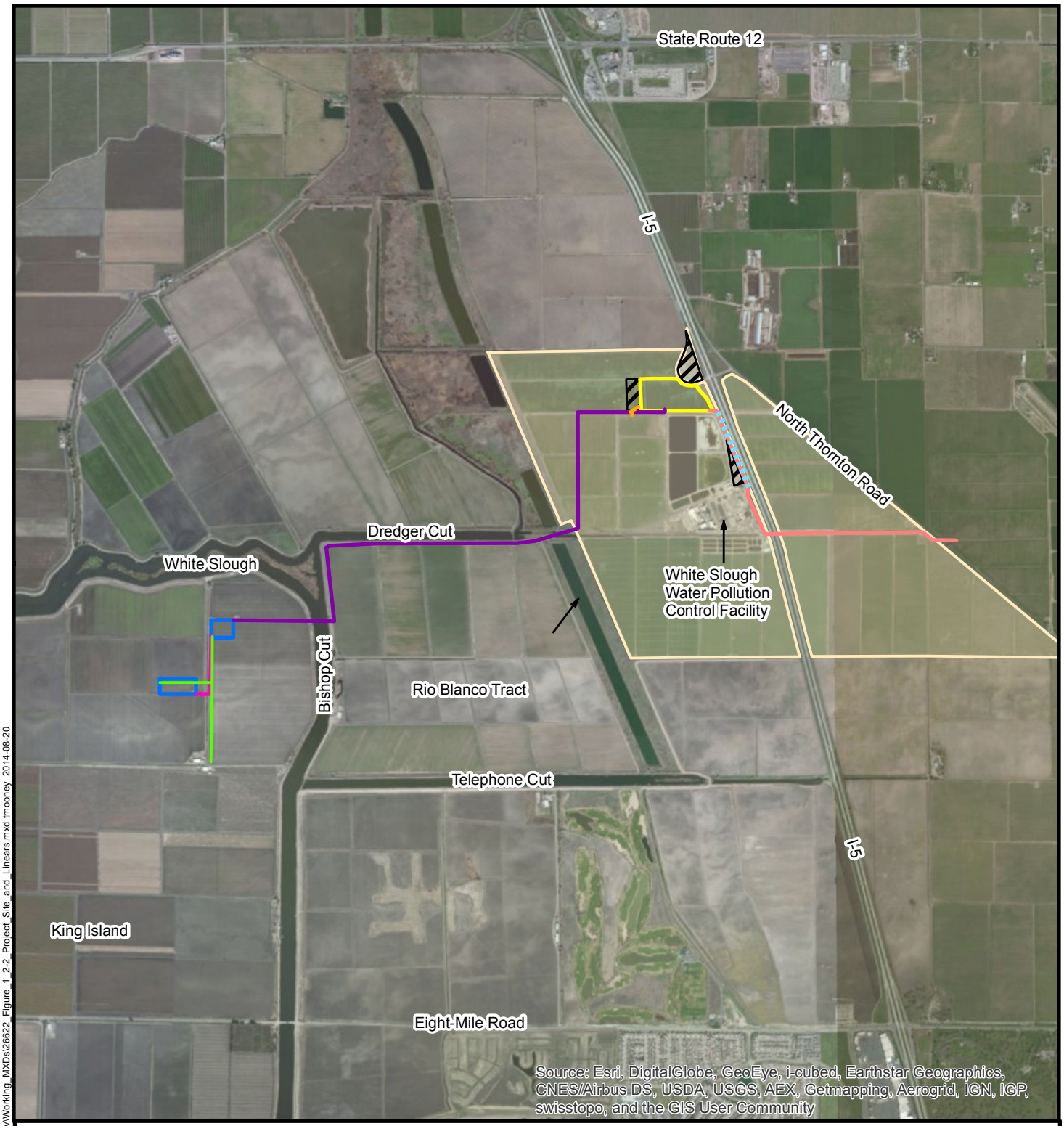


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North State Resources, Inc.

PG&E King Island Compressed Air Energy Storage Project

Figure 1.2-1
Project Location



G:\Projects\26622_PG&E_CAES_AFC_Lite_Env\Working_MXDs\26622_Figure_1_2-2_Project_Site_and_Linears.mxd tmooney 2014-08-20

North State Resources, Inc.

PG&E King Island Compressed Air Energy Storage Project

Figure 1.2-2
Project Site and Linears

SECTION 2.0

Project Description

The King Island CAES Project (KICP) would store energy in the form of compressed air for later release and use to generate electricity, as outlined and studied by PG&E in the CAES Feasibility Study. The project would use electric-powered compressors to compress air and move the air through a pipeline to an underground air storage reservoir in the King Island natural gas field. When additional power and ancillary services are needed to meet the California Independent System Operator (CAISO) system needs, the air would be released from the reservoir, heated via natural-gas-fired combustors and used to drive the turbo-expanders coupled with generators that would generate electricity for grid use. The facility would have a nominal generating capacity of 316 megawatts (MW)[1].

Principal base case design features of the project include the following:

- Energy Conversion Facility (ECF)/power island site for the turbo-machinery including compressors, turbo-expanders, generators, switchyard, emission controls, and cooling equipment on a 20-acre site
- Underground storage injection and withdrawal (I/W) equipment at 2 well pads with up to 30 I/W wells, native natural gas monitoring/control equipment, control building, and water storage tanks; 10 acres total footprint for the west and east well pads (approximately 6 and 4 acres, respectively)
- Underground compressed air pipeline, ECF to East Well Pad; 2.6 miles
- Air collection pipeline (East Well Pad to West Well Pad); 0.3 mile
- Natural gas pipeline to convey fuel to the ECF from PG&E Distribution Feeder Main (DFM) 1616-01; 1.4 miles
- Generator tie-line connecting the ECF to the existing Gold Hill-Eight Mile 230-kilovolt (kV) transmission line circuit; 270 feet
- Recycled cooling water supply pipeline from the City of Lodi's White Slough WPCF; 0.3 mile
- Two (total) wastewater injection wells: one at the east well pad and one either located at the ECF or the west well pad.

2.1 Facility Design

The KICP facility would have two major project operational locations: (1) The ECF/Power Island and (2) the storage reservoir and I/W well field with two well pads. There will be an underground compressed air pipeline connecting the ECF with the well pads (See Figure 1.2-2). The following are facility process descriptions pertaining to these locations and the air pipeline. Design of two additional linear facilities serving the ECF (natural gas pipeline and generator tie line) is outlined in Sections 3.0, Electrical Transmission, and 4.0, Natural Gas. Alternatives (technology and locational) to the base case for project siting and linear appurtenances routing are discussed in Section 6.0, Alternatives.

[1] Approximate facility gross output with both turbo expander trains operating at 100% load at International Standards Organization (ISO) conditions (15° C, 65% relative humidity, ambient pressure at sea level) and maximum reservoir supply pressure. Net output would be approximately 6 MW less.

2.1.1 Process Description – ECF/Power Island

2.1.1.1 Simple-Cycle Gas Turbine Process Comparison

The compressor and expansion/generation components of the King Island CAES facility share certain fundamental characteristics with conventional utility-scale gas turbines in that both technologies use a compressible gas and air mixture as the working fluid, operating on the same thermodynamic cycle (the Brayton cycle). However, equipment design and configuration of the CAES facility are significantly different from a conventional simple-cycle gas turbine (SCGT).

An SCGT has a compressor section and an expander section, connected on a common shaft with an electrical generator. Inlet air is compressed (at a compression ratio of approximately 16:1 in a modern utility-scale machine), fired with natural gas, and the resulting hot, high-pressure gas is expanded through a series of turbine blades. The work done in the expansion turbine drives both the compression section and the generator.

While suitable for many electrical generation purposes, the SCGT has a relatively limited load range. Minimum load for a SCGT is typically 30 to 60 percent of maximum output, and heat rate deteriorates as the machine output is reduced from full load. In addition, the SCGT's operating range is limited by the compressor section. A compressor cannot be designed to operate efficiently over a broad range of flow rates and pressure ratios.

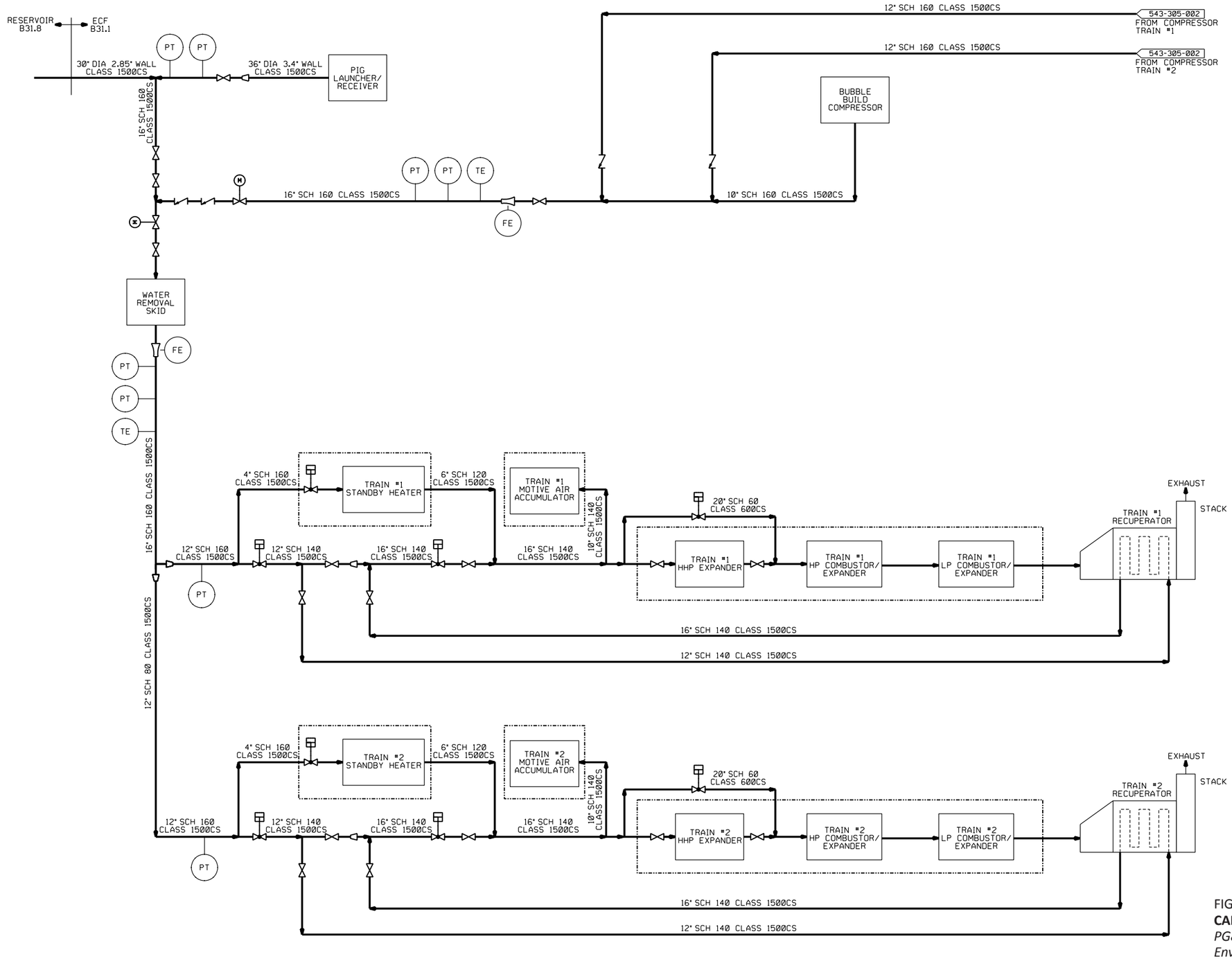
Because CAES expanders use high-pressure air from the air storage reservoir instead of air compressed in a SCGT compressor, CAES operation does not suffer the turndown limitations of a SCGT compressor. Thus, the expansion trains at the CAES facility are capable of operating sustainably at an extremely low output (less than 15% of maximum rated output) while also maintaining the ability to ramp from zero to full load in less than 10 minutes. CAES expanders also do not suffer the losses in fuel efficiency when operating at very low loads (as measured by heat rate) that are seen in SCGT power plants. For example, at ISO conditions, a reduction in generation from 100% load to 15% load, only results in a loss in fuel efficiency of approximately 6-7 percent.

This rapid response rate and broad operating range make CAES very useful for providing grid reliability services such as frequency regulation or standby capacity (commonly called "regulation reserves" and "spinning reserves"). Within the CAISO grid, the wholesale market compensates generators for provision of such grid reliability services (ancillary services).

2.1.1.2 King Island CAES Design

The KICP as currently envisioned would employ two Dresser-Rand CAES compression trains and two expansion/generation trains. Each compression train would consist of a multi-stage compressor section driven by a dedicated approximately 137 MW (nominal rating) electric motor. Each compression train would be capable of producing up to 410 pounds per second of air at a compressor outlet pressure of up to 2,800 psia.

Each expansion/generation train would each be rated at 158.3 MW (gross). Thus, at maximum compression load, the facility would consume up to 274 MW of electric energy, while at maximum generator output the facility would consume 1,215 MMBtu/hr of energy from natural gas and produce approximately 316 MW on a gross basis (the facility is designed for 300 MW of nominal maximum continuous rating, otherwise known as Net Rated Output, for 10 hours). Facility power production on a net basis accounts for various auxiliary loads of approximately 6 MW. Figures 2.1-1a and b are process flow



NOTES:

1. FOR GENERAL NOTES, ABBREVIATIONS AND SYMBOLS SEE DRAWING PGCS-0-DW-012-305-001.
2. THIS DRAWING IS REPRESENTATIVE OF THE PROCESS FLOW DESIGN EXPECTED AND IS BASED ON CONCEPTUAL ENGINEERING. ALL INFORMATION IS SUBJECT TO CHANGE DURING FINAL DESIGN.

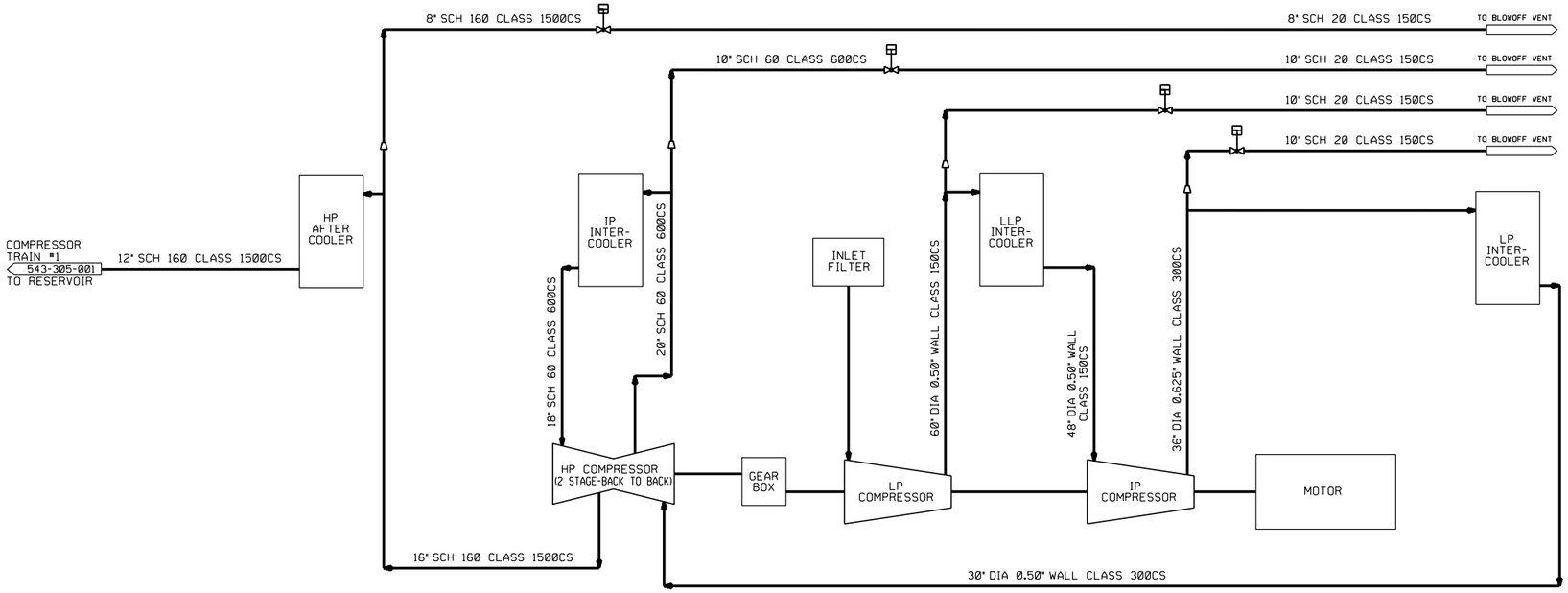
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NOT TO BE USED FOR CONSTRUCTION

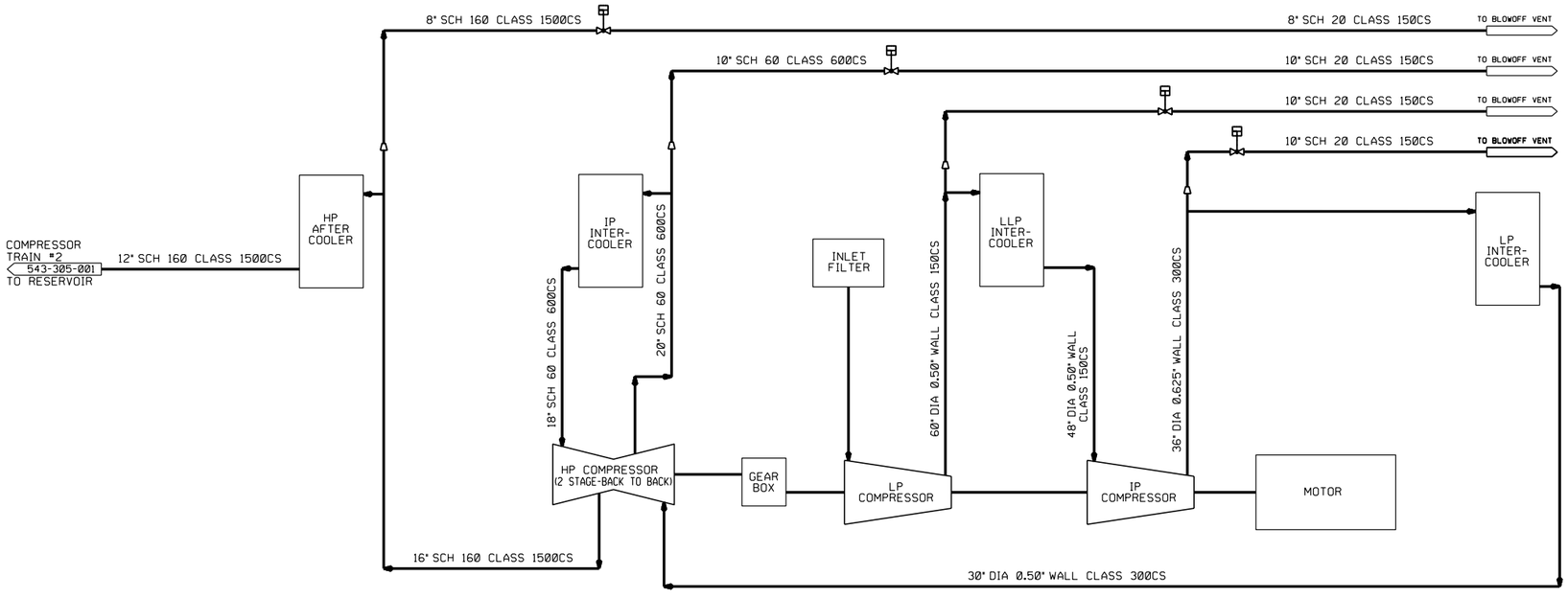
FIGURE 2.1-1a
CAES Process Flow, Generation
PG&E King Island Compressed Air Energy Storage Project Environmental Siting, Licensing, and Permitting Analysis

Source: WorleyParsons, Drawing PGCS-0-DW-543-305-001 Rev. A, 08/27/2014.

NOTES:

1. FOR GENERAL NOTES, ABBREVIATIONS AND SYMBOLS SEE DRAWING PGCS-0-DW-012-305-001.
2. THIS DRAWING IS REPRESENTATIVE OF THE PROCESS FLOW DESIGN EXPECTED AND IS BASED ON CONCEPTUAL ENGINEERING. ALL INFORMATION IS SUBJECT TO CHANGE DURING FINAL DESIGN.





INFORMATION ONLY
NOT TO BE USED FOR CONSTRUCTION

FIGURE 2.1-1b
CAES Process Flow, Compression
PG&E King Island Compressed Air Energy Storage Project
Environmental Siting, Licensing, and Permitting Analysis

Source: WorleyParsons, Drawing PGCS-0-DW-543-305-002 Rev. A, 08/27/2014.

PLANT DESCRIPTION

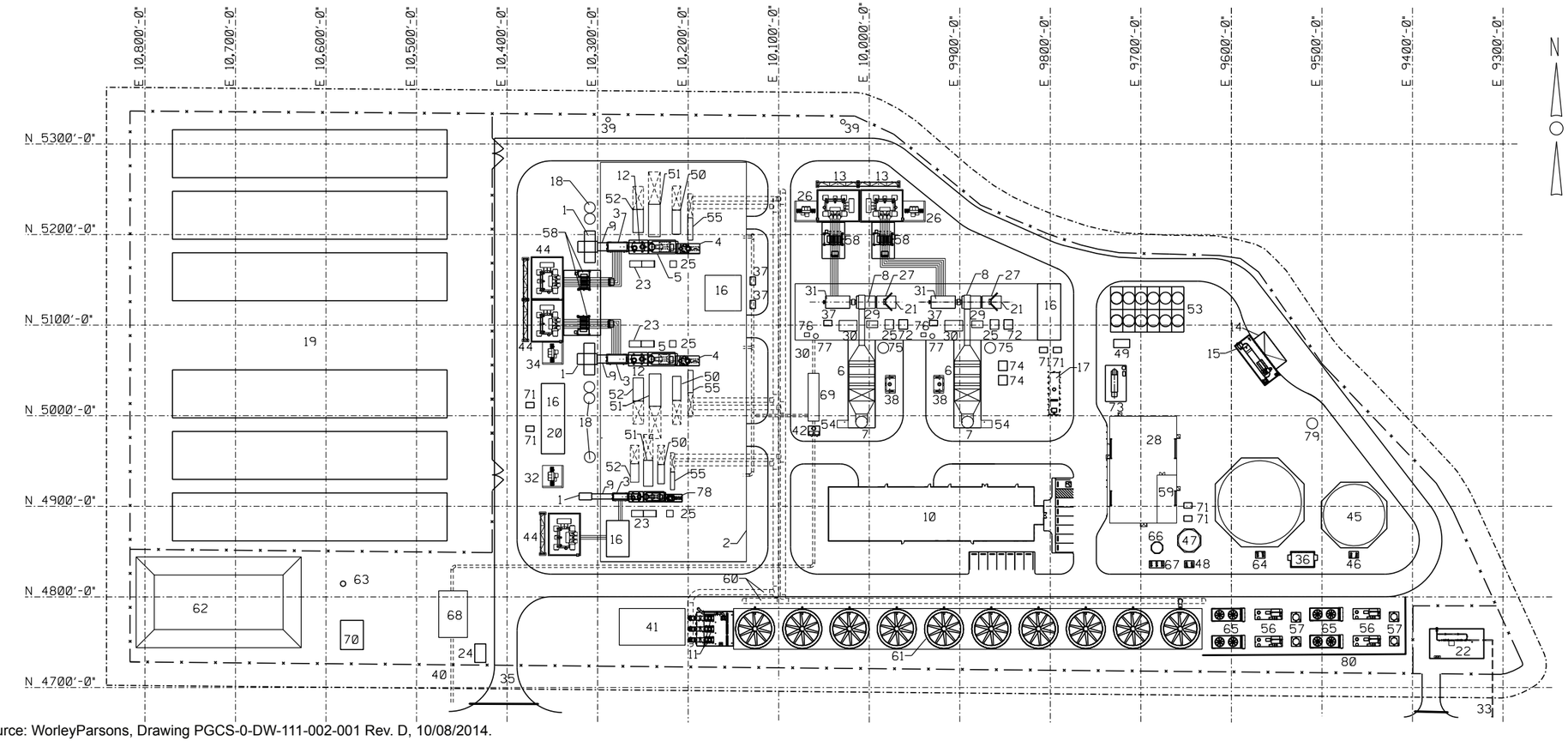
1. AIR INLET FILTER HOUSE
2. COMPRESSOR BUILDING
3. COMPRESSOR MOTOR
4. HP COMPRESSOR
5. LP COMPRESSOR
6. RECUPERATOR
7. STACK
8. LP EXPANDER
9. AIR INLET DUCT
10. ADMIN./MAINTENANCE/CONTROL BUILDING
11. CIRC. WATER PUMP
12. IP COMPRESSOR
13. GSU TRANSFORMER
14. AMMONIA UNLOADING
15. AMMONIA STORAGE TANK
16. ELECTRICAL PDC
17. OIL WATER SEPARATOR
18. COMPRESSOR BLOWOFF SILENCERS
19. PG&E SWITCHYARD
20. VFD STARTER
21. VHP EXPANDER
22. GAS METERING YARD
23. LUBE OIL COOLER SKID (COMPRESSOR)
24. ENTRANCE SECURITY BOOTH
25. LUBE OIL SKID
26. 4160V UNIT AUX. TRANSFORMER
27. HP EXPANDER
28. WATER TREATMENT BUILDING
29. LUBE OIL COOLER SKID (EXPANDER)
30. ELECTRICAL/CONTROL MODULE
31. EXPANDER GENERATOR
32. VFD STARTER INPUT TRANSFORMER
33. FUEL GAS SUPPLY POI
34. VFD STARTER OUTPUT TRANSFORMER
35. MAIN ENTRANCE
36. FIREWATER PUMPHOUSE
37. EXCITATION TRANSFORMER
38. AMMONIA SKID
39. 230KV OVERHEAD UTILITY POLE
40. AIR TRANSMISSION PIPELINE POI
41. TOWER CHEM. STORAGE & FEED SYSTEM
42. PLANT AIR COMPRESSOR PACKAGE
43. SERVICE WATER/FIRE WATER STORAGE TANK 2,250,000 GALLONS
44. STATION SERVICE TRANSFORMER
45. COOLING TOWER BLOWDOWN STORAGE TANK 875,000 GALLONS
46. COOLING TOWER BLOWDOWN FORWARDING PUMPS
47. DEMINERALIZED WATER STORAGE TANK
48. DEMINERALIZED WATER FORWARDING PUMPS
49. CLOSED COOLING WATER PUMP SKID
50. IP INTERCOOLER
51. LLP INTERCOOLER
52. LP INTERCOOLER
53. AIR COOLED HEAT EXCHANGER
54. CEMS SHELTER
55. HP INTERCOOLER
56. FUEL GAS COMPRESSOR
57. FUEL GAS SCRUBBER SKID
58. CIRCUIT BREAKER
59. ELECTRICAL EQUIPMENT ROOM
60. CIRC WATER PIPING
61. MECHANICAL DRAFT COOLING TOWER
62. STORMWATER RETENTION POND
63. WASTEWATER INJECTION WELL (FINAL LOCATION (TBD))
64. SERVICE WATER PUMPS
65. GAS COMPRESSOR LUBE OIL COOLER
66. DEMINERALIZATION SYSTEM BREAK TANK
67. DEMINERALIZATION SYSTEM FORWARDING PUMPS
68. PIG LAUNCHER/RECEIVER
69. MOTIVE AIR WATER SEPARATOR
70. DEEPWELL INJECTION PUMPS
71. SUS TRANSFORMERS
72. EXPANDER WATER INJECTION SKID
73. DIESEL GENERATOR
74. GAS FUEL CONDITIONING SKID
75. EXPANDER SILENCER
76. ELECTRIC STANDBY HEATER
77. MOTIVE AIR ACCUMULATOR
78. BUBBLE BUILD COMPRESSOR, SKID MOUNTED (FINAL LOCATION (TBD))
79. POTABLE WATER WELL (FINAL LOCATION (TBD))
80. SOUND WALL

NOTES:

1. THIS DRAWING IS PRELIMINARY AND FOR INFORMATION ONLY.
2. NO SURVEY OR LEGAL PROPERTY DESCRIPTION WAS UTILIZED FOR PREPARATION OF THIS DRAWING. SITE BOUNDARIES ARE APPROXIMATE BASED ON AERIAL IMAGES AND TOPO DRAWINGS. PROPERTY BOUNDARY ON NORTH AND EAST SIDES IS ASSUMED TO BE THE INSIDE (SOUTH/WEST) EDGE OF THE EXISTING CONCRETE DITCH.
3. TOTAL ENERGY CONVERSION FACILITY (ECF) USABLE AREA SHOWN IS 18 ACRES. OF THIS AREA, 5 ACRES ARE OCCUPIED BY THE ONSITE SWITCHYARD.THE AREA OF THE SWITCHYARD IS 500 FEET X 400 FEET. SWITCHYARD ENTRANCE DETAILS ARE NOT INCLUDED.
4. NO SITE HYDROLOGY INFORMATION WAS UTILIZED FOR PREPARATION OF THIS DRAWING. LOCATION AND SIZE OF STORM WATER RETENTION POND IS PRELIMINARY.
5. TWENTYFIVE FOOT SPACING FOR EASEMENT WAS ALLOWED BETWEEN ESTIMATED PROPERTY BOUNDARY AND FACILITY FENCE.
6. ACTUAL LOCATION OF OFFSITE LINEAR INTERFACE POINTS IS UNKNOWN. INTERFACE POINTS SHOWN ARE APPROXIMATE.
7. EXPANDER GENERATOR CONNECTION TO SWITCHYARD IS VIA OVERHEAD UTILITY POLES AT 230KV, WHICH WILL REQUIRE RIGHT OF WAY ACCESS ON BOTH SIDES OF PROPERTY LINE.
8. MOTIVE AIR FROM RESERVOIR ASSUMED TO MEET DRESSER-RAND REQUIREMENTS AT INTERCONNECT WITH MOTIVE AIR TRANSMISSION PIPELINE. NO SPACE ALLOCATED FOR MOTIVE AIR TREATMENT.
9. ALL EQUIPMENT PHYSICAL SIZING IS REPRESENTATIVE BASED ON AVAILABLE INFORMATION AND ASSUMPTIONS. EQUIPMENT SELECTION, LOCATION AND SIZE ARE SUBJECT TO CHANGE.
10. COMPRESSION EQUIPMENT SELECTION BASED UPON 6 HOUR PER DAY RESERVOIR CHARGE CYCLE WITH 2X50% TRAINS.
11. EXPANSION EQUIPMENT SELECTION BASED UPON 10 HOUR PER DAY GENERATION (OR WITHDRAWL) CYCLE.
12. COMPRESSOR AND EXPANDER BUILDINGS EQUIPPED WITH OVERHEAD CRANES FOR ERECTION AND MAINTENANCE ACTIVITIES.
13. WATER TREATMENT ASSUMES RAW WATER SUPPLIED FROM TERTIARY SOURCE, NO RAW WATER PRE-TREATMENT, AND DEEPWELL INJECTION FOR COOLING TOWER BLOWDOWN.

REFERENCE ONLY

1" = 60' Scale 0 60 120 180 Feet
SCALE REFERENCE



Source: WorleyParsons, Drawing PGCS-0-DW-111-002-001 Rev. D, 10/08/2014.

FIGURE 2.1-2
General Arrangement, Energy Conversion Facility
PG&E King Island Compressed Air Energy Storage Project
Environmental Siting, Licensing, and Permitting Analysis

diagrams of the KICP expansion and compression systems, respectively, and Figure 2.1-2 is a general arrangement and Figure 2.1-3 shows elevations of the King Island CAES ECF.

During periods of low power demand, excess, low-cost energy supplied to the grid by base-load facilities, renewable energy sources (wind or solar) or other resources would be used to drive the compressor trains to pump compressed air into the reservoir for storage. The compressor trains are intercooled to reduce power-consumption requirements and after-cooled to reduce the compressed air's temperature prior to injection into the underground storage reservoir.

The King Island CAES reservoir is a depleted natural gas well field in the Mokelumne River Formation approximately 4,650 feet below ground surface and approximately 2.6 miles southwest of the ECF site. Based on project design modeling, the reservoir would likely operate over a wellhead pressure range of approximately 1,900 to 2,830 psia (static pressure range). If fully charged, the reservoir would support approximately 5 weekdays at 10 hours of generation per day at full rated output with 6 hours of daily recharge. Alternatively, 7 days per week at 10 hours of generation per day of operation could be supported by increasing the daily hours that the reservoir is recharged. Multiple possibilities exist for recharging the reservoir and operating the generation depending upon the operational flexibility required and the system value of that operational flexibility. An underground injection control (UIC) permit analysis provided in Appendix 2A includes detailed information about the reservoir.

Air compression to build and refresh the reservoir 'bubble' of compressed air would occur in four stages. Because air compression raises air temperature, it is necessary to cool the air between stages using circulated cooling water to absorb and convey heat away from the compressors. This heated cooling water would be re-cooled in a conventional mechanical draft cooling tower, using recycled water from the City of Lodi White Slough WPCF as make-up water.

The process flow diagram in Figure 2.1-1a also depicts the expansion/generation process. During periods of peak or intermediate power demand, and/or the need for ancillary services, the stored compressed air would be released from the reservoir, preheated in a recuperator, and expanded through the reheat-turbo-expander train. At maximum generator output, approximately 400 lbs/second per train of reservoir air would be piped through the recuperator and preheated to 630°F. The recuperator reclaims the low pressure expander's exhaust heat and consequently reduces the generation heat rate significantly. A very high pressure (VHP or HHP) expander is used as a topping turbine to provide additional power beyond what the LP and HP expanders can provide and to provide a more efficient mechanism for stepping down reservoir pressure to design inlet pressure of the HP expander.

The KICP would manage any residual entrained native natural gas using a combination of turbo-expander system controls and well field management and operational strategies. The combustor system controls would manage the temperature rise associated with any residual native natural gas. These controls fall into two categories: (1) fuel gas valve adjustment based on measured residual native natural gas in the air pipe, and (2) recuperator bypass if other methods are insufficient to manage the residual native natural gas. In addition, the facility could reduce load, remove a train from service or remove the I/W well producing high levels of native natural gas from service. Although the current hydrocarbon (HC) limit specified by the manufacturer at the inlet to the HP combustor is 0.9 percent (by volume) further discussions may increase this limit using additional control technologies, upgraded materials, etc.

Each of the two expander trains has three bodies of multistage expansion. Compressed air from the reservoir is first preheated in the recuperator from where it flows to the very high pressure (VHP or HHP) expander. The discharge of VHP expander is directed to the HP expander where it is heated via natural gas-

fired combustors, which are also equipped with water injection for emissions control. These combustors are mounted on the inlet of the HP expander and provide the first direct heat input for the stored, compressed air, after pre-heating in the recuperator. The gases exit the HP expander, flowing to the low-pressure (LP) combustor, where additional natural gas is burned to increase the gas temperature for further expansion in the LP expander.

The low pressure (LP) expander features eight gas-fuel combustors arranged in a can-annular configuration on the expander. The combustor system includes water injection for NOx abatement. Gases exiting the LP expander flow through the recuperator, where they are used to heat the cool air entering the expansion-generator train from the reservoir, and then exhaust through the stack.

Figure 2.1-1a describes the normal start-up sequence of the CAES equipment for the post-purge generation phase. In this mode, the system is designed to synchronize, start-up, and provide full output in less than 10 minutes. Once synchronized, any output from 15 to 100 percent of rated load can be sustained until the stored air volume is utilized. Within this range, output may be ramped up or down at approximately 20 percent of rated load per minute.

Figure 2.1-1b describes the normal start-up sequence of the CAES equipment for the compression phase. In this mode, the system is designed to compress on daily, weekly or other cycles up to the reservoir design capacity. Figures 2.1-4a and 2.1-4b show the heat and mass balances for the Compression and Generation phases, respectively. Principal equipment components at the ECF include the following:

- Two main compressor trains each driven by a motor rated at 13,800 volts and approximately 137 MW each
- One compressor motor for the initial (plant commissioning period start-up) air bubble build, rated at 13,800 volts and 10 MW
- One high-pressure natural gas compressor, rated at 4,160 volts and approximately 804 HP
- Two generator-expanders, rated at 13,800 volts and approximately 150 MW each
- Water injection and selective catalytic reduction (SCR) equipment for emissions control
- Ten-cell, mechanical draft cooling tower
- A 230-kilovolt (kV) onsite switchyard

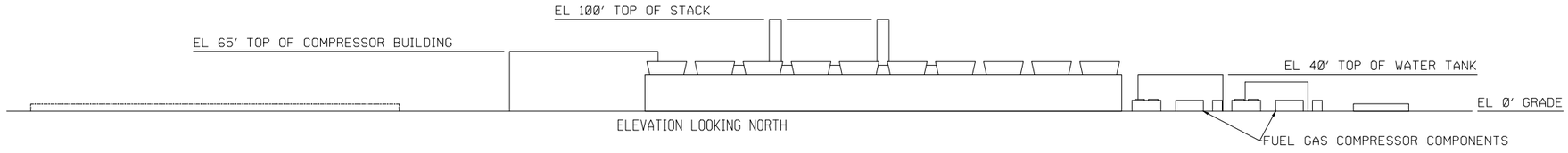
2.1.1.3 ECF/Power Island Equipment

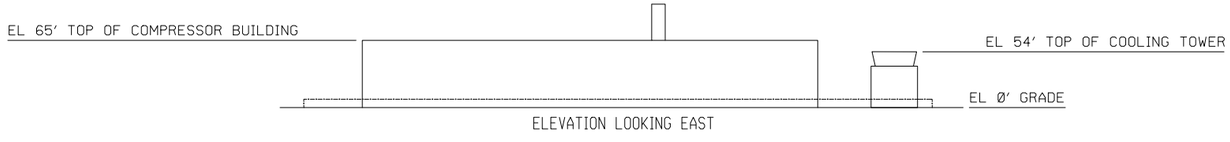
The CAES compression system consists of three compressor sections, each driven by an electric motor. The low-pressure and intermediate pressure compressors each incorporate one section of compression, while high-pressure compressor incorporates two sections of compression in a back-to-back configuration, making four sections of compression. The compressed air is cooled after each section to reduce the temperature of air entering the next section. Water-cooled heat exchangers are used for all process air cooling requirements. The compressor train uses a series of inter-stage valves, recycle valves, and control valves to permit it to start up and synchronize while using less than its design power consumption. An electric variable frequency drive system is used to accelerate and synchronize the compression trains.

The following are major specifications of the turbo-machinery components:

2.1.1.3.1 Low Pressure (LP) Compressor

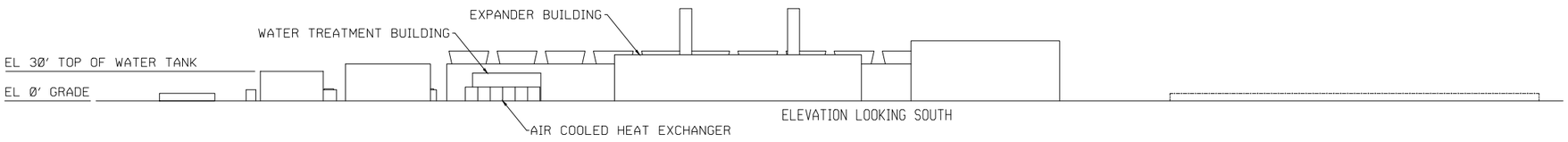
- Axial Compressor with horizontally split pressure casing
- AC motor driven lifting oil system for LP Compressor, mounted on skid





REFERENCE ONLY

1" = 60′ 0 60 120 180
Scale Feet
SCALE REFERENCE



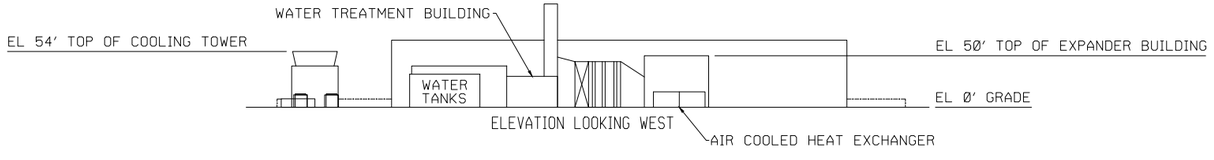
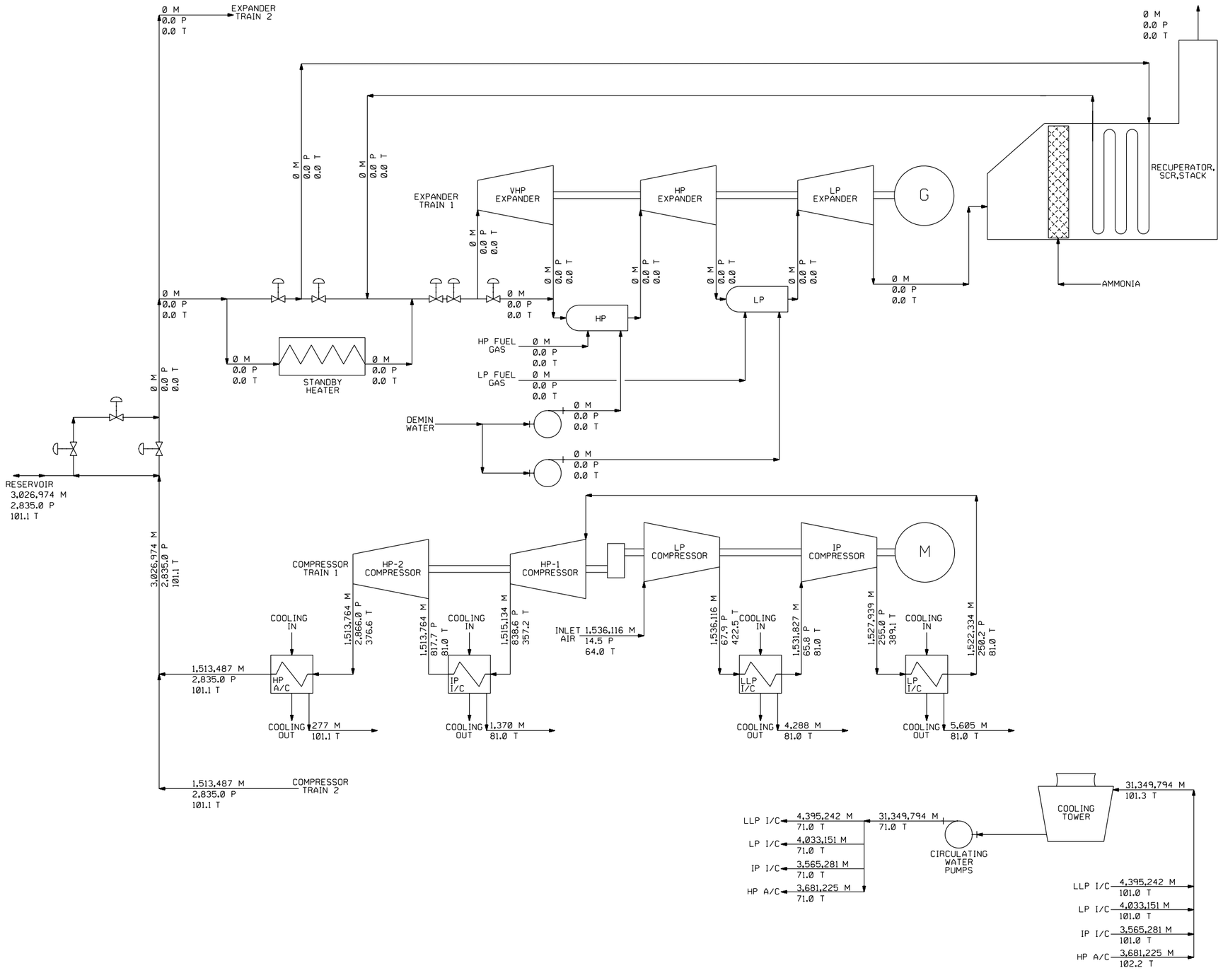


FIGURE 2.1-3
Elevations
PG&E King Island Compressed Air Energy Storage Project
Environmental Siting, Licensing, and Permitting Analysis

Source: WorleyParsons, Drawing PGCS-0-DW-111-002-003 Rev. D, 11/04/2014.



NOTES:

1. STANDBY HEATER ONLY OPERATES DURING STANDBY (TURNING GEAR) OPERATION.
2. FLOW TO THE RESEVOIR WILL BE INDICATED BY A POSITIVE NUMBER. FLOW EXTRACTED FROM THE RESEVOIR WILL BE INDICATED BY A NEGATIVE NUMBER.

LEGEND:

T	TEMPERATURE, °F
P	PRESSURE, PSIA
M	MASS FLOW, LB/HR
H	ENTHALPY, BTU/LBM
KW	POWER, ELECTRICAL

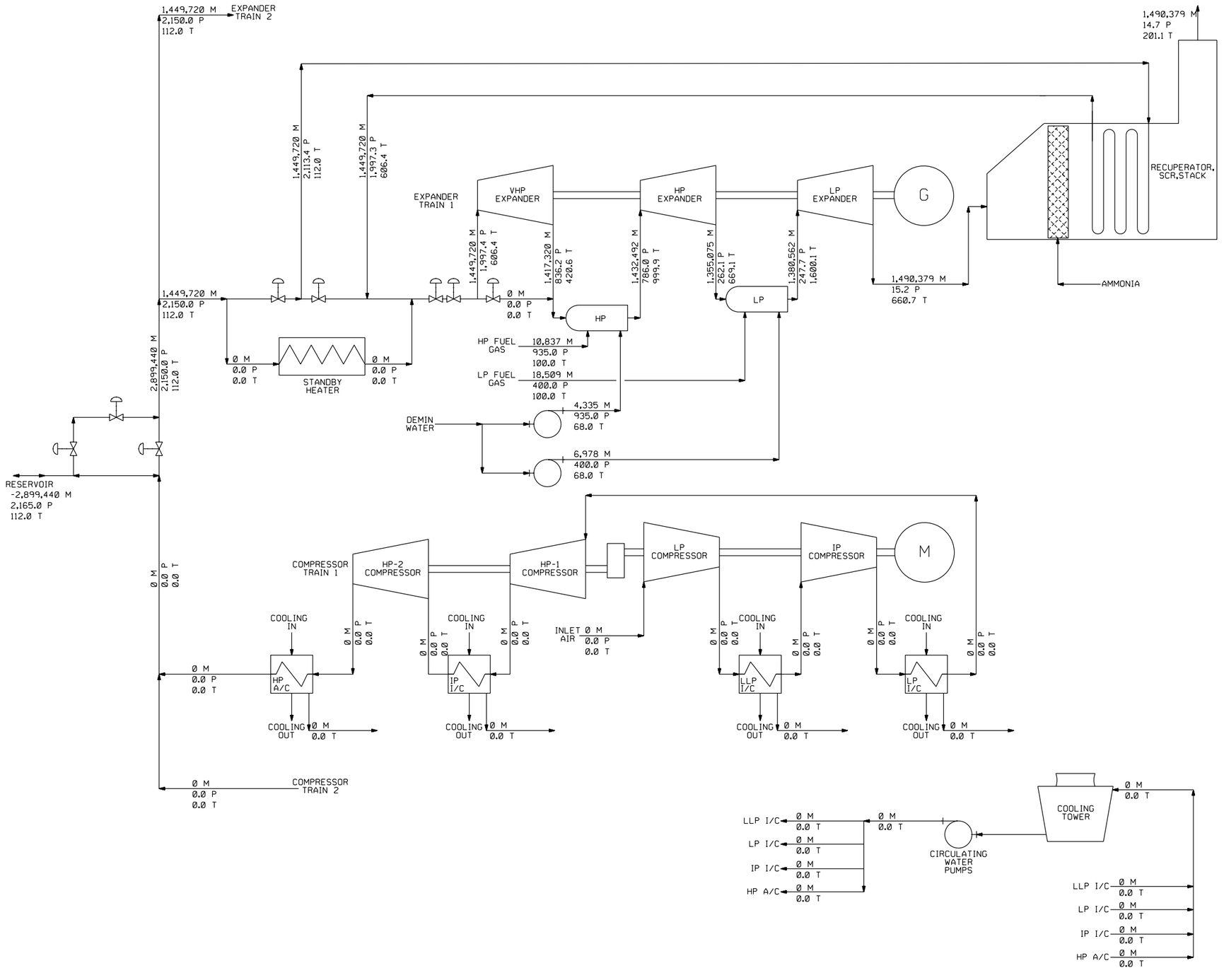
PERFORMANCE SUMMARY

DRY BULB TEMPERATURE: 64°F
WET BULB TEMPERATURE: 56.2°F
RELATIVE HUMIDITY: 61.7 %
FUEL LHV: 20700 BTU/LB
FUEL HHV: 22971 BTU/LB
GROSS EXPANDER POWER, EACH: 0 KW
GROSS EXPANDER POWER, TOTAL: 0 KW
GROSS COMPRESSOR POWER, EACH: 137804 KW
GROSS COMPRESSOR POWER, TOTAL: 275608 KW
AUXILIARY LOAD, COMPRESSION: 6180 KW
AUXILIARY LOAD, EXPANSION: 0 KW
NET POWER: -281788 KW
NET PLANT HEAT RATE (LHV): N/A BTU/KWH
NET PLANT HEAT RATE (HHV): N/A BTU/KWH
EXPANDER FUEL CONSUMED, EACH (HHV): 0 MMBTU/HR
EXPANDER FUEL CONSUMED, TOTAL (HHV): 0 MMBTU/HR

INFORMATION ONLY NOT TO BE USED FOR CONSTRUCTION

FIGURE 2.1-4a
Heat Balance, Compression Phase
PG&E King Island Compressed Air Energy Storage Project
Environmental Siting, Licensing, and Permitting Analysis

Source: WorleyParsons, Drawing PGCS-0-HT-021-001 Rev. A, 09/02/2014.



NOTES:

1. STANDBY HEATER ONLY OPERATES DURING STANDBY (TURNING GEAR) OPERATION.
2. FLOW TO THE RESEVOIR WILL BE INDICATED BY A POSITIVE NUMBER. FLOW EXTRACTED FROM THE RESEVOIR WILL BE INDICATED BY A NEGATIVE NUMBER.

LEGEND:

T	TEMPERATURE, °F
P	PRESSURE, PSIA
M	MASS FLOW, LB/HR
H	ENTHALPY, BTU/LBM
KW	POWER, ELECTRICAL

PERFORMANCE SUMMARY

DRY BULB TEMPERATURE: 64°F
WET BULB TEMPERATURE: 56.2°F
RELATIVE HUMIDITY: 61.7 %
FUEL LHV: 20700 BTU/LB
FUEL HHV: 22971 BTU/LB
GROSS EXPANDER POWER, EACH: 158013 KW
GROSS EXPANDER POWER, TOTAL: 316026 KW
GROSS COMPRESSOR POWER, EACH: 0 KW
GROSS COMPRESSOR POWER, TOTAL: 0 KW
AUXILIARY LOAD, COMPRESSION: 0 KW
AUXILIARY LOAD, EXPANSION: 5780 KW
NET POWER: 310246 KW
NET PLANT HEAT RATE (LHV): 3916 BTU/KWH
NET PLANT HEAT RATE (HHV): 4346 BTU/KWH
EXPANDER FUEL CONSUMED, EACH (HHV): 674 MMBTU/HR
EXPANDER FUEL CONSUMED, TOTAL (HHV): 1348 MMBTU/HR

INFORMATION ONLY NOT TO BE USED FOR CONSTRUCTION

FIGURE 2.1-4b
Heat Balance, Generation Phase
PG&E King Island Compressed Air Energy Storage Project
Environmental Siting, Licensing, and Permitting Analysis

Source: WorleyParsons, Drawing PGCS-0-HT-021-101 Rev. A, 09/02/2014.

- LP Compressor is mounted on a baseplate with the gearbox with all piping and wiring brought to the skid edge

2.1.1.3.2 Intermediate Pressure (IP) Compressor

- Centrifugal Compressor with horizontally split pressure casing
- AC motor driven lifting oil system for IP Compressor, mounted on skid
- IP Compressor is mounted on its own baseplate w/ all piping and wiring brought to the skid edge

2.1.1.3.3 High Pressure (HP) Compressor

- Centrifugal Compressor with radially split pressure casing
- Back-to-back compressor design incorporates the 3rd and 4th sections of compression in one pressure containing case
- HP Compressor is mounted on its own baseplate w/ all piping and wiring brought to the skid edge

2.1.1.3.4 Speed Increasing Gearbox

- Single-stage, parallel shaft, double-helical speed increasing gearbox
- Gearbox is mounted on a baseplate with the LP compressor

2.1.1.3.5 Compressor Train Turning Gear

- Located at the gearbox high-speed shaft non-drive end
- The turning gear is used to slow-roll the compressor train when it is not operating

2.1.1.3.6 Coupling and Guards

- Flexible Disc Coupling and coupling guard–Motor to IP Compressor
- Flexible Disc Coupling and coupling guard–IP Compressor to LP Compressor
- Flexible Disc Coupling and coupling guard–LP Compressor to Gearbox
- Flexible Disc Coupling and coupling guard–Gearbox to HP Compressor

2.1.1.3.7 Compressor Air-Cooled Heat Exchangers

- Forced-draft type, finned tube heat exchangers
- These exchangers are applied as the high temperature coolers for the 2nd and 3rd compressor sections, and for the final cooler after the 4th section discharge

2.1.1.3.8 Compressor Water-Cooled Heat Exchangers

- Extended surface type water-cooled exchangers are used after the 1st compressor section and as the low temperature cooler for the 2nd section. In these coolers, gas is on the shell side. These coolers incorporate an integral demisting pad at the outlet to recover condensate that is removed from the air in the cooling process.
- A conventional shell and tube exchanger is used as the low temperature cooler for the 3rd section. In this cooler, gas is on the tube side.

2.1.1.3.9 Inlet Air Filter System

- Air filter system based on cylindrical filter cartridge array
- Self-cleaning feature including cleaning air manifolds, pulse pipes, and pulse air control valves
- Filter house with weather hoods, access doorways, and interior lighting
- Clean air plenum
- Inlet silencer
- Duct work between inlet filter and system and compressor inlet
- Filter support structure with stairs and platforms for mounting filter located roughly 5 feet above grade.

2.1.1.3.10 Fourth Section Moisture Separator

- Since the third section compressor cooler does not incorporate an integral demisting pad as the first two sections do, a moisture separator is needed upstream of the entrance to the fourth compressor section.
- Compressor train control valves
- First section blow-off valve—Cage guided control valve with pneumatic actuator
- Second section recycle valve—Cage guided control valve with pneumatic actuator
- Third second section recycle valve—Cage guided control valve with pneumatic actuator
- Fourth section recycle valve—Cage guided control valve with pneumatic actuator
- Final blow-off valve—Cage guided control valve with pneumatic actuator
- First / second section interstage valve—Triple offset butterfly valve with pneumatic actuator
- Second / third section interstage valve—Triple offset butterfly valve with pneumatic actuator
- Third / fourth section interstage valve—Triple offset butterfly valve with pneumatic actuator
- Interstage butterfly bypass valves—Cage guided control valves with pneumatic actuators

2.1.1.3.11 Compressor Train Starting System

- Twelve-pulse LCI-type VFD
- Two-winding phase-shifted VFD isolation transformer
- Two-winding phase-shifted VFD output transformer
- Closed-loop de-ionized water cooling system with water-water heat exchanger for heat rejection to plant cooling water
- One system can be shared to start all compressor trains at a site (note that switchgear and cabling needed to share the VFD is by others)

2.1.1.3.12 Low Pressure (LP) Expander and Combustors

- Multi-stage expander with horizontally split pressure casing
- Eight (8) gas-fuel combustors with water injection for emissions control, configured in a can annular arrangement and mounted on the LP Expander
- AC motor driven lifting oil system for LP Expander, mounted on skid
- LP Expander is mounted on its own baseplate with all piping and wiring brought to the skid edge

2.1.1.3.13 High Pressure (HP) Expander and Combustors

- Multi-stage expander with horizontally split pressure casing
- Two (2) gas-fuel combustors with water injection for emissions control, mounted on the inlet of the HP expander
- AC motor driven lifting oil system for HP and VHP Expander, mounted on skid
- HP Expander is mounted on a common baseplate with the VHP expander. All piping and wiring brought to the skid edge

2.1.1.3.14 Very High Pressure (VHP) Expander

- Multi-stage expander with horizontally split pressure casing

2.1.1.3.15 Expander Train Turning Gear

- Located at the non-drive end of the generator
- The turning gear is used to slow-roll the expander train when it is not operating

2.1.1.3.16 Couplings and Guards

- Flexible Disc Coupling and coupling guard—Generator to LP Expander

- Flexible Disc Coupling and coupling guard—LP Expander to HP Expander
- Flexible Disc Coupling and coupling guard—HP Expander to VHP Expander

2.1.1.3.17 Recuperator and Exhaust Stack

- Gas / gas heat exchanger mounted inside the expander exhaust duct
- Self-supported exhaust stack terminating 100’ above grade
- Four emissions sample ports at 50’ elevation with ladders and platforms for access
- Transition ducting from recuperator to exhaust stack

2.1.1.3.18 Gas Fuel Conditioning Skid (see also Section 4.0)

- Pressure regulating valves for HP and LP fuel gas supplies
- Dual redundant coalescing filters for HP and LP supplies with online transfer valves
- Electric heater with temperature control system for HP and LP supplies
- Flow measurement for HP and LP fuel gas supplies
- Automatic shut-down valves for HP and LP gas supplies
- All components mounted on a baseplate with piping and wiring brought to skid edge

2.1.1.3.19 Motive Air Accumulator

- An air storage vessel that is connected to the VHP Expander inlet piping.
- In an expander trip event, the accumulated volume sustains a controlled flow of cooling air to prevent harmful combustion liner temperature excursions affected by combustion of remnant fuel

2.1.1.3.20 Electric Standby Heater

- The standby heater provides hot air at the inlet to the VHP expander while the expander train
- Is off-line in order to maintain temperatures in the expanders and recuperator

2.1.1.3.21 Expander Emergency Stop Valve (Trip Valve)

- Offset corner body trip valve with hydraulic actuator

2.1.1.3.22 Expander Train Control Valves

- Motive Air Control Valve—Cage guided control valve with hydraulic actuator
- VHP Expander Bypass Valve—Cage guided control valve with pneumatic actuator
- LP Fuel control Valve—Control valve with electric actuator
- HP Fuel control Valve—Control valve with electric actuator

2.1.1.3.23 Expander Interconnecting Piping

- Crossover duct between HP and LP expanders
- Expander inlet pipe between motive air control valve and VHP expander
- VHP expander bypass line piping

2.1.1.3.24 Insulation

- Pre-fabricated, removable blanket insulation covering the following items

2.1.1.3.25 Valves

- Expander trip valve
- Motive air control valve
- VHP bypass line and bypass valve

2.1.1.3.26 Ductwork and Piping

- HP Expander inlet piping & expansion joint assemblies

- HP combustors and expander casing
- HP to LP expander interconnecting duct
- LP combustors, expander casing and exhaust duct

2.1.1.3.27 Hydraulic Power Unit (HPU)

- Hydraulic fluid reservoir
- Dual redundant AC motor driven positive displacement pumps
- Dual redundant filter assembly
- Simplex Hydraulic Fluid Cooler
- All components mounted on a common base with the reservoir

2.1.1.3.28 Hydraulic Fluid Accumulator

- Bladder type high-pressure hydraulic fluid accumulator assembly, mounted on-skid with the HP and VHP expanders

2.1.1.4 Common Compressor and Expander Train Components

The following paragraphs describe components that are either shared between the compressor and expander trains or is of similar construction, type, or characteristic for both expander and compressor trains.

2.1.1.4.1 Four Electrical Machines (Two Motors, Two Generators)

- The motor for the compressor train and the generator for the expander train would be electrical machines of identical design.
- Synchronous electrical machine with static exciter
- Totally Enclosed Water-to-Air (TEWAC) cooling arrangement
- Soleplates and necessary hardware for mounting to concrete foundation
- AC motor driven lifting oil system mounted to the side of the motor

2.1.1.4.2 Four Excitation Control Systems

- Excitation control panel incorporating a dual-redundant thyristor bridge, dual redundant automatic voltage regulator, and dual redundant motor protection relay
- Excitation equipment and controls are mounted in a free-standing cabinet

2.1.1.4.3 Four Line and Neutral Cubicles

- Side-mounted line-connection and neutral connection cubicles incorporating all instrumentation for control and protection of the motor
- All instrumentation is wired to an auxiliary terminal box mounted on the side of each cubicle

2.1.1.4.4 One Plant-wide Control System

- Plantwide control system, including performance control of main machinery, control of auxiliary systems (such as balance of plant systems), start-up and shut-down sequencing, and equipment health monitoring.
- Network architecture design and provision of necessary hardware required to implement the plant wide control system.
- Input-output (I/O) and control functions are partitioned into various modules to be located throughout the plant at strategic locations to minimize field wiring work.
- Provisions for communication and control from remote locations, including interface with the CAISO wide area network as needed for CAISO market participation.
- Operator interface stations suitable for mounting in a control room environment

- Data logging and historian system

2.1.1.4.5 Two Lube Oil Systems

- Each lube system is shared by one compressor train and one expander train and consists of the following:
  - Lube oil reservoir with all other components mounted on top of the reservoir
  - Dual redundant AC motor driven lube oil pumps
  - One air-operated emergency lube oil pump
  - Dual redundant lube oil coolers with online transfer valve
  - Dual redundant lube oil filters with online transfer valve
  - Lube oil temperature control valve
  - Lube oil pressure control valve for the compressor train
  - Lube oil pressure control valve for the expander train
  - One electric lube oil heaters with thermostats, inserted into the reservoir from the top
  - Three 50 percent duty oil mist separators

2.1.1.4.6 Isolation Valves

- These valves are control ball valves incorporating various safety features allowing them to serve as sole isolation device between the high pressure (cavern) air header and the machinery trains. Isolation valves are applied at each of the following locations at identified quantities:
  - Compressor train final throttle valve—One valve per compressor train
  - Recuperator pressure regulator valve—One valve per expander train
  - Extraction line isolation valve—One valve per compressor train

2.1.1.4.7 Relief Valves

- Relief valves are pilot operated type with manual lift lever. Relief valves are applied at each of the following locations at identified quantities:
  - Second section compressor discharge—Three relief valves per compressor train
  - Third section compressor discharge—One relief valves per compressor train
  - Fourth section compressor discharge—Two relief valves per compressor train
  - Recuperator inlet—Four relief valves per expander train
  - HP expander inlet—One relief valve per expander train

2.1.1.4.8 Silencers

All Silencers are carbon steel shell, head, and internals, with glass-fiber acoustic packing. Silencers are applied at the following locations at identified quantities:

- Compressor train LP silencer (serves compressor first section blow-off valve and second section relief valve) –One silencer per compressor train
- Compressor train HP silencer (serves compressor third and fourth stage relief valves and final blow-off valve)—One silencer per compressor train
- Expander Train silencer (serves recuperator inlet relief valve, recuperator de-inventory valve, and HP expander relief valve)—One silencer per expander train

2.1.1.5 Balance of Plant Equipment and Systems

The Balance of Plant (BOP) and common equipment and systems support all modes of plant operations and are comprised of the following major systems:

- Motive-Air System for the delivery of compressed air to and from the turbo-machinery and underground storage reservoir, including incoming air filtration, piping, and control valves
- Heat-Rejection Systems that serve the heat removal requirements of the turbo-machinery and other essential equipment
- Natural Gas System that conditions and delivers natural gas from the PG&E meter station to the turbo-expander combustors
- Emissions Control and Monitoring System that ensures CAES plant stack emissions meet local environmental air quality regulations (see further discussion, below)
- Electrical Power Systems that include High-Voltage and Medium-Voltage transformers and switchgear, Variable Frequency Drive for Motor "soft starting", and Grid Synchronization (see further discussion, below)
- Control System that provides integrated performance monitoring and operation of the entire CAES Plant from a common control room with remote access capability as an option
- Water Systems for cooling, water injection for emission control, and general purpose
- Engineered Noise Controls for Plant and Equipment to comply with local noise ordinance
- Ancillary equipment supporting the CAES train, such as lube oil system, electric standby heater, blackstart generator
- Lighting, HVAC, Fire Protection, Communications, and Waste Systems as commonly found in a contemporary power plant

2.1.1.6 Air Pollution Control Equipment and Systems

Assuming the turbo-expanders employed by the KICP are similar to simple-cycle combustion turbines, emission limits at the stack exhaust, based on BACT levels for recently permitted simple-cycle combustion turbines, are approximately 2.5 ppm NOx, 2 ppm CO, 1 ppm VOC, and less than 2 pounds per hour of $PM_{10}/PM_{2.5}$.

2.1.1.6.1 Selective Catalyst Reduction (SCR) System

- Single stage CO-reducing catalyst bed
- Ammonia injection grid piping and nozzle system
- Single stage NOx-reducing catalyst bed
- Exhaust duct work housing catalyst beds and ammonia injection system with internal insulation and insulation liner
- Ammonia vaporizer and injection skid for use with aqueous ammonia, suitable for locating in outdoor environment
- Control of the ammonia system would be incorporated into the plant-wide control system

2.1.1.6.2 Water-Injection System for Emissions Control

- Dual redundant water filter
- Dual redundant water injection pumps for HP and LP water supplies
- Flow measurement for HP and LP water supplies
- Flow control valves for HP and LP water supplies
- All components mounted on a baseplate with piping and wiring brought to skid edge

2.1.1.6.3 Continuous Emissions Monitoring System

- Extractive Probe with controller
- Chemiluminescent NO-NO2-NOx Analyzer with Paramagnetic O2 Sensor
- Gas Filter Correlation CO Analyzer
- Optical Filter Correlation CO2 Analyzer
- Umbilical sample line up to 150'
- Analyzer auxiliaries detailed in the technical appendix.
- Data acquisition system
- Analyzer shelter housing instruments and data acquisition system

2.1.1.7 Cooling Tower System

The cooling tower system includes a 10-cell mechanical draft cooling tower, circulating cooling water pumps, interconnecting piping, and the associated equipment to transfer heat between the compressors and the cooling water system.

Within the recirculating cooling water loop, water is piped through the tubes of the heat exchanger where it absorbs a determined amount of heat energy from the compressed air. The heated water is pumped to a cooling tower, where it is sprayed across the top of the tower and allowed to be air cooled by flowing freely through a fill medium to a basin at the bottom of the tower. The fill slows the water movement so that cooling air has more contact time with the water. Simultaneously, induced draft fans move the air counter to the water flow. As the air passes over the heated water, some of the water's heat energy is removed via evaporation, cooling the remaining water, which is not evaporated. The evaporated water exits the cooling tower as a vapor along with a very small percentage (approximately 0.0005 percent) of water droplets that are entrained in the counter-flow air stream (known as "atmospheric drift" or "cooling tower drift").

The cooled water is then pumped from the cooling tower basin back to the shell-and-tube heat exchangers and the cooling process is repeated as described above. The water lost in the evaporation process is recovered by adding makeup water from the cooling water supply, which would be recycled water supplied by the City of Lodi's White Slough WPCF.

In addition to the water loss due to evaporation in a wet cooling cycle, water loss due to cooling tower blowdown occurs. Every time the water cycles through the cooling tower and is evaporated, trace mineral concentration in the water increases.

In order to prevent fouling and to maintain required circulating water chemistry, some of the mineral-concentrated water is discharged on a continuous basis via a process called blowdown. The higher the concentration of minerals in the cooling tower water, the higher rate of blowdown is required. Water that is lost during blowdown must be replenished via makeup water. Therefore makeup water must account for the total water lost due to evaporation and blowdown.

2.1.2 Process Description—Storage Reservoir and I/W Well Field

The compressed air storage reservoir is an underground geological structure located approximately 4,700 feet below the surface on King Island, approximately 2.6 miles southwest of the ECF site. The reservoir is a nearly depleted natural gas field that has been used for gas production from October 1985 to the present. All gas production from this field would have ceased prior to project commissioning, making the structure available for CAES. The project design includes two well pads, totaling 10 acres, with up to 30 total I/W wells. Each well pad would also have a control building, native natural gas monitoring and a control system to manage residual natural gas entrained in compressed air withdrawn from the I/W wells,

and a produced water storage tank. The base case design includes a total of two injection wells for produced and waste water disposal: one located at the East Well Pad and one either located at the West Well Pad or at the ECF. Figures 2.1-5 and 2.1-6 are general arrangement drawings of the East and West well pads, respectively.

Compressed air pumped through the air pipeline from the ECF would be injected into the storage reservoir at the well pads, during periods of excess or low-cost generation. When needed for energy production, air would be released from the reservoir, stripped of produced water, monitored for excess native natural gas, and then returned to the ECF through the pipeline.

2.1.2.1 Reservoir Design Considerations

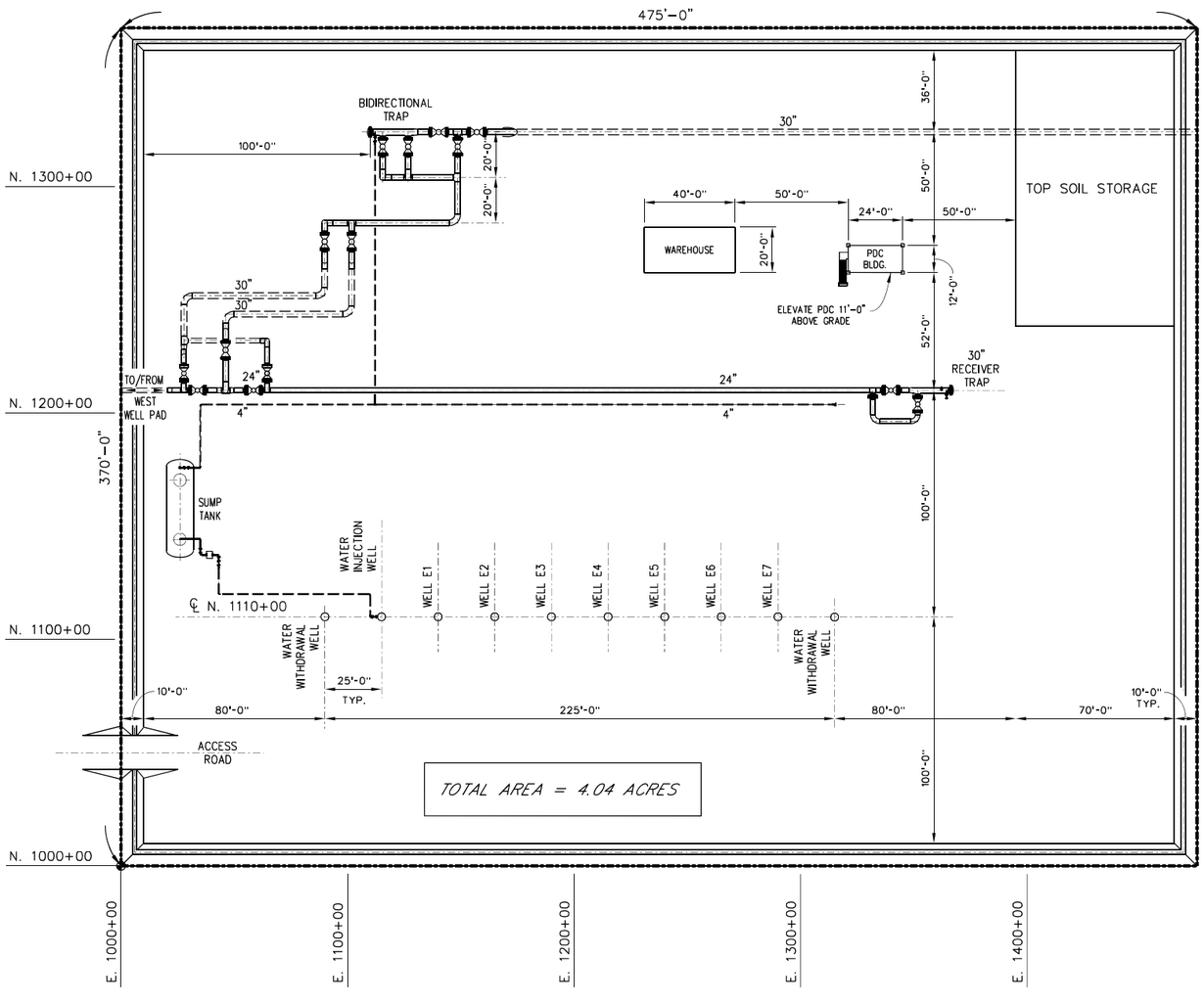
The King Island gas well field was selected as an air storage reservoir based on the results of detailed evaluation of its surface and subsurface attributes and performance testing. This reservoir evaluation process was conducted under U.S. DOE Project DE-OE0000198 (Recovery Act Smart Grid—Advanced Underground Compressed Air Energy Storage). The compression testing was completed in mid-2015. Reservoir core analysis and modeling indicate that with an established air compression bubble of approximately 8 to 10 Bscf (billion standard cubic feet), the reservoir can support a 300 MW power generation facility under a variety of operating scenarios. For example, to achieve that power output for 10 hours/day Monday through Friday, the air flow requirements from the reservoir are 1.1 Bscfd (billion standard cubic feet per day) at a minimum pressure of 1,700 psig delivered to the ECF. A corresponding charging cycle could follow a weekday injection period of 6 hours (at approximately the same rate as maximum withdrawal), preceded by 20 hours of weekend charging. Alternatively, weekend charging could be reduced or increased as weekday injection is varied. The objective of the injection program would be to maintain the bubble size and pressure by equalizing injected and withdrawn volumes in relatively short time periods, weekly, if possible.

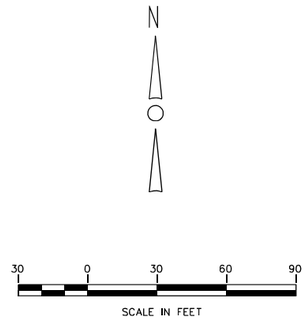
The development of the CAES reservoir is very similar to that of a natural gas underground storage reservoir. The key elements are high capacity injection/withdrawal (I/W) wells, observation wells to monitor conditions within and around the reservoir, and water injection wells for the disposal of produced and ECF wastewater. The I/W wells' locations within the reservoir need to be based on a plan to minimize flow interference between the wells during periods of high flow rates and also to fully utilize the reservoir's volumetric capacity, which provides for longer sustained operations.

The anticipated design of the I/W wells is based on the results of the compression modeling and the simulation results of various well completion designs. It was determined that straight, directional or highly deviated wells are preferred to horizontal well designs. Directional and highly deviated wells would provide better control over the native gas concentrations in the withdrawal flow stream than horizontal wells.

Based on experience during the UIC permitting process for the compression testing I/W well it appears that the U.S. Environmental Protection Agency (EPA) would require two separate strings of casing to be cemented from below the Underground Sources of Drinking Water (USDW) to the surface. The preliminary casing program design calls for 20-inch surface casing, an intermediate casing to true vertical depth (TVD), and then casing set to the top of the reservoir. The reservoir would be completed with a well screen and gravel pack and tubing set on a packer near the top of the reservoir. Casing and tubing lengths would be longer for more highly deviated wells. Each I/W well is designed for a flow rate of up to 50 MMscfd. Additional well design parameters are covered in detail in the UIC well permitting analysis document (Appendix 2A).

Limits on residual entrained natural gas concentration may be required to meet thresholds related to ECF equipment (e.g., combustor/control). To assure the prescribed limits are met, each well would be equipped with native gas monitoring and control features.





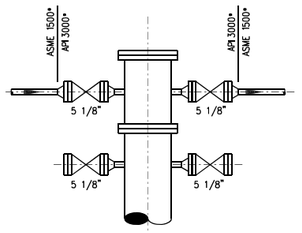
NOTES:

1. THIS DRAWING IS REPRESENTATIVE OF THE EAST WELL PAD DESIGN EXPECTED AND IS BASED ON CONCEPTUAL ENGINEERING. ALL INFORMATION IS SUBJECT TO CHANGE DURING FINAL DESIGN.

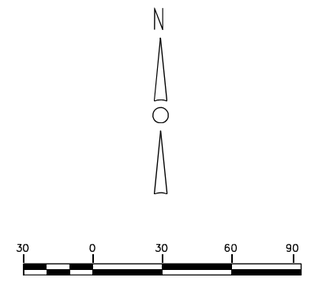
CONCEPTUAL DESIGN
NOT FOR CONSTRUCTION
DATE 9-11-14

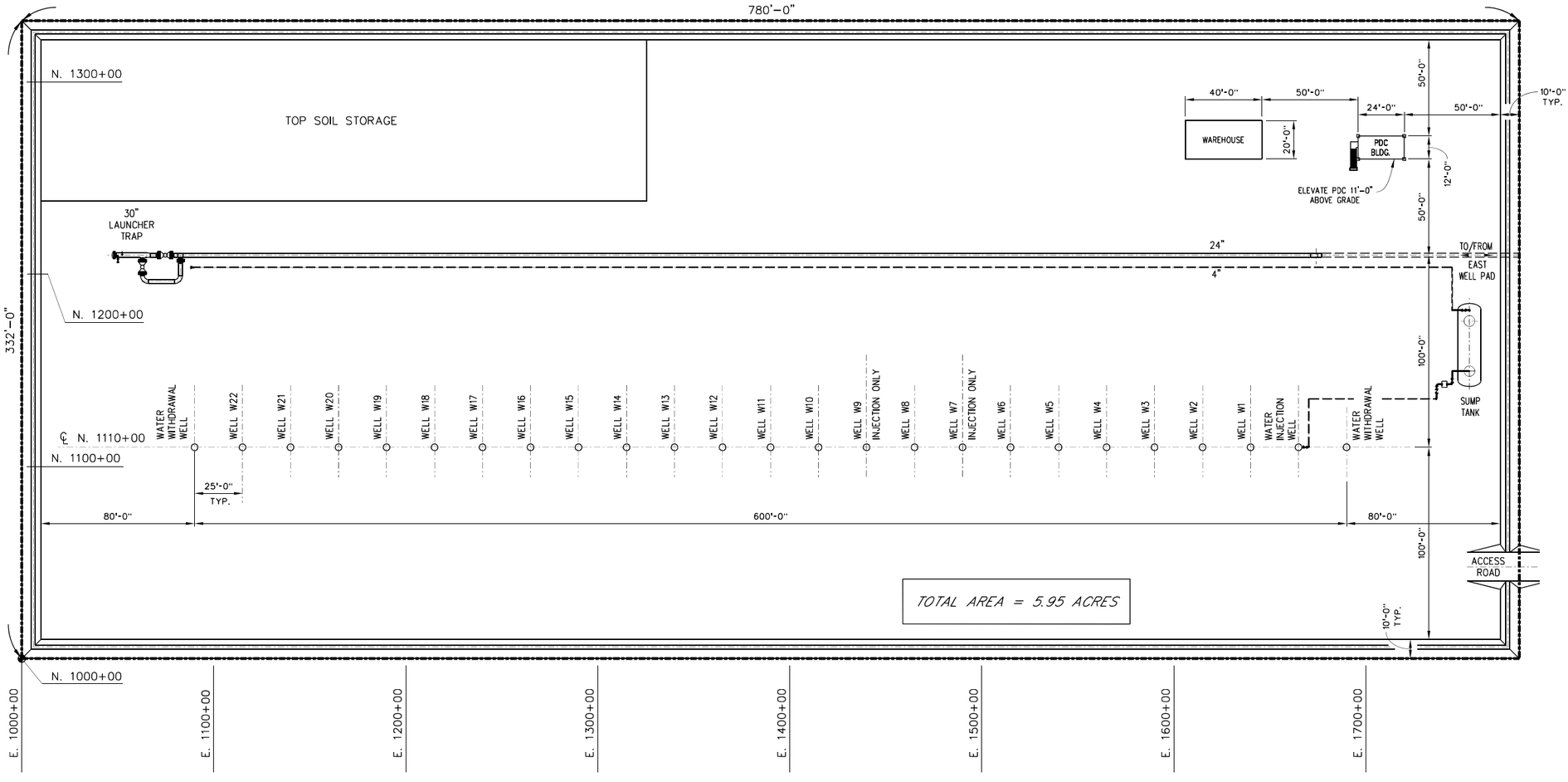
FIGURE 2.1-5
General Arrangement, Eastern Well Pad
PG&E King Island Compressed Air Energy Storage Project
Environmental Siting, Licensing, and Permitting Analysis

Source: WorleyParsons, Drawing SK-5 EAST PLOT, Rev. C, 09/11/2014.



ELEVATION
TYPICAL WELLHEAD
AIR WITHDRAWAL/INJECTION
NOT TO SCALE





NOTES:
1. THIS DRAWING IS REPRESENTATIVE OF THE WEST WELL PAD DESIGN EXPECTED AND IS BASED ON CONCEPTUAL ENGINEERING. ALL INFORMATION IS SUBJECT TO CHANGE DURING FINAL DESIGN.

CONCEPTUAL DESIGN
NOT FOR CONSTRUCTION
DATE 9-11-14

FIGURE 2.1-6
General Arrangement, Western Well Pad
PG&E King Island Compressed Air Energy Storage Project
Environmental Siting, Licensing, and Permitting Analysis

Source: WorleyParsons, Drawing SK-4 WEST PLOT, Rev. C, 09/11/2014.

2.1.2.2 Water Withdrawal and Disposal

One of the key findings from the modeling work is that reservoir pressure will be affected by a partial water drive. As natural gas was produced from the reservoir, water flowed into the reservoir from the underlying aquifer in response to declining pressure resulting from the release of the natural gas. Over time, reservoir pressure has continued to rise due to a continued influx of water. This response has been relatively slow, and the modeling has revealed that the effort to push the water from the reservoir back into the aquifer would likely be slow as well. With a given maximum injection pressure constraint, a developer could either inject at a rate that the water would naturally efflux from the reservoir (push the water back with pressure), or physically remove a volume of the water from the invaded zone in the reservoir. Time constraints to develop an adequately sized air bubble in a reasonable period of time may require the physical removal of some water from the reservoir.

The initial modeling runs assumed the water removal strategy during the bubble build period would involve four water withdrawal wells located on the perimeter of the storage reservoir and operating at approximately 3,200 Bbl per day per water well. Modeling based on this water removal rate and a maximum injection pressure of 3,000 psi, showed that building an 8 to 10 Bscf bubble in approximately one year would be feasible. The removed water would be re-injected into EPA-permitted injection wells completed to zones deeper than the underground sources of drinking water (USDW). In the vicinity of King Island, the Starkey formation would meet this criterion as it is deeper than the USDW and would not interfere with the air storage operations in the Mokelumne River formation. Disposal of produced waters into the Starkey formation would require one or more disposal wells, tankage for temporary storage, properly sized pumps for this purpose, and the interconnecting piping between the equipment location and the disposal well site.

In addition to the need to dispose of water withdrawn from the storage reservoir during the bubble build period, it will be necessary to dispose of waters produced during normal operations. Reservoir modeling has indicated that an estimated 2,500 to 3,500 Bbl/day of water could be produced and separated from the air flow stream during normal withdrawal operations. This produced water would be disposed of in the wastewater injection wells (see section 2.1.4).

2.1.2.3 Reservoir Operations

Unlike other gas storage operations, the air stored in a CAES reservoir is the motive force that would be used to drive electric generation equipment. The following basic principles of operation would be followed to maintain the maximum capability and greatest operational flexibility for the reservoir:

- The bubble build will take place slowly and will ensure high pressure throughout the withdrawal cycle.
- Reservoir pressure will be maintained at a high level. This will improve delivery of high pressure air to the surface equipment, and prevent groundwater from encroaching into the reservoir.
- Concentration of native natural gas in the air flow from the reservoir to the I/W wellheads should be limited by actively monitoring and intervening in the withdrawal of individual wells as required. Individual wells are expected to perform differently than others, so identifying wells having higher gas concentrations and using operating strategies to limit their impact on the total flow stream will be important.
- Well operation will be investigated and reworked at the first sign of impaired performance. Any underperforming well puts a proportionately larger burden on the remaining wells and can have an impact on the total performance of the reservoir.

- High-performing wells should not be over-produced. This could lead to a reduction in capability if one of these wells were to fail.

2.1.3 Compressed Air Pipelines

A 30-inch diameter pipeline approximately 2.6 miles long would be constructed to deliver compressed air from the ECF compressors to the well field/reservoir and from the well field to the ECF generation equipment. Thus the air pipeline would allow bi-directional flow between the ECF and the well pads. The air pipeline design would include cathodic protection, blow-down valves (silenced as necessary), condensate traps/drains to manage water dropout as the air cools in the pipeline, and pipeline "pigging" equipment for maintenance. Figure 1.2-2 shows the pipeline route. A 0.3-mile-long air collector/connector pipeline would also be constructed between the East and West well pads.

2.1.4 Wastewater Disposal System

In the base case design, ECF wastewater would be disposed of via two wastewater injection wells. These wells would also be used for injection of the produced water from the reservoir. One injection well would be located at the east well pad and a second at either the ECF site or the west well pad. To connect the ECF to the injection well(s) at the well pads, cooling tower blowdown and other industrial wastewater from the ECF could be piped to King Island for disposal. The waste water pipeline would be co-located in the same trench as the air pipeline. The injection wells would require Underground Injection Control (UIC) permits from the EPA. An analysis of the UIC permit process for the KICP is found in Appendix 2A.

Implementation of a zero liquid discharge system has been considered as a wastewater disposal alternative to the injection wells (see Section 6.0, Alternatives).

2.1.5 Major Electrical Equipment and Systems

The bulk of the electric power produced by the facility would be transmitted to the electrical grid through a 270-foot-long connection from the facility switchyard to PG&E's 230 kV Gold Hill-Eight Mile Road transmission line. Electric power would be used onsite mainly to drive the compressors, but also for minor uses to power auxiliaries such as pumps and fans, control systems, and general facility loads including lighting, heating, and air conditioning. A station battery and UPS system also would be used to provide power requirements as backup power for control systems and other critical uses to allow for safe coast down during emergency trip events. Transmission and auxiliary uses are discussed in the following subsections.

2.1.5.1 Alternating Current (AC) Power—Transmission

Power would be generated by the expander-generators at 13.8-kV and stepped up by two fan-cooled generator step-up (GSU) transformers to 230-kV for transmission to the grid. Auxiliary power would be fed from the 13.8-kV bus of the two expanders through separate station unit service transformers, which would step the power down to 4.16 kV. Each expander would have a 13.8-kV generator circuit breaker, located on the generator output, to isolate and synchronize the expander to the grid during startup. Surge arresters would be provided at the high-voltage bushings to protect the transformers from surges on the 230-kV system caused by lightning strikes or other system disturbances. The high-voltage side of the GSU transformers would be connected to gas-insulated (SF_6) circuit breakers and then radially connected to the outgoing generation tie line to the transmission system. The generation tie-line would be approximately 270 feet long and would use lattice and/or tubular steel support towers. Section 3.0, Electrical Transmission, presents additional information regarding the electrical transmission system.

2.1.5.2 AC Power—Distribution to Auxiliaries

Auxiliary power to the expander-generator train would be supplied at 4.16-kV and 480 volts AC by a double-ended 4.16-kV switchgear lineup and a double-ended 480-volt load center substation arrangement, as indicated on the single line diagram. Two oil-filled, 18kV/4.16-kV station unit service transformers would supply primary power to the switchgear and then subsequently to large motor loads including the fuel gas compressors and to the 4.16 kV side of the 4.16-kV/480-volt, oil-filled load center transformers. The high-voltage side of the station unit service transformers would be connected to a tap on the isolated phase bus duct connecting the generator to the respective GSU transformer low voltage (secondary) winding. This connection would allow the switchgear to be powered from the local grid via the GSU transformer whenever the expander-generators are not running or directly from the expander-generators when the expander-generators are running. The 4.16-kV switchgear lineup would supply power to the fuel gas compressors, other large motor loads, the turbo expander starting system, and to the load center transformers for 480-volt power distribution. The 4.16-kV switchgear would have vacuum interrupter circuit breakers for the main incoming feeds and for power distribution. Each load center transformer would be oil-filled and would supply 480-volt, three-phase power to the expander-generators and balance-of-plant 480-volt motor control centers (MCCs).

The MCCs would provide power through feeder breakers to the various 480-volt motor loads, and other low-voltage plant loads, including 480-volt power distribution panels, and lower voltage lighting and distribution panel transformers. Power for the AC power supply (240-volt/120-volt) system would be provided by the 480-volt MCCs and 480-volt power panels. Dry-type transformers would transform 480-volt power to 240/120-volt power.

2.1.5.3 125-volt DC Power Supply System

A 125-volt DC power supply system consisting of a minimum of two battery banks, two battery chargers per battery bank, and one or more distribution panels would be supplied for balance-of-plant equipment. Each turbo expander and the plant switchyard would be provided with its own separate battery systems, chargers, and panel boards.

Under normal operating conditions, the balance-of-plant battery chargers supply DC power to the DC loads. The battery chargers receive 480-volt, three-phase AC power from the AC power supply system and continuously charge the battery banks while supplying power to the DC loads.

Under abnormal or emergency conditions, when power from the AC power supply system is unavailable, the batteries supply DC power to the DC system loads. Recharging of a discharged battery occurs whenever 480-volt power becomes available from the AC power supply system. The rate of charge depends on the characteristics of the battery, battery charger, and the connected DC load during charging. The anticipated maximum recharge time would be 24 hours.

2.1.5.4 Uninterruptible Power Supply System

The turbo-expanders and power block also would have an essential service 120-volt AC, single-phase, 60-hertz uninterruptible power supply (UPS) to supply AC power to essential instrumentation, critical equipment loads, and unit protection and safety systems that require uninterruptible AC power.

A UPS inverter would supply 120-volt AC single-phase power to the UPS panel boards that supply critical AC loads. The UPS inverter would be fed from the station 125-volt DC power supply system. The UPS system would consist of one full-capacity inverter, a static transfer switch, a manual bypass switch, an alternate source transformer, and one or more panel boards.

The normal source of power to the system would be from the 125-volt DC power supply system through the inverter to the UPS panel board. A solid-state static transfer switch would continuously monitor the inverter output and the alternate AC source. The transfer switch would automatically transfer essential AC loads without interruption from the inverter output to the alternate source upon loss of the inverter output. The distributed control system (DCS) operator stations would be supplied from the UPS. The continuous emission monitoring system equipment, DCS controllers, and input/output (I/O) modules would be fed using either UPS or 125-volt DC power directly.

2.1.5.5 Alternate Power Source

The project would include an alternate power source fed from the PG&E local distribution system and provided with a circuit breaker, transformer, and meter. The transformer would step-down the voltage from the associated distribution voltage (e.g., 12 kV) to 480 volts. The alternate power feed would be connected to the 480-volt plant essential service MCC to provide power to those plant loads that require AC power to allow for a safe shutdown in the event of a loss of the 230 kV and plant power. The alternate power source would power loads such as the plant battery chargers; expander-turbine turning gears; plant essential lighting system; fire protection system; DCS (plant computer system); and heating, ventilation, and air conditioning systems in the event of the loss of facility power. In the event of a loss of power at the 230-kV level, the alternate power source would be manually activated via a transfer switch that interrupts the normal 480-volt feed to the plant essential service MCC.

2.1.5.6 12-kV Distribution Service to the Well Pads

An approximately 3,000 foot extension from the local 12-kV distribution system would provide power to the well pads for injection well operation, lighting, and control room power.

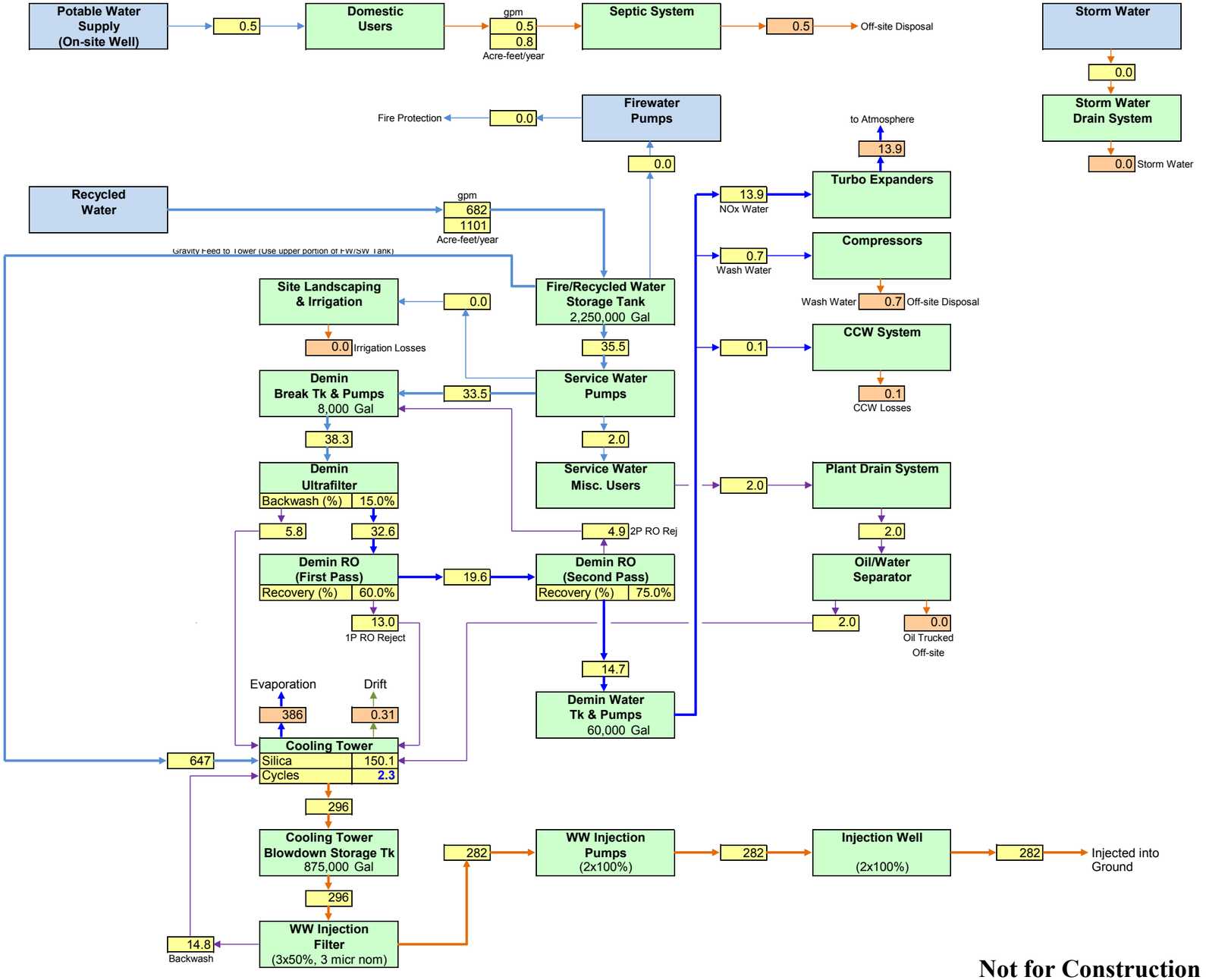
2.1.6 Fuel System

The combustors would be designed to burn natural gas only. The natural gas requirement during base load operation at ISO conditions is approximately 1,363 MMBtu/hr (HHV basis, total for two expanders). Natural gas would be delivered to the site from PG&E's Distribution Feeder Main (DFM) via a new 1.36-mile-long, 12-inch diameter pipeline that would extend from just east of North Thornton Road, under I-5, then north along the east side of the White Slough WPCF and its treatment ponds to the ECF site. At the plant site, the PG&E pipeline would terminate at a meter station. On the ECF side of the meter station, natural gas would flow through gas pressure control, compressor and gas scrubber/filtering equipment, prior to entering the expanders. Section 4.0 contains additional information about natural gas supply and use.

2.1.7 Water Supply and Use

Figures 2.1-7a, 2.1-7b, and 2.1-7c are water balances representing three operating conditions. Figure 2.1-7a represents average water use over one year, including compression and expansion/generation. Figure 2.1-7b represents operation of the compressors (the most water-intensive use) at peak summer conditions (111.6°F dry bulb temperature) with both compressors operating at 100 percent load. Figure 2.1-7c represents operation of the compressors under cold winter conditions (16.5°F dry bulb temperature) with both compressors operating at 100 percent load.

The King Island CAES facility would use recycled water provided by the City of Lodi for cooling and process uses. The project would access this water through a 0.3-mile-long pipeline in I-5 Frontage Road from the City's White Slough WPCF. Potable water would be supplied from an on-site well.



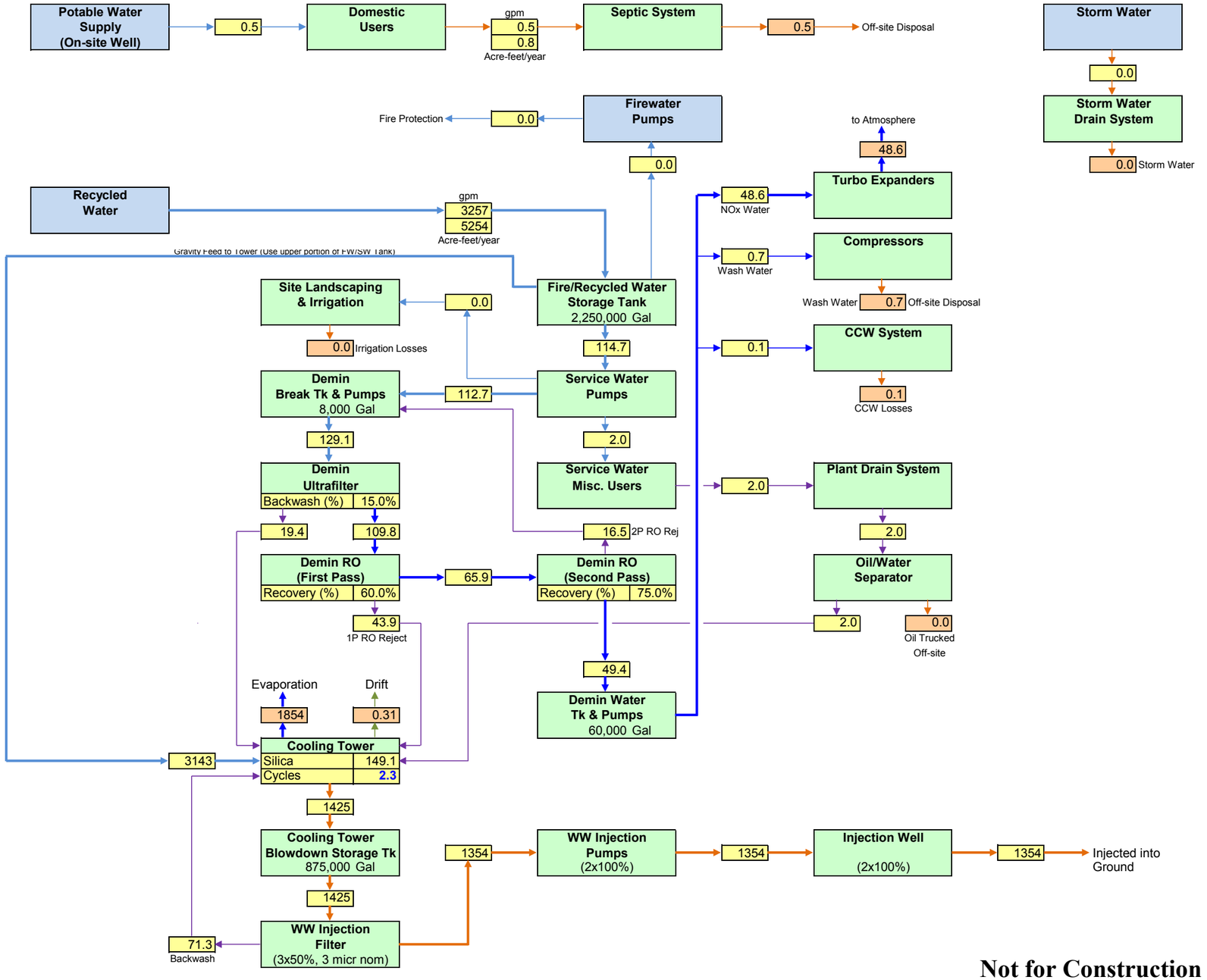
All flows are in US GPM unless otherwise specified.

Thermal Design Case:	Case 26
Configuration	Annual Average
Dry Bulb Temp, deg. F	Varies
Wet Bulb Temp, deg. F	Varies
Ambient Pressure, psia	14.70
Units Operating	2.00
Net Power Output (MW)	5
Dispatch (%)	28.54%

Not for Construction

FIGURE 2.1-7a
Water Balance, Average Annual
PG&E King Island Compressed Air Energy Storage Project
Environmental Siting, Licensing, and Permitting Analysis

Source: WorleyParsons, Drawing PGCS-0-SK-021-010-012 Rev. A, 08/20/2014.



Legend

- Major Process Flow
- Minor Process Flow
- Recycled/Potable Water
- Cooling Water
- Waste Stream
- Recovered/Recycled Water
- Steam
- High Purity Water

Indicates material that leaves the system

Internal flow

Water Source

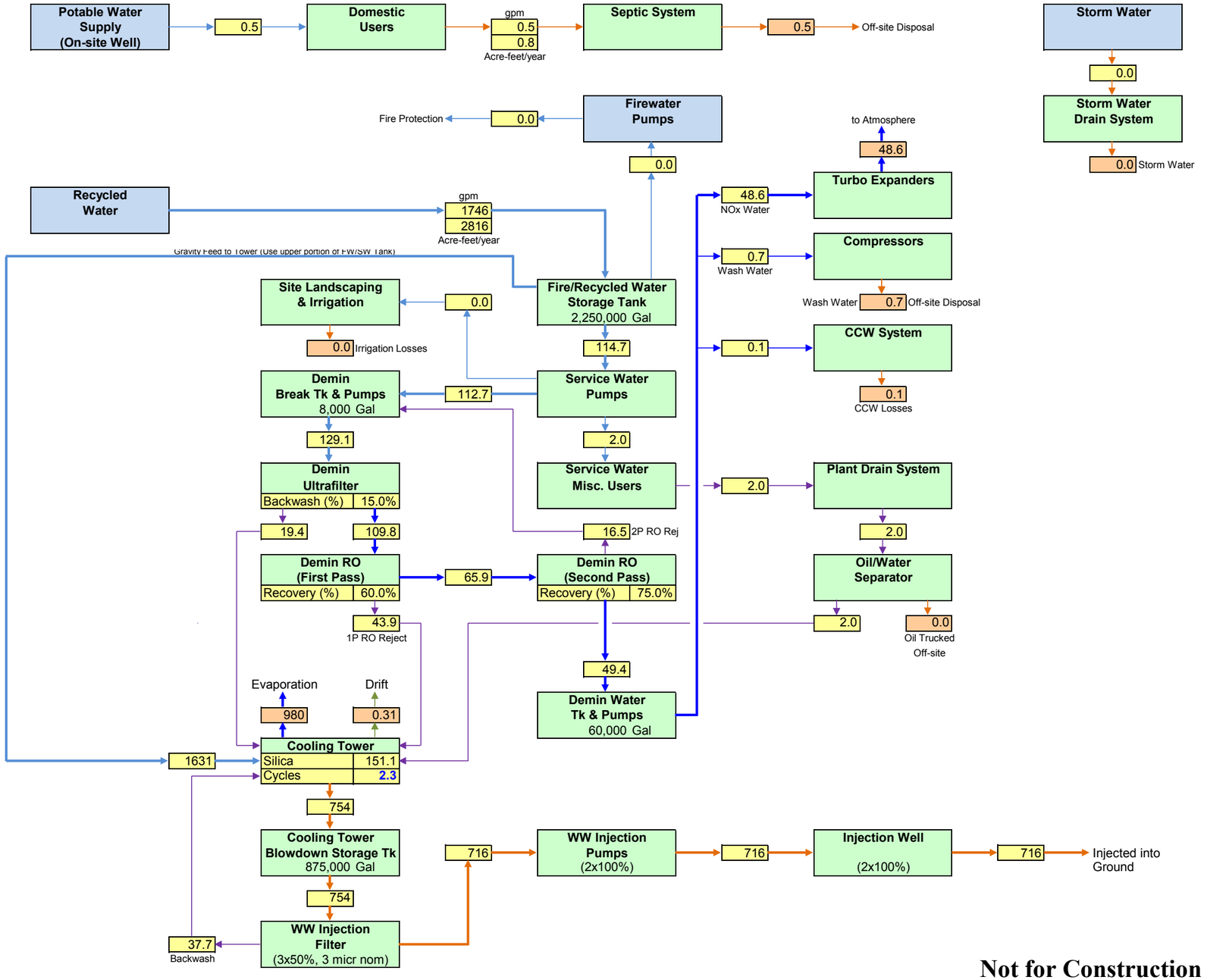
All flows are in US GPM unless otherwise specified.

Thermal Design Case:	Case 10
Configuration	Extreme High
Dry Bulb Temp, deg. F	111.60
Wet Bulb Temp, deg. F	79.40
Ambient Pressure, psia	14.70
Units Operating	2.00
Net Power Output (MW)	-267
Dispatch (%)	100.00%

Not for Construction

FIGURE 2.1-7b
Water Balance, Extreme High Temperature Configuration
PG&E King Island Compressed Air Energy Storage Project
Environmental Siting, Licensing, and Permitting Analysis

Source: WorleyParsons, Drawing PGCS-0-SK-021-010-010 Rev. A, 08/20/2014.



All flows are in US GPM unless otherwise specified.

Thermal Design Case:	Case 11
Configuration	Extreme Low
Dry Bulb Temp, deg. F	16.50
Wet Bulb Temp, deg. F	15.50
Ambient Pressure, psia	14.70
Units Operating	2.00
Net Power Output (MW)	-298
Dispatch (%)	100.00%

Not for Construction

FIGURE 2.1-7c
Water Balance, Compressor Operation, Extreme Low Temperature Configuration
PG&E King Island Compressed Air Energy Storage Project
Environmental Siting, Licensing, and Permitting Analysis

Source: WorleyParsons, Drawing PGCS-0-SK-021-010-011 Rev. A, 08/20/2014.

2.1.7.1 Water Requirements

Average annual operations based on the expected operation configuration would require process water use of about 1,101 acre-feet per year. Plant makeup water would be fed the water supply pipeline through metering and an air gap into the service water/fire water storage tank. Water from the fire/service water tank would be used as plant service water, irrigation water, makeup to the cooling tower. The fire/service water storage tank would hold approximately 2.25 million gallons of storage in the event of a disruption in water supply.

Cooling tower blowdown would be stored in an 875,000 gallon tank for use and later disposal in the injection well system.

2.1.7.2 ECF Process Wastewater Requirements

On an annual average basis, discharge of ECF process water to the injection wells would be about 282 gpm. Under peak July conditions (111.6°F dry bulb temperature) with both compressors operating at 100 percent, discharge ECF process water to the injection wells would be about 1,354 gpm. On an average annual basis, the total process wastewater discharged from the ECF is estimated to be approximately 42.3 million gallons per year. Wastewater disposal would be as described in section 2.1.4.

2.1.7.3 Water Disposal from the Storage Reservoir

Four water withdrawal wells would be located on the perimeter of the storage reservoir during the bubble build stage and would operate at rates of approximately 3,200 Bbl per day per water withdrawal well. This water would be re-injected into EPA-permitted injection wells in the Starkey formation, which is deeper than the USDW. Disposal of produced waters into the Starkey formation would require one or more disposal wells, tankage for temporary storage, properly sized pumps for this purpose, and the interconnecting piping between the equipment location and the disposal well site.

It will also be necessary to dispose of water produced during normal air withdrawal operations. An estimated 5,000 Bbl/day of water may be produced and separated from the air flow stream during steady state withdrawal operations. Up to 2.5 times that amount could be produced during the first 6 months of operation. In the base case scenario, this produced water would be disposed of at the same injection wells as the water withdrawn during the initial bubble-build process.

2.1.7.4 Water and Wastewater Treatment

ECF process makeup water would be demineralized by passing service water through a reverse osmosis system followed by offsite-regenerated mixed-bed demineralizer bottles. The reject stream from the reverse osmosis system would be discharged to the plant process drain system and the demineralized water would be sent to a 60,000-gallon storage tank. The demineralized water storage tank would provide approximately 48 hours of storage at peak demand. Demineralized water would be used for power cycle makeup and for turbo expander wash water. Wastewater from turbo expander water washes would be collected in turbine expander drain tanks and then trucked offsite for disposal.

Microfilters provide additional filtering of the recycled water prior to use as service water and makeup to the demineralized water system. Backwash water from the microfilters would be discharged to the plant process drain system and ultimately the sanitary sewer. Service water would be used for equipment washdown and other miscellaneous plant uses. Wastewater from process areas that could potentially include oil or other lubricants would be directed to an oil-water separator for removal of accumulated oil that may result from equipment leakage or small spills and large particulate matter that may be present

from equipment washdowns. Effluent from the oil-water separator would be collected and stored for off-site disposal. Sanitary wastewater would be discharged to the on-site septic system.

2.1.8 Emission Control and Monitoring

Air emissions from the combustion of natural gas in the combustors would be controlled using state-of-the-art systems. To ensure that the systems perform correctly, continuous emission monitoring for NO_x and carbon monoxide would be performed. Section 5.1, Air Quality, includes additional information on emission control and monitoring.

2.1.8.1 NOx Emission Control

In addition to water injection as described above, selective catalytic reduction would be used to control NO_x concentrations in the exhaust gas emitted to the atmosphere to 2.0 ppmvd from the stack. The SCR process would use aqueous ammonia. Ammonia slip, or the concentration of unreacted ammonia in the exiting exhaust gas, would be limited to 5 ppmvd from the stack. The SCR equipment would include a reactor chamber, catalyst modules, ammonia storage system, ammonia vaporization and injection system, and monitoring equipment and sensors. The project would make use of the ammonia delivery system, which consists of a single horizontal and cylindrical 10,000-gallon 19 percent ammonia tank, a spill containment basin, and a refilling station with a spill containment basin and sump.

2.1.8.2 Carbon Monoxide and Volatile Organic Compounds

An oxidizing catalytic converter would be used to reduce the carbon monoxide concentration in the exhaust gas emitted to the atmosphere from the stacks to 2 ppmvd and volatile organic compounds to 2 ppmvd.

2.1.8.3 Particulate Emission Control

Particulate emissions would be controlled by the use of best combustion practices; the use of natural gas, which is low in sulfur, as the sole fuel for the combustors.

2.1.8.4 Continuous Emission Monitoring

Continuous emission monitors would sample, analyze, and record fuel gas flow rate, NO_x and carbon monoxide concentration levels, and percentage of oxygen in the exhaust gas from each of the two stacks. This system would generate reports of emission data in accordance with permit requirements and would send alarm signals to the plant supervisory control system when emissions approach or exceed pre-selected limits.

2.1.9 Waste Management

Waste management is the process whereby all wastes produced at the facility are properly collected, treated if necessary, and disposed of. Wastes include process and sanitary wastewater, nonhazardous waste (liquid and solid), and hazardous waste (liquid and solid). Waste management is discussed in more detail in Section 5.14.

2.1.9.1 Stormwater Collection, Treatment, and Disposal

Stormwater that falls within process equipment containment areas would be collected and discharged to the plant process drain system. Wastewater having the potential for contamination with oil or grease would be routed to the oil/water separator. Stormwater that falls outside the process equipment containment areas would either percolate directly into the soil or drain to the stormwater retention pond. Effluent from the oil-water separator would be collected and stored for off-site disposal. Sanitary

wastewater would be discharged to the on-site septic system. The water balance diagrams, Figures 2.1-7a, 2.1-7b, and 2.1-7c, show the expected wastewater streams.

2.1.9.2 Plant Drains and Oil/Water Separator

General plant drains would collect containment area washdown, sample drains, and drainage from facility equipment drains. Water from these areas would be collected in a system of floor drains, hub drains, sumps, and piping and routed to the process drain collection system. Drains that potentially could contain oil or grease would first be routed through an oil/water separator. Wastewater streams that are unlikely to contain oil and grease, including cooling tower blowdown and reverse osmosis reject would bypass the oil/water separator. Miscellaneous wastewaters, including those from combustion turbo expander water washes and from some water treatment membrane-based system's cleaning operations, would be collected in holding tanks or sumps and would be trucked offsite for disposal at an approved wastewater disposal facility.

2.1.9.3 Sanitary Wastewater

Sanitary wastewater from such uses as sinks, toilets, showers, dishwashers, and other sanitary facilities would be discharged to the facility's sanitary sewer collector and septic system. Effluent from the oil/water separator would be trucked offsite for disposal. The water balance diagrams, Figures 2.1-7a, 2.17b, and 2.1-7c, show the expected wastewater streams.

2.1.9.4 Solid Wastes

The facility would produce maintenance and plant wastes typical of power generation operations. Generation plant wastes include oily rags, broken and rusted metal and machine parts, defective or broken electrical materials, empty containers, and other solid wastes, including the typical refuse generated by workers. Solid wastes would be trucked offsite for recycling or disposal (see Section 5.14, Waste Management).

2.1.9.5 Hazardous Wastes

Several methods would be used to properly manage and dispose of hazardous wastes generated by the facility. Waste lubricating oil would be recovered and recycled by a waste oil recycling contractor. Spent lubrication oil filters would be disposed of in a Class I landfill. Spent SCR and oxidation catalysts would be recycled by the supplier or disposed of in accordance with regulatory requirements. Workers would be trained to handle hazardous wastes generated at the site.

Chemical cleaning wastes would consist of alkaline and acid cleaning solutions used during pre-operational chemical cleaning and turbine wash waters. These wastes, which are subject to high metal concentrations, would be temporarily stored onsite in portable tanks or sumps, and disposed of offsite in accordance with applicable regulatory requirements.

2.1.10 Management of Hazardous Materials

A variety of chemicals would be stored and used during construction and operation of the KICP. The storage, handling, and use of all chemicals would be conducted in accordance with applicable laws, ordinances, regulations, and standards (LORS). Chemicals would be stored in appropriate chemical storage facilities. Bulk chemicals would be stored in storage tanks, and most other chemicals would be stored in returnable delivery containers. Chemical storage and chemical feed areas would be designed to contain leaks and spills. Concrete containment pits and drain piping design would allow a full-tank capacity spill without overflowing the containment area. For multiple tanks located within the same containment area, the capacity of the largest single tank would determine the volume of the containment area and drain

piping. Containment areas subject to rainfall would be provided additional containment volume sufficient to contain the rainfall from a 25-year, 24-hour storm event. Drain piping for reactive chemicals would be trapped and isolated from other drains to eliminate noxious or toxic vapors.

The aqueous ammonia storage and delivery area would have spill containment and ammonia vapor detection equipment.

Safety showers and eyewashes would be provided adjacent to, or in the vicinity of, chemical storage and use areas. Plant personnel would use approved personal protective equipment during chemical spill containment and cleanup activities. Personnel would be properly trained in the handling of these chemicals and instructed in the procedures to follow in case of a chemical spill or accidental release. Adequate supplies of absorbent material would be stored onsite for spill cleanup.

A list of the chemicals anticipated to be used at the facility and their storage locations is provided in Section 5.5, Hazardous Materials Handling. The list identifies each chemical by type, intended use, and estimated quantity to be stored onsite.

2.1.11 Fire Protection

The fire protection system would be designed to protect personnel and limit property loss and plant downtime in the event of a fire. The primary source of fire protection water for the ECF would be supplied via a connection to the City of Lodi White Slough WPCF. The secondary source of fire protection water would be supplied from an onsite fire/service water storage tank, sized in accordance with National Fire Protection Association (NFPA) guidelines to provide 2 hours of protection for the onsite worst-case single fire. Electric motor-driven and a diesel engine-driven fire pumps would be provided to pump water from the onsite storage tank.

Fire protection water from the City of Lodi connection and onsite fire/service water storage tank would be provided to a dedicated underground fire loop piping system. The fire hydrants and the fixed suppression systems would be supplied from the fire-water loop. Fixed fire suppression systems would be installed at determined fire risk areas. Sprinkler systems also would be installed in the administration/maintenance building as required by NFPA and local code requirements. The turbo expander units would be protected by a carbon dioxide fire protection system. Hand-held fire extinguishers of the appropriate size and rating would be located in accordance with NFPA 10 throughout the facility.

The fire protection system for the well pads would consist of fire extinguishers and the bi-directional water supply line to the well pads from the ECF cooling tower blowdown storage tank connected to standpipes.

Section 5.5, Hazardous Materials Handling, includes additional information on fire and explosion risk, and Section 5.10, Socioeconomics, provides information on local fire protection capability.

2.1.12 Plant Auxiliaries

The following systems would support, protect, and control the generating facility.

2.1.12.1 Lighting

The lighting system provides personnel with illumination for operation under normal conditions and for egress under emergency conditions. The system also provides 120-volt convenience outlets for portable lamps and tools. Lighting would be designed to minimize light escaping the site into the surrounding areas utilizing techniques such as local task lighting, motion detection, and directional lighting hoods.

2.1.12.2 Grounding

The electrical system is susceptible to ground faults, lightning, and switching surges that result in high voltage that constitutes a hazard to personnel and electrical equipment. The station grounding system provides an adequate path to permit the dissipation of current created by these events.

The station grounding grid would be designed for adequate capacity to dissipate the ground fault current from the ground grid under the most severe conditions in areas of high ground fault current concentration. The grid spacing would maintain safe voltage gradients. Bare conductors would be installed below grade in a grid pattern. Each junction of the grid would be bonded together by an exothermic weld. Ground resistivity readings would be used to determine the necessary numbers of ground rods and grid spacing to ensure safe step and touch potentials under severe fault conditions. Grounding conductors would be brought from the ground grid to connect to building steel and non-energized metallic parts of electrical equipment.

2.1.12.3 Distributed Control System

The DCS provides modulating control, digital control, monitoring, and indicating functions for the plant power block systems.

The DCS would provide the following functions:

- Coordinate control of the compressors, turbo expanders, and other systems
- Control the balance-of-plant systems in response to plant demands
- Monitor controlled plant equipment and process parameters and deliver this information to plant operators
- Provide control displays (printed logs, LCD video monitors) for signals generated within the system or received from I/O
- Provide consolidated plant process status information through displays presented in a timely and meaningful manner
- Provide alarms for out-of-limit parameters or parameter trends, display on alarm video monitor(s), and record on an alarm log printer
- Provide storage and retrieval of historical data

The DCS would be a redundant microprocessor-based system and would consist of the following major components:

- PC-based operator consoles with LCD video monitors
- I/O cabinets
- Historical data unit
- Printers
- Data links to the turbo expander control systems

The DCS would have a functionally distributed architecture allowing integration of balance-of-plant equipment that may be controlled locally via a programmable logic controller. The DCS would interface with the compressor and turbo expander control systems to provide remote control capabilities, as well as data acquisition, annunciation, and historical storage plant operating information. The system would be designed with sufficient redundancy to preclude a single device failure from significantly affecting overall plant control and operation. This also would allow critical control and safety systems to have redundancy of controls and a UPS. As part of the quality control program, daily operator logs would be available for review to determine the status of the operating equipment.

2.1.12.4 Cathodic Protection

The cathodic protection system would be designed to control the electrochemical corrosion of designated metal piping buried in the soil. Depending on the corrosion potential and the site soils, either passive or impressed current cathodic protection may be provided.

2.1.12.5 Service Air

The service air system would supply compressed air to hose connections for general plant use. Service air headers would be routed to hose connections located at various points throughout the facility. The instrument air system would provide the source of air for the service air system. Each service air header would include a backpressure regulating valve to maintain a minimum instrument air system pressure, regardless of service air use.

2.1.12.6 Instrument Air

The instrument air system would provide dry air to pneumatic operators and devices. An instrument air header would be routed to locations within the facility equipment areas and within the water treatment facility where pneumatic operators and devices would be located.

2.1.13 Interconnection to the Electrical Grid

The two turbo-expanders would each be connected to separate two-winding, three-phase, step-up transformers that would be connected to the 230-kV switchyard. Each bay would consist of a 230-kV, SF6 circuit breaker and air break disconnect switches and would be connected to the generation tie line in a radial feed scheme. From the switchyard, the generated power would be transmitted via the single-circuit, 230-kV generation tie line approximately 270 feet to loop into PG&E's Gold Hill-Eight Mile Road transmission line. Refer to Section 3.0 for additional information on the switchyards and generation tie line.

Compressor step down transformers would also be located in the switchyard. Both the expander and compressor systems would be metered and the switchyard would have spare bays.

2.2 Project Construction

2.2.1 Schedule

Construction of the facility, from site preparation and grading to commercial operation, is expected to take place approximately in accordance with the following durations per project component/stage. Construction of the ECF, well pads and wells, and pipeline could take place concurrently. Major activities and their durations are listed in Table 2.2-1.

TABLE 2.2-1
KICP Construction Duration, by Phases

Activity	Approximate duration
ECF Construction	24 months
Well and pad equipment installation	12 months
Underground air pipeline construction	6 months
Bubble build	12 months
Commissioning	4 months

Construction would take an average and peak workforce of approximately 200 and 400, respectively, of construction craft people, supervisory, support, and construction management personnel on site during construction.

Typically, noisy construction would be scheduled to occur between 6:00 a.m. and 7:00 p.m. Monday through Saturday. Additional hours may be necessary to make up schedule deficiencies or to complete critical construction activities (for example, pouring concrete at night during hot weather, working around time-critical shutdowns and constraints). During some construction periods and during the startup phase of the project, some activities would continue 24 hours per day, 7 days per week.

2.2.2 Workforce

The peak construction site workforce level is expected to last from month 10 through month 17 of the 24-month construction period, with the peak being month 16. Table 2.2-2 provides an estimate of the average and peak construction traffic during the construction period.

TABLE 2.2-2
Estimated Average and Peak Construction Traffic

Vehicle Type	Average Daily Round Trips	Peak Daily Round Trips
Construction Workers	112	300
Deliveries	5	25
Total	117	325

2.2.3 Laydown

Construction laydown and parking areas at the ECF would be within existing site boundaries, on a small parcel adjacent to and east of the plant site (see Figure 1.2-2), a teardrop-shaped parcel northeast of the plant adjacent to I-5, and a wedge-shaped parcel south of the ECF immediately north of the White Slough WPCF and west of the I-5 frontage road. These laydown areas total 13.7 acres.

The preliminary estimate for the earthmoving quantities at the CAES ECF is as follows:

Total cut = 67,613 cu yd

Total fill = 12,296 cu yd

This calculation is based on the following source documents:

- Topography data from LIDAR flights of the Sacramento-San Joaquin Delta conducted during late January and February of 2007 and obtained by the California Department of Water Resources (2007 CDWR LiDAR: San Joaquin River Delta, California).
- The Preliminary Geotechnical Evaluation dated May 15, 2014

2.3 Equipment Train Startup

The start-up process can begin for each train when that train achieves mechanical completion, all components and auxiliary systems have undergone basic functional verification, and communication between the control system and all instruments and actuators pertinent to the train's operation has been confirmed. By this time, the operations and maintenance staff in place with staffing of the plant 24 hours a day, 7 days a week. The start-up process, which would proceed as follows:

- Develop and communicate site safety plans for start-up.
- Verify readiness of all safety systems, including correct isolation of non-operating trains.
- Initiate auxiliary systems
- Initiate operation of main equipment
- Synchronize equipment and place into automatic control
- Exercise the equipment within its design range
- Conduct normal and emergency shut-down procedures
- Observe system performance throughout and make any adjustments necessary to control parameters or start- up and shut-down sequences to achieve optimal performance of the system
- Verify correct performance of balance of plant systems and/or make adjustments.

2.4 Field Performance Testing

Field Performance testing would be conducted as soon as practical upon conclusion of the start-up procedures. The current plan for field performance testing of the compressor and expander trains is to utilize permanent plant instrumentation, to conduct the test. Detailed test procedures would be developed by test engineers in the course of project execution. The plant's operations staff would be responsible for execution of the performance test procedures. Original Equipment Manufacturer (OEM) field service representatives would oversee the preparations for the testing process. OEM representatives would be present during the actual execution of the tests to ensure operational adherence to the test procedures and to verify that data is being collected correctly. The test process would generally proceed as follows:

- Verify calibration of critical instruments that would be used to verify performance
- Initiate operation of the equipment and bring to desired operating point for testing
- Hold at desired operating point to achieve a stabilized and accurate data set
- Move to / hold at alternate operating points if required
- Upon completion of the test, shut down the equipment or return to unconstrained commercial service

2.5 Facility Operation

The facility would be capable of being dispatched throughout the year and would generally have, exclusive of annual maintenance requirements, annual availability in the range of 92 to 98 percent. The facility would employ a staff of approximately 25 (20 for the ECF and up to 5 staff for the well field operation), including plant operation technicians, supervisors, administrative personnel, mechanics, engineers, chemists, and electricians (Table 2.5-1), in three rotating shifts. The facility would be capable of operating 24 hours per day, 7 days per week.

TABLE 2.5-1
Operating Employees

Classification	Number
Plant Manager	1
Operations Supervisor	1
Maintenance Supervisor	1

TABLE 2.5-1
Operating Employees

Classification	Number
Plant Engineer	1
Chemistry Technician	1
Power Plant Technicians	11
Mechanical Specialty Power Plant Technicians	3
Electrical Specialty Power Plant Technician	2
Controls Specialty Power Plant Technician	1
Power Plant Assistant	1
Maintenance Planner	1
Operational Buyer	1
Total	**25**

The facility is designed for operational flexibility with fast start, high turndown (i.e., ability to turn down to a low load), and high ramp rates. Because of the need to react quickly to firm intermittent renewables, the facility is expected to be dispatched frequently and may have a capacity factor as high as 40 percent. The actual capacity factor in any month or year would depend on weather-related customer demand, load growth, hydroelectric/renewable energy supplies, generating unit retirements and replacements, the level of generating unit and transmission outages, and other factors. The exact operational profile of the plant would depend on weather conditions, system requirements and the power purchaser's economic dispatch decisions.

The facility could be operated in one or all of the following modes:

- **Load Following**. The facility would operate at less than maximum available output at low load times of the day. The output of each unit would be adjusted periodically, either by schedule or automatic generation control, to meet load and/or operational requirements of the power purchaser and/or the California Independent System Operator (CAISO).
- **Partial Shutdown**. One of the turbo-expanders would be shut down and the other would be operating at full load or in load-following mode. If the shutdown unit is not undergoing maintenance, it would in most cases be available to the power purchaser and the CAISO as non-spinning reserve.
- **Full Shutdown**. This would occur if forced by economics, equipment malfunction, fuel supply interruption, transmission line disconnect, or scheduled maintenance of equipment common to all units.

2.6 Engineering

Engineering design basis documents are provided in a separate volume.

2.6.1 Facility Safety Design

The facility would be designed to maximize safe operation. Potential hazards that could affect the facility include earthquake, flood, and fire/explosion. Facility operators would be trained in safe operation, maintenance, and emergency response procedures to minimize the risk of personal injury and damage to

the plant. Current NFPA purge standards would be followed to keep combustibles within recommended levels as well as NFPA recommendations for LEL limits in piping. Continuous native natural gas concentration monitoring would be employed in the well field and ECF to shutdown components if unsafe levels are approached.

2.6.2 Natural Hazards

The principal natural hazards associated with the facility site are earthquakes and floods. The site is located in Seismic Risk Zone 3. Structures would be designed to meet the seismic requirements of California Code of Regulations Title 24 and the California Building Code. Section 5.4, Geologic Hazards and Resources, discusses the geological hazards of the area and site. This section includes a review of potential geologic hazards, seismic ground motions, and the potential for soil liquefaction caused by ground shaking. A geotechnical investigation was conducted for KICP and a geotechnical report was prepared (Ninyo and Moore 2014).

Per Federal Emergency Management Agency (FEMA) Floodplain Insurance Rate Map (FIRM) Map Number 06077C0285F, dated October 16, 2009, the proposed ECF site is located in its entirety within Flood Zone AE with a Base Flood Elevation of 10.0 feet (referenced to the North American Vertical Datum of 1988 or NAVD 88). Top of concrete foundation elevation for the site equipment would be at least 1.0 foot (per San Joaquin County code and standard engineering practices) above the 100-year, 24-hour storm drain event or Flood Elevation. This implies that the top of foundations for the equipment should be at a minimum elevation of 11.0 feet above sea level (or about 2.0 feet higher than the existing ground).

According to the Federal Emergency Management Agency (see Section 5.15), the well field/pad site is also within the 100-year floodplain. King Island is hydrologically isolated and surrounded by levees that protect it from flows and floodwaters from Bishop and Honker Cuts and White and Disappointment Sloughs. The well pads could be inundated, however, in the event of a levee breach. For this reason, in the base case design, critical equipment at the well pads would either be located in control buildings or stand alone on platforms elevated above the flood level. Other well pad equipment would be designed to cease operation (shutdown) safely in the event of a flood, per San Joaquin County guidelines and good engineering safety practices.

Section 5.15, Water Resources, includes additional information on the potential for flooding and Section 5.6, Land Use, discusses the San Joaquin County regulations for construction in a flood zone such as King Island.

2.6.3 Emergency Systems and Safety Precautions

This section discusses the fire protection systems, emergency medical services, and safety precautions to be used by project personnel. Section 5.10, Socioeconomics, includes additional information on area medical services, and Section 5.16, Worker Safety, includes additional information on safety for workers.

2.6.3.1 Fire Protection Systems

The project would rely on onsite fire protection systems and local fire protection services.

2.6.3.1.1 Onsite Fire Protection Systems

The fire protection systems are designed to protect personnel and limit property loss and plant downtime from fire or explosion. The project would have the following fire protection systems.

Carbon Dioxide and Dry Chemical Fire Protection Systems

These systems protect the turbo expanders and certain accessory equipment compartments from fire. The system would have fire detection sensors in all protected compartments. Actuating one sensor would provide a high-temperature alarm on the turbo expander control panel. Actuating a second sensor would trip the generator, turn off ventilation, close ventilation openings, and automatically release the gas and chemical agents. The gas and chemical agents would be discharged at a design concentration adequate to extinguish the fire.

Sprinkler and Deluge Systems

These systems protect equipment, buildings, and large transformers and specific electrical equipment rooms. Buildings would generally be protected by automatic wet-type sprinkler systems. Large transformers (e.g., the generator step-up and auxiliary transformers) would be protected by automatic water spray (deluge) systems. Electrical equipment and battery rooms would be protected with pre-action sprinkler systems.

Fire Hydrants/Hose Stations

This system would supplement the plant's fixed fire suppression systems. Water would be supplied from the plant fire water system.

Fire Extinguisher

The plant administrative/control/warehouse/maintenance building, water treatment building, and other structures would be equipped with portable fire extinguishers as required by the local fire department.

Prior to facility construction, a Fire Risk Evaluation Plan would be completed to address the following topics:

- Fire Protection System Status
- Building/Structure Fire Protection Requirements
- Equipment Fire Protection Requirements
- Water Supply and Distribution
- Water-Based Suppression Systems
- Gaseous Suppression Systems
- Foam Systems
- Fire Alarm And Detection Systems
- Portable Fire Extinguishers
- Evaluation and Decision Making Authority
- Drainage and Containment Design
- Emergency Response

The fire protection system design would accommodate the following:

- Establish appropriate administrative controls for operating and maintaining their equipment and facilities for safeguarding of human life and physical assets against the potential for harm or losses.
- Design and operate all facilities with proper consideration given to fire safety, protecting physical assets, and maintaining insurability.
- Support periodic loss control inspections and surveys as needed. The facility safety team would establish a process to address recommendations for improvements that are presented in the inspection reports.

2.6.3.1.2 Local Fire Protection Services

In the event of a major fire, the plant personnel would be able to call upon the Woodbridge Fire Department for assistance. The Hazardous Materials Business Plan (see Section 5.5, Hazardous Materials Handling) for the plant would include all information necessary to allow firefighting and other emergency response agencies to plan and implement safe responses to fires, spills, and other emergencies.

2.6.3.2 Personnel Safety Program

The project would operate in compliance with federal and state occupational safety and health program requirements. Compliance with these programs would minimize project effects on employee safety. These programs are described in Section 5.16, Worker Safety.

2.7 Facility Reliability

This section discusses the expected facility availability, equipment redundancy, fuel availability, water availability, and project quality control measures.

2.7.1 Facility Availability

The facility would be designed to operate between about 10 and 100 percent of base load to support dispatch service in response to customer demands for electricity.

The project would be designed for an operating life of 30 years. Reliability and availability projections are based on this operating life. Operation and maintenance procedures would be consistent with industry standard practices to maintain the useful life status of plant components.

2.7.2 Redundancy of Critical Components

The following subsections identify equipment redundancy as it applies to project availability. Specifically, redundancy in the power island and in the balance-of-plant systems that serve it is described. The power island would be served by the following balance-of-plant systems: fuel supply system, DCS, demineralized water system, power cycle makeup and storage, cooling water system, and compressed air system. Major equipment redundancy is summarized in Table 2.7-1.

2.7.2.1 Power Block

Two separate turbo expander power generation trains would operate in parallel within the ECF power island. Major equipment redundancies are listed in Table 2.7-1.

TABLE 2.7-1
Major Equipment Redundancy

Description	Number	Note
Turbo-expanders	2 – 50% trains	—
Compressors	2 – 50%	—
Cooling tower	1 – 100%	Must be in operation for plant to operate, however, it would include approximately 10 cells, thus there is a level of redundancy in fans, gearboxes, and motors.
Auxiliary Cooling Water Pumps	2 – 100%	—
Fuel Gas Compressors	2 – 50%	Delivery pressure is such that gas compressors are expected to rarely operate.
Reverse Osmosis Units	2 – 100%	—

TABLE 2.7-1
Major Equipment Redundancy

Description	Number	Note
Waste water injection wells	2 – 100%	Separate wells, but either could be used for power block process water or withdrawal produced water
I/W wells	30 – 3.3%	—
Mixed Bed Demineralizers	100% spare capacity	Rack space for offsite regenerated bottles or skids.

2.7.2.2 Turbo-Expander Subsystems

The turbo-expander subsystems would include the expanders, combustors, generators, waste heat recuperators (WHRU), cooling/heating system, lubrication oil systems, starting system, fuel system, generator and excitation systems, and turbine control and instrumentation. The turbo-expander would use mechanical energy stored in the form of compressed air in the reservoir and would also produce thermal energy through the combustion of natural gas. The thermal energy would be converted into mechanical energy through rotation of the turbo-expander shaft, which drives the generator. The generator excitation system would be a solid-state static system. Turbo expander control and instrumentation (interfaced with the DCS) would cover the turbine governing system, the protective system, and the sequence logic.

2.7.2.3 Plant Distributed Control System

The DCS would be a redundant microprocessor-based system and would have a functionally distributed architecture comprising a group of similar redundant processing units; these units would be linked to a group of operator consoles and an engineer work station by redundant data highways. Each processor would be programmed to perform specific dedicated tasks for control information, data acquisition, annunciation, and historical purposes. Because they would be redundant, no single processor failure can cause or prevent a unit trip.

The DCS would interface with the control systems furnished by the compressors, turbo expander, selected well field equipment, and fuel gas compressors, as well as data acquisition, annunciation, and historical storage of turbo expander operating information.

The system would be designed with enough redundancy to preclude a single device failure from significantly affecting overall plant control and operation. Consideration would be given to the action performed by the control and safety devices in the event of control circuit failure. Controls and controlled devices would move to the safest operating condition upon failure.

Plant operation, including select well field functions, would be controlled from the operator panel in the control room. The operator panel would consist of five individual monitor-keyboard consoles, one engineering workstation, and one historian workstation. Each monitor-keyboard console would be an independent electronic package so that failure of a single package would not disable more than one monitor-keyboard. The engineering workstation would allow the control system operator interface to be revised by authorized personnel. Local workstations would be provided in the control rooms for the east and west well pads.

2.7.2.4 Power Cycle Makeup Water Treatment System

The cycle makeup would include two, 100-percent-capacity trains of two-pass reverse osmosis equipment followed by offsite-regenerated mixed bed demineralizer bottles. Sufficient bottle rack space would be provided to accommodate 200 percent of the required capacity of mixed bed demineralizer bottles or skids.

2.7.2.5 Power Cycle Makeup and Storage

The power cycle makeup and storage subsystem provides demineralized water storage and pumping capabilities to supply high purity water for system cycle makeup, turbo expander water wash, and chemical cleaning operations. The major components of the system are a single demineralized water storage tank and two 100-percent-capacity, horizontal, centrifugal, cycle makeup water pumps.

2.7.2.6 Compressed Air System

The compressed air system would be designed to supply service and instrument air for the facility. Dry, oil-free instrument air would be provided for pneumatic operators and devices throughout the plant. Compressed service air would be provided to appropriate areas of the plant as utility stations consisting of a ball valve and quick disconnect fittings.

The instrument air system would be given demand priority over the service air system. A backpressure control valve would cut off the air supply to the service air header so as to maintain the minimum required instrument air pressure.

Two, 100-percent-capacity or three, 50-percent-capacity, oil free, rotary screw package air compressors would supply compressed air to the service and instrument air systems. Two, 100-percent capacity, heat-less desiccant air dyers would be provided to dry the service and instrument air.

2.7.3 Fuel Availability

Fuel would be delivered via a new 1.36-mile-long pipeline that would connect into PG&E's DFM 1616-01 natural gas line east of the ECF site (see Section 4.0). PG&E's preliminary study has determined that its system, with the proposed additional pipe, has sufficient capacity to supply the facility.

2.7.4 Water Availability

The facility would use, on average, 1,101 acre-feet per year of recycled water provided by the City of Lodi WPCF for power plant cooling and process water, and fire protection.

The availability of water to meet the needs of the King Island CAES facility is discussed in more detail in Section 5.15, Water Resources.

2.7.5 Wastewater Treatment Availability

The facility would discharge, on average, 42.3 million gallons per year of power island process wastewater and 23 million gallons per year of well field withdrawal produced water, to the wastewater disposal/injection wells, after initial commissioning. During the first 6 months of operation the produced water rate could be as much as 2.5 times the average steady-state rate.

2.7.6 Project Quality Control

The quality control program that would be applied to a typical facility such as the King Island CAES facility is summarized in this subsection. The objective of the quality control program would be to ensure that all systems and components have the appropriate quality measures applied, whether during design, procurement, fabrication, construction, or operation. The goal of the quality control program would be to achieve the desired levels of safety, reliability, availability, operability, constructability, and maintainability for generating electricity.

The required quality assurance for a system is obtained by applying controls to various activities, according to the activity being performed. For example, the appropriate controls for design work are checking and

review, and the appropriate controls for manufacturing and construction are inspection and testing. Appropriate controls would be applied to each of the various activities for the project.

2.7.6.1 Project Stages

For quality assurance planning purposes, the project activities have been divided into the following stages that apply to specific periods during the project:

- **Conceptual Design Criteria.** Activities such as definition of requirements and engineering analyses.
- **Detail Design.** Activities such as the preparation of calculations, drawings, and lists needed to describe, illustrate, or define systems, structures, or components.
- **Procurement Specification Preparation.** Activities necessary to compile and document the contractual, technical, and quality provisions for procurement specifications for plant systems, components, or services.
- **Manufacturer's Control and Surveillance.** Activities necessary to ensure that the manufacturers conform to the provisions of the procurement specifications.
- **Manufacturer Data Review.** Activities required to review manufacturers' drawings, data, instructions, procedures, plans, and other documents to ensure coordination of plant systems and components, and conformance to procurement specifications.
- **Receipt Inspection.** Inspection and review of product at the time of delivery to the construction site.
- **Construction/Installation.** Inspection and review of storage, installation, cleaning, and initial testing of systems or components at the facility.
- **System/Component Testing.** Actual operation of generating facility components in a system in a controlled manner to ensure that the performance of systems and components conform to specified requirements.
- **Plant Operation.** As the project progresses, the design, procurement, fabrication, erection, and checkout of each generating facility system would progress through the stages defined above.

2.7.6.2 Quality Control Records

The following quality control records would be maintained for review and reference:

- Project instructions manual
- Design calculations
- Project design manual
- Quality assurance audit reports
- Conformance to construction records drawings
- Procurement specifications (contract issue and change orders)
- Purchase orders and change orders
- Project correspondence

For procured component purchase orders, a list of qualified suppliers and subcontractors would be developed. Before contracts are awarded, the subcontractors' capabilities would be evaluated. The evaluation would consider suppliers' and subcontractors' personnel, production capability, past performance, and quality assurance program.

During construction, field activities are accomplished during the last four stages of the project: receipt inspection, construction/installation, system/component testing, and plant operations. The construction contractor would be contractually responsible for performing the work in accordance with the quality requirements specified by the contract.

The subcontractors' quality compliance would be surveyed through inspections, audits, and administration of independent testing contracts.

A plant operation and maintenance program, typical of a project this size, would be implemented by the developer to control operation and maintenance quality. A specific program for this project would be defined and implemented during initial plant startup.

2.8 Thermal Efficiency

The thermal efficiency of a CAES facility must be considered in relation to the plant energy ratio (MWH in/MWH out) and also in relation to the total round trip efficiency ([MWH out] / [MWH in+ gas MWH in]) because of the way the facility operates by using grid electricity to fill and refill the compressed air reservoir, recovering it for energy generation during the turbo expander phase. The plant energy ratio is approximately 81.6 percent while the Roundtrip Efficiency is approximately 50.9 percent. As stated previously, a CAES plant can operate with greater efficiency at low loads, compared with a standard combustion turbine operating in simple-cycle mode or a combined-cycle plant operating under similar load conditions. It is expected that the facility would be primarily operated in load-following or cycling service. The number of startup and shutdown cycles is expected to range between 50 and 300 per year per turbo expander train.

Plant fuel consumption would depend on the operating profile of the ECF. It is estimated that the range of fuel consumed by the ECF would be from a minimum of 100 MMBtu/hr at minimum load (Pmin) to a maximum of approximately 1200 MMBtu/hr (HHV basis) at full load and minimum ambient conditions. Under full load base case conditions, the fuel consumption divided by the plant electric output (heat rate) is 3,916 Btu/kWH on an LHV basis.

The net annual electrical production of the King Island CAES facility cannot be accurately forecasted at this time because of uncertainties in the system load dispatching model and the associated policies. However, because of the efficiency of the plant, its operating characteristics would be as described above. The maximum annual generation likely from the facility is estimated to be approximately 900 gigawatt hours per year (based on an annual average facility base load MW rating of 300 MW and 35 percent capacity factor).

2.9 Facility Closure

Facility closure can be temporary or permanent. Temporary closure is defined as a shutdown for a period exceeding the time required for normal maintenance, including closure for overhaul or replacement of the compressors or turbo expanders. Causes for temporary closure include a disruption in the supply of natural gas or damage to the plant from earthquake, fire, storm, or other natural acts. Permanent closure is defined as a cessation in operations with no intent to restart operations because of plant age, damage to the plant beyond repair, economic conditions, or other reasons. The following sections discuss temporary and permanent facility closure.

2.9.1 Temporary Closure

For a temporary facility closure, where there is no release of hazardous materials, security of the facilities would be maintained on a 24-hour basis, and the CEC and other responsible agencies would be notified. Depending on the length of shutdown necessary, a contingency plan for the temporary cessation of operations would be implemented. The contingency plan would be conducted to ensure conformance with all applicable laws, ordinances, regulations, and standards (LORS) and the protection of public health, safety, and the environment. The plan, depending on the expected duration of the shutdown, may include the draining of all chemicals from storage tanks and other equipment and the safe shutdown of all equipment. All wastes would be disposed of according to applicable LORS, as discussed in Section 5.14.

Where the temporary closure includes damage to the facility, and there is a release or threatened release of regulated substances or other hazardous materials into the environment, procedures would be followed as set forth in a Risk Management Plan and a Hazardous Materials Business Plan to be developed as described in Section 5.5. Procedures would include methods to control releases, notification of applicable authorities and the public, emergency response, and training for plant personnel in responding to and controlling releases of hazardous materials. Once the immediate problem is solved, and the regulated substance/hazardous material release is contained and cleaned up, temporary closure would proceed as described above for a closure where there is no release of hazardous materials.

2.9.2 Permanent Closure

The planned life of the generation facility is 30 years. However, if the generation facility were still economically viable, it could be operated longer. It is also possible that the facility could become economically noncompetitive in less than 30 years, forcing early decommissioning. Whenever the facility is permanently closed, the closure procedure would follow a plan that would be developed as described below.

The removal of the facility from service, or decommissioning, may range from “mothballing” to the removal of all equipment and appurtenant facilities, depending on conditions at the time. Because the conditions that would affect the decommissioning decision are largely unknown at this time, these conditions would be presented to the CEC when more information is available and the timing for decommissioning is more imminent.

To ensure that public health and safety and the environment are protected during decommissioning, a decommissioning plan would be submitted to the CEC for approval prior to decommissioning. The plan would address the following:

- Proposed decommissioning activities for the facility, storage reservoir and all appurtenant facilities constructed as part of the facility
- Conformance of the proposed decommissioning activities to all applicable LORS and local/regional plans
- Activities necessary to restore the site if the plan requires removal of all equipment and appurtenant facilities
- Decommissioning alternatives other than complete restoration
- Associated costs of the proposed decommissioning and the source of funds to pay for the decommissioning

In general, the decommissioning plan for the facility would attempt to maximize the recycling of all facility components. If possible, unused chemicals would be sold back to the suppliers or other purchasers or users. All equipment containing chemicals would be drained and shut down to ensure public health and safety and to protect the environment. All nonhazardous wastes would be collected and disposed of in appropriate landfills or waste collection facilities. All hazardous wastes would be disposed of according to all applicable LORS. The site would be secured 24 hours per day during decommissioning activities.

2.10 References

Ninyo and Moore, 2014. Preliminary Geotechnical Evaluation, PG&E Compressed Air Energy Storage, Lodi, California. May

SECTION 3.0

Electric Transmission

This section discusses the transmission interconnection between the King Island CAES Project (KICP) and the existing electrical grid, and the anticipated impacts that operation of the facility would have on the flow of electrical power in the project region. This analysis contains the following discussions:

- The proposed electrical interconnection between the KICP and the electrical grid
- The impacts of the project on the existing transmission grid
- Description of applicable laws, ordinances, regulations, and standards (LORS)

Sections 3.2 and 3.3 discuss the transmission interconnection studies and safety and nuisances.

3.1 Transmission Lines Description, Design, and Operation

PG&E's electrical infrastructure in the vicinity of the KICP includes an existing PG&E 230-kilovolt (kV) double-circuit transmission line running north-south to the west of the Energy Conversion Facility (ECF) site and the PG&E Eight-Mile Road Substation, approximately 2.7 miles south of the ECF site. Both circuits are looped into the substation. The circuits are the Gold Hill–Eight Mile Road circuit, on the west side of the towers, and the Gold Hill–Lodi STIG–Eight Mile Road circuit, on the east side. Northern California Power Agency's (NCPA) Lodi Energy Center (LEC), a 255-megawatt, natural-gas-fired, combined-cycle power plant, is looped into the eastern circuit approximately 0.5 mile south of the project.

3.1.1 Interconnection

The KICP interconnection would be made near the southwest corner of the ECF site using a tie-line approximately 270 feet long. The tie-line would cross under the east circuit to connect with the west circuit on transmission tower number 074/313. The generation and compression stages of the project would be separately connected to a new project 230-kV switchyard configured in a breaker-and-a-half arrangement.

The project owner would perform all construction work up to the ECF facility's first point of interconnection. PG&E would perform all work associated with building the interconnecting switchyard, and any required network upgrades.

Figure 3.2-1 shows the connection of the ECF with PG&E's Gold Hill–Eight Mile Road circuit via the 270-foot-long connection. Figure 3.2-2 is an electrical system one-line diagram that shows the proposed breaker-and-a-half scheme of the ECF interconnection.

3.1.2 Power Plant Substation Characteristics

The ECF switchyard would use 230-kV, gas-insulated circuit breakers with a single breaker and step-up transformer for each of the two generating units and each of the two compression units. The substation and all equipment would be designed per California Public Utilities Commission General Order 95 (GO 95), California Title 8 Section 2700, and other IEEE and NEC standards as applicable.

Startup and standby power would be supplied through the generator step-up transformer and auxiliary transformer. Auxiliary controls and protective relay systems for the ECF switchyard would be located in the switchyard control building.

3.2 Transmission Interconnection Studies

PG&E has not submitted a Generator Interconnection Application to the California Independent System Operator (CAISO), which would be necessary to initiate the process to connect the KICP facility to the grid. PG&E did commission an independent, third-party transmission screening study to conduct an exploratory assessment of the capability of the transmission system to support the operation of the KICP (RCI, 2014). The study identified potential upgrades to the transmission system needed to mitigate any identified deficiencies in meeting the North American Electric Reliability Corporation (NERC) / Western Electricity Coordinating Council (WECC) / CAISO Planning Standards. It is assumed the project owner would enter the formal CAISO process with a submittal for a System Impact Study some time in 2016 and receive actual study results that would be utilized to fully develop the KICP.

For the purposes of this document and the other preliminary engineering studies being conducted for the KICP base case, a screening-level power flow analysis was performed and the performance of the system was evaluated using the NERC and WECC and CAISO planning standards. For the King Island CAES screening study, the focus was on the steady-state power flow simulations. No transient stability or short-circuit analysis was prepared.

Power flow analysis was used to evaluate thermal and voltage performance of the transmission system for NERC/WECC Category A (TPL-001) normal (all elements in-service) conditions, selected NERC/WECC Category B (TPL-002) emergency (one element out of service) conditions, and selected NERC/WECC Category C (TPL-003) emergency (multiple elements out of service) conditions. Category A (N-0) normal overloads are those that exceed 100 percent of normal ratings that occur with all facilities in service. Category B and C overloads are those that exceed 100 percent of emergency ratings that occur due to a Category B or C contingency.

All power flow analysis was conducted with version 18.0_01 of General Electric's PSLF/PSDS/SCSC software. The analysis assumed commercial operation for the compression load of June 1, 2020, and commercial operation for the generation supply of June 1, 2021.

System performance before and after the interconnection of the KICP was evaluated under normal conditions and following loss of single or multiple Bulk Electric System elements as defined by the applicable reliability standards and criteria. The contingencies were limited to the areas identified in the transmission screening study (RCI, 2014). The initial contingency files were those used in the CAISO 2013-14 Transmission Planning Process and modified to accommodate the changes made to the base cases as described below. No Category D (Extreme Event) contingencies were simulated.

The summer peak base case was selected from the most current available CAISO generation interconnection cluster study (Cluster 6, Phase 1). The summer partial peak and off-peak base cases developed as part of the CAISO 2013-14 Transmission Planning Process reliability assessment were selected to provide a range of system conditions. The year 2018 was selected for the summer peak and partial peak based on the availability of system models. The off-peak case for year 2023 was selected to capture the potential impacts of load growth on the ability of the transmission system to support the ECF compression mode.

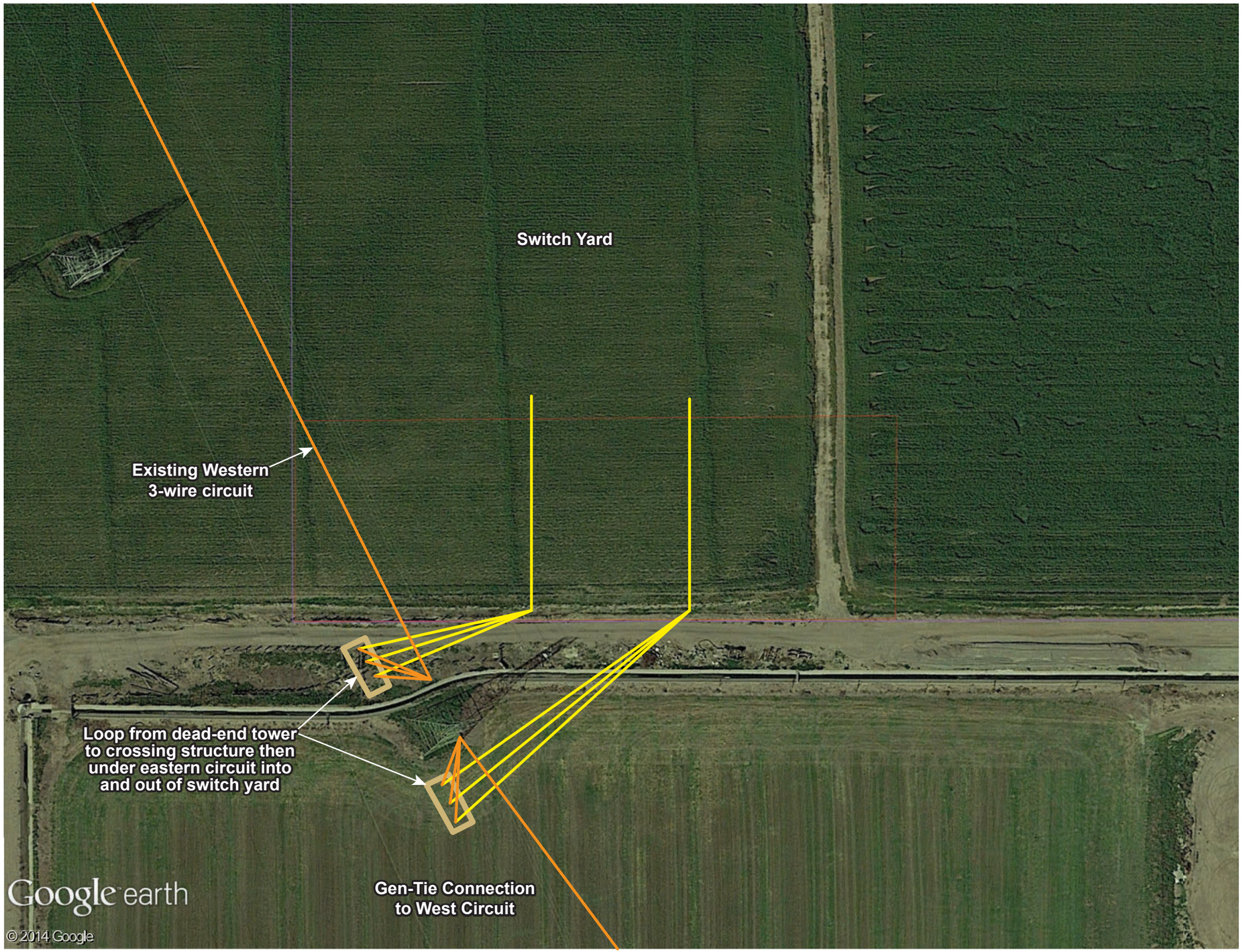


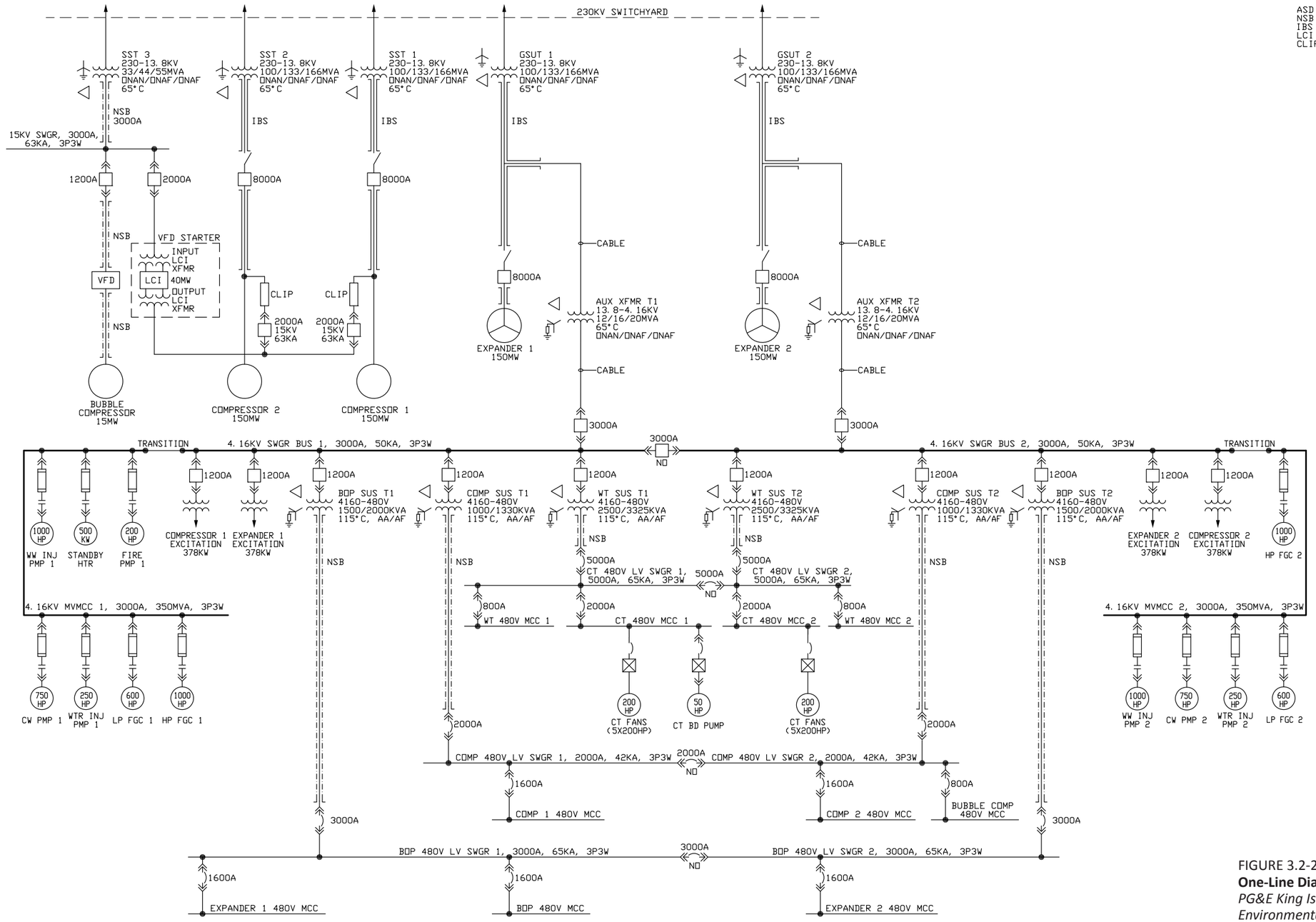
FIGURE 3.2-1
Generator Tie-line Interconnection
PG&E King Island Compressed Air Energy Storage Project
Environmental Siting, Licensing, and Permitting Analysis

GENERAL NOTES:

THREE 230KV SWITCHYARD BAYS WILL BE REQUIRED FOR THE FIVE GSUT/SST TRANSFORMER PRIMARY CONNECTIONS.

LEGEND:

ASD	ADJUSTABLE SPEED DRIVE
NSB	NON-SEGREGATED PHASE BUS DUCT
IBS	ISO-PHASE BUS DUCT
LCI	LOAD COMMUTATED INVERTER
CLIP	CURRENT LIMITING PROTECTOR



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FIGURE 3.2-2
One-Line Diagram
PG&E King Island Compressed Air Energy Storage Project
Environmental Siting, Licensing, and Permitting Analysis

Source: WorleyParsons, Drawing PGCS-0-DW-601-206-001 Rev. A, 09/04/2014.

The impacts of high generation in the summer peak and spring partial peak conditions as well as compression mode during summer off-peak conditions were analyzed.

For the ECF generation case:

- The CAISO Cluster 6, Phase 1 2018 summer peak base case for the North PG&E system
- The CAISO 2013-14 Transmission Planning Process 2018 Summer Partial Peak Reliability Case for the PG&E system

For the compression cycle case:

- The 2013-14 Transmission Planning Process 2023 Summer Off-Peak Reliability Case for the Central Valley

The critical circuit associated with the generation mode is the segment of the Gold Hill–Eight Mile Road circuit between the ECF and Eight Mile Road Substation:

- Under normal conditions, flows of up to 93 percent of the existing conductor normal rating were identified. If the NCPA Lodi Energy Center is off-line, the normal loading increases to 98 percent.
- Under contingency conditions (loss of the Lodi-Eight Mile Road Substation 230-kV line), this circuit loads to **107 percent** of its applicable emergency rating.

The issues on the ECF–Eight Mile Road segment are primarily under contingency conditions, but high stress dispatch patterns could lead to heavy loading under normal conditions. It is recommended that the ECF to Eight Mile 230-kV line be reconductored from the existing 1113 kcmil AAC to either 795 kcmil ACSS or 1113 kcmil ACSS to accommodate the KICP.

The studies did not identify any normal or contingency system limitations associated with the compression cycle under off-peak conditions. The partial peak sensitivity study also did not identify capacity limitations. Refer to the study for further details (RCI, 2014).

3.3 Transmission Line Safety and Nuisances

Analysis would be performed to assess the transmission line design and operational plan for the transmission lines proposed for transmitting the power from the proposed project to determine whether their related field and non-field impacts would constitute a significant environmental hazard in the area around the proposed routes. Related health and safety LORS are aimed at minimizing such hazards. Analysis would focus on the following issues, taking into account both the physical presence of the line and the physical interactions of its electric and magnetic fields:

- Aviation safety
- Interference with radio-frequency communication
- Audible noise
- Fire hazards
- Hazardous shocks
- Nuisance shocks
- Electric and magnetic field (EMF) exposure

3.3.1 Aviation Safety

Federal Aviation Administration (FAA) Regulations, 14 Code of Federal Regulations (CFR) Part 77, establish standards for determining obstructions in navigable airspace and set forth requirements for notification of proposed construction. These regulations require FAA notification for construction over 200 feet above ground level. Notification also is required if the obstruction is lower than specified heights and falls within restricted airspace in the approaches to public or military airports and heliports. For airports with runways longer than 3,200 feet, the restricted space extends 20,000 feet (3.3 nautical miles) from the runway. For airports with runways measuring 3,200 feet or less, the restricted space extends 10,000 feet (1.7 nautical miles). For public or military heliports, the restricted space extends 5,000 feet (0.8 nautical mile). The nearest public airport to the KICP ECF is the Kingdon Executive Airport, which is approximately 1.4 miles from the ECF (7,250 feet). This is discussed further in Sections 5.6, Land Use, and 5.12, Traffic and Transportation. The height of the ECF stacks will trigger FAA air navigation hazard review, but this review is unlikely to find that the project could cause a hazard to air navigation, because of the distance to the Kingdon airport and height of the stacks.

3.3.2 Fire Hazards

The proposed 230-kV transmission interconnection would be designed, constructed, and maintained in accordance with applicable standards including GO 95, which establishes clearances from other manmade and natural structures as well as tree-trimming requirements to mitigate fire hazards. PG&E would maintain the transmission line corridor and immediate area in accordance with existing regulations and accepted industry practices that would include identification and abatement of fire hazards.

3.4 Applicable Laws, Ordinances, Regulations, and Standards

This section provides a list of applicable LORS that apply to the proposed transmission line, switchyards, substations, and engineering.

3.4.1 Design and Construction

Table 3.5-1 lists the LORS for the design and construction of the proposed transmission line and switchyard.

TABLE 3.5-1
Design and Construction LORS for the Proposed Transmission Line and Switchyard

LORS	Applicability
Title 8 CCR, Section 2700 et seq. "High Voltage Electrical Safety Orders"	Establishes essential requirements and minimum standards for installation, operation, and maintenance of electrical installation and equipment to provide practical safety and freedom from danger.
GO-52, CPUC, "Construction and operation of power and communication lines for the prevention or mitigation of inductive interference"	Applies to the design of facilities to provide or mitigate inductive interference.
GO-95, CPUC, "Overhead electric line construction"	CPUC rule covers all aspects of design, construction, operation, and maintenance of electrical transmission line and fire safety (hazards).
GO-128, CPUC, "Construction or' underground electric supply and communication systems"	Applies to the design and construction of underground transmission lines.
ANSI/IEEE 593, "IEEE Recommended Practices for Seismic Design of Substations"	Recommends design and construction practices.

TABLE 3.5-1
Design and Construction LORS for the Proposed Transmission Line and Switchyard

LORS	Applicability
IEEE 1119, "IEEE Guide for Fence Safety Clearances in Electric-Supply Stations"	Recommends clearance practices to protect persons outside the facility from electric shock.
IEEE 998, "Direct Lightning Stroke Shielding of Substations"	Recommends protections for electrical system from direct lightning strikes.
IEEE 980, "Containment of Oil Spills for Substations"	Recommends preventions for release of fluids into the environment.

ANSI = American National Standards Institute

3.4.2 Electric and Magnetic Fields

The LORS pertaining to EMF are listed in Table 3.5-2.

TABLE 3.5-2
Electric and Magnetic Field LORS

LORS	Applicability
Decision 93-11-013, CPUC	Presents the CPUC position on EMF reduction.
GO-131-D, CPUC, "Rules for Planning and Construction of Electric Generation, Line, and Substation Facilities in California"	Establishes the CPUC construction application requirements, including requirements related to EMF reduction.
ANSI/IEEE 544-1994, "Standard Procedures for Measurement of Power Frequency Electric and Magnetic Fields from AC Power Lines"	Presents the standard procedure for measuring EMF from an electric line that is in service.

3.4.3 Hazardous Shock

Table 3.5-3 lists the LORS regarding hazardous shock protection that apply to the transmission interconnection and the overall project.

TABLE 3.5-3
Hazardous Shock LORS

LORS	Applicability
8 CCR 2700 et seq. "High Voltage Electrical Safety Orders"	Establishes essential requirements and minimum standards for installation, operation, and maintenance of electrical equipment to provide practical safety and freedom from danger.
ANSI/IEEE 80, "IEEE Guide for Safety in Alternating Current Substation Grounding"	Presents guidelines for assuring safety through proper grounding of alternating current outdoor substations.
NESC, ANSI C2, Section 9, Article 92, Paragraph E; Article 93, Paragraph C	Covers grounding methods for electrical supply and communications facilities.

3.4.4 Communication Interference

The LORS pertaining to communication interference are listed in Table 3.5-4.

TABLE 3.5-4
Communication Interference LORS

LORS	Applicability
47 CFR 15.25, "Operating Requirements, Incidental Radiation"	Prohibits operations of any device emitting incidental radiation that causes interference to communications; the regulation also requires mitigation for any device that causes interference.
GO-52, CPUC	Covers all aspects of the construction, operation, and maintenance of power and communication lines and specifically applies to the prevention or mitigation of inductive interference.
CEC staff, Radio Interference and Television Interference (RI-TVI) Criteria (Kern River Cogeneration) Project 82-AFC-2, Final Decision, Compliance Plan 13-7	Prescribes the CEC's RI-TVI mitigation requirements, developed and adopted by the CEC in past citing cases.

CEC = California Energy Commission

3.4.5 Aviation Safety

Table 3.5-5 lists the aviation safety LORS that may apply to the proposed transmission interconnection and the overall project.

TABLE 3.5-5
Aviation Safety LORS

LORS	Applicability
Title 14 CFR, Part 77, "Objects Affecting Navigable Airspace"	Describes the criteria used to determine whether a "Notice of Proposed Construction or Alteration" (FAA Form 7450-1) is required for potential obstruction hazards.
FAA Advisory Circular No. 70/7450-1G, "Obstruction Marking and Lighting"	Describes the FAA standards for marking and lighting of obstructions as identified by FAA Regulations Part 77.
CPUC, Sections 21555-21550	Discusses the permit requirements for construction of possible obstructions in the vicinity of aircraft landing areas, in navigable airspace, and near the boundaries of airports.

3.4.6 Fire Hazards

Table 3.5-6 lists the LORS governing fire hazard protection for the proposed transmission interconnection and the overall project.

TABLE 3.5-6
Fire Hazard LORS

LORS	Applicability
14 CCR Sections 1250-1258, "Fire Prevention Standards for Electric Utilities"	Provides specific exemptions from electric pole and tower firebreak and electric conductor clearance standards, and specifies when and where standards apply.
ANSI/IEEE 80, "IEEE Guide for Safety in AC Substation Grounding"	Presents guidelines for assuring safety through proper grounding of AC outdoor substations.
GO-95, CPUC, "Rules for Overhead Electric Line Construction," Section 35	CPUC rule covers all aspects of design, construction, operation, and maintenance of electrical transmission line and fire safety (hazards).

3.4.7 Jurisdiction

Table 3.5-7 identifies national, state, and local agencies with jurisdiction to issue permits or approvals, conduct inspections, or enforce the above-referenced LORS. Table 3.5-7 also identifies the responsibilities of these agencies as they relate to the construction, operation, and maintenance of the King Island CAES facility.

TABLE 3.5-7
National, State, and Local Agencies with Jurisdiction over Applicable LORS

Agency or Jurisdiction	Responsibility
FAA	Establishes regulations for marking and lighting of obstructions in navigable airspace (AC No. 70/7450-1G).
Caltrans Department of Aeronautics	Grants permits to private heliports in California. May advise local jurisdictions regarding obstructions to helicopter navigation.
CEC	Jurisdiction over new transmission lines associated with thermal power plants that are 50 MW or more (Public Resources Code [PRC] 25500).
CEC	Jurisdiction of lines out of a thermal power plant to the interconnection point to the utility grid (PRC 25107).
CEC	Jurisdiction over modifications of existing thermal power plants that increase peak operating voltage or peak kilowatt capacity 25 percent (PRC 25123).
CPUC	Regulates construction and operation of overhead transmission lines. (GO-95)
CPUC	Regulates construction and operation of power and communications lines for the prevention of inductive interference. (General Order No. 52)
Local Electrical Inspector	Jurisdiction over safety inspection of electrical installations that connect to the supply of electricity (National Fire Protection Association 70).
County of San Joaquin	Establishes and enforces zoning regulations for specific land uses. Issues variances in accordance with zoning ordinances.

3.5 References

California Independent System Operator (CAISO). 2008. *Generator Interconnection Process Reform, Revised Draft Proposal, June 27, 2008*. Available online at: http://www.caiso.com/1f42/1f42c00d28c30.html.

RCI. 2014. *PG&E 300 MW Compressed Air Energy Storage Transmission Interconnection Screening Study Report*. Prepared for Pacific Gas and Electric Company. October 21, 2014.

SECTION 4.0

Natural Gas Supply

The King Island CAES Project (KICP) would require construction of a pipeline to supply natural gas to the project site from PG&E's natural gas transmission system. An initial study by PG&E indicates that PG&E would propose to serve the project from an 8-inch PG&E distribution feeder pipeline supplied from an existing PG&E gas transmission line. In 2011, PG&E looped this distribution line with a 12-inch diameter pipeline to a valve just east of Thornton Road. The study indicates that PG&E would propose to serve the KICP by installing an additional 12-inch-diameter pipe from this same valve in three segments. Segment 1 would be approximately 0.9 mile and extend to a new valve lot located adjacent to the west side of Interstate 5 in the southeast corner of the City of Lodi White Slough Water Pollution Control Facility (WPCF) property. From this new valve lot, the pipeline serving the project would extend north along the White Slough WPCF entrance road into the southeast corner of the KICP Energy Conversion Facility (ECF) site, a distance of approximately 3,100 feet. The third segment would extend west from the new valve lot for approximately 1,000 feet to the NCPA meter lot. Approximately 8,363 feet of 12-inch-diameter pipe would be installed to provide the necessary volume and pressures required for the KICP. The locations of these segments are as shown in Figure 4.0-1. Construction would be by open trench within a construction corridor width of 100 feet or less. The crossing of Interstate 5 would be completed using the horizontal directional drilling method. PG&E would construct, own, and operate the new pipeline. Refer to the Gas Line Route Feasibility Study (PG&E, August 2014, Recommended Alternative) for further technical, logistical and economic details and a comparison of alternatives.

The pipeline would be constructed of alloyed carbon steel in accordance with the American Petroleum Institute (API) specification for gas pipeline and PG&E standards. The pipe would have factory-applied corrosion-protection coating. Joints would be welded, inspected using x-ray or other non-destructive testing method, and wrapped with a corrosion-protection coating.

Alternative gas pipeline routes are discussed in Chapter 6 and considered in the PG&E study referenced above.

4.1 Gas Compression

The minimum natural gas delivery pressure to the ECF would be approximately 250 pounds per square inch gauge (psig). The facility would include one skid-mounted two-stage reciprocating compressor installed with skid-mounted running gear, lube oil console crank shaft-driven, with motor drive backup. The compressor would achieve the final discharge gas pressure of 1,020 psig.

4.2 Fuel Gas Design Criteria

Table 4.2-1 lists fuel gas design values and temperature ranges for gas constituents.

TABLE 4.2-1
Fuel Gas Specifications

Constituent	Design Value[a]	Range[a]
Hexane (C6)	0.014	0–0.03
Propane (C3)	0.246	0.10–0.50

TABLE 4.2-1
Fuel Gas Specifications

Constituent	Design Value[a]	Range[a]
I Butane (C4)	0.030	0–0.06
N Butane (C4)	0.036	0–0.06
Iso Pent (C5)	0.010	0–0.03
N Pent (C5)	0.007	0–0.03
Nitrogen	1.030	0.90–1.20
Methane (C1)	95.642	94.5–96.5
CO2	0.671	0.50–1.00
Ethane (C2)	2.315	1.8–3.0
Total	**100.00**	
Hydrogen (% volume)		Max. 2
Water and hydrocarbons condensates		Not allowed
Ammonia (mg/m^3N)		Max. 25
Chlorine + fluorine (mg/m^3N)		Max. 50
Particles and solids (mg/m^3N)		Max. 50
Particles and solids size (μm)		Max. 5
Pressure delivered to interconnection point (psig)		170–320 psig
Temperature delivered to interconnection point (°F)	60	60–100 at the revenue meter
Heating Value, HHV [b]	1021.1	1010–1030
Compressibility Factor	1.0021	1.0021
Real Relative Density	0.581	0.57 - 0.59
Methane Number	90	Approximately 86–93

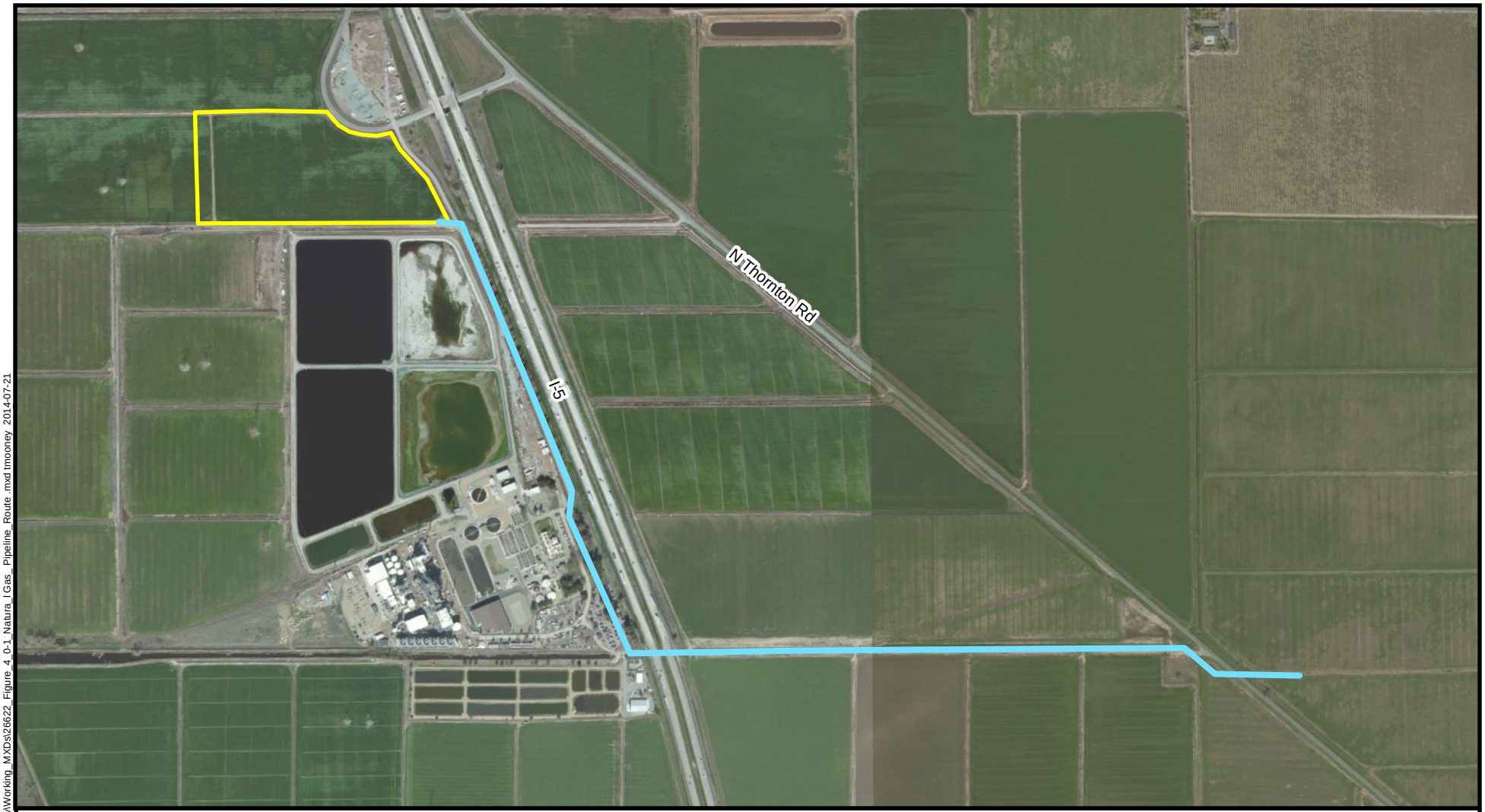
[a] % Mole at 14.730 pounds per square inch absolute (psia) and uncorrected for compressibility
[b] HHV is in Dry Btu at 14.730 psia and 60°F and corrected for compressibility

The following are additional design specifications for fuel gas:

- The sum of other hydrocarbons besides those specified above (C1 through C6 compounds) is not to exceed 0.05 mass-percent
- Aromatic hydrocarbons, or silicon-based compounds or impurities resulting from the operating and maintenance of the gas delivery systems are not allowed
- Total sulfur not to exceed 5 parts per million (ppm) on a mass basis
- It is understood that variations in the gas composition inside the specification would occur and are normal
- No sudden and extreme changes in gas temperature, pressure, or composition (recognizing that fluctuations would occur within a normal range)

4.3 Construction

The construction of the natural gas pipeline would consist of the following activities:



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North State Resources, Inc.

PG&E King Island Compressed Air Energy Storage Project

Figure 4.0-1
Natural Gas Pipeline Route

1. **Trenching width** depends on the type of soils encountered and requirements of the governing agencies. Trenching would be done in accordance with the requirements of the soil to ensure the safety of construction personnel. The optimal trench would be approximately 18 to 24 inches wide and72 inches deep. In agricultural areas, PG&E installs gas pipelines with 60 inches of cover to protect the pipe from soil tilling operations. If loose soil is encountered, a trench up to 10 feet wide at the top and 2 feet wide at the bottom may be required. The excavated soil would be piled on one side of the trench and used for backfilling after the pipe is installed. The pipeline would be installed through trenching at all locations except where directional drilling is required to cross beneath Interstate 5.
2. **Stringing** consists of trucking lengths of pipe to the right-of-way and laying them on skids beside the open trench.
3. **Installation** consists of bending, welding, and coating the weld-joint areas of the pipe after it has been strung, padding the ditch with sand or fine spoil, and lowering the pipe string into the trench. Bends would be made using a cold bending machine or would be shop fabricated as required for various changes in bearing and elevation. Welding would meet the applicable API standards and would be performed by qualified welders. Welds would be inspected in accordance with API Standard 1104 (API, 1999). Welds would undergo 100 percent radiographical inspection by an independent, qualified radiography contractor. All coating would be checked for defects and would be repaired before lowering the pipe into the trench.
4. **Backfilling** consists of returning spoils back into the trench around and on top of the pipe, ensuring that the surface is returned to its original grade or level. The backfill would be compacted to protect the stability of the pipe and to minimize subsequent subsidence.
5. **Plating** consists of covering any open trench in areas of foot or vehicle traffic at the end of a workday. Plywood plates would be used in areas of foot traffic and steel plates would be used in areas of vehicle traffic. Plates would be removed at the start of each workday.
6. **Hydrostatic testing** consists of filling the pipeline with water, venting all air, increasing the pressure to code requirements, and holding the pressure for a period of time. After hydrostatic testing, the test water would be analyzed for pH and total dissolved solids (TDS) and discharged to the sanitary sewer system, unless the analysis shows that the water's pH or TDS exceeds the district's discharge criteria. In that case, the water would be trucked to an appropriate treatment or disposal facility. The construction contractor would obtain all necessary approvals for test water use and discharge.
7. **Cleanup** consists of restoring the surface of the ground by removing any construction debris, grading to the original grade and contour, and revegetating or repairing where required.
8. **Commissioning** consists of cleaning and drying the inside of the pipeline, purging air from the pipeline, and filling the pipeline with natural gas.

4.4 Metering Station

A gas-metering station would be installed at or adjacent to the ECF site to measure and record gas volumes. Additionally, downstream facilities would be installed as part of the ECF to regulate the gas pressure, remove any liquids or solid particles, and provide compression, when necessary.

Construction activities related to the metering station would include grading a pad and installing aboveground and belowground gas piping, metering equipment, gas conditioning, pressure regulation, and

possibly pigging facilities. A distribution power line also would be installed to provide power for metering station operation lighting and communication equipment. Additionally, a perimeter chain-link fence would be installed around the gas metering station for security.

4.5 Pipeline Operations

The proposed natural gas supply pipeline would be designed, constructed, operated, and maintained in accordance with Code 49 Code of Federal Regulations (CFR) 192 and California Public Utilities Commission General Order No. 112. Specifically, the pipeline would be designed in accordance with the standards required for gas pipelines in populated areas. It would be installed with a minimum of 36 inches of cover as required by the CFR.

PG&E's standard operations and maintenance plan would be in place, addressing normal procedures and conditions and any upset or abnormal conditions that could occur. Periodic leak surveys and cathodic protection surveys would be performed along the pipeline, as required by 49 CFR 192. The pipeline would be continuously protected by a cathodic protection system. PG&E's standard emergency plan would provide for prompt and effective responses to upset conditions detected along the pipeline or reported by the public. This plan is reviewed with local agencies annually.

PG&E would own and operate the metering facility to measure the gas supply to the ECF. A pipeline Supervisory Control and Data Acquisition system (SCADA) would provide flow rate and pressure data to the project. Communication with PG&E gas line operations will be by dedicated telephone lines or other means.

4.6 References

American Petroleum Institute (API). 1999. *Welding of Pipelines and Related Facilities*. ANSI/API 1104, 19th edition. September.

California Public Utilities Commission. CPUC General Order No. 112: Design, Construction, Testing, Maintenance and Operation of Utility Gas Gathering, Transmission and Distribution Piping Systems.

Pacific Gas and Electric Company. 2014. *CAES ECF Lodi Gas Line Route Feasibility Study*. PG&E Gas Engineering. August.

SECTION 5.0

Environmental Information

This chapter contains 16 individual sections. The sections represent the standard environmental, public health and safety, and local impact assessment disciplines for which the California Energy Commission (CEC) Energy Facilities Siting Regulations (Title 20, California Code of Regulations [CCR], Section 1704, Appendix B) require information in an Application for Certification (AFC). Most of the sections use a standardized format under the following headings and associated content:

- **Affected Environment** includes relevant background information about the project's environmental, social, and regulatory settings.
- **Environmental Analysis** addresses the potential environmental consequences of the construction and operation of the King Island CAES Project (KICP). The section begins with a list of the criteria used to determine whether environmental effects of the project qualify as significant adverse environmental impacts.
- **Cumulative Effects** discusses potential effects of the project that are not significant adverse impacts, but that could reach significance cumulatively in combination with other projects.
- **Mitigation Measures** describes any mitigation measures necessary to reduce potential impacts below the level of significance.
- **Laws, Ordinances, Regulations, and Standards** (LORS) lists the LORS that pertain to the project for a given discipline and includes a demonstration that the project, as designed, would comply with all applicable LORS.
- **Agencies and Agency Contacts** is a list of federal agencies with permitting authority over the project, and state and local regulatory agencies that would have such permitting authority, but for the exclusive purview of the CEC to license thermal power plants with a capacity of 50 megawatts (MW) or more in California. This section also contains a list of regulatory agency staff and their locations.
- **Permits and Permit Schedules** identifies applicable permits and their schedules.

5.1 Air Quality

The KICP would store energy in the form of compressed air for later release and use to generate electricity. The facility would use electric-powered compressors to compress air and move the air through a pipeline to an underground air storage reservoir in the King Island natural gas field. When electrical power and ancillary services are needed to meet the California Independent System Operator (CAISO) system needs, pressurized air would be released from the reservoir, heated via natural gas-fired combustors, and used to drive turbo-expander units that would generate electricity for grid use. The facility would have a nominal generating capacity of 316 MW.[1] This section describes and evaluates the potential air quality effects of the KICP.

5.1.1 Affected Environment

5.1.1.1 Geography and Topography

The KICP energy conversion facility (ECF) site would be located on land owned and incorporated by the City of Lodi in San Joaquin County, which falls under the jurisdiction of the San Joaquin Valley Air Pollution Control District (SJVAPCD). The ECF site is on the west side of Interstate 5 (I-5), approximately 1.5 miles south of State Route 12 (SR-12), and just north of the City of Lodi's White Slough Water Pollution Control Facility (WPCF). The White Slough WPCF's treatment and holding ponds are located immediately to the south of the proposed ECF site. Further south of the proposed ECF site is the Lodi Energy Center; the Northern California Power Agency Combustion Turbine Project #2, with a 230-kilovolt (kV) Pacific Gas and Electric Company (PG&E) overhead electrical transmission line; and the San Joaquin County Mosquito and Vector Control District facility. The well pad sites are located approximately 2.5 miles southwest of the ECF site on King Island. The ECF and well pad sites are nearly level, at elevations very near sea level. The ECF is located at 9 feet above mean sea level (msl), whereas the east and west well pads are located at 0 and -5 feet msl, respectively. Essentially flat terrain extends for many miles on all sides of the proposed ECF and well pad sites.

Climate and Meteorology

The San Joaquin Valley Air Basin (SJVAB) is approximately 250 miles long and averages 35 miles wide. It is defined by the Sierra Nevada Mountains in the east, Coast Ranges in the west, and Tehachapi Mountains in the south. The valley is basically flat with a slight downward gradient to the northwest and opens to the Carquinez Strait, where the San Joaquin-Sacramento River Delta (Delta) empties into the San Francisco Bay. Although marine air generally flows into the SJVAB from the Delta, the region's topographic features restrict air movement through and out of the basin. As a result, the SJVAB is highly susceptible to pollutant accumulation over time (SJVAPCD, 2002). Local climatological effects, including wind speed and direction, temperature, inversion layers, and precipitation and fog, can exacerbate the air quality problem in the SJVAB, as described below.

Wind Speed and Direction. Wind speed and direction data indicate that summer wind usually originates at the north end of the SJVAB and flows in a south-southeasterly direction through the SJVAB, into the Southeast Desert Air Basin. Alternately, wind speed and direction data indicate that winter wind

[1] This is the approximate facility gross output with both turbo-expander generator trains operating at 100 percent load at International Standards Organization (ISO) conditions (15 degrees Celsius, 65 percent relative humidity, and ambient pressure at sea level).

occasionally originates from the south end of the SJVAB and flows in a north-northwesterly direction. Also during the winter months, the SJVAB experiences light, variable winds with speeds less than 10 miles per hour (mph). These low wind speeds, combined with low inversion layers, create a winter climate conducive to high concentrations of carbon monoxide (CO) and particulate matter with an aerodynamic diameter less than or equal to 10 micrometers (PM_{10}) (SJVAPCD, 2002).

Temperature. The SJVAB has an "inland Mediterranean" climate averaging over 260 sunny days per year. The valley floor is characterized by warm, dry summers and cooler winters. Summer high temperatures can exceed 100 degrees Fahrenheit (°F), averaging in the low 90s in the northern valley and high 90s in the south (SJVAPCD, 2002). The average daily high temperature recorded in Lodi[2] during the summer months is 91.5°F (Western Regional Climate Center, 2014). Alternately, the SJVAB experiences winters that are mild and humid. Average high temperatures in the winter are in the 50s, but temperatures in the 30s and 40s can occur on days with persistent fog and low cloudiness. Temperatures below freezing are unusual (SJVAPCD, 2002). The average daily low temperature recorded in Lodi during the winter months is 36.9°F (Western Regional Climate Center, 2014).

Inversion Layers. The vertical dispersion of air pollutants in the SJVAB is limited by the presence of persistent temperature inversions. Semi-permanent systems of high barometric pressure fronts frequently establish themselves over the SJVAB, deflecting low-pressure systems that might otherwise bring cleansing rain and winds. Daytime temperature inversions during the summer are usually encountered 2,000 to 5,000 feet above the valley floor. Inversions are more persistent (stable) during the winter months. The daily cycle has overnight inversions occurring 500 to 1,000 feet above the valley floor (SJVAPCD, 2002).

Precipitation and Fog. Precipitation in the SJVAB is strongly influenced by the position of the semi-permanent subtropical high-pressure belt located off the Pacific coast (Pacific High). In the winter, this high-pressure system moves southward, allowing Pacific storms to move through the SJVAB. Precipitation in the SJVAB decreases from north to south because the Pacific storm track often passes through the northern part of the state, while the southern part of the state remains protected by the Pacific High. Precipitation in the SJVAB is confined primarily to the winter months, with some also occurring in late summer and fall. Average annual rainfall for the entire SJVAB is 9.3 inches (SJVAPCD, 2002). The average annual rainfall recorded in Lodi is 17.2 inches, of which about 81 percent occurs between November and March (Western Regional Climate Center, 2014).

The winds and unstable air conditions experienced during the passage of storms result in periods of low pollutant concentrations and excellent visibility. Between winter storms, high pressure and light winds allow cold moist air to pool in the SJVAB. This creates strong, low-level temperature inversions and stable air conditions, which lead to the formation of natural fog, known as tule fog. Conditions favorable to fog formation are also conditions typically favorable to high concentrations of CO and PM_{10}. However, ozone levels are low during these periods because of the lack of sunlight to drive the photochemical reaction. At the same time, fog could help in the formation of secondary particulates, which are believed to be a significant contributor to concentrations of PM_{10} and particulate matter with an aerodynamic diameter less than or equal to 2.5 micrometers ($PM_{2.5}$) (SJVAPCD, 2002).

[2] The meteorological monitoring station located in Lodi, California (Station ID 045032) is approximately 5.7 miles east-northeast of the proposed ECF site.

Criteria Pollutants and Air Quality Trends

State and National Ambient Air Quality Standards

The U.S. Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS) for the following seven criteria pollutants: ozone, nitrogen dioxide (NO_2), CO, sulfur dioxide (SO_2), PM_{10}, $PM_{2.5}$, and airborne lead. The federal Clean Air Act (CAA) requires EPA to designate areas (counties) as attainment or nonattainment with respect to each criteria pollutant, depending on whether the areas meet the NAAQS. An area that is designated nonattainment means the area is not meeting the NAAQS and is subject to planning requirements to attain the standard.

In addition to the seven pollutants listed above, the California Air Resources Board (CARB) has established state standards for visibility-reducing particles, sulfates, hydrogen sulfide (H_2S), and vinyl chloride. Similar to EPA, CARB designates counties in California as attainment or nonattainment with respect to these California Ambient Air Quality Standards (CAAQS). The CAAQS were designed to protect the most sensitive members of the population, such as children, the elderly, and people who suffer from lung or heart diseases. The attainment status of the SJVAB with respect to the state and federal standards is summarized in Table 5.1-1.

TABLE 5.1-1
State and Federal Air Quality Designations for San Joaquin County (SJVAB)

Pollutant	State Designation	Federal Designation
Ozone	1-hour: Nonattainment 8-hour: Nonattainment	1-hour: N/A 8-hour: Nonattainment (Extreme)
CO[a]	1-hour: Attainment 8-hour: Attainment	1-hour: Attainment 8-hour: Attainment
NO_2	1-hour: Attainment Annual: Attainment	1-hour: Attainment Annual: Attainment
SO_2	1-hour: Attainment 24-hour: Attainment	1-hour: Attainment 24-hour: N/A
PM_{10}	24-hour: Nonattainment Annual: Nonattainment	24-hour: Maintenance (Serious) Annual: N/A
$PM_{2.5}$	24-hour: N/A Annual: Nonattainment	24-hour: Nonattainment (Moderate) Annual: Nonattainment (Moderate)
Lead	Attainment	Attainment
H_2S, Sulfates	Unclassified, Attainment	N/A, N/A

Notes:

N/A = Not applicable (i.e., no standard)

[a]Note that Stockton, California is classified as a maintenance area for CO; however, the ECF site is not located within this specific maintenance area.

Sources: CARB, 2013b; EPA, 2014b

Both CAAQS and NAAQS are based on two variables: maximum concentration and an averaging time over which the concentration would be measured. Maximum concentrations are based on levels that may have an adverse effect on human health. Averaging times are based on whether the damage caused by the pollutant would occur during exposures to a high concentration for a short time (e.g., 1 hour) or during exposures to a relatively lower average concentration over a longer period (e.g., 8 hours, 24 hours, or

1 month). For some pollutants, there is more than one air quality standard, reflecting both short- and long-term effects. Table 5.1-2 presents the NAAQS and CAAQS.

TABLE 5.1-2
Ambient Air Quality Standards

Pollutant	Averaging Time	CAAQS	NAAQS
Ozone	1 hour 8 hours	0.09 ppm (180 µg/m^3) 0.070 ppm (137 µg/m^3)	N/A 0.075 ppm (147 µg/m^3)
CO	1 hour 8 hours	20 ppm (23 mg/m^3) 9.0 ppm (10 mg/m^3)	35 ppm (40 mg/m^3) 9 ppm (10 mg/m^3)
NO_2	1 hour Annual Arithmetic Mean	0.18 ppm (339 µg/m^3) 0.030 ppm (57 µg/m^3)	100 ppb (188 µg/m^3)[a] 0.053 ppm (100 µg/m^3)
SO_2[b]	1 hour 24 hours	0.25 ppm (655 µg/m^3) 0.04 ppm (105 µg/m^3)	75 ppb (196 µg/m^3) N/A
PM_{10}	24 hours Annual Arithmetic Mean	50 µg/m^3 20 µg/m^3	150 µg/m^3 N/A
$PM_{2.5}$	24 hours Annual Arithmetic Mean	N/A 12 µg/m^3	35 µg/m^3[c] 12 µg/m^3[d]
Sulfates	24 hours	25 µg/m^3	N/A
Lead	30-day Average Calendar Quarter	1.5 µg/m^3 N/A	N/A 1.5 µg/m^3
H_2S	1 hour	0.03 ppm (42 µg/m^3)	N/A
Vinyl Chloride	24 hours	0.01 ppm (26 µg/m^3)	N/A
Visibility-reducing Particles	8 hours (10 a.m. to 6 p.m. PST)	Insufficient amount to produce an extinction coefficient of 0.23 per kilometer due to particles when the relative humidity is less than 70 percent	N/A

Notes:

mg/m^3 = milligram(s) per cubic meter
µg/m^3 = microgram(s) per cubic meter
ppb = part(s) per billion
ppm = part(s) per million
PST = Pacific Standard Time

[a]To attain this standard, the 3-year average of the 98th percentile of the 1 hour daily maximum concentrations at each monitor within an area must not exceed 100 ppb.

[b]On June 2, 2010, EPA established a new 1 hour SO_2 standard, effective August 23, 2010, which is based on the 3-year average of the annual 99th percentile of 1 hour daily maximum concentrations. The EPA also revoked both the 24-hour SO_2 standard of 0.14 ppm and the annual primary SO_2 standard of 0.030 ppm, effective August 23, 2010. The secondary SO_2 standard was not revised at that time; however, the secondary standard is undergoing a separate review by EPA.

[c]The 24-hour standard is attained when 98 percent of the daily concentrations, averaged over 3 years, are equal to or less than the standard.

[d]The 3-year average of weighted annual mean concentrations.

Source: CARB, 2013c

Ambient Monitoring Stations

Data from two ambient air monitoring stations were used to characterize air quality at the proposed ECF site. They were chosen because of their proximity to the site and because they record areawide ambient conditions, rather than the localized impacts of any particular facility. All ambient air quality data presented in this section were taken from CARB or EPA air quality data tables. Ambient concentrations of ozone, CO, NO_2, PM_{10}, and $PM_{2.5}$ are recorded at the Stockton-Hazelton monitoring station, located at 1593 East Hazelton Avenue in Stockton, about 11.3 miles southeast of the ECF site. The nearest monitoring station for SO_2 is the Bethel Island monitoring station, located at 5551 Bethel Island Road in Bethel Island, about 13 miles southwest of the ECF site.

Ozone

Ozone is an end product of complex reactions between volatile organic compounds (VOCs) and nitrogen oxides (NO_x) in the presence of intense ultraviolet radiation. VOC and NO_x emissions from millions of vehicles and stationary sources, in combination with daytime wind-flow patterns, mountain barriers, a persistent temperature inversion, and intense sunlight, result in high ozone concentrations. For purposes of state and federal air quality planning, the SJVAB is a nonattainment area for ozone.

Table 5.1-3 shows the annual maximum 1-hour and 8-hour ozone levels recorded at the Stockton-Hazelton monitoring station from 2011 through 2013, as well as the number of days in which the state and federal standards were exceeded. The data show that the state 1-hour and 8-hour standards, as well as the federal 8-hour standard, were exceeded during 2012 at the Stockton-Hazelton monitoring station.

TABLE 5.1-3
Ozone Levels at the Stockton-Hazelton Monitoring Station for 2011-2013[a]

	2011	2012	2013
Highest 1-hour Average (ppm)	0.089	0.097	0.080
Highest 8-hour Average (ppm)	0.068	0.083	0.067
Number of Days Exceeding:			
State Standard (0.09 ppm, 1 hour)	0	1	0
State Standard (0.070 ppm, 8 hours)	0	6	0
Federal Standard (0.075 ppm, 8 hours)	0	2	0

Notes:
[a]Data collected by CARB at the monitoring station located at 1593 East Hazelton Avenue in Stockton, California.
Source: CARB, 2014

Nitrogen Dioxide

Atmospheric NO_2 is formed primarily from reactions between nitric oxide (NO) and oxygen (O_2) or ozone. NO is formed during high temperature combustion processes, when the nitrogen and O_2 in the combustion air combine. Although NO is much less harmful than NO_2, it can be converted to NO_2 in the atmosphere under certain ambient conditions. For purposes of state and federal air quality planning, the SJVAB is an attainment area for NO_2.

Table 5.1-4 shows the annual maximum 1-hour NO_2 levels recorded at the Stockton-Hazelton monitoring station from 2011 through 2013, as well as the annual average level for each of those years. The number of days in which the state and federal standards were exceeded is also presented. During this period, there have been no violations of either the state or federal standards at the Stockton-Hazelton monitoring station.

Carbon Monoxide

CO is a product of incomplete combustion, principally from automobiles and other mobile sources of pollution. In many areas of California, CO emissions from wood-burning stoves and fireplaces can also be measurable contributors to high ambient levels of CO. Industrial sources typically contribute less than 10 percent of ambient CO levels. Peak CO levels occur typically during winter months, due to a combination of higher emission rates and stagnant weather conditions. For purposes of state and federal air quality planning, the SJVAB is an attainment area for CO.[3]

TABLE 5.1-4
NO_2 Levels at the Stockton-Hazelton Monitoring Station for 2011-2013[a]

	2011	2012	2013
Highest 1-hour Average (ppm)	0.062	0.078	0.062
Annual Average (ppm)	0.016	0.014	0.015
Number of Days Exceeding:			
State Standard (0.18 ppm, 1 hour)	0	0	0
State Standard (0.030 ppm, Annual Average)	0	0	0
Federal Standard (0.100 ppm, 1 hour)	0	0	0
Federal Standard (0.053 ppm, Annual Average)	0	0	0

Notes:
[a]Data collected by CARB at the monitoring station located at 1593 East Hazelton Avenue in Stockton, California.
Source: CARB, 2014

Table 5.1-5 shows the annual maximum 1-hour and 8-hour CO levels recorded at the Stockton-Hazelton monitoring station from 2011 through 2013, as well as the number of days in which the state and federal standards were exceeded. During this period, there have been no violations of either the state or federal standards at the Stockton-Hazelton monitoring station.

TABLE 5.1-5
CO Levels at the Stockton-Hazelton Monitoring Station for 2011-2013 [a]

	2011	2012	2013
Highest 8-hour Average (ppm)	2.13	1.78	1.8 [b]
Highest 1-hour Average (ppm) [b]	3.2	3.0	2.7
Number of Days Exceeding:			
State Standard (20 ppm, 1 hour)	0	0	0
State Standard (9 ppm, 8 hours)	0	0	0
Federal Standard (35 ppm, 1 hour)	0	0	0
Federal Standard (9 ppm, 8 hours)	0	0	0

Notes:
[a]Unless otherwise noted, data collected by CARB at the monitoring station located at 1593 East Hazelton Avenue in Stockton, California.
[b]Data collected by EPA at the monitoring station located at Hazelton-HD in Stockton, California. This monitoring station is presumed to be the same as that located at 1593 East Hazelton Avenue.
Source: CARB, 2014; EPA, 2014a

[3] Note that Stockton, California is classified as a maintenance area for CO; however, the ECF site is not located within this specific maintenance area.

Sulfur Dioxide

SO_2 is produced when any sulfur-containing fuel is burned. It is also emitted by chemical plants that treat or refine sulfur or sulfur-containing chemicals. Natural gas contains negligible sulfur, while fuel oils contain much larger amounts. Because of the complexity of the chemical reactions that convert SO_2 to other compounds (such as sulfates), peak concentrations of SO_2 occur at different times of the year in different parts of California, depending on local fuel characteristics, weather, and topography. For purposes of state and federal air quality planning, the SJVAB is an attainment area for SO_2.

Table 5.1-6 shows the annual maximum 1-hour and 24-hour SO_2 levels recorded at the Bethel Island monitoring station from 2011 through 2013, as well as the number of days in which the state and federal standards were exceeded. During this period, there have been no violations of either the state or federal standards at the Bethel Island monitoring station.

TABLE 5.1-6
SO_2 Levels at the Bethel Island Monitoring Station for 2011–2013[a]

	2011	2012	2013
Highest 1-hour Average (ppm)	0.008	0.020	0.004
Highest 24-hour Average (ppm)	0.003	0.003	0.002
Number of Days Exceeding:			
State Standard (0.25 ppm, 1 hour)	0	0	0
State Standard (0.04 ppm, 24 hours)	0	0	0
Federal Standard (0.075 ppm, 1 hour)	0	0	0

Notes:
[a]Data collected by EPA at the monitoring station located at 5551 Bethel Island Road in Bethel Island, California.
Source: EPA, 2014a

Fine Particulates (PM_{10} and $PM_{2.5}$)

Particulates in the air are caused by a combination of wind-blown fugitive dust; particles emitted from combustion sources (usually carbon particles); and organic, sulfate, and nitrate aerosols formed in the air from emitted hydrocarbons, sulfur oxides, and NO_x. In 1984, CARB adopted standards for fine particulates (PM_{10}) and phased out the total suspended particulate (TSP) standards that had previously been in effect. PM_{10} standards were substituted for TSP standards because PM_{10} corresponds to the size range of inhalable particulates related to human health. In 1987, EPA also replaced national TSP standards with PM_{10} standards. For purposes of state and federal air quality planning, the SJVAB is a nonattainment area for state PM_{10} standards and a maintenance area for the federal 24-hour PM_{10} standard.

Table 5.1-7 shows the annual maximum 24-hour PM_{10} levels recorded at the Stockton-Hazelton monitoring station from 2011 through 2013, as well as the annual average level for each of those years. The number of days in which the state and federal 24-hour standards were exceeded is also presented. The data show that the maximum 24-hour PM_{10} levels frequently exceed the state standard at the Stockton-Hazelton monitoring station, but have not exceeded the federal standard. The annual average PM_{10} levels are above the state standard (20 $\mu g/m^3$) during this monitoring period.

TABLE 5.1-7
PM_{10} Levels at the Stockton-Hazelton Monitoring Station for 2011-2013[a]

	2011	2012	2013
Highest 24-hour Average (µg/m^3)	70.1	70.0	95.5
Annual Average (µg/m^3)	24.1	22.8	32.0
Estimated Number of Days Exceeding:			
State Standard (50 µg/m^3, 24 hours)	24.4	17.9	58.2
Federal Standard (150 µg/m^3, 24 hours)	0	0	0

Notes:
[a]Data collected by CARB at the monitoring station located at 1593 East Hazelton Avenue in Stockton, California.
Source: CARB, 2014

$PM_{2.5}$ is also measured at the Stockton-Hazelton monitoring station. For purposes of state and federal air quality planning, the SJVAB is a nonattainment area for $PM_{2.5}$.

Table 5.1-8 shows the annual maximum 24-hour $PM_{2.5}$ levels recorded at the Stockton-Hazelton monitoring station from 2011 through 2013, as well as the annual average level for each of those years. The number of days in which the federal 24-hour standard was exceeded is also presented. The data show that the maximum 24-hour $PM_{2.5}$ levels frequently exceed the federal standard at the Stockton-Hazelton monitoring station. The annual average $PM_{2.5}$ levels are above the state and federal standards (both 12 µg/m^3) during this monitoring period.

TABLE 5.1-8
$PM_{2.5}$ Levels at the Stockton-Hazelton Monitoring Station for 2011-2013[a]

	2011	2012	2013
Highest 24-hour Average (µg/m^3)	65.5	60.4	66.5
Annual Average (µg/m^3)	14.0	12.4	17.6
Estimated Number of Days Exceeding:			
Federal Standard (35 µg/m^3, 24 hours)	11.0	6.0	27.6

Notes:
[a]Data collected by CARB at the monitoring station located at 1593 East Hazelton Avenue in Stockton, California.
Source: CARB, 2014

5.1.2 Project Description

The proposed KICP would employ two Dresser-Rand CAES compression trains, each consisting of a multi-stage compressor section driven by a dedicated 137-MW (nominal rating) electric motor. Each compression train would be capable of producing up to approximately 400 pounds per second of air at a compressor outlet pressure of up to 2,720 pounds per square inch absolute (psia). There are no combustion-related air emissions produced during the compression cycle.

The expansion/generation component of the KICP would consist of two turbo-expander generator trains, each rated at 158 MW. Each of the two turbo-expander generator trains has three bodies of multi-stage expansion and a high-pressure (HP) and low-pressure (LP) combustor. The combustors burn natural gas and allow for water injection for emissions control. The HP combustors are mounted on the inlet of each HP expander and provide the first direct heat for the stored, compressed air, after indirect preheating in the recuperator. Each HP expander's design is similar to a back-pressure steam turbine and its combustor

elevates the inlet air temperature to approximately 1,000°F at a pressure of 800 psia. The gases exit each HP expander, flowing to the LP combustor, where additional natural gas is burned to increase the gas temperature for further expansion in the LP expanders.

Each LP expander features eight gas-fuel combustors arranged in a can-annular configuration on the expander. The combustors allow for water injection for emissions control and NO_x abatement. Each LP expander uses its combustors to provide itself an inlet temperature of approximately 1,600°F. Gases exiting each LP expander flow through the recuperator, where they are used to heat the cool air entering the expansion generator train from the reservoir, and then exhaust through the stack.

The combustors for the LP and HP expanders are designed to burn only natural gas. The natural gas requirement during base load operation at ISO conditions for each turbo-expander is approximately 674 million British thermal units per hour (MMBtu/hr) on a higher heating value (HHV) basis for the HP and LP expanders. The maximum heat input expected for the HP and LP expanders is further described in Section 5.1.3.2.1.

Post-combustion air pollution controls for the turbo-expander generator trains would include selective catalytic reduction (SCR) for NO_x control and an oxidation catalyst for CO control. The reservoir would support 49.7 hours per week of generation at full rated output with 47.6 hours per week of compression. Because of the need to react quickly to firm intermittent renewables, the KICP is expected to be dispatched frequently and may have a capacity factor as high as 40 percent. The exact operational profile of the KICP would depend on weather conditions, system requirements, and the power purchaser's economic dispatch decisions.

In addition to the turbo-expander generator trains, the KICP would include a blackstart generator and fire water pump engine, both fired exclusively with diesel fuel. The blackstart generator is rated at approximately 489 horsepower with a 96 percent efficiency; the fire water pump engine is rated at approximately 250 horsepower. Both engines are only expected to operate during emergency power outage scenarios, and would be limited to 50 hours per year of operation for maintenance and testing.

The KICP would also include several noncombustion emission sources, such as a 10-cell mechanical draft cooling tower, well field, and oil-water separator. The 10-cell mechanical draft cooling tower make-up water would be primarily recycled water with recovered process water from the City of Lodi's White Slough WPCF. The well field would include approximately 30 injection and withdrawal (I/W) wells, located at two well pads. Any trace amounts of native natural gas entrained in the withdrawal air stream from the I/W wells would flow to the ECF and be consumed with combustor fuel gas in the turbo-expanders. Therefore, emissions from the well field would be limited to fugitive emissions from well operations and pipeline venting, which are expected to be negligible. Emissions from the oil-water separator are expected to be small relative to the turbo-expanders and other noncombustion emission sources. Therefore, the oil-water separator emissions were not estimated at this time, but should be evaluated further during the licensing process.

5.1.3 Emissions Evaluation

Criteria pollutant and greenhouse gas (GHG) emission rates were calculated for two phases of the project. The first phase is construction of the new electrical generating components and ancillary facilities, and the second phase is facility operation. Annual criteria pollutant emissions from construction were calculated based on a 27-month construction schedule, as discussed in Section 5.1.3.1. Hourly, daily, and annual criteria pollutant emissions from operation were calculated based on the expected operation schedule for

each source, as discussed in Section 5.1.3.2. The criteria pollutants evaluated include NO_x, SO_2, VOC, CO, PM_{10}, and $PM_{2.5}$. GHG emissions were also evaluated and presented in terms of carbon dioxide equivalents (CO_2e), based on emissions of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). No significant emissions of hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), or sulfur hexafluoride (SF_6)[4] are expected during construction or operation of the KICP.

5.1.3.1 Construction

Onsite construction activities for the KICP would consist of site preparation, grading, construction, and installation of the following base case components:

- ECF for the power island (20 acres)
- Underground storage I/W wells and equipment at two well pads (10 acres total)
- Underground compressed air pipeline extending from the ECF to the east well pad (2.57 miles)
- Air collection pipeline extending from the East Well Pad to the west well pad (0.29 mile)
- Natural gas pipeline extending from PG&E's distribution feeder main to the ECF (1.36 miles)
- Generator tie-line connecting the ECF to the existing Gold Hill-Eight Mile 230-kV transmission line circuit (270 feet)
- Recycled cooling water supply pipeline from the City of Lodi's White Slough WPCF (0.3 mile)
- Two wastewater injection wells: one located at the east well pad and one located at either the west well pad or the ECF

Additionally, construction laydown and parking areas are planned within existing site boundaries, including a small parcel adjacent to and east of the plant site; on a teardrop-shaped parcel northeast of the plant, adjacent to I-5; and a wedge-shaped parcel south of the ECF, immediately north of the White Slough WPCF and west of the I-5 frontage road. These laydown areas total 13.7 acres. Laydown for well pad construction will occur within the pad areas.

Offsite construction activities for the KICP would consist of worker commutes, vendor deliveries, and offsite transport of both excavated soil and soil imported for backfill.

Per the information provided by the owner's engineer (Worley Parsons, 2015), construction of the ECF, from site preparation and grading to commercial operation, is expected to take approximately 27 months (Worley Parsons assumed a start date of December 2015 when estimating/forecasting the construction schedule; in actuality, the construction would start much later though the expected duration of construction would remain at 27 months). Construction work was assumed to occur for 8 hours per day, Monday through Friday.

Onsite and offsite ECF construction emissions have been estimated, based on two categories of emission sources: (1) vehicle and construction equipment exhaust; and (2) fugitive dust from operating vehicle and construction equipment, including grading and cut/fill activities. The ECF fugitive dust and construction

[4] Transformers associated with the project would have a total SF_6 charge of 10 kilograms, with an expected leakage rate of 0.5 percent per year. This quantity is negligible compared to the GHG emissions associated with the rest of the project.

equipment exhaust emissions have been estimated using methodology and emission factors consistent with the California Emissions Estimator Model (CalEEMod; Version 2013.2.2 or newer), which incorporates portions of the EPA's *AP-42* (ENVIRON, 2013; EPA, 2006; South Coast Air Quality Management District [SCAQMD], et. al., 2011).[5] Exhaust emissions from vehicles traveling on paved and unpaved roads were estimated using EMFAC2011 emission factors,[6] as consistent with the CalEEMod methodology. Maximum daily and annual emissions were estimated based on the number and type of construction equipment, number of heavy-duty trucks, and workforce projected for each month of construction.

CalEEMod was used as a screening tool to estimate emissions for the construction of the well pads and pipelines. To facilitate this approach, CalEEMod defaults and the following key assumptions were used:

- Used a land use category of General Light Industry.
- The land use area was set equal to the sum of the areas for well pads (10 acres total) and underground pipelines (22 acres). Although the rights-of-way (ROWs) for the various underground pipelines are expected to extend up to 100 feet wide, it was assumed that significant disturbance would only occur within 20 feet of the pipelines (40 feet total). Acreage for construction of the generator tie-line was expected to be small relative to these other areas and was, therefore, not estimated.
- Construction of the well pads and pipelines was assumed to occur concurrently with construction of the ECF, using a similar schedule. However, the construction duration was shortened to approximately 23 months, based on the assumption that the well pads and pipelines will be completed prior to commissioning of the ECF in the 24th month of ECF construction.
- It was assumed that application of architectural coatings would not be a part of the construction activities.
- Construction activities were assumed to begin in December 2015, in accordance with the ECF construction schedule (Worley Parsons, 2015).
- Construction of the 30 I/W wells at two well pads, identified as the well drilling phase, was assumed to be best represented by the building construction phase in CalEEMod.
- One bore/drill rig was added to the CalEEMod default construction equipment list during the well drilling phase.

[5]CalEEMod is a statewide computer model created by ENVIRON and SCAQMD to quantify criteria pollutant and GHG emissions associated with the construction activities from a variety of land use projects (ENVIRON, 2013). Developed in cooperation with air districts throughout the state, CalEEMod is intended to standardize air quality analyses while allowing air districts to provide specific defaults reflecting regional conditions, regulations, and policies (SCAQMD, et al., 2011).

[6]The EMFAC2011-PL (project level assessment) module was used for vehicle emission factors. EMFAC2011 consists of three modules: EMFAC-LDV, which estimates passenger vehicle emissions; EMFAC-HD, which estimates emissions from diesel trucks and buses over 14,000 pound(s) (lb); and a third module called EMFAC-SG, which integrates the output of EMFAC-LDV and EMFAC-HD and the ability to conduct scenario assessments for air quality and transportation planning (CARB, 2013e). In order to aid in obtaining emission rates for project level assessments, CARB has released a new tool, EMFAC2011-PL, which can be used for most assessments using EMFAC default information to obtain standard emission rates for the desired vehicle category scheme (CARB, 2013e).

- The total material imported and exported was assumed equal to the predicted cut/fill volume of 74,450 cubic yards (yd^3). It was assumed that all cut/fill activities would be completed during the grading phase.
- The number of material haul truck trips was estimated based on the predicted cut/fill volume required for the well pads (34,450 yd^3), assuming the cut/fill volume for the pipelines would not require offsite transport.
- The maximum daily and annual criteria pollutant and GHG emissions from the combined onsite and offsite construction activities for the ECF and well pad/pipeline activities are presented in Tables 5.1-9 and 5.1-10, respectively. Detailed construction calculations and the CalEEMod output is provided in Appendix 5.1A.

TABLE 5.1-9
Maximum Annual Criteria Pollutant Emissions from Construction[a]

Construction Emissions	NO_x	CO	VOC	SO_2	PM_{10}	$PM_{2.5}$
Maximum Daily Emissions from ECF Construction (lb/day)	278	148	23.6	0.36	1,056	116
Maximum Daily Emissions from Well Pad/Pipeline Construction (lb/day)[b]	95	124	11.3	0.23	21.4	12.8
Maximum Daily Emissions (lb/day)	**373**	**272**	**35.0**	**0.60**	**1,078**	**129**
Maximum Annual Emissions from ECF Construction (tpy)	16.7	10.1	1.45	0.027	73.5	8.11
Maximum Annual Emissions from Well Pad/Pipeline Construction (tpy)[b]	9.7	13.1	1.29	0.025	1.78	0.78
Maximum Annual Emissions (tpy)	**26.4**	**23.2**	**2.74**	**0.052**	**75.3**	**8.89**

Notes:

tpy = ton(s) per year

[a]Maximum emissions include contributions from onsite and offsite construction equipment, onsite and offsite vehicles, fugitive sources (PM_{10} and $PM_{2.5}$ only), and paving off-gassing (ROG only).

[b]Emissions from well pad/pipeline construction were estimated using CalEEMod.

TABLE 5.1-10
Maximum Daily and Annual Greenhouse Gas Emissions from Construction

GHG Emissions	CO_2	CH_4	N_2O	CO_2 Equivalent[a]
Maximum Daily Emissions from ECF Construction (lb/day)	35,739	1.07	0.38	35,879
Maximum Daily Emissions from Well Pad/Pipeline Construction (lb/day)[b]	21,038	1.99	0.00	21,080
Maximum Daily Emissions (lb/day)	**56,777**	**3.06**	**0.38**	**56,960**
Maximum Annual Emissions from ECF Construction (MT/yr)	2,345	0.069	0.023	2,354
Maximum Annual Emissions from Well Pad/Pipeline Construction (MT/yr) [b]	2,115	0.189	0.000	2,119
Maximum Annual Emissions (MT/yr)	**4,460**	**0.258**	**0.023**	**4,473**

Notes:

MT/yr = metric ton(s) per year

[a]CO_2e assumes a global warming potential (GWP) of 25 for CH_4 and 298 for N_2O (40 Code of Federal Regulations [CFR] 98, Table A-1).

[b]Emissions from well pad/pipeline construction were estimated using CalEEMod.

Construction emissions control techniques proposed for use at the KICP include, but are not limited to, the following:

- Operational measures, such as limiting time spent with the engine idling by shutting down equipment when not in use, consistent with state law.

- Regular preventive maintenance to prevent emission increases due to engine problems.
- Use of construction equipment with low-emitting gas and diesel engines, typically equipped with catalytic converter systems and diesel particulate filter systems. Where available, CARB-certified engines will be used.

The following mitigation measures are proposed to control fugitive dust emissions during construction of the project:

- Use either water application or chemical dust suppressant application to control dust emissions from onsite unpaved road travel and unpaved parking areas.
- Use vacuum sweeping of paved road surfaces to remove buildup of loose material to control dust emissions from travel on the paved access road (including adjacent public streets impacted by construction activities) and paved parking areas.
- Cover all trucks hauling soil, sand, and other loose materials or require all trucks to maintain at least 2 feet of freeboard.
- Limit traffic speeds on all unpaved site areas to 15 mph.
- Install erosion-control measures to prevent silt runoff to roadways.
- Replant vegetation in disturbed areas as quickly as possible.
- Install rumble tracks at each construction site exit.
- Mitigate fugitive dust emissions from wind erosion of areas disturbed from construction activities (including storage piles) by application of either water or chemical dust suppressant.

The KICP construction site impacts are not unusual in comparison to most construction sites. Construction sites that use good dust suppression techniques and low-emitting vehicles typically do not cause violations of air quality standards.

5.1.3.2 Operational Emissions

Operational emission estimates were prepared for the turbo-expander steady-state operating mode. Emission estimates for this operating mode are based on vendor data and engineering estimates. Natural gas would be the only fuel burned in the turbo-expanders and the turbo-expanders would use advanced combustion controls, combined with SCR, to limit emissions of NO_x to 2.0 parts per million by volume, corrected to 15 percent O_2 (parts per million by volume, corrected to 15% oxygen [ppmvdc). Advanced combustion controls, combined with the use of an oxidation catalyst, would be used to limit CO and VOC emissions to 2.0 and 1.3 ppmvdc, respectively. PM_{10} and SO_2 emissions would be kept to a minimum through the exclusive use of natural gas and inlet air filtration (for particulate matter control).

Operational emission estimates were also prepared for the blackstart generator, fire water pump engine, and cooling tower. As described above, emissions from the well field and oil-water separator were not estimated as they are expected to be negligible.

Turbo-Expanders

Project designers evaluated turbo-expander performance at ISO conditions. Maximum annual emissions of VOC, NO_x, CO, SO_2, PM_{10}, and $PM_{2.5}$ are based on expected operations, excluding startups, shutdowns, and commissioning, assuming an operation schedule of 49.7 hours per week of generation and 47.6 hours per week of compression.

Turbo-expander performance data are provided in Appendix 5.1B, Table 5.1B.1. Emissions of NO_x, CO, and VOC were calculated from emission limits (in ppmvdc) and the exhaust flow rates. The NO_x emission limit reflects the application of SCR, VOC emission limit reflects the use of good combustion practices, and CO emission limit reflects the expected performance of the oxidation catalyst. Maximum emissions were based on the exhaust rates associated with the heat input rates shown below, in Table 5.1-11.

TABLE 5.1-11
Maximum Hourly, Daily, and Annual Heat Input

	Heat Input (MMBtu, HHV)	
Interval	**Per Turbo-expander**	**Total**
Hourly	674	1,348
Daily	6,701	13,401
Annual	1,685,250	3,370,500

SO_2 emissions were calculated from the heat input rates in Table 5.1-11, an SO_2 emission factor (in pound(s) per MMBtu [lb/MMBtu]), and the maximum allowable fuel sulfur content of 0.75 grain per 100 standard cubic feet (scf).

Maximum hourly PM_{10} emissions reflect expected turbo-expander performance, based on emission limits from similar installations. $PM_{2.5}$ emissions were determined based on the assumption that all particulate matter emissions are less than 2.5 micrometers in size.

Maximum emission rates per turbo-expander are summarized in Table 5.1-12. The analysis of best available control technology (BACT), on which the emission factors are based, is summarized in Section 5.1.4.1.

TABLE 5.1-12
Maximum Emission Rates per Turbo-expander

	Maximum Emission Rates		
Pollutant[a]	**(ppmvdc)**	**(lb/MMBtu)**	**(lb/hr)**
NO_x	2.0	7.9E-03	5.31
SO_2[b]	0.4	2.0E-03	1.38
CO	2.0	4.8E-03	3.23
VOC	1.3	1.7E-03	1.12
$PM_{10}/PM_{2.5}$	--	--	10.0

Notes:
lb/hr = pound(s) per hour
[a]NO_x, CO, VOC, and $PM_{10}/PM_{2.5}$ emission rates exclude startups, shutdowns, and commissioning.
[b]SO_2 emission rates are based on a maximum natural gas sulfur content of 0.75 grain per 100 scf.

Blackstart Generator

The KICP would employ a blackstart generator for emergency use during power outages. The generator would be rated at approximately 489 horsepower with a 96 percent efficiency and fired exclusively with low-sulfur diesel fuel. Operation of the generator during testing and maintenance would be limited to 1 hour per day (1 day per week) and 50 hours per year, as mandated by 17 CCR 93115. NO_x, CO, and PM_{10} emissions from the generator were estimated using manufacturer specifications and emission rates

provided by PG&E. VOC emissions were estimated using an equivalent Tier 3 generator emission rate. SO_2 emissions were estimated using a fuel sulfur content of 15 part(s) per million by weight (ppmw) and the maximum engine fuel consumption rate, as provided by the owner's engineer, Worley Parsons.

Fire Water Pump Engine

The KICP would also employ a fire water pump engine for emergency use during power outages. The engine would be rated at approximately 250 horsepower and fired exclusively with low-sulfur diesel fuel. Similar to the blackstart generator, operation of the engine during testing and maintenance would be limited to 1 hour per day (1 day per week) and 50 hours per year, as mandated by 17 CCR 93115. Criteria pollutant emissions from the engine were estimated using manufacturer specifications and emission rates for an equivalent Tier 3 engine.

Cooling Tower

The KICP would employ a 10-cell mechanical draft cooling tower to cool the heated air between compression stages. The drift rate for this cooling tower would be approximately 0.3 gallon per minute (gpm). PM_{10} emissions from the cooling tower were estimated using methodology consistent with EPA's *AP-42* (EPA, 2006), assuming the cooling tower operates 4,900 hours per year and has a total dissolved solids (TDS) concentration of 1,123 ppmw. This TDS value was estimated based on cooling tower drift calculations in the engineering analysis (Worley Parson, 2015). $PM_{2.5}$ emissions were assumed equal to PM_{10} emissions.

Criteria Pollutant Emissions Summary

Maximum KICP emissions are shown in Table 5.1-13. The turbo-expander emission calculations are based on the per turbo-expander emission rates presented in Table 5.1-12, the fuel use estimates presented in Table 5.1-11, and the operating assumptions noted above. Maximum daily operations are based on full-load operation of the turbo-expander for approximately 9.9 hours, estimated from the operation schedule of 49.7 hours per week and 5 days per week of generation. These assumptions are used as the basis for the calculations and are not intended to be proposed as limits. The emission calculations for the remaining combustion and non-combustion sources are based on the operating assumptions above. Detailed calculations are shown in Appendix 5.1B, Tables 5.1B.2, 5.1B.5, 5.1B.6, and 5.1B.7.

TABLE 5.1-13
Maximum KICP Emission Rates

Emissions/Equipment	NO_x	SO_2	CO	VOC	$PM_{10}/PM_{2.5}$
Maximum Hourly Emissions (lb/hr)					
Turbo-expanders	10.6	2.76	6.46	2.24	20.0
Blackstart Generator	5.17	4.91E-03	2.80	8.62E-02	0.16
Fire Pump	1.36	2.96E-03	0.65	3.40E-02	6.09E-02
Cooling Tower	-	-	-	-	0.18
Total	**17.2**	**2.77**	**9.92**	**2.36**	**20.4**
Maximum Daily Emissions (lb/day)					
Turbo-expanders	106	27.4	64.2	22.3	199
Blackstart Generator	5.17	4.91E-03	2.80	8.62E-02	0.16
Fire Pump	1.36	2.96E-03	0.65	3.40E-02	6.09E-02
Cooling Tower	-	-	-	-	4.23
Total	**112**	**27.5**	**67.7**	**22.4**	**203**

TABLE 5.1-13
Maximum KICP Emission Rates

Emissions/Equipment	NO_x	SO_2	CO	VOC	$PM_{10}/PM_{2.5}$
Maximum Annual Emissions (tpy)					
Turbo-expanders	13.3	3.45	8.08	2.80	25.0
Blackstart Generator	0.13	1.23E-04	7.01E-02	2.16E-03	4.04E-03
Fire Pump	3.40E-02	7.40E-05	1.64E-02	8.51E-04	1.52E-03
Cooling Tower	-	-	-	-	0.43
Total	**13.4**	**3.45**	**8.16**	**2.80**	**25.4**

Note:
lb/day = pound(s) per day

5.1.3.3 Greenhouse Gas Emissions

Combustion of natural gas in the turbo-expanders and diesel fuel in the blackstart generator and fire water pump engine would result in emissions of CO_2, CH_4, and N_2O. GHG emissions for normal facility operations were calculated based on the maximum fuel use predicted for the KICP and emission factors contained in The Climate Registry's (TCR's) *General Reporting Protocol* (TCR, 2014). Detailed calculations, including the emission factors used to estimate GHG emissions, are shown in Appendix 5.1B, Tables 5.1B.4, 5.1B.5, and 5.1B.6. Emissions of CO_2, CH_4, and N_2O resulting from KICP operation are presented in Table 5.1-14. In addition, small amounts of CH_4 may be present in air periodically vented from the wells and air pipe. Future calculations of GHGs may need to account for this contribution and will be dependent on the ultimate concentration of native natural gas and plant operating procedures.

TABLE 5.1-14
GHG Emissions from KICP Operation (MT/yr)

Emissions/Equipment	CO_2	CH_4	N_2O	CO_2e
Turbo-expanders	178,704	12.8	3.03	179,928
Generator	11.8	6.73E-04	3.02E-04	12.0
Fire Pump	7.15	4.06E-04	1.82E-04	7.21
Total	**178,723**	**12.8**	**3.03**	**179,947**

5.1.4 Mitigation Measures

Mitigation would be provided for KICP criteria pollutant emissions in the form of the installation of BACT and offsets, as required under SJVAPCD regulations. It is expected that sufficient Emission Reduction Credits (ERCs) or offsets would be provided to mitigate operational air emissions. GHG emissions would be offset at the state level through CARB's GHG auction mechanism.

5.1.4.1 Best Available Control Technology

Based on the SJVAPCD's BACT definition and major source thresholds, a BACT analysis is required for the uncontrolled emissions of NO_x, VOC, CO, SO_2, PM_{10}, and $PM_{2.5}$. The turbo-expanders employed by the KICP are similar to simple-cycle combustion turbines and, for this analysis, it has been assumed BACT would be the same as recently permitted simple-cycle combustion turbines. Continued discussions with the SJVAPCD may be necessary to confirm this assumption.

The proposed KICP emission limits are presented in Table 5.1-15, and are based on the following BACT:

- Use of water-injected low NOx combustors with SCR
- Best combustion design
- Installation of an oxidation catalyst system
- Use of pipeline-quality natural gas
- Use of inlet air filtration

TABLE 5.1-15
Proposed BACT Emission Limits for the KICP

Pollutant	Emission Limit (at 15 percent O_2)
NO_x	2 ppmvdc (averaged over 1 hour)
CO	2 ppmvdc (averaged over 1 hour)
VOC	2 ppmvdc (averaged over 1 hour)
PM_{10}	Low Sulfur/Ash, Clean Burning Natural Gas
$PM_{2.5}$	Low Sulfur/Ash, Clean Burning Natural Gas
SO_2	Low Sulfur, Clean Burning Natural Gas

5.1.4.2 Offsets Requirements

In addition to the BACT requirements, SJVAPCD Rule 2201 requires the project to provide emission offsets when emissions exceed specified levels on a pollutant-specific basis. As shown in Table 5.1-16, it is expected that the KICP would be required to provide emission offsets for NO_x and PM_{10} emissions, based on its projected annual emissions (see Table 5.1-13). Note that the quantity of offsets required is likely to change based on the incorporation of KICP startup and shutdown emissions estimates. Therefore, a full offsets analysis would be required during the licensing process.

TABLE 5.1-16
SJVAPCD Offset Requirements and Project Emissions

Pollutant	Emissions from KICP (tpy)	SJVAPCD Offset Thresholds (tpy)	Offsets Required
VOC	2.8	10.0	No
NO_x	13.4	10.0	Yes
CO	8.2	100	No
SO_2	3.5	27.4	No
PM_{10}	25.4	14.6	Yes

SJVAPCD Rule 2201 requires emission reductions to be provided at an offset ratio of between 1 and 1.5 to 1, depending on the distance between the source and the offset location. Interpollutant offset trades are permitted at the discretion of the SJVAPCD. Most importantly, such interpollutant offsets may be allowed between NO_x and VOC and between $PM_{2.5}$ and $PM_{2.5}$ precursors.

Table 5.1-17 shows the ERCs available within the SJVAPCD's jurisdiction as of August 2013 (SJVAPCD, 2013).[7] According to the SJVAPCD, the average annual ERCs used to mitigate emissions increases during the past 5 years is less than 2.5 percent of the available credits in the bank; therefore, the ERC bank appears to have an adequate balance to accommodate future growth (SJVAPCD, 2013).

TABLE 5.1-17
SJVAPCD Offset Availability

Pollutant	Available ERCs (tpy)
VOC	5,950
NO_x	5,400
CO	26,700
SO_2	3,100
PM_{10}	1,300

Source: SJVAPCD, 2013

Annually, CARB compiles information regarding New Source Review (NSR) offset transactions collected from all 35 air districts. For calendar year 2013, 52 transactions were reported for the SJVAPCD, and included offset purchases for VOC, NO_x, PM_{10}, and SO_2 (CARB, 2013a). Table 5.1-18 presents the range of costs associated with these transactions and the total offsets traded.

TABLE 5.1-18
SJVAPCD Offset Transaction Summary

Pollutant	Price Range ($/ton)	Total Trades (tons)
VOC	$2,000 - $4,800	180.28
NO_x	$40,000 - $50,000	31.41
SO_2	$21,000	3.00
PM_{10}	$19,100 - $39,455	24.33

Source: CARB, 2013a

Based on the projected KICP emissions (see Table 5.1-16), the cost of ERCs within the SJVAPCD (see Table 5.1-18), and the offset requirements of the SJVAPCD, it is expected that the combined cost of NO_x and PM_{10} ERCs for the KICP would be in the range of $511,940 to $1,599,716, assuming NO_x ERCs could be purchased at the price of VOC ERCs.

SJVAPCD Rule 2201 also only allows project approval if air quality modeling results indicate emissions would not cause or exacerbate the violation of the applicable ambient air quality standards, after accounting for mitigation. It is expected that the KICP emissions would not interfere with the attainment or maintenance of the applicable air quality standards; however, this would be confirmed through modeling performed as part of the licensing process. Because the SJVAB is currently a nonattainment area for state and federal $PM_{2.5}$ ambient air quality standards, any increase in $PM_{2.5}$ emissions has the potential to exacerbate existing violations. Therefore, the project owner would be expected to provide $PM_{2.5}$ offsets to mitigate the impact of the emissions increase. If the offsets are provided as ERCs, the additional cost of ERCs for the KICP would

[7] Note that August 2013 is the most recent data available from the SJVAPCD on ERC availability and pricing, as listed at http://www.valleyair.org/busind/pto/annual_offset_report/annual_offset_report.htm.

be in the range of $485,140 to $1,503,236. However, offsets could be provided through implementation of emission reduction measures, such as replacing wood-burning stoves with electric stoves in the area surrounding the project. Different solutions will have a different project cost. Regardless of which offset approach is used, the surrendering of offsets would ensure the $PM_{2.5}$ emissions would not interfere with the attainment or maintenance of the applicable air quality standards.

SJVAPCD Rule 2520 applies to major sources on a pollutant-specific basis. The acid rain requirements of SJVAPCD Rule 2540 are also applicable to the KICP. As an acid rain facility, the KICP would be required to provide sufficient allowances for every ton of SO_2 emitted during a calendar year. The project owner would file the appropriate applications for Title V and acid rain permits and would obtain any additional offsets, as needed, on the open trade market. The KICP would also install and operate the required continuous emissions monitoring systems (CEMS).

5.1.5 Laws, Ordinances, Regulations, and Standards

The CAA, implemented by EPA, requires major new and modified stationary sources of air pollution to obtain a construction permit prior to commencing construction through a program known as the federal NSR program. The requirements of the NSR program are dependent on whether the air quality in the area where the new source (or modified source) is being located attains the NAAQS. The program that applies in areas that are in attainment of the NAAQS is the Prevention of Significant Deterioration (PSD). The program that applies to areas where the air does not meet the NAAQS (termed nonattainment areas) is the nonattainment NSR.

EPA implements the NSR program through regional offices. Arizona, California, Hawaii, Nevada, and specific Pacific trust territories are administrated out of the EPA Region IX office in San Francisco, California. EPA typically delegates its NSR, Title V, and Title IV authority to local air quality agencies that have sufficient regulatory structure to implement these programs consistent with requirements of the CAA and implementing regulations. SJVAPCD has been delegated several of these programs, including the authority to administer the PSD program.

CARB was established by the state legislature in 1967 with the purpose of attaining and maintaining healthy air quality, conducting research into causes and solutions to air pollution, and addressing the impacts that motor vehicles have on air quality. To this end, CARB implements the following programs:

- Establish and enforce motor vehicle emission standards, including fuel standards.
- Monitor, evaluate, and set health-based air quality standards.
- Conduct research to solve air pollution problems.
- Establish toxic air contaminant (TAC) control measures.
- Oversee and assist local air quality districts.

Air quality management districts and air pollution control districts were established based on meteorological and topographical factors. The districts were established to enforce air pollution regulations for the purpose of attaining and maintaining all state and federal ambient air quality standards. The districts regulate air emissions by issuing air permits to stationary sources of air pollution in compliance with approved regulatory programs. Each district promulgates rules and regulations specific to air quality issues within its jurisdiction. The air emissions sources regulated by each district vary. The types of air pollution sources that might be regulated include manufacturers, power plants, refineries, gasoline service stations, and auto body shops.

The LORS applicable to the KICP are discussed in more detail in the following sections.

5.1.5.1 Federal LORS

EPA promulgates and enforces federal air quality regulations, with Region IX administering the federal air programs in California. The federal CAA provides the legal authority to regulate air pollution from stationary sources. The applicable federal regulations are summarized in Table 5.1-19, along with the agency responsible for administration of the regulation.

5.1.5.2 State LORS

CARB's primary responsibilities are to develop, adopt, implement, and enforce the state's motor vehicle pollution control program; administer and coordinate the state's air pollution research program; adopt and update, as necessary, the CAAQS; review the operations of the local air pollution control districts; and review and coordinate preparation of the State Implementation Plan for achievement of the NAAQS.

The California Health and Safety Code Section 41700 prohibits the discharge from a facility of air pollutants that cause injury, detriment, nuisance, or annoyance to the public; that endanger the comfort, repose, health, or safety of the public; or that cause, or have a natural tendency to cause, injury or damage business or property. The state has promulgated numerous laws and regulations at the state level (e.g., for TACs and evaluating air toxic hot spots) which are effectuated at the local level by the air districts. A discussion of these state and local LORS is presented in Tables 5.1-20 and 5.1-21, respectively.

In August 2006, the California legislature passed Assembly Bill (AB) 32, the California Global Warming Solutions Act of 2006. AB 32 requires California resource agencies to establish a comprehensive program of regulatory and market mechanisms to achieve reductions in GHG emissions (CARB, 2006). The KICP would be subject to AB 32, and would be required to comply with all final rules, regulations, emissions limitations, emission reduction measures, or market-based compliance mechanisms adopted under AB 32. CARB has also promulgated a Cap-and-Trade regulation to limit GHG emissions and to develop a market-based compliance mechanism for the creation, sale, and use of GHG allowances.

In addition to AB 32, Senate Bill (SB) 1368 (Perata, Chapter 598, Statutes of 2006) was signed into law on September 29, 2006. The law limits long-term investments in base load generation by the state's utilities to power plants that meet an emissions performance standard jointly established by the CEC and the California Public Utilities Commission (CPUC). In response, the CEC has designed regulations that establish a standard for base load generation owned by, or under long-term contract to, publicly owned utilities of 1,100 pound(s) per megawatt-hour (lb/MWh) of CO_2. Base load generation is defined as electricity generation from a power plant that is designed and intended to provide electricity at an annualized plant capacity factor of at least 60 percent. Because of the need to react quickly to firm intermittent renewables, the KICP is expected to be dispatched frequently and may have a capacity factor as high as 40 percent. Since this is still less than 60 percent, the KICP does not meet the definition of a base load facility and would not, therefore, be subject to the emissions performance standard.

TABLE 5.1-19
Applicable Federal Laws, Ordinances, Regulations, and Standards for the Protection of Air Quality

LORS	Purpose	Regulating Agency	Applicability
Title 40 CFR Part 50	Establishes ambient air quality standards for criteria pollutants.	EPA Region IX	During the licensing process, the project owner would need to conduct a dispersion modeling analysis to determine if the project would exceed the state or federal ambient air quality standards. Nonattainment pollutant emissions would be mitigated consistent with the SJVAPCD's State Implementation Plan and approved NSR program.
Title 40 CFR Part 51 (NSR) (SJVAPCD Rule 2201)	Requires preconstruction review and permitting of new or modified stationary sources of air pollution to allow industrial growth without interfering with the attainment and maintenance of ambient air quality standards.	SJVAPCD with EPA Region IX oversight	Requires NSR facility permitting for construction or modification of specified stationary sources. NSR applies to pollutants for which ambient concentration levels are higher than NAAQS. The NSR requirements are implemented at the local level with EPA oversight. Prior to construction of the ECF, the project owner would obtain an Authority to Construct (ATC) and Permit to Operate (PTO).
Title 40 CFR Part 52 (PSD)	The PSD program allows new sources of air pollution to be constructed, or existing sources to be modified, in areas classified as attainment, while preserving the existing ambient air quality levels, protecting public health and welfare, and protecting Class I areas (e.g., national parks and wilderness areas).	SJVAPCD with EPA Region IX oversight	The PSD requirements apply on a pollutant-specific basis to any project that is a new major stationary source or a major modification to an existing major stationary source. In May 2010, EPA issued the GHG permitting rule officially known as the "Prevention of Significant Deterioration and Title V Greenhouse Gas Tailoring Rule" (GHG Tailoring Rule), in which EPA defined six GHG pollutants (collectively combined and measured as CO_2e) as NSR-regulated pollutants. Under this rule, new projects that emit GHG pollutants above certain threshold levels would be subject to PSD permitting beginning in July 2011. However, in July 2014, the U.S. Supreme Court ruled that EPA could not regulate GHG emissions alone. As a result, new sources with a GHG potential to emit (PTE) equal to or greater than 100,000 tpy of CO_2e are no longer required to obtain a PSD permit specifically for GHG emissions. If the new source would require a PSD permit as a result of criteria pollutant PTE, a BACT analysis to evaluate GHG emissions control would still be required. The KICP ECF is similar to a simple-cycle combustion turbine and would, therefore, not be considered one of the 28 source categories. As a result, the emission rates were compared to the 250 tpy threshold. As shown in Table 5.1-13, the proposed emissions would not exceed the 250 tpy threshold. Therefore, the KICP would not be subject to PSD analysis requirements. Because the KICP does not exceed the PSD thresholds for any criteria pollutants, a BACT analysis for GHG emissions control under the PSD program would not be warranted, even though the KICP's GHG emissions are expected to be greater than 100,000 tpy CO_2e.

TABLE 5.1-19
Applicable Federal Laws, Ordinances, Regulations, and Standards for the Protection of Air Quality

LORS	Purpose	Regulating Agency	Applicability
Title 40 CFR Part 60 (SJVAPCD Rule 4001)	Establishes national standards of performance for new or modified facilities in specific source categories.	SJVAPCD with EPA Region IX oversight	40 CFR 60 Subpart KKKK—NO_x and SO_2 Emission Limits for New Stationary Combustion Turbines, applies to all new combustion turbines that commence construction, modification, or reconstruction after February 18, 2005. The rule requires natural-gas-fired turbines with a heat input greater than 850 MMBtu/hr to meet a NO_x emission limit of 15 ppm at 15 percent O_2, and an SO_2 limit of 0.060 lb/MMBtu. Alternatively, a fuel sulfur limit of 20 grains per 100 scf could be met. Stationary combustion turbines regulated under this subpart would be exempt from the requirements of Subpart GG. Because the ECF turbo-expanders are expected to function similarly to a simple-cycle combustion turbine and have a heat input less than 850 MMBtu/hr, these standards are not likely to apply to the KICP. However, these sources would still demonstrate compliance by including SCR for NO_x control and the use of pipeline-quality natural gas. Additionally, a certified CEMS would be used to monitor compliance with applicable NO_x emissions limits.
Title 40 CFR Part 63 (SJVAPCD Rule 4002)	Establishes national emission standards to limit emissions of Hazardous Air Pollutants (HAPs) or air pollutants identified by EPA as causing or contributing to the adverse health effects of air pollution, but for which NAAQS have not been established from facilities in specific categories.	SJVAPCD with EPA Region IX oversight	40 CFR 63—National Emission Standards for Hazardous Air Pollutants (NESHAPs) for Source Categories, establishes emission standards to limit emissions of HAPs from specific source categories for major HAP sources. Sources subject to 40 CFR 63 requirements must either use the maximum achievable control technology (MACT), be exempted under 40 CFR 63, or comply with published emission limitations. The potential NESHAP applicable to the project is Subpart YYYY, which sets a formaldehyde emission limit or an operational limit of 91 parts per billion by volume (ppbv) for turbines. Additionally, a project would be subject to the 40 CFR 63 requirements if the HAP PTE is greater or equal to 25 tpy for combined HAPs and 10 tpy for individual HAPs. Natural gas would be the only fuel fired in the KICP ECF turbo-expanders. Therefore, the KICP is not expected to emit HAPs at levels above the major source thresholds. However, the project owner would need to evaluate this further during the licensing process.
Title 40 CFR Part 64 (Compliance Assurance Monitoring [CAM] Rule)	Establishes onsite monitoring requirements for emission control systems.	SJVAPCD with EPA Region IX oversight	40 CFR 64—CAM, requires facilities to monitor the operation and maintenance of emissions control systems and report any control system malfunctions to the appropriate regulatory agency. If an emission control system is not working properly, this rule also requires a facility to take action to correct the control system malfunction. This rule applies to emissions units with uncontrolled PTE levels greater than applicable major source thresholds. Emission control systems governed by Title V operating permits requiring continuous compliance determination methods are generally compliant with this rule. The KICP ECF would have an emissions control system for NO_x and CO (SCR and oxidation catalyst). Additionally, emissions of NO_x and CO would be directly measured by CEMS. Therefore, the KICP is exempt from the CAM provisions based on the exemption in 40 CFR 64.2(b)(vi) for NO_x.

TABLE 5.1-19
Applicable Federal Laws, Ordinances, Regulations, and Standards for the Protection of Air Quality

LORS	Purpose	Regulating Agency	Applicability
Title 40 CFR Part 70 (SJVAPCD Rule 2520)	CAA Title V Operating Permit Program.	SJVAPCD with EPA Region IX oversight	40 CFR 70—Operating Permits Program, requires the issuance of operating permits that identify all applicable federal performance, operating, monitoring, recordkeeping, and reporting requirements. The requirements of 40 CFR 70 apply to facilities that are subject to New Source Performance Standards (NSPS) requirements and are implemented at the local level through the SJVAPCD. According to SJVAPCD Rule 2520, a facility would be required to submit a Title V application if the facility has a PTE greater than 10 tpy of NO_x or VOC, 100 tpy of $PM_{2.5}$ or CO, or 70 tpy of SO_2 or PM_{10} or if the HAP PTE is greater than or equal to 25 tpy for combined HAPs and 10 tpy for individual HAPs. The KICP ECF would exceed the Title V thresholds listed in SJVAPCD Rule 2520 for NO_x. As a result, the necessary Title V applications would be submitted as part of the permitting process.
Title 40 CFR Part 72 (SJVAPCD Rule 2540)	CAA Acid Rain Program.	SJVAPCD with EPA Region IX oversight	40 CFR 72—Acid Rain Program, establishes emission standards for SO_2 and NO_x emissions from electric generating units through the use of market incentives, requires sources to monitor and report acid gas emissions, and requires the acquisition of SO_2 allowances sufficient to offset SO_2 emissions on an annual basis. An acid rain facility must also obtain an acid rain permit as mandated by Title IV of the CAA. The necessary Title IV applications would be submitted as part of the permitting process.

TABLE 5.1-20
Applicable State Laws, Ordinances, Regulations, Standards, and Permits for the Protection of Air Quality

LORS	Purpose	Regulating Agency	Applicability
California Health and Safety Code, Section 41700	Prohibits emissions in quantities that adversely affect public health, safety, businesses, or property.	SJVAPCD with CARB oversight	The CEC Conditions of Certification and the air pollution control district ATC processes are developed to ensure that no adverse public health effects or public nuisances result from operation of the project.
California AB 32 – Global Warming Solutions Act of 2006 (AB 32)	The purpose is to reduce carbon emissions within the state by approximately 25 percent by the year 2020.	SJVAPCD with CARB oversight	Requires CARB to develop regulations to limit and reduce GHG emissions.
CCR, Title 17, Article 5	Establishes GHG limitations, reporting requirements, and a Cap-and-Trade offsetting program.	CARB	CARB has promulgated a Cap-and-Trade regulation that limits or caps GHG emissions and requires subject facilities to acquire GHG allowances. Because the GHG emissions for KICP ECF operation are expected to be above 25,000 MT/yr of CO_2e, the project owner would need to report emissions and acquire allowances and offsets consistent with these regulations.
California SB 1368 – Emissions Performance Standards (SB 1368)	The law limits long-term investments in base load generation by the state's utilities to power plants that meet an emissions performance standard jointly established by the CEC and the CPUC.	CEC with CARB oversight	The CEC has designed regulations that establish a standard for base load generation (having a capacity factor greater than 60 percent) owned by, or under long-term contract to, publicly owned utilities of 1,100 lb/MWh of CO_2. The KICP would not be subject to this emissions performance standard because it is not a base load facility.

TABLE 5.1-21
Laws, Ordinances, Regulations, Standards, and Permits for Protection of Air Quality

LORS	Purpose	Regulating Agency	Applicability
SJVAPCD Rule 2010 (Permits Required)	Establishes procedures and standards for issuing permits and standards and limitations on a source-specific basis.	SJVAPCD with EPA Region IX oversight	Specifies that any facility installing nonexempt equipment that causes or controls the emission of air pollutants must first obtain an ATC from the SJVAPCD. Under Section 5.8.8 of SJVAPCD Rule 2201, the SJVAPCD's Final Determination of Compliance acts as an ATC for a power plant on approval of the project by the CEC.
SJVAPCD Rule 2201 (NSR Rule)	Requires that preconstruction review be conducted for all proposed new or modified sources of air pollution, including BACT, emissions offsets, and air quality impact analyses.	SJVAPCD with EPA Region IX oversight	See 40 CFR 51 (Table 5.1-19) to review applicability.
SJVAPCD Rule 2520 (Federally Mandated Operating Permits)	Implements Title V operating permit requirements under the CAA.	SJVAPCD with EPA Region IX oversight	See 40 CFR 70 (Table 5.1-19) to review applicability.
SJVAPCD Rule 2540 (Acid Rain Program)	Title IV acid rain regulations under the CAA.	SJVAPCD with EPA Region IX oversight	See 40 CFR 72 (Table 5.1-19) to review applicability.
SJVAPCD Rule 4001 (NSPS)	Establishes national standards of performance for new stationary sources.	SJVAPCD with EPA Region IX oversight	See 40 CFR 60 (Table 5.1-19) to review applicability.
SJVAPCD Rule 4002 (NESHAPs)	Establishes NESHAPs.	SJVAPCD with EPA Region IX oversight	See 40 CFR 63 (Table 5.1-19) to review applicability.
SJVAPCD Rule 4101 (Visible Emissions)	Establishes limits for visible emissions from stationary sources.	SJVAPCD with CARB oversight	Limits visible emissions to no darker than Ringelmann No. 1 for periods greater than 3 minutes in any hour. Natural gas would be the only fuel fired in the KICP turbo-expanders. Therefore, the KICP would not create visible emissions as dark as or darker than Ringelmann No. 1.
SJVAPCD Rule 4102 (Nuisance)	Prohibits emissions in quantities that adversely affect public health, other businesses, or property.	SJVAPCD with CARB oversight	The KICP would not emit significant quantities of odorous or visible substances; therefore, the KICP would comply with this regulation.

TABLE 5.1-21
Laws, Ordinances, Regulations, Standards, and Permits for Protection of Air Quality

LORS	Purpose	Regulating Agency	Applicability
SJVAPCD Rule 4201 (Particulate Matter Concentration)	Establishes limits for particulate matter emissions.	SJVAPCD with CARB oversight	Limits particulate matter emissions to less than 0.1 grain per dry scf. Natural gas would be the only fuel fired in the KICP turbo-expanders. Therefore, the KICP is expected to comply with this limit.
SJVAPD Rule 4301 (Fuel-burning Equipment)	Establishes limits for combustion contaminant emissions from fuel-burning equipment.	SJVAPCD with CARB oversight	Limits combustion contaminant emissions (defined in Rule 1020 as particulate matter from burning carbon-containing material) from any furnace, boiler, apparatus, stack, and all appurtenances thereto, used in the process of burning fuel for the primary purpose of producing heat or power by indirect heat transfer to 0.1 grain of combustion contaminants per dry scf at 12 percent CO_2; 10 lb/hr of combustion contaminants; 200 lb/hr of sulfur compounds, as SO_2; and 140 lb/hr of NO_x, as NO_2. Natural gas would be the only fuel fired in the KICP turbo-expanders and would, therefore, comply with the 0.1 grain of combustion contaminants per dry scf at 12 percent CO_2 limit. Similarly, the KICP would comply with this rule by not exceeding the maximum hourly emission limits per combustion unit (see Tables 5.1-12 and 5.1-13).
SJVAPCD Rule 4703 (Stationary Gas Turbines)	Establishes limits for NO_x emissions from gas turbines with a rating equal to or greater than 0.3 MW or a maximum heat input rating of more than 3 MMBtu/hr.	SJVAPCD with CARB oversight	NO_x and CO emissions from the turbo-expanders would be well below the limits in this rule, largely through the use of SCR and an oxidation catalyst for emissions control. Additionally, the project owner would assure compliance by configuring the CEMS to meet the requirements of 40 CFR 60. Compliance with these limits would be confirmed through the complete BACT assessment to be performed during the licensing process. This rule also limits startup and shutdown periods to 2 hours. If startup and shutdown is expected to last more than 2 hours, the project owner would submit an application to the SJVAPCD to request an exception to this requirement.
SJVAPCD Rule 4801 (Sulfur Compounds)	Establishes limits for sulfur emissions from permitted sources.	SJVAPCD with CARB oversight	Because the KICP would use only natural gas fuel, all of the limits in this rule would easily be complied with.

TABLE 5.1-21
Laws, Ordinances, Regulations, Standards, and Permits for Protection of Air Quality

LORS	Purpose	Regulating Agency	Applicability
SJVAPCD Rule 7012 (Hexavalent Chromium – Cooling Towers)	Establishes limits for hexavalent chromium emissions and materials in cooling towers.	SJVAPCD with CARB oversight	Prohibits hexavalent chromium-containing compounds from being added to cooling tower circulating water that is exposed to the atmosphere and limits hexavalent chromium concentration levels in circulating water to 0.15 milligram(s) per Liter (mg/L) for wooden and nonwooden cooling towers. The KICP would not have cooling tower circulating water that is exposed to the atmosphere and would not use materials containing hexavalent chromium in the cooling tower construction. Therefore, the KICP is expected to comply with this rule.
SJVAPCD Regulation VIII (Fugitive PM_{10} Prohibition)	Requires control of fugitive PM_{10} emissions from various sources.	SJVAPCD with CARB oversight	Rule 8011 – General Requirements, sets forth definitions, applicability, and administrative requirements for anthropogenic sources of PM_{10}. Rule 8021 – Construction, Demolition, Excavation, Extraction and Other Earthmoving Activities, limits fugitive dust emissions from construction, demolition, excavation, and related activities. Rule 8031 – Bulk Materials, requires application of specific measures to minimize fugitive dust emissions from the handling, storage, and transport of bulk materials. Rule 8041 – Carryout and Trackout, requires application of specific measures to minimize fugitive dust emissions from construction carryout and trackout. Rule 8051 – Open Areas, requires application of specific measures to minimize fugitive dust emissions from open areas larger than 3.0 acres containing more than 1,000 square feet of disturbed surface. Rule 8061 – Paved and Unpaved Roads, requires application of specific measures to minimize fugitive dust emissions from constructed paved and unpaved roads on the project site. Rule 8071 – Unpaved Vehicle/Equipment Traffic Areas, requires application of specific measures to minimize fugitive dust emissions from unpaved vehicle/equipment traffic areas experiencing more than 50 annual average daily traffic (AADT). Each of the above rules would be applicable at various phases throughout construction and operation of the KICP. The KICP would be expected to comply with any construction-related

TABLE 5.1-21
Laws, Ordinances, Regulations, Standards, and Permits for Protection of Air Quality

LORS	Purpose	Regulating Agency	Applicability
			requirements by implementing the construction mitigation measures described in Section 5.1.3.1. Large quantities of fugitive dust emissions are not expected as part of KICP's operation.

5.1.5.3 Local LORS

When the state's air pollution statutes were reorganized in the mid-1960s, local districts were required to be established in each county of the state. There are three different types of districts: county, regional, and unified (including the SJVAPCD). Local districts have principal responsibility for developing plans for meeting the NAAQS and CAAQS; for developing control measures for non-vehicular sources of air pollution necessary to achieve and maintain both state and federal air quality standards; implementing permit programs established for the construction, modification, and operation of sources of air pollution; enforcing air pollution statutes and regulations governing non-vehicular sources; and developing programs to reduce emissions from indirect sources.

SJVAPCD plans define the proposed strategies, including stationary source control measures and NSR rules, whose implementation would attain the CAAQS. The relevant stationary source control measures and NSR requirements are presented in Table 5.1-21.

5.1.6 Agencies and Agency Contacts

Each level of government has adopted specific regulations that limit emissions from stationary combustion sources, several of which are applicable to the KICP. The agencies having permitting authority for the KICP, and their contact information, are shown in Table 5.1-22.

TABLE 5.1-22
Agency Contacts for Air Quality

Agency	Authority	Contact
EPA Region IX	PSD oversight, enforcement	Permits Office EPA Region IX 75 Hawthorne Street San Francisco, CA 94105
CARB	Regulatory oversight	Project Assessment Branch California Air Resources Board 2020 L Street Sacramento, CA 95814
SJVAPCD	Permit issuance, enforcement	San Joaquin Valley Air Pollution Control District 4800 Enterprise Way Modesto, CA 95356

5.1.7 Permits and Permit Schedule

An Authority to Construct (ATC) for the ECF is required in accordance with SJVAPCD Rule 2010. A complete application for an ATC would be filed with the SJVAPCD prior to submittal of the complete Application for Certification (AFC) to the CEC. A Preliminary Determination of Completion (PDOC) would be expected within approximately 180 days after acceptance of the permit application as complete.

A screening health risk assessment would be required to be submitted before the start of construction. A Title IV application would be submitted within 12 months of the start of facility operation. A Title V permit would be issued after review of the ATC application, and 12 months prior to the start of facility operation.

5.1.8 References

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5.2 Biological Resources

This section describes biological resources in the King Island CAES Project (KICP) area (Figure 5.2-1), potential impacts of the proposed project on sensitive biological resources, and recommended measures to avoid and minimize the potential for project-related impacts. Biological resources potentially affected by the proposed KICP include waters of the United States, vegetation communities, associated wildlife habitats, and special-status species that can be found in the northern San Joaquin Valley.

5.2.1 Regional Overview

The KICP is located in the northern portion of the San Joaquin Valley in the Delta Basins subsection of the Great Valley Ecoregion (Miles and Goudey, 1997). This region includes nearly level basins and floodplains on late Quaternary alluvium derived predominantly from granitic rock sources associated with the Mokelumne, Calaveras, and Cosumnes rivers as they flow out of the Sierra Nevada mountain range. The regional climate is characterized by cool, wet winters and hot, dry summers. Average annual temperatures range from a low of 37 degrees Fahrenheit (°F) in December to a high of 91°F in July. Average annual precipitation is 17 inches, with most of the rainfall occurring between November and March.

Land use in the project area is predominantly agricultural, with urban areas in the communities of Lodi and Stockton. Major roadways through the area include Interstate 5 (I-5), State Route 12, and State Route 4.

5.2.1.1 Sacramento-San Joaquin Delta

The Sacramento-San Joaquin Delta is an expansive complex of rivers and estuaries covering approximately 738,000 acres that formed at the confluence of the Sacramento and San Joaquin rivers. Historically, the Delta was a large, tidally influenced marshland intermixed with riparian habitats along natural levees. Large-scale reclamation of the Delta began in 1850 with the passage of the Arkansas Act (Swampland Act), which ceded nearly 500,000 acres of federal marshland to the state. By 1930, nearly 1,150 square miles (approximately 736,000 acres) of public and private lands consisting of 57 islands or tracts had been created through the construction of over 1,100 miles of levees. The majority of the land is in agricultural production. Principal crops grown in the Delta include corn, alfalfa, grain, hay, asparagus, sugar beets, safflower, and fruits. Land not in active cultivation is used for irrigated pasture for livestock production. Approximately 136,000 acres of the Delta consist of undeveloped lands and open water (CH2M HILL, 2008).

5.2.1.2 San Joaquin Valley

The San Joaquin Valley extends from the Sacramento-San Joaquin Delta south to the Tehachapi Mountains. It is bordered to the west by the Coast Range and to the east by the Sierra Nevada foothills. Extensive areas of the valley have been converted to agriculture, including over 800,000 acres of San Joaquin County. Principal crops include fruit, nuts, grain crops, alfalfa, and hay. Land not in active cultivation is used for livestock production (CH2M HILL, 2008).

5.2.1.3 Wetlands and Water Resources

The proposed project is located within the San Joaquin Delta Hydrologic Unit (Hydrologic Unit Code 18040003), which encompasses approximately 433,300 acres. Major waterways include the San Joaquin, Mokelumne, Old, and Middle rivers, as well as Bear Creek. Rivers that confluence in the Delta are often channelized or leveed to support “Delta Islands” before they reach the estuary of the San Francisco Bay. Bishop Cut and Telephone Cut are channelized water bodies near the project area. Drainage is generally to the west from the Sierra Nevada foothills and then to the north into the Sacramento-San Joaquin Delta.

N. Thornton Rd

White Slough Wildlife Area

White Slough Water Pollution Control Facility (WPCF)

Dredger Cut

White Slough WPCF Discharge Canal

White Slough

King Island

Bishop Cut

Rio Blanco Tract

Telephone Cut

Project Study Area

Excluded From Study

Vegetation Communities

- Annual Grassland
- Cropland
- Fresh Emergent Wetland
- Orchard/Vineyard
- Open Water
- Ruderal
- Urban
- Valley Foothill Riparian

N

1,200 0 1,200

Feet

Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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North State Resources, Inc.

PG&E King Island Compressed Air Energy Storage Project

Figure 5.2-1
Vegetation Communities

5.2.1.4 Biological Resources Areas in the Project Vicinity

The California Department of Fish and Wildlife (CDFW) White Slough Wildlife Area (WA) is located in the eastern portion of the project area. Other regionally significant biological resource areas near the project include the Cosumnes River Preserve, located approximately 6.5 miles northwest; Woodbridge Ecological Reserve, located approximately 5 miles north; and the CDFW Lower Sherman Island WA, located approximately 22 miles west of the project area.

5.2.2 Habitat and Vegetation Communities

The project area is situated in a landscape that currently supports active agricultural operations, access roads, several agricultural residences, and appurtenant facilities/equipment (e.g., farm equipment, staging area, and barn). It also includes a natural gas well pad previously developed for the compression testing phase of the project in the western portion of the project area. The City of Lodi White Slough Water Pollution Control Facility (WPCF) and Lodi Energy Center (LEC) are located adjacent to and immediately south of the eastern portion of the project area. Portions of the project area border I-5 and North Thornton Road. The project area is located within the "Delta Islands," which are areas of former marshlands of the Sacramento–San Joaquin Delta that were historically reclaimed for agricultural use by the construction of levees/dikes and draining. Water levels in White Slough and Bishop Cut are slightly above sea level and are separated from King Island by a series of levees topped by paved and unpaved roads.

Most of the project area is in agricultural fields that are frequently disturbed and nearly all native vegetation has been removed. The project area encompasses a small portion of Bishop Cut and White Slough, and a portion of the White Slough WA.

Vegetation communities within the project area include annual grassland, fresh emergent wetland, orchard/cropland, open water, ruderal, and valley foothill riparian (Figure 5.2-1). For the purposes of this document, vegetation communities are classified based on descriptions provided in *A Guide to Wildlife Habitats of California* (Mayer and Laudenslayer, 1988).

Small areas of annual grasslands occur adjacent to I-5 near the entrance to the White Slough WPCF. Several valley oaks (*Quercus lobata*), two cottonwoods (*Populus fremontii*), and one Goodding's black willow (*Salix goodingii*) are scattered through the grassland community near I-5 Frontage Road. The annual grassland is mowed during the spring and is densely vegetated with milk thistle (*Silybum marianum*), black mustard (*Brassica nigra*), long-beaked stork's bill (*Erodium botrys*), and ripgut brome (*Bromus diandrus*).

Irrigation ditches throughout the project area that are sufficiently hydrated contain fresh emergent wetland vegetation, and appear to be subject to regular vegetation management using both mechanical and chemical techniques. Ditches develop fresh emergent vegetation when they are not maintained by clearing vegetation. Fresh emergent vegetation that sometimes occupies ditches include water primrose (*Ludwigia* sp.), cattails (*Typha* sp.), smartweed (*Persicaria* sp.), mosquito fern (*Azolla* sp.), and water hyacinth (*Eichhornia crassipes*).

Cropland and orchards/vineyards (e.g., corn, winter wheat, safflower, vineyards, and walnut) occur throughout most of the project area. The open areas between the rows in the walnut orchards and vineyards are disked and/or mowed annually. All fields are actively farmed and annually disked, harvested, and/or disturbed up to the edge of existing roads.

Bishop Cut and White Slough are Sacramento-San Joaquin Delta waterways that provide habitat for aquatic species. Bishop Cut is an artificial navigation channel connecting White Slough to the north and

Disappointment Slough to the south. White Slough is a semi-natural water body that contains islands of fresh emergent and riparian vegetation. Dredger Cut is an artificial channel that connects White Slough WPCF discharge canal south of the White Slough WPCF to the natural portion of White Slough. The eastern end of the Dredger Cut is revetted with rip-rap, but vegetation has colonized the banks. Dredger Cut is vegetated with waterweed (*Elodea* sp.) and water hyacinth (*Eichhornia* sp.) and its banks are vegetated with hardstem bulrush (*Schoenoplectus acutus*). The continuation of this water course to the east of White Slough WA is the discharge canal for the White Slough WPCF. The levee banks of Bishop Cut are rip-rapped with large rock and the channels are generally devoid of vegetation. Small patches of hardstem bulrush and water hyacinth are located along its banks. The waterways in the project area are tidally influenced but, because there is no fresh water inflow, there is no current except that associated with tidal action or from the WPCF discharges.

Areas that are often disturbed (e.g., mowed, disked) were classified as ruderal. Ruderal areas are located along the levee banks of Bishop Cut, White Slough, Dredger Cut, open areas around farm yards, and adjacent road shoulders. Dominant plant species include common mallow (*Malva neglecta*), poison hemlock (*Conium maculatum*), mustard (*Brassica* sp.), milk thistle, Johnson grass (*Sorghum halepense*), redroot pigweed (*Amaranthus retroflexus*), and common knotweed (*Polygonum aviculare*).

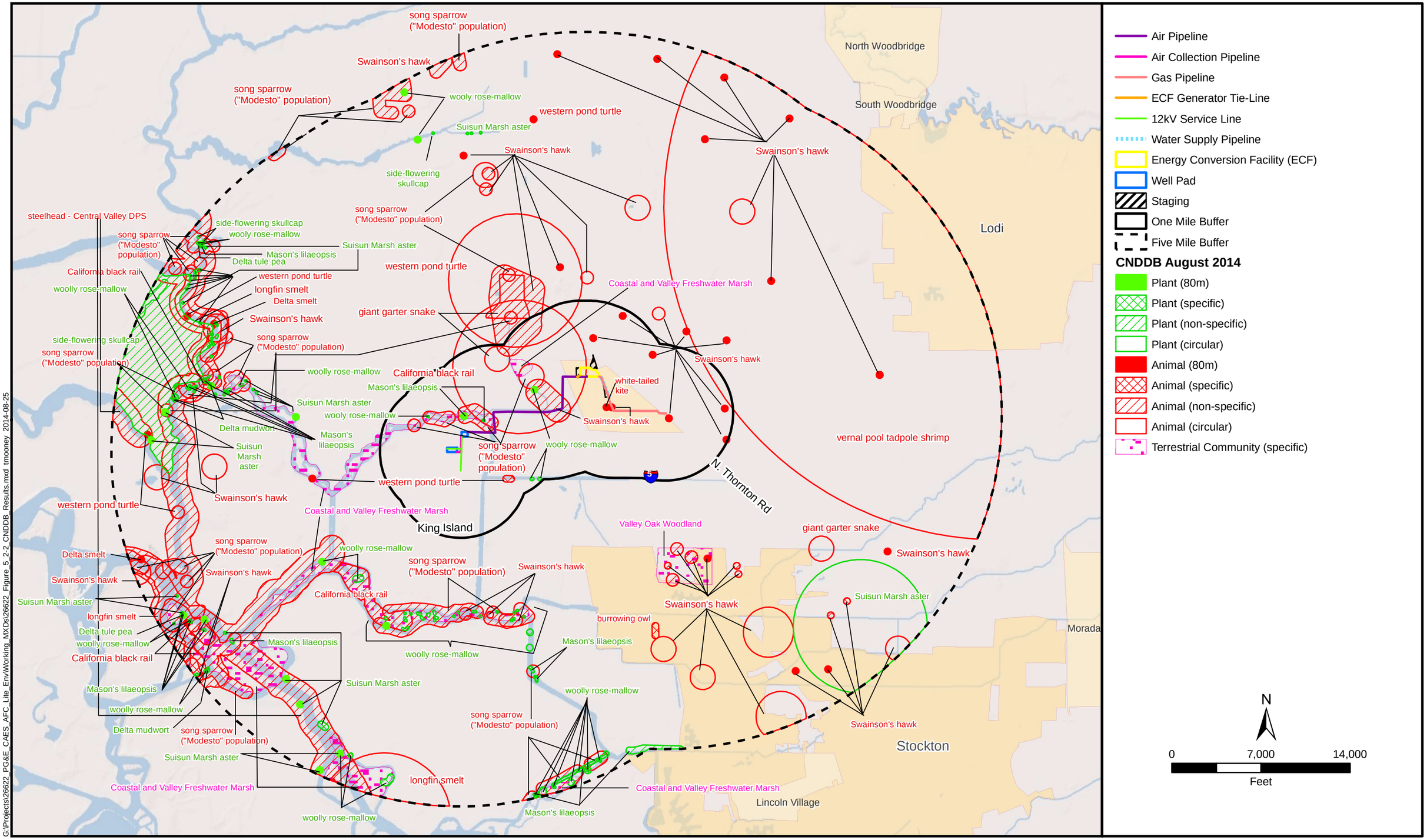
Valley foothill riparian habitat occurs in the White Slough WA and as a small stand of Fremont cottonwood adjacent to the western portion of the project area. Riparian areas are also located adjacent to ditches and canals. Dominant plant species in the riparian areas include Fremont cottonwood, arroyo willow (*Salix lasiolepis*), coyote bush (*Baccharis pilularis*), and Himalayan blackberry (*Rubus armeniacus*).

5.2.3 Special-status Species

This section addresses the special-status species that could occur in the northern San Joaquin Valley region and presents a preliminary analysis of whether each could occur in the KICP project area. Special-status plant species include plants that are listed as threatened or endangered under the California Endangered Species Act (CESA) or the federal Endangered Species Act (ESA), proposed for federal listing as threatened or endangered, state or federal candidate species, designated as rare by the CDFW, and California Rare Plant Rank (RPR) 1A, 1B, 2A, or 2B. Special-status animal species include species that are listed as threatened or endangered under the CESA or ESA, proposed for federal listing as threatened or endangered, state or federal candidate species, and species identified by the CDFW as species of special concern or fully protected species.

Details regarding methods and results of the assessment of species that could occur in the project area are provided in the *PG&E King Island Compressed Air Energy Storage Project Biological Reconnaissance* (Appendix 5.2A). Special-status species with potential to occur in the project area were determined from the results of the preliminary review of the U.S. Fish and Wildlife Service (USFWS) list of species that could be affected by the project; California Natural Diversity Database (CNDDB) and California Native Plant Society queries; and the field reconnaissance, botanical, and wildlife surveys. Special-status plants with potential to occur in the region are listed in Appendix 5.2A. Botanical surveys conducted during the spring and summer of 2014 did not detect any special-status plant species and plants are not discussed further in this document (See Appendix 5.2A for a discussion of the plant survey methods and results). Species for which habitat does not exist within the project area are not discussed further in this document.

Twenty-one special-status wildlife species have the potential to occur in the project area (Table 5.2-1) Reported CNDDB occurrences within 1 and 5 miles of the KICP project area are shown in Figure 5.2-2.



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North State Resources, Inc.

PG&E King Island Compressed Air Energy Storage Project

Figure 5.2-2
CNDDB Results

TABLE 5.2-1
Special-status Species Potentially Occurring in the Project Area

Common Name Scientific Name	Status* (Fed/State)	Habitat Requirements	Potential for Occurrence
Delta smelt *Hypomesus transpacificus*	T/E	Estuarine systems in the Sacramento-San Joaquin Delta.	Moderate. Bishop Cut potentially provides limited spawning and juvenile rearing habitat and is a seasonal migratory corridor for this species. Project is within designated critical habitat. Species present near Bishop Cut in Little Potato Slough and Little Venice Island CDFW sampling points approximately 3 and 4 miles west of Bishop Cut, respectively (CDFW, 2014).
Central Valley steelhead distinct population segment (DPS) *Oncorhynchus mykiss*	T/—	Spawns in cool, moderately fast-flowing water with gravel bottom. Migrates through the Delta and up streams to its breeding ground.	Moderate. Bishop Cut potentially provides a seasonal migratory corridor for this species and is designated critical habitat. Bishop Cut is within known distribution of the species (National Marine Fisheries Service [NMFS], 2014).
Winter-run Chinook salmon evolutionary significant unit (ESU) *Oncorhynchus tshawytscha*	E/E	Spawns and rears in main-stem Sacramento River. Requires cool year-round water temperatures, because spawning occurs during the summer. Requires deep pools and riffles, and clean gravel and cobble substrate to spawn. Migrates through the Delta and up streams to its breeding ground.	None. Bishop Cut is outside of the geographically occupied area for this species (NMFS, 2014).
Central Valley spring-run Chinook salmon ESU *Oncorhynchus tshawytscha*	T/T	Cool streams that reach the ocean and that have shallow, partly shaded pools and clear-water depression pools. Migrates through the Delta and up-streams to its breeding ground.	Moderate. Bishop Cut provides a seasonal migratory corridor for this species and is within known the distribution of the species (NMFS, 2014); however, it is not part of designated critical habitat for this species (70 FR 52488).
Green sturgeon, southern DPS *Acipenser medirostris*	T/SC	DPS includes green sturgeon that spawn in rivers south of the Eel River and includes the Sacramento-San Joaquin Delta. Preferred spawning substrate is large cobble, but can range from clean sand to bedrock. Migrates through the Delta and up-streams to its breeding ground.	Low. Species known to occur throughout the Sacramento-San Joaquin Delta (Beamesderfer et al., 2006). Bishop Cut may provide seasonal transient rearing and a migratory corridor for this species and is designated critical habitat.
Longfin smelt San Francisco Bay-Delta DPS *Spirinchus thaleichthys*	—/T	Sloughs of Suisun Bay and Delta.	Low. Bishop Cut provides a migratory corridor for this species. Species present near Bishop Cut in Little Potato Slough and Little Venice Island CDFW sampling points approximately 3 and 4 miles west of Bishop Cut, respectively (CDFW, 2014). However, its presence in this area is considered rare (Moyle, 2002).

TABLE 5.2-1
Special-status Species Potentially Occurring in the Project Area

Common Name Scientific Name	Status* (Fed/State)	Habitat Requirements	Potential for Occurrence
Central Valley fall/late fall-run Chinook salmon ESU *Oncorhynchus tshawytscha*	SC/SC	Spawns and rears in main-stem Sacramento River and suitable perennial tributaries. Requires cool water temperatures for spawning, egg-incubation, and juvenile rearing. Spawns in riffles with gravel and cobble. Migrates through the Delta and up-streams to its breeding ground.	Moderate. Bishop Cut provides transient rearing and a migratory corridor for this species. Species likely to occur in Bishop Cut (Moyle, 2002).
Sacramento splittail *Pogonichthys macrolepidotus*	—/SC	Uses a variety of estuarine and riverine habitats. Generally spawns and rears in shallow, dead-end sloughs with submerged vegetation, bypasses, and seasonally flooded lowlands with flooded vegetation.	Moderate. Species is known to occur throughout the Sacramento-San Joaquin Delta (Moyle, 2002). Suitable habitat occurs in both Bishop Cut, Dredger Cut and White Slough, although it is suspected that the habitat in the project area is most likely utilized for transient rearing and migration.
River lamprey *Lampetra ayresi*	—/SC	Anadromous fish found in rivers from San Francisco Bay watershed north to Alaska. Spawns in similar habitat as salmon. Migrates through the Delta and up-streams to its breeding ground.	Moderate. Species known to occur throughout the Sacramento-San Joaquin Delta (Moyle, 2002). Bishop Cut provides a migratory corridor for this species.
Giant garter snake *Thamnophis gigas*	T/T	Freshwater marshes and low gradient streams with emergent vegetation. Adapted to drainage canals and irrigation ditches with mud substrate.	Moderate. Habitat is present in the wastewater treatment ponds, White Slough WA, irrigation ditches and wetted irrigation canals, and associated wetlands throughout the project area. The nearest extant population of giant garter snake is located in Coldani Marsh 1 mile northwest of the Energy Conversion Facility [ECF] (Hansen, 2013a).
Western pond turtle *Emys marmorata*	—/SC	Slow-water aquatic habitat with available basking sites. Hatchlings require shallow water with dense submergent or short emergent vegetation. Requires an upland oviposition site near the aquatic site.	High. Observed in White Slough and the ECF site. White Slough, Bishop Cut, wetted irrigation ditches, and canals provide aquatic habitat. Uplands adjacent to aquatic habitat provide upland nesting habitat.
California black rail *Laterallus jamaicensis coturniculus*	—/T, FP	Coastal and inland marsh habitat. Needs water about 1 inch deep that does not fluctuate during the year. Dense vegetation for nesting habitat.	Low. Limited marsh habitat present in the White Slough WA in the central portion of the project area provides habitat for this species. The project area is within a CNDDB occurrence polygon for this species.

TABLE 5.2-1
Special-status Species Potentially Occurring in the Project Area

Common Name Scientific Name	Status* (Fed/State)	Habitat Requirements	Potential for Occurrence
Swainson's hawk *Buteo swainsoni*	—/T	Breeds in stands with few trees in juniper-sage flats, riparian areas, and oak savannah; forages in adjacent livestock pasture, grassland, or grain fields.	High. Isolated or groups of trees provide nesting habitat for Swainson's hawk. Swainson's hawks were observed nesting in a tree along North Thornton Road in the eastern portion of the project area and on the north bank of White Slough approximately 0.2 mile northwest of the east well pad.
White-tailed kite *Elanus leucurus*	—/FP	Nests in tall shrubs and trees; forages in grasslands, agricultural fields and marshes.	Moderate. Isolated trees and shrubs near the project area provide nesting habitat. The nearest CNDDB occurrence is near the White Slough WPCF.
Northern harrier *Circus cyaneus*	—/SC	Forages in marshes, grasslands, and ruderal habitats; nests in extensive marshes and wet fields.	Moderate. Wet meadows and wetlands in the White Slough WA provide nesting habitat for northern harrier. Nesting observed 1.25 miles northwest (North State Resources, 2013a)
Western burrowing owl *Athene cunicularia*	—/SC	Grasslands and ruderal habitats.	Moderate. Ground squirrel burrows occurring along levees, roads, and ruderal areas throughout the project area are of sufficient size to accommodate owls. However, low-growing vegetation is limited to the access road and margins. Due to the limited grassland/ruderal foraging area it is unlikely that burrowing owl would occupy the project area. The nearest CNDDB occurrence is 3.2 miles southeast of the project area.
Short-eared owl *Asio flammeus*	—/SC	Breeds in dense vegetation in open grassland and marshes.	Low. Wet meadows and wetlands in the White Slough WA provide nesting habitat for this species. Due to the limited availability of nesting habitat within the project area, likelihood for occurrence is low.
Loggerhead shrike *Lanius ludovicianus*	—/SC	Nests in tall shrubs and dense trees; forages in grasslands, marshes, and ruderal habitats.	Moderate. Isolated trees and shrubs near the project area could provide potential nesting habitat for this species.
Yellow warbler *Dendroica petechia*	—/SC	Breeds in riparian woodlands, particularly those dominated by willows and cottonwoods.	Low. Valley foothill riparian habitat within White Slough WA provides habitat for this species. Species is rare in the Central Valley (Small, 1994).
Yellow-breasted chat *Icteria virens*	—/SC	Breeds in riparian habitats having dense understory vegetation, such as willow and blackberry.	Low. Valley foothill riparian habitat within White Slough WA provides habitat for this species. Species is rare in the Central Valley (Small, 1994).

TABLE 5.2-1
Special-status Species Potentially Occurring in the Project Area

Common Name Scientific Name	Status* (Fed/State)	Habitat Requirements	Potential for Occurrence
Western red bat *Lasiurus blossevillii*	—/SC	Prefers sites with a mosaic of habitats that includes trees for roosting and open areas for foraging. Strongly associated with extensive stands of riparian vegetation.	Moderate. Trees within valley foothill riparian in the White Slough WPCF may provide habitat for this species.

*Status Codes: Federal and State: E = Endangered; T = Threatened; D = Delisted; SC = Species of Special Concern; FP = California Fully Protected species

Any special-status species whose habitat is present within the KICP project area were evaluated for potential impacts from construction and KICP operation (Section 5.2.2). Detailed descriptions of species' life histories are provided in the *PG&E King Island Compressed Air Energy Storage Project Biological Reconnaissance* (Appendix 5.2A).

5.2.4 Method of Field Surveys, Analysis, and Results

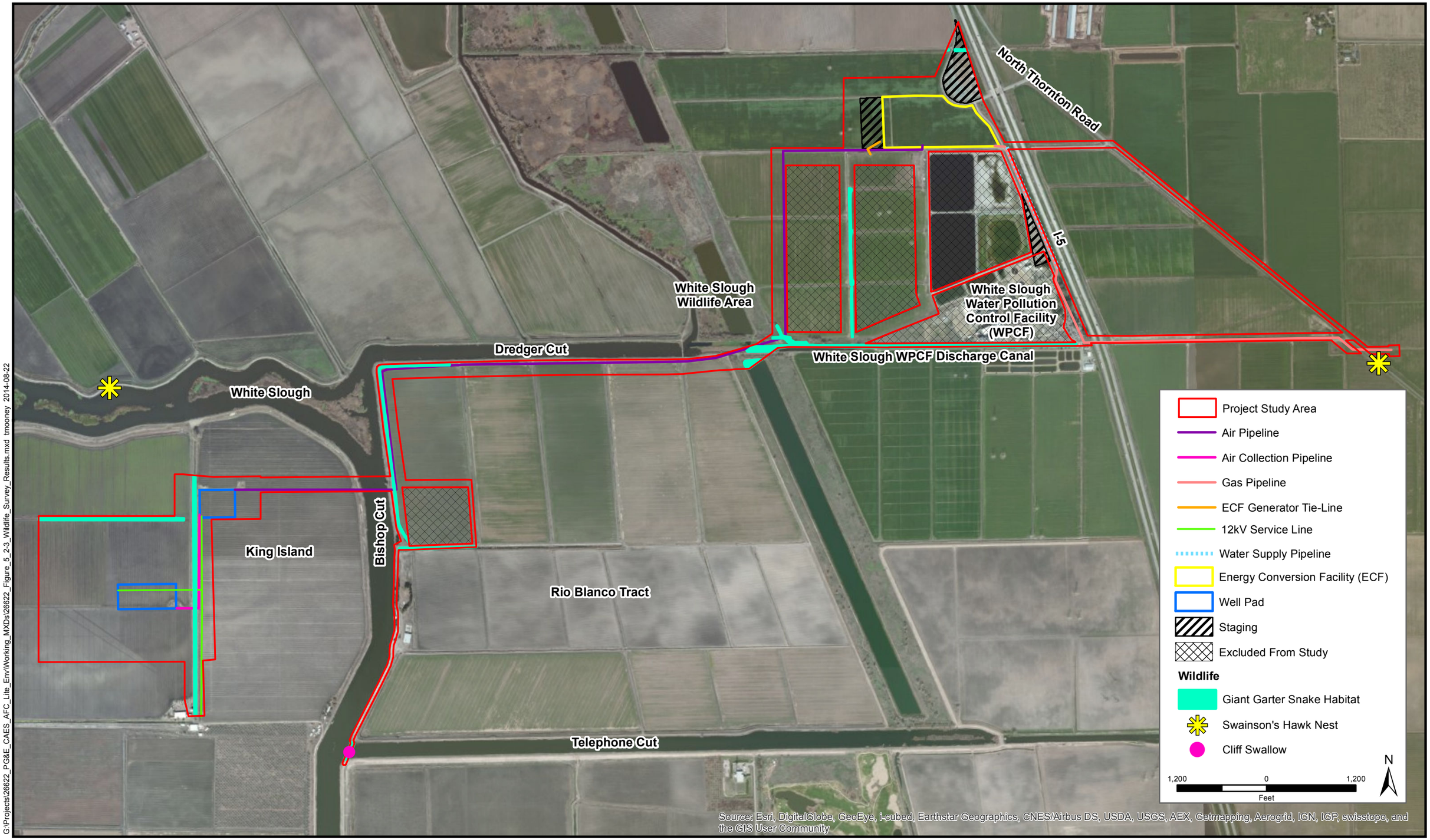
Biological resources evaluated for project impacts include vegetation communities, wetlands, wildlife, and wildlife habitats within all the temporary and permanent impact locations associated with the proposed KICP. Pedestrian surveys for habitat, wildlife, and plants included the proposed ECF site; adjacent staging areas; air, gas, and water pipeline corridors (50- to 100-foot corridors); and well pad locations (Figure 5.2-1). Qualifications of field surveyors are presented in Appendix 5.2B.

Reconnaissance-level biological field surveys to identify biological resources within the KICP project area focused on potential special-status plant, fish, and wildlife species and their habitats. Surveys of the KICP project area were conducted on April 17 and 18, and October 6, 2014. Field surveys were conducted by Brandon Amrhein, NSR Biologist; Heather Kelly, NSR Senior Biologist; and Catalina Reyes, PG&E Aquatic Biologist. Vegetation communities were mapped and sensitive habitats were identified (e.g., open water, riparian habitat, and fresh emergent wetlands). Details regarding methods and results of the field surveys are provided in the *PG&E King Island Compressed Air Energy Storage Project Biological Reconnaissance* (Appendix 5.2A).

In 2012, field surveys were conducted of the east well pad (Piacentine gas well) and access roads as part of the geological core drilling phase of the project. The report of this survey (North State Resources, 2012) is included as Appendix 5.2C. Field surveys were also conducted of the well pad site, access roads, and 12 kV distribution line as part of the compression testing phase of the project (U.S. Department of Energy [DOE], 2014). The report of this survey (North State Resources, 2013b) is included as Appendix 5.2D.

5.2.4.1 Wildlife Survey

Surveys for wildlife species, including incidental sightings of special-status species and their habitats in the KICP project area were conducted during the early spring nesting period for species known to occur in San Joaquin County. Wildlife surveys were conducted by Brandon Amrhein, NSR wildlife biologist, on April 17 and 18, 2014. Two potential Swainson's hawk nests were observed: one in a tree along North Thornton Road in the eastern portion of the project area and one along the north bank of White Slough approximately 0.2 mile northwest of the project area. Western pond turtles were observed in White



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North State Resources, Inc.

PG&E King Island Compressed Air Energy Storage Project

Figure 5.2-3
Wildlife Survey Results

Slough outside the northwest portion of the project area and in an irrigation ditch on the east side of the project area. Cliff swallow (*Petrochelidon pyrrhonota*) nests were observed under the Rio Blanco Road bridge over Telephone Cut. Wildlife survey results are shown in Figure 5.2-3. Detailed survey methods and results including a list of all wildlife species observed is provided in the *PG&E King Island Compressed Air Energy Storage Project Biological Reconnaissance* (Appendix 5.2A).

5.2.4.2 Botanical Survey

Botanical surveys of the project area were conducted in the spring during the appropriate blooming period for special-status plant species with potential to occur in the project area. NSR botanist Paul Kirk conducted surveys on April 18, and July 2, 2014. Surveys were floristic in nature and followed the taxonomic nomenclature for plant species is in accordance with *The Jepson Manual: Vascular Plants of California* (Baldwin et al., 2012). Botanical surveys did not detect any special-status plant species and these species are not expected to occur within the project area. Detailed survey methods and results including a list of special-status plant species with potential to occur and a list of all plant species observed is provided in the *PG&E King Island Compressed Air Energy Storage Project Biological Reconnaissance* (Appendix 5.2A).

5.2.4.3 Wetland Survey

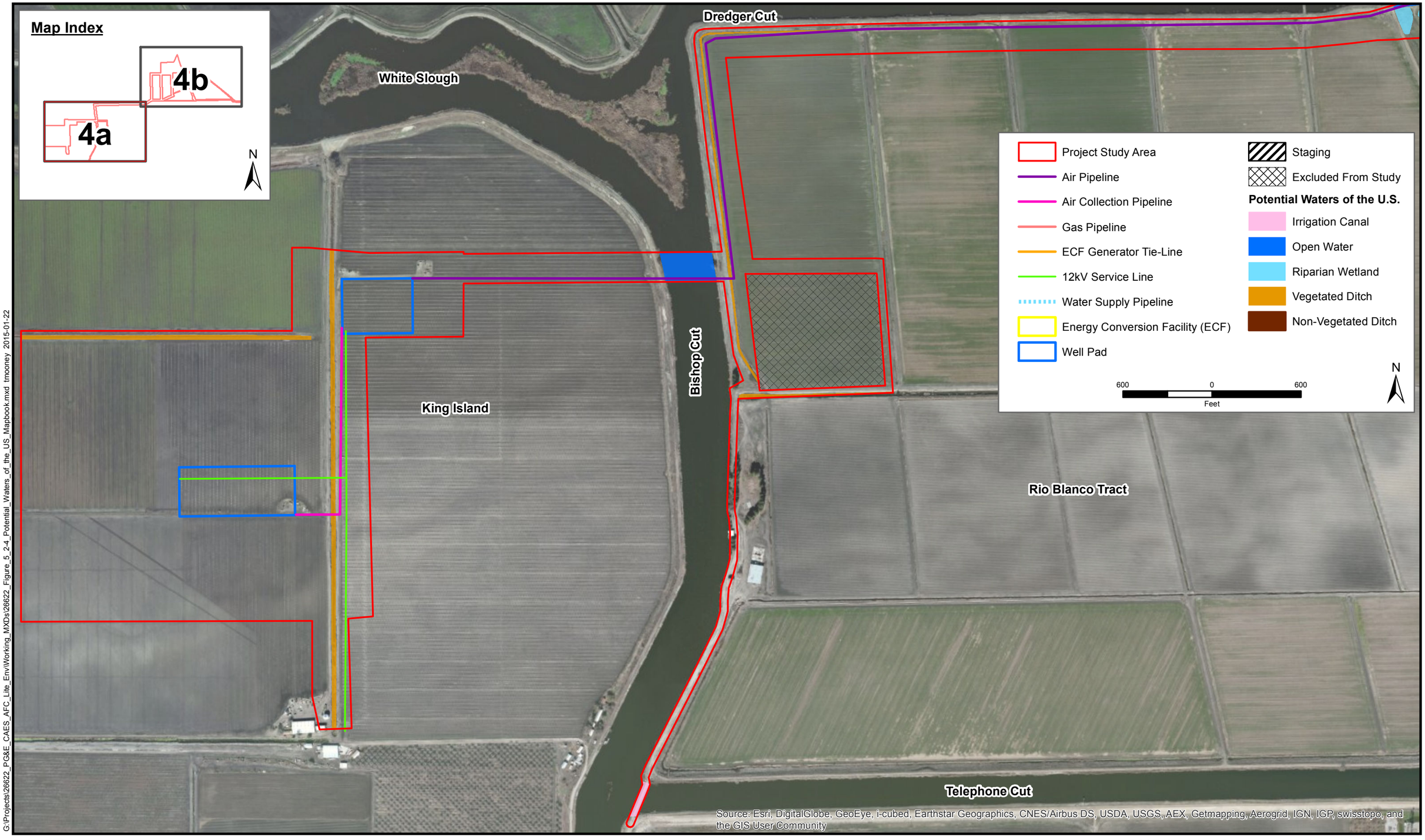
A reconnaissance-level survey for potential waters of the United States within the project area was conducted. NSR biologist Brandon Amrhein mapped potential waters of the United States on April 17 and 18, 2014. Surveys for potential waters of the United States were conducted throughout the project area (Figure 5.2-4). Potential waters of the United States occur as irrigation canal, open water, riparian wetland, vegetated ditch, wetland swale, and non-vegetated ditch (Figure 5.2-4). Detailed survey methods and results for the reconnaissance-level survey are provided in the *PG&E King Island Compressed Air Energy Storage Project Biological Reconnaissance* (Appendix 5.2A).

5.2.5 Environmental Analysis

This analysis is based on PG&E's base case design for the project as discussed in detail in Section 2.0. A summary of the project construction and operation impacts on sensitive biological resources is provided below.

In 2014 and early 2015, PG&E constructed a temporary site facility at the east well pad to test the performance of the King Island natural gas field as a potential storage reservoir for future use as a compressed air energy storage (CAES) facility. Elements of this initial project phase included installation of an air injection/withdrawal well, a 2.6 acre gravel work pad, and improvements to an electrical distribution line. These facilities were approved by the DOE and DOE prepared a National Environmental Policy Act (NEPA) Environmental Assessment for the project (U.S. DOE, 2014a, 2014b). The CAES reservoir evaluation was conducted under the DOE's Smart Grid Demonstration Program, PG&E CAES Compression Testing Phase Project [DOE contract DE-OE0000198].

Because DOE provided funding for the project, it was required to determine effects on species listed under the federal ESA. The Assessment of Effects on Federally Listed Species (North State Resources, 2013c) was prepared for DOE to initiate informal consultation with USFWS. The Assessment determined that giant garter snake was the only species that the project may affect, but not adversely affect during construction and operational activities. In response to the DOE informal consultation, the USFWS issued a letter of concurrence on August 2, 2013. Effects and measures recommended during the informal consultation are incorporated into the assessment below. A summary of potential project effects is presented in Table 5.2-2.



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North State Resources, Inc.

PG&E King Island Compressed Air Energy Storage Project

Figure 5.2-4a
Potential Waters of the United States

Map Index

4b

4a

N

North Thornton Road

I-5

White Slough Wildlife Area

White Slough Water Pollution Control Facility (WPCF)

Dredger Cut

White Slough WPCF Discharge Canal

- Project Study Area
- Air Pipeline
- Air Collection Pipeline
- Gas Pipeline
- ECF Generator Tie-Line
- 12kV Service Line
- Water Supply Pipeline
- Energy Conversion Facility (ECF)
- Well Pad
- Staging
- Excluded From Study

Potential Waters of the U.S.

- Irrigation Canal
- Open Water
- Riparian Wetland
- Vegetated Ditch
- Non-Vegetated Ditch

N

600 0 600

Feet

Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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North State Resources, Inc.

PG&E King Island Compressed Air Energy Storage Project

Figure 5.2-4b
Potential Waters of the United States

TABLE 5.2-2

Summary of Potential KICP Impacts on Biological Resources during Construction

Location	Project Work	Construction Zone Size	Habitat Type	Sensitive Biological Resources	Temporary Impacts on Biological Resources	Permanent Impacts on Biological Resources
Energy Conversion Facility	Grading, trenching, other excavation for utility support	20 acres	Cropland	Low-quality giant garter snake and western pond turtle habitat in wastewater treatment ponds south. Nesting birds, including Swainson's Hawk	None with implementation of mitigation measures	Loss of 20 acres of Swainson's hawk foraging habitat
ECF Generator Tie-in	Aerial tie-in to Gold Hill-Eight Mile 230-kV transmission line	270 feet X 50 feet	Cropland	Nesting birds	None with implementation of mitigation measures	None with implementation of mitigation measures
Injection/ Withdrawal Well Pads (expand one existing pad, construct one new pad)	Grading, trenching, other excavation for utility support	10 acres total Existing East Well Pad expanded to 4 acres from 2.5 acres. New West well pad 6 acres.	Orchard	Nesting birds	None with implementation of mitigation measures	None with implementation of mitigation measures
Air Pipeline	Trenching, horizontal directional drilling	2.6 miles X 100 feet	Orchard/ Vineyard, cropland, open water/ San Joaquin Delta, fresh emergent wetland	Special-status fish Giant garter snake Western pond turtle Special-status birds and raptors Western red bat	None with implementation of mitigation measures	None with implementation of mitigation measures
Air Collection Pipeline	Trenching, jack and bore	0.3 mile X 50 feet	Orchard	Low quality giant garter snake habitat Nesting birds Potential waters of the United States	None with implementation of mitigation measures	None with implementation of mitigation measures

TABLE 5.2-2

Summary of Potential KICP Impacts on Biological Resources during Construction

Location	Project Work	Construction Zone Size	Habitat Type	Sensitive Biological Resources	Temporary Impacts on Biological Resources	Permanent Impacts on Biological Resources
Gas Pipeline	Trenching, HDD under I-5	1.4 miles X 50 feet	Ruderal, cropland	Nesting birds	None with implementation of mitigation measures	None with implementation of mitigation measures
12-kV Service Line	Excavation for pole installation; installation of overhead lines	0.6 mile X 50 feet	Orchard	Giant garter snake Nesting birds	None with implementation of mitigation measures	None with implementation of mitigation measures
Water Supply Pipeline	Trenching	0.3 mile X 50 feet	Ruderal, developed	Nesting birds	None with implementation of mitigation measures	None with implementation of mitigation measures
Staging	Equipment and material storage	13.6 acres	Ruderal, cropland	Nesting birds	None with implementation of mitigation measures	None with implementation of mitigation measures
Operations	Post-construction operation of injection wells and ECF	King Island well pads and ECF	Developed	Giant garter snake Nesting birds	No effects	No effects

5.2.5.1 Significance Criteria

Significance criteria used to analyze the potential impacts of the project on sensitive biological resources include factual and scientific information as well as regulatory standards of county, state, and federal agencies, including California Environmental Quality Act (CEQA) Guidelines. The proposed project would have a significant effect on the environment if it results in any of the following:

- A substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by CDFG or USFWS
- A substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations, or by CDFW or USFWS
- A substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (CWA; including, but not limited to, marsh, vernal pool, coastal, etc.), or state protected waters as defined by the Porter-Cologne Act California Water Code, through direct removal, filling, hydrological interruption, or other means
- Substantial interference with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impeding the use of native wildlife nursery sites
- Conflict with any federal, state, or local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance
- Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan

5.2.5.2 Potential Impacts by Construction and Operation

5.2.5.2.1 Construction and Operation Impacts on Special-Status Species

Construction activities (e.g., grading, trenching, excavation, horizontal directional drilling (HDD), well pad build-out), to construct the ECF site, well pads, and the associated infrastructure could affect special-status animal species including special-status fish species, giant garter snake, western pond turtle, California black rail, Swainson's hawk, white-tailed kite, northern harrier, western burrowing owl, short-eared owl, loggerhead shrike, yellow warbler, yellow breasted chat, and western red bat. Effects on these species by construction and operation activities, and potential avoidance and minimization measures are provided below.

Special-status plant species were not observed during the botanical surveys and they are not expected to be present in the project area. Impacts on special-status plants are not expected and mitigation measures are not required.

Special-Status Fish Species

The Dredger Cut in the eastern portion of the project area does not provide spawning, rearing, or migration habitat for any of the special-status fish species. The channel terminates at the location of the proposed HDD and is connected via a screw valve and culvert to the White Slough WPCF discharge canal (Figure 5.2-3). Water quality is likely poor due to the combination of a lack of flow and receiving discharge from the White Slough WPCF. Algae, water hyacinth, and waterweed dominate the submergent and emergent vegetation, which indicates poor water quality in this portion of the channel, and water quality is degraded due to lack of flow and possible discharge of nutrient-rich water from the WPCF. The lack of surface flow and algae indicate potentially high nutrient loads that may lead to low dissolved oxygen levels and high water

temperatures. Additionally, the terminus of the channel provides highly suitable habitat for predatory fish species like largemouth bass (*Micropterus salmoides*), which were observed during the reconnaissance visit. Given the poor water quality, hydrology, and exposure potential to predatory fish, special-status fish species are likely absent from the east end of Dredger Cut and the White Slough WPCF discharge canal.

Portions of Bishop Cut and White Slough located in the western portion of the project area provide seasonal habitat for special-status fish species including Delta smelt (*Hypomesus transpacificus)*, Central Valley steelhead DPS (*Oncorhynchus mykiss)*, Central Valley spring-run Chinook salmon ESU (*Oncorhynchus tshawytscha)*, Central Valley fall/late fall-run Chinook salmon ESU (*Oncorhynchus tshawytscha)*, green sturgeon southern DPS (*Acipenser medirostris)*, longfin smelt (*Spirinchus thaleichthys)*, Sacramento splittail (*Pogonichthys macrolepidotus)*, and river lamprey *(Lampetra ayresi*).

White Slough (north of the project area; see Figure 5.2-3) and, to a lesser extent, Bishop Cut provide limited suitable spawning and rearing habitat and are a seasonal migratory corridor for Delta smelt, although no data are available on their current distribution or abundance in the project area. The greatest extent of emergent and submergent vegetation suitable for delta smelt spawning and rearing occurs in White Slough approximately 450 feet north of the project area. This species would be expected to use aquatic habitat seasonally (December–July); however, the extent and quality of spawning and rearing habitat is limited by the extent of exposed revetment and limited emergent vegetation and cover in the project area. There is greater potential that Delta smelt and longfin smelt could potentially seasonally use habitat in the project area as a migratory corridor.

The aquatic habitat available in White Slough and Bishop Cut in the project area provides transient rearing and migratory habitat for juvenile and adult salmon, steelhead, and green sturgeon. It is designated critical habitat for steelhead and green sturgeon and is Essential Fish Habitat for Pacific salmon. Juvenile and adult salmonids have the greatest potential to occur and use aquatic habitats in the project area from about October through June of most years (California Department of Fish and Game, 2005). Adult green sturgeon migrate upstream primarily through the western edge of the Delta into the lower Sacramento River between March and June (Adams et al. 2002). Larvae and post-larvae are present in the lower Sacramento and north Delta between May and October, primarily in June and July (California Department of Fish and Game 2002). Green sturgeon spawning has not been documented in the San Joaquin River and the distribution of juvenile green sturgeon through the Delta is not well understood; however, because of the connectivity of waters of the Delta and critical habitat in the project area, the potential for green sturgeon to occur in the project area is very low.

Bishop Cut and White Slough seasonally provide transient juvenile rearing habitat for migrating Delta smelt, longfin smelt, spring-run and fall late-fall Chinook salmon, and Central Valley steelhead; however, the extent and quality of rearing habitat is limited by the extent of exposed revetment and limited emergent vegetation and cover in the project area. Rock revetment has been shown to locally reduce densities of juvenile Chinook salmon 4 to 12 times that of undisturbed areas (California Department of Fish and Game 2005). Further, evidence suggests that water quality, in particular water temperature, is seasonally high and may exceed suitable thresholds for sensitive species like salmonids. Shallow aquatic habitat is present in both Bishop Cut and White Slough, although, deep-water aquatic habitat with minimal submergent aquatic vegetation (10 feet or deeper) is dominant in Bishop Cut. Substrates in this water body are dominated by fine sediments (e.g., sand, silt, and clay). Habitat in the project area is suitable for predatory fish species like largemouth bass and striped bass (*Morone saxatilis*), which are common throughout the Delta.

The inadvertent release of drilling mud ("frac-out") could have adverse effects on special-status fish (i.e., Chinook salmon, steelhead, Delta smelt, longfin smelt, green sturgeon, and river lamprey) in Dredger Cut, White Slough, or Bishop Cut. Drilling mud typically consists of a mixture of bentonite, water, and soil

cuttings. Bentonite, itself, is essentially non-toxic (Breteler et al., 1985; Hartman and Martin, 1984; Sprague and Logan, 1979) and chemical toxicity of drilling muds will not exist without toxic additives. However, bentonite, as with any fine particulate material, can interfere with oxygen exchange by the gills of aquatic organisms. Affected organisms may suffocate if exposed to high concentrations of the clay, overwhelming the animal's ability to clear the impacted gill filaments through physiological processes such as "coughing" or mucous secretion. Sub-lethal effects may include impairment of normal behaviors that are essential to growth and survival. Deposition of fine sediments could reduce the abundance and availability of other biota including aquatic insects upon which many special-status fish feed. Significant deposition of fine sediments could adversely affect photosynthesis and survival of aquatic vegetation important as cover, spawning substrate, and food production.

Direct impacts from a frac-out in the project area would be limited to the less mobile life stages present at the time of release since adult and larger juvenile fish (e.g., salmon smolts) are more mobile and capable of moving out of the area. Behavioral disruption, even temporarily, could result in some increased vulnerability to competitive interactions or predation for juvenile salmonids (Berg and Northcote, 1985). However, rearing habitat is not extensive and most juvenile salmonids are expected to keep moving through the area or to other nearby suitable habitat. Less mobile organisms, such as macroinvertebrates, could perish if high concentrations of drilling mud are released into Bishop Cut or Dredger Cut for an extended period. However, due to the size of Bishop Cut and Dredger Cut, local hydrology, and implementation of a HDD fluid release contingency plan, it is expected that any release would be limited in size and duration to levels not acutely lethal or sub-lethal for special-status fish. Levees would provide separation between the drilling equipment and open water, thus no effects from erosion, sedimentation, or accidental fuel leaks and spills during drilling activities are expected.

The potential for impacts on special-status fish from HDD is temporary and is only a threat during drilling activities beneath Bishop Cut and Dredger Cut. HDD activities would not result in permanent impacts to aquatic habitat, including primary constituent elements of critical habitat or essential fish habitat (EFH). Implementation of mitigation measures presented in Section 5.2.7 would reduce the potential effects on special-status fish species. Measures include development of an HDD fluid release contingency plan to mitigate for any fluid release into Bishop Cut and Dredger Cut. The plan would provide measures to provide a biological monitor to identify potential frac-outs. The plan would require the crew to stop and clean up any inadvertent spills of drilling fluids. Further, because the aquatic habitat in Bishop Cut and Dredger Cut is primarily used seasonally by special-status species it is recommended that all drilling occur between August 1 and November 30 when fish are least vulnerable to effects of in-channel disturbances, in accordance with CDFW guidelines (California Department of Fish and Game, 2005).

Because operation of the ECF and well pad facilities would be located more than 0.25 mile from suitable aquatic habitat, no operational impacts (e.g., lighting, noise) are expected.

Giant Garter Snake

Fresh emergent wetlands associated with White Slough WA, and irrigation ditches and canals present throughout the project area provide low to moderate quality habitat for giant garter snake (*Thamnophis gigas*). Low-quality aquatic habitat is located in the irrigation ditches on King Island and in the wastewater treatment ponds adjacent to the ECF (North State Resources, 2012; Hansen, 2013a, b). Aquatic habitat for giant garter snake within the White Slough WA is considered of moderate quality and is near to and connected with an extant population of giant garter snake in the Coldani Marsh approximately 1 mile north of the project area. Upland habitat throughout most of the project area is considered of low quality due to frequent agricultural disturbance (North State Resources, 2012; Hansen, 2013a).

Construction activities (e.g., vegetation removal, grading, trenching, and HDD) to construct the well pads, ECF site, pipeline trenches, and 12-kV service line near potential giant garter snake aquatic habitat may have permanent or temporary impacts on giant garter snake. Project effects on giant garter snake vary based on the giant garter snake activity period (e.g., inactive or active) in which the work would be conducted. Giant garter snakes are typically limited to aquatic habitat with some basking on the banks during the active period from May 1 through October 1. During the inactive period (October 2 through April 30), giant garter snakes seek refuge in upland cover types such as rodent burrows, debris piles, rip-rap, and other types of generally within 200 feet of aquatic habitat.

Giant garter snakes are expected to occur within, and immediately adjacent to, aquatic habitats during the active period. Effects on giant garter snake could result from direct contact with vehicles or equipment if construction were to occur within irrigation ditches or fresh emergent wetlands, or giant garter snake avoidance of foraging habitat (e.g., fresh emergent wetlands, irrigation ditches) due to the increased level of disturbance. During the inactive period, giant garter snakes are expected to be in upland refugia. In proximity to giant garter snake habitat on King Island and White Slough WA (Figure 5.2-3), vehicles or grading equipment could collapse refugia in which snakes may take cover, or giant garter snakes could be injured or killed if trenching or other excavations excavate snake refugia. Additionally, project implementation could result in the degradation of aquatic habitat due to increased erosion, sedimentation, or accidental fuel leaks and spills.

The HDD under the White Slough WA may result in a frac-out into aquatic habitat that may provide habitat for giant garter snake. Aquatic habitat in White Slough WA is limited in the area under which the HDD would occur; however, effects on individual giant garter snakes are not expected because they would be able to move from the affected area. A frac-out could occur in the Dredger Cut, the White Slough WPCF discharge canal, or in an enclosed impoundment to the south of the HDD location. Frac-out fluids could dissipate with the tide if it occurred in the Dredger Cut. A frac-out would be contained in the irrigation canal and south water body, and downstream resources would not be affected. However, concentrations would not dilute in closed ditch systems and could have a greater detrimental effect on prey present. The HDD fluid release contingency plan would provide measures to monitor, identify, stop, and clean up any inadvertent spills of drilling fluids, which would reduce effects on prey items that may be present. Due to available foraging habitat in the marshes and irrigation canals within White Slough WA and with a plan in place to minimize and clean-up any spills, effects on the giant garter snake prey base would be negligible.

Construction activities associated with the development of the air pipeline (e.g., mobilization of vehicles and equipment, trenching, and excavation) would result in temporary impacts on giant garter snake habitat since no work will occur within aquatic habitat and all habitat within 200 feet of aquatic habitat will be restored to preconstruction conditions. Construction activities (e.g., HDD, trenching for the air pipeline) near giant garter snake aquatic habitat are anticipated to occur over one construction season; therefore, no permanent or temporary impacts on giant garter snake habitat lasting for more than one year are expected.

Operation of the ECF would result in a permanent increase in noise and additional nighttime lighting to operate the facility, which is adjacent to the wastewater treatment ponds that provide low-quality habitat for giant garter snake. Equipment within the ECF would be fitted with silencers or acoustic enclosures as needed to reduce decibel levels to levels required by applicable code. Operational noise would be less than or equal to adjacent sources including I-5 (ranges from 85 to 90 decibels depending on traffic), White Slough WPCF, and the adjacent Lodi Energy Center. Although snakes do not have external ears or an ear drum, they do have an inner ear that is connected to their jawbone. Snakes “hear” by sensing vibrations traveling through the ground (and possibly the air), which cause vibrations in the jawbone that are relayed to the brain via the inner ear. Effects on giant garter snake from noise could result in avoidance of aquatic or

upland habitats if noise vibrations interfere with foraging activities or are otherwise uncomfortable for the snake. Given the low potential for giant garter snakes to be present in the ponds near the ECF, attenuation of noise with increased distance from the ECF, noise generated from the ECF would be similar to existing conditions resulting from adjacent uses, and the ability for snakes to move from the area, noise effects from operations are not considered adverse.

Operation of the project would require permanent nighttime lighting at the ECF. The lighting would be focused on the ECF and would be designed to illuminate the extent of the ECF only. Therefore, operational lighting at the ECF site is not expected to have an effect on giant garter snake. Additionally, giant garter snakes forage during the day and nighttime lighting would not affect foraging behavior.

The KICP well pads and the infrastructure between the ECF and the well pads would be routinely maintained. Nighttime lighting, noise and an increase in traffic related to routine maintenance activities may have an effect on giant garter snake. Nighttime light would be present; however, giant garter snakes are diurnal and forage during the day, thus no effects on giant garter snake foraging behavior or loss of foraging habitat is expected. Additionally, nighttime lighting would be designed to illuminate only the well pads. Agricultural land is adjacent to the well pads and infrastructure and agricultural activities (e.g., harvesting, tilling, and planting) occur often. Because routine maintenance would likely be limited to single crews or light vehicles, noise generated and road use to maintain the well pads and infrastructure would likely not exceed the existing levels of disturbance from agricultural activities on adjacent parcels.

Potential effects resulting from construction and operational activities would be avoided or minimized with the implementation of mitigation measures presented in Section 5.2.7. Measures would include worker awareness training, pre-construction surveys, biological monitoring, and designated avoidance areas. Because effects on foraging would be limited to the immediate construction area and foraging habitat is available within the region, temporary effects on foraging would be negligible and no mitigation measures are recommended. Permanent impacts or temporary impacts for more than one year are not expected and compensatory mitigation would not be required.

Western Pond Turtle

Fresh emergent and riparian wetlands associated with White Slough WA and irrigation ditches and canals present throughout the project area provide habitat for western pond turtle (*Emys marmorata*). Riparian and ruderal habitat within the White Slough WA and undisturbed areas throughout the project area provide upland nesting habitat. Western pond turtles were observed in White Slough and in irrigation ditches near the ECF site.

Construction activities could have adverse direct effects on western pond turtle if an individual or a nest were crushed during the construction phase of the project. Pond turtles are typically restricted to aquatic habitat throughout the year. However, pond turtles move overland during the spring and early summer and have been documented to move over 325 feet (Jennings and Hayes, 1994). Mortality of individual western pond turtles could occur as a result of project-related construction activities, including equipment use or vehicle traffic in or near irrigation ditches or fresh emergent wetlands. It is expected that adults could be encountered along roads if the project were built during the spring. Additionally, project implementation could result in indirect effects including the degradation of aquatic habitat resulting from increased erosion, sedimentation, or accidental fuel leaks and spills.

Effects from operational activities (e.g., noise and lighting) would mainly affect western pond turtle at the ECF site and effects would be similar to those described for giant garter snake. As described for giant garter snake, noise generated from the ECF site would be attenuated with increased distance from the ECF site and western pond turtles could move to other available habitat in the White Slough WA. The lighting would be

focused on the ECF and would be designed to illuminate the extent of the ECF only. Therefore, effects from operational noise and lighting at the ECF site are not expected. Additionally, western pond turtles are diurnal and forage during the day and nighttime lighting would not affect foraging behavior.

Potential effects resulting from construction and operational activities would be avoided or minimized with the implementation of mitigation measures presented in Section 5.2.7. These measures include a preconstruction survey and stop work measures if a turtle is encountered.

Swainson's Hawk

Swainson's hawk (*Buteo swainsoni*) nesting and foraging habitat is present within and adjacent to the project area. Isolated trees may provide nesting habitat and agricultural land cultivated in annual or perennial low-growing crops provide foraging habitat. Two potential nests were observed during the reconnaissance survey: one in the western portion of the project area approximately 0.2 mile northwest of the project area, and one in the eastern portion of the project area along North Thornton Road. During surveys conducted in 2013, NSR observed a Swainson's hawk pair build a nest approximately 1.5 miles north of the project area (North State Resources, 2013a).

Noise generated during construction could affect Swainson's hawks if active nests are located within 0.25 mile of the project area (California Department of Fish and Game, 1994). If construction were to occur during the nesting season, noise disturbance could result in the incidental loss of fertile eggs, nestlings, or otherwise lead to nest abandonment.

The project would convert farmland (i.e., that provides foraging habitat) to industrial use, which would result in the permanent loss of approximately 20 acres of foraging habitat (includes only crops suitable for foraging; excludes orchards).

Noise and lighting that would be used during ECF operations may deter Swainson's hawk from nesting in the trees adjacent to the facility. Potential nest trees are present between the existing frontage road and I-5, but no raptor nests were observed in these trees during the 2013 reconnaissance survey. Given the proximity of the potential nesting habitat to I-5 and the White Slough WPCF approximately 0.3 mile south of the project, it is likely that Swainson's hawks are habituated to freeway traffic and operations of the White Slough WPCF. Because of the proximity of new construction to existing facilities that produce similar disturbance from noise and lighting, and no additional foraging habitat would be converted during operations, no effects on potential nesting, or nesting and foraging habitat are expected during operations.

Facilities at the well pad sites would consist of control buildings and other equipment necessary to operate the wells. Operations at the KICP well pads would require nighttime lighting and well operations may generate some noise. Potential nesting on King Island is limited to a small group of Fremont cottonwood trees approximately 700 feet north of the project area. Nighttime lighting would be focused on the well pads and would be designed to illuminate the extent of the well pads only. Nighttime lighting and noise associated with the control buildings and well equipment may deter Swainson's hawks from nesting in this group of trees; however, isolated trees are present throughout the region, thus no effects on loss of nesting habitat due to nighttime lighting or noise at the King Island well pads are anticipated.

Potential effects resulting from construction activities would be avoided or minimized with the implementation of mitigation measures presented in Section 5.2.7. These measures include removal of vegetation outside the nesting season, preconstruction survey (CDFW may require protocol-level surveys), construction buffers, and/or limited operating periods until a qualified biologist has confirmed that young have fledged. Compensatory mitigation is addressed in Section 5.2.7.

Other Special-Status Birds, Migratory Birds, and Raptors

Habitat for California black rail (*Laterallus jamaicensis coturniculus*), white-tailed kite (*Elanus leucurus*), northern harrier (*Circus cyaneus*), western burrowing owl (*Athene cunicularia*), short-eared owl (*Asio flammeus*), loggerhead shrike (*Lanius ludovicianus*), yellow warbler (*Dendroica petechial*), and yellow breasted chat (*Icteria virens*) is present in the project area. Potential nesting habitat for loggerhead shrike and white-tailed kite is present in the trees and shrubs in the project area. Fresh emergent wetlands and open areas in the White Slough WA may provide nesting habitat for California black rail, northern harrier, and short-eared owl, while riparian habitat in the White Slough WA may provide habitat for yellow warbler and yellow breasted chat. Burrows and other structures (e.g., culverts) in annual grasslands and ruderal habitats along road shoulders, open areas, and levee berms may provide habitat for burrowing owl.

The CNDDB documents California black rails within the marsh near the project area, a white-tailed kite nest just south of the White Slough WPCF, and burrowing owls within 3.2 miles southeast of the project area. A northern harrier was observed nesting 1.25 miles northwest of the project area during April 2013 (North State Resources, 2013a).

Migratory birds and raptors (i.e., birds of prey) protected under the federal Migratory Bird Treaty Act and California Fish and Game Code may nest on open ground, vegetation, or structures within the project area. Multiple stick nests and mud nests were observed during the field visits. Cliff swallow nests were observed under the Rio Blanco Road Bridge over Telephone Cut.

As described for the Swainson's hawk, construction and operation activities could affect nesting success for other special-status birds, migratory birds, and raptors. Ground-disturbing activities and vegetation removal could directly affect birds nesting on the ground or in trees slated for removal (e.g., mortality of young in nest). Direct effects (e.g., nest abandonment due to noise disturbance) on nesting birds may result if construction activities commence after the nesting season begins. Project implementation would result in the permanent loss of up to 30 acres of orchards and cropland. However, due to the abundance and availability of cropland in the region, effects from the loss of cropland would be negligible.

Construction activities could also affect burrowing owl during the non-nesting season. Burrowing owls occupy burrows throughout the year and effects on burrowing owl could occur during any time of year. Although no burrowing owls were observed during the field reconnaissance survey, burrowing owls could move into the area prior to construction. Ground-disturbing activities could result in direct mortality of burrowing owls if an occupied burrow is collapsed. Noise and lighting effects resulting from construction and operation activities would be the same as those described for Swainson's hawk.

Birds that perch or build nests on utility poles may become electrocuted if they come in contact with live wires and a ground at the same time. Raptors and other migratory birds use power poles to perch and build nests. It is anticipated that birds would not be subject to the potential for electrocution because the lines would meet avian protection specifications.

Potential effects resulting from construction activities would be avoided or minimized with the implementation of the mitigation measures presented in Section 5.2.7. These measures include removal of vegetation outside the nesting season, preconstruction surveys, construction-free buffers, and limited operating periods until a qualified biologist has confirmed that young have fledged.

Western Red Bat

Riparian habitat located in the White Slough WA may provide habitat for western red bat (*Lasiurus blossevillii*). No tree removal is expected, therefore, no direct impacts on roosting bats are expected.

In the eastern portion of the project, the HDD bore would occur under riparian habitat and no vegetation removal is expected. However, construction noise may affect roosting bats. Many bats, including pregnant and lactating females, frequently change their diurnal roost location (Lewis, 1996). When disturbed, many bats transport their young while they are non-volant (i.e., not flying) (Davis, 1970). The presence of construction activity and noise may deter the bats from roosting or result in relocation (including young) from the construction area. Because of the ability for bats to move their young, construction noise is not expected to have an adverse effect on western red bats.

Because western red bats roost during the day, nighttime lighting would not affect roosting bats. Nighttime lighting at both the ECF site and the well pads may affect foraging behavior. Nighttime lighting at the ECF site is not expected to affect foraging behavior over the wastewater treatment ponds because it is anticipated that lighting would illuminate only the ECF site. If lighting were to extend beyond the ECF site, illumination would be similar to the area illuminated from the lighting associated with the White Slough WPCF and bats are likely habituated to the additional light if they use this area for foraging. Nighttime lighting at the well pad is more than 0.2 mile from foraging habitat over White Slough and is not expected to affect bats.

Operational noise would be less than or equal to adjacent sources including I-5 (ranges from 85 to 90 decibels depending on traffic), White Slough WPCF, and the adjacent Lodi Energy Center. Because noise generated from the ECF would be similar to existing conditions resulting from adjacent uses, effects on bats from operational noise is not expected. The nearest roosting habitat to the well pad site is 700 feet. Well pad noise would also be within standards and would attenuate over the distance from the well pad. No effects from operation of the well pad are expected.

No effects resulting from construction or operation activities are expected.

5.2.5.2.2 Construction and Operation Impacts on Waters of the United States

Potential waters of the United States occur as irrigation canal, open water, riparian wetland, vegetated ditch, wetland swale, and non-vegetated ditch (Figure 5.2-4). Permanent impacts on waters of the United States occur when there is a permanent discharge of dredged or fill material, or other activities that result in a permanent loss of function. Temporary impacts occur when work occurs within a feature, and the feature is restored to its original grade and function.

Non-vegetated agricultural ditches occur throughout the project area and do not qualify as waters of the United States. If work is to occur within the agricultural ditches and water is present within the ditches during construction, placement of materials within the water may be subject to the California Porter Cologne Water Quality Control Act as waters of the State.

Impacts on waters of the United States or waters of the State would be avoided or minimized with the implementation of mitigation measures presented in Section 5.2.7. Appropriate permits and authorizations would be required if work is to occur within a waters of the United States. These permits and authorizations are presented in Section 5.2.10.

Operations wastewater would be injected into deep injection wells; thus, no effects from project operations would be expected. Run-off from the ECF pad would be routed through storm drains and oil/water separators, then pumped into the proposed stormwater retention pond in the southwest corner of the ECF site. Well pads are graveled surfaces and precipitation is expected to percolate through the gravel or drain to the existing agricultural drainage ditches adjacent to the site.

5.2.5.2.3 Construction and Operation Impacts on Other Sensitive Biological Resources

Tree Resources

Very few mature, non-orchard trees are present within the project area. The San Joaquin County Development Title (Ordinance 4368, Chapter 9-1500) requires an improvement plan and replacement plantings at specified ratios for the removal of significant tree resources (e.g., native oak trees, heritage trees, and riparian habitat). Riparian trees may also be subject to a CDFW Lake and Streambed Alteration Agreement if notification is required. The City of Lodi does not require any tree removal permits on private property.

Because no protected trees would require removal to construct or operate the facility and its infrastructure, no impacts are expected.

Valley Fresh Water Marsh and Riparian Habitat

Valley Fresh Water Marsh as designated by CDFW and riparian habitat is located in the White Slough WA in the central portion of the project area.

Construction or operational activities would not involve the removal of Valley Fresh Water Marsh or riparian habitat and no adverse effects are expected.

5.2.6 Cumulative Effects

A cumulative impact refers to a proposed project's incremental effect together with other closely related past, present, and reasonably foreseeable future projects whose impacts may compound or increase the incremental effect of the proposed project (Public Resources Code § 21083; California Code of Regulations, title 14, § 15064(h), 15065(c), 15130, and 15355).

Due to uncertainty of when this project would be built, to properly assess the past, present, and future cumulative effects of the project, cumulative effects would be analyzed during the completion of the California Energy Commission (CEC) Application for Certification process.

5.2.7 Mitigation Measures

The following section describes the mitigation measures recommended or that may be required as permit conditions that are intended to avoid, minimize, and otherwise mitigate potential adverse effects of the project on biological resources. Measures that address water and air quality are provided in Section 5.15, Water Resources and Section 5.1, Air Quality.

These mitigation measures are derived from past approved measures by agencies including CDFW and USFWS. Measures from the San Joaquin County Multi-Species Habitat Conservation and Open-Space Plan (SJMSCP) and the letter of concurrence from the USFWS regarding the previous phases of the CAES project are integrated into the possible measures that may be applied to avoid impacts on sensitive species. Potential measures for giant garter snake were developed in reference to the Programmatic Formal Consultation for U.S. Army Corps of Engineers (USACE) CWA Section 404-permitted projects with relatively small effects, and the USFWS Letter of Concurrence for the PG&E CAES Project dated August 2, 2013.

5.2.7.1 General Mitigation Measures

5.2.7.1.1 Measure 1—Worker Training and General Measures

1. A site-specific Worker Environmental Awareness Program (WEAP) will be administered by the designated biologist as part of the mitigation plan. The WEAP is intended to educate construction workers and operators on the sensitive resources in the area and the measures that will be implemented to avoid or minimize impacts on these species. The WEAP will include an oral presentation accompanied by a video or PowerPoint presentation and written materials. The presentation will include: construction activities

that could impact biological resources, measures developed to mitigate or avoid impacts, contact information and procedures, encounters with wildlife, and addressing issues with biological resources.

2. Construction monitoring will be provided by a qualified biologist as appropriate to ensure compliance with the protection measures.
3. Preconstruction and clearance surveys for special-status species will be performed as appropriate within areas that will be impacted by construction activities.
4. The irrigation ditches, canals, features with surface water, and Bishop Cut will be designated as environmentally sensitive areas and physical disturbance to these features will be avoided during construction.
5. In coordination with a qualified biologist, access routes and construction areas will be demarcated to minimize impacts on habitat and special-status species during construction and operations.
6. High visibility fencing will be installed around the proposed ECF site, laydown areas, and well pads to limit construction activities to the work area. Chain link fencing is an appropriate alternative to limit construction activities to the work area. The Construction Contractor will inspect fencing before the start of each workday and the fencing will be maintained by the Contractor until project completion.
7. Equipment and materials will be stockpiled outside of riparian habitat, waters of the United States, or other biologically sensitive areas.
8. Prior to moving parked vehicles or equipment, construction personnel will visually check for snakes and other wildlife.
9. Portable lighting should only be used during construction when absolutely necessary for worker safety, or as necessary to accomplish critical construction equipment maintenance or time-critical continuous process tasks that extend into nighttime hours. When in operation, the temporary flood lighting should be directed toward the work area to minimize illumination of areas beyond the immediate work areas, and minimize reflected glare and illumination of the nighttime sky to the maximum extent practicable. When not in immediate use the temporary floodlights should be directed downward or turned off.
10. Temporarily disturbed areas will be restored following construction.
11. Vehicular speed within the project area will be limited to 10 miles per hour to avoid impacts on wildlife that may be present on or near roadways.

5.2.7.2 Special-Status Species

5.2.7.2.1 Measure 2—Special-status Fish

The following measures will be implemented to avoid impacts on special-status fish in Bishop Cut and Dredger Cut during HDD activities.

1. HDD drilling will be limited to August 1 through November 30 to minimize project-related effects on all life forms of special-status fish species.
2. HDD drilling under the White Slough WA will be located south of the Dredger Cut.
3. A biological monitor will be present to monitor channel crossings for potential fluid escape to the ground surface or river to allow for quick response time.
4. HDD operations will be limited to daylight hours to effectively allow for frac-out detection by the biological monitor.

5. A detailed HDD frac-out contingency plan will be developed and implemented prior to the initiation of construction activities. The contingency plan will include procedures for shutting down drilling operations, spill containment in terrestrial and aquatic habitats, spill clean-up, frac-out stabilization, and resuming drilling procedures. In addition, the plan will include the names and contact information for agency staff that must be notified in the event of a frac-out into aquatic habitat. An abandonment plan for the bore must be developed in the event the frac-out cannot be stabilized and sealed, and drilling cannot resume at the original bore site.
6. Construction equipment will be inspected for leaks prior to the onset of each day's work activities. External oil, grease, and mud will be removed from equipment by hand using rags or absorbent materials. Spill containment booms will be maintained onsite at all times during construction operations and/or staging of equipment or fueling supplies.

5.2.7.2.2 Measure 3—Giant Garter Snake

The following measures will be implemented to avoid impacts on giant garter snake for construction activities that could occur during the active or inactive period. Implementation of Measure 2 for special-status fish would minimize potential impacts resulting from HDD activities on aquatic environments in White Slough WA. These measures were developed in reference to the Programmatic Formal Consultation for USACE CWA Section 404-permitted projects with relatively small effects, San Joaquin County Multi-Species Habitat Conservation and Open-Space Plan, and the USFWS Letter of Concurrence for the PG&E CAES Project dated August 2, 2013.

1. All construction activity within giant garter snake habitat will be conducted between May 1 and October 1 during the active season for giant garter snake.
2. Prior to working on any phase of the project, all workers will be provided with Environmental Awareness Training by a qualified biologist. The training will address the identification and general ecology of giant garter snake, regulations, and avoidance and minimization measures to avoid impacts.
3. Preconstruction surveys for giant garter snake will occur within 24 hours of ground disturbance.
4. Any dewatered habitat must remain dry for 15 consecutive days after April 15 and prior to excavating or filling any dewatered habitat.
5. If ground-disturbing activity cannot be conducted during the active season, preconstruction surveys for potential wintering sites (e.g., burrows and soils crevices) within proposed disturbance areas will be conducted by a qualified biologist approved by USFWS and CDFW. The preconstruction survey will be conducted no more than two weeks prior to construction activities. All burrows or potential refuge habitat will be flagged and avoided. If work is suspended for a period of five days or greater, the project area must be resurveyed for giant garter snake. If it is determined that potential giant garter snake wintering habitat (e.g., burrows and crevices) is present within areas planned for ground disturbance, ground-disturbing activities will be postponed until the giant garter snake active season (i.e., between May 1 and October 1).
6. If work is to occur during the inactive period, construction activities will be set back from aquatic habitat by 200 feet. However, in consultation with USFWS, exclusionary fencing may be installed around work areas within 200 feet of aquatic habitat, or along aquatic habitat a minimum of 200 feet on either side of the work area to prohibit snake entry, allowing work to be conducted during the inactive period. Exclusionary fencing will be placed during the active period (between May 1 and October 1), so that the fence is erected before snakes move to upland refugia that may occur in the work area. Snake exclusionary fencing will be buried at least six inches below the ground to prevent snakes from

attempting to move under the fence. If burrows are present along the ditch, methods to hold the exclusionary fencing flush with the ground (e.g., sand or rock bags, pins) will be employed as appropriate to avoid damage to burrows. The fencing will not contain any holes along the ground large enough for snakes to enter the construction site. Fencing can be as high as 12 to 24 inches above ground.

7. The movement and staging of vehicles, equipment, and other materials within 200 feet of the banks of aquatic habitat will be minimized to the greatest extent practicable.
8. A biological monitor approved by USFWS and CDFW will be onsite during all phases of construction to direct traffic and construction work around irrigation ditches and other sensitive habitats that may support giant garter snake. Full-time monitoring will be employed during construction activities that require increased vehicle traffic and ground disturbance within 200 feet of aquatic habitat. Part-time monitoring (1–2 days per week) will be employed during project activities limited to the ECF or well pad areas with limited traffic (i.e., well drilling). The purpose of the part-time monitor is to ensure that mitigation measures are in place and to meet the crews' monitoring needs (e.g., environmental awareness training for new crew members, mobilization/ demobilization of large equipment, or other unforeseeable need for a monitor). The biological monitor will coordinate closely with construction personnel to ensure monitors are present during key construction activities.
9. If any giant garter snakes are observed within the project area during work activities, work will cease and the onsite project manager will immediately contact the project biologist and subsequently the USFWS and CDFW will be contacted before work proceeds. The biological monitor has the authority to stop construction until appropriate corrective measures have been implemented or it is determined that the giant garter snake will not be harmed. The monitor will remain in the area for the remainder of the work day to make sure the giant garter snake is not harmed. Any giant garter snake encountered during construction activities will be allowed to move away from construction activities on its own. Capture and relocation is not permitted unless approved by USFWS. Any dead or injured giant garter snakes will be immediately reported to the biological monitor and to the USFWS and CDFW.
10. Open ends of pipes, conduits or other materials stored onsite will be covered to exclude wildlife and will be inspected prior to use.

5.2.7.2.3 Measure 4—Western Pond Turtle

The following measures will be implemented to avoid construction-related impacts on western pond turtle. Implementation of Mitigation Measures 2 for special-status fish would minimize potential impacts resulting from HDD activities on aquatic environments in Bishop Cut and White Slough WA.

1. If work is to occur within or within 300 feet of aquatic or riparian environments, a pre-construction survey will be conducted by a qualified biologist. If a western pond turtle is found, it will be moved to appropriate habitat outside of the construction area. If a pond turtle nest is found, the biologist will flag the site and establish a 300-foot buffer between the nesting site (which may be immediately adjacent to wetlands or extend up to 400 feet away) and the wetland located near the nesting site. These buffers will be indicated by temporary fencing if construction will occur within the nesting period between April and November.
2. If a western pond turtle is encountered during construction, activities in the vicinity will cease until appropriate corrective measures have been implemented (e.g., relocation of the turtle to appropriate habitat identified by a qualified biologist or to allow it to move away on its own) or it has been determined that the turtle will not be harmed. Any trapped, injured, or killed turtles will be reported immediately to the CDFW.

5.2.7.2.4 Measure 5—Special-Status Birds, Migratory Birds, and Raptors

The following measures are recommended to avoid or minimize the potential for project-related impacts on nesting California black rail, Swainson's hawk, white-tailed kite, northern harrier, western burrowing owl, loggerhead shrike, and yellow breasted chat, migratory birds and raptors:

1. Grading and other construction activities, including vegetation removal should be scheduled to avoid the nesting season (February 1 through August 31) to the extent possible. If construction activities occur outside of the breeding season, no further mitigation is necessary. Vegetation removal outside the nesting season would help preclude nesting birds.
2. If construction activities are scheduled to occur within the nesting season, a preconstruction survey for all special-status birds, migratory birds and raptors will be conducted two weeks prior to construction activities. Surveys for passerines will be conducted within 250 feet of construction activities, and surveys for raptors will be conducted within 300 feet. If an active nest is found, a qualified biologist, in consultation with CDFW, will establish a construction buffer around the nest until nestlings have fledged or breeding has failed (based on field verification by a qualified biologist).
3. Because burrowing owls may be present outside of the nesting period, surveys for resident burrowing owls will be conducted within 250 feet of construction activities prior to start of construction. If burrowing owls are present and could be affected by construction activities, burrowing owls should be evicted using passive relocation as described in the California Department of Fish and Game's Staff Report on Burrowing Owl Mitigation (CDFW, 2012) and as described in the San Joaquin County Multi-Species Habitat Conservation and Open Space Plan (San Joaquin County, 2010).
4. If required, surveys for Swainson's hawk will be conducted within 0.25-mile of the project between March 1 and July 31, and follow guidance provided by the Swainson's hawk Technical Advisory Committee (2000).
5. Known or potential Swainson's hawk nest trees (i.e., known to have nested within the last three years), may be removed between September 1 and February 15 or may be retained. However, if Swainson's hawk occupy a nest tree during construction activities, then all construction activities will remain a distance of two times the drip line of the tree measured from the nest (San Joaquin County, 2000).
6. Set-backs for special-status birds nesting near the construction zone will be as described in the San Joaquin County Multi-Species Habitat Conservation and Open-Space Plan (San Joaquin County, 2000). Setbacks range from 100 to 500 feet depending on bird species.

5.2.7.2.5 Measure 6—Waters of the United States

Although King Island, Rio Blanco Tract, and the White Slough WPCF lands are hydrologically isolated from waters of the United States, implementation measures provided in Section 5.15, Water Resources, would avoid any unanticipated potential impacts on waters of the United States. If a permanent or temporary discharge of dredged or fill material is anticipated, the following measures are may be required.

1. Direct impacts (i.e., discharge of dredged or fill material) to waters of the United States will be avoided to the greatest extent practicable. If complete avoidance of direct impacts is not practicable, impacts will be limited to the minimum area and linear distance necessary to accomplish the project objectives.
2. All required permits and authorizations will be obtained from USACE, the Regional Water Quality Control Board (RWQCB), and CDFW prior to any direct impacts on waters of the United States. All terms and conditions of the required permits and authorizations will be met.

3. To the extent practicable, all construction activities that involve direct impacts on waters of the United States will be conducted during the dry season (i.e., periods of low to no stream flow) to minimize the potential for erosion.
4. All waters of the United States temporarily impacted by construction activities will be restored, as close as practicable, to pre-construction contours and conditions upon completion of the project.
5. Appropriate sediment control measures (e.g., silt fences, catch basins) will be implemented in compliance with the project Stormwater Pollution Prevention Plan.
6. If work is to occur within ditches not subject to USACE jurisdiction and water is present within the ditches during construction, it is advised that any activities that affect the storm drain channels be conducted when they are dry.

5.2.8 Laws, Ordinances, Regulations, and Standards

The following sections describe the primary laws, ordinances, regulations, and standards (LORS) that apply to potential impacts on biological resources in the project area, and list the agencies responsible for enforcing the regulations.

5.2.8.1 Federal LORS

Rivers and Harbors Act, Section 10 (33 United States Code [USC] Section 401 et seq.) regulates the placement of structures in, under, or over "navigable waters of the United States" by the USACE. Projects are permitted under either individual or general (i.e., nationwide) permits. The specific applicability of the permit types is determined by the USACE on a case-by-case basis.

Clean Water Act of 1977, Section 404 (33 USC Sections 1251–1376) objective is to restore and maintain the chemical, physical, and biological integrity of the nation's waters. Discharge of dredged or fill material into waters of the United States, including jurisdictional wetlands, is regulated by USACE under Section 404 of the CWA. USACE regulations implementing Section 404 define waters of the United States to include intrastate waters, including lakes, rivers, streams, wetlands, and natural ponds, the use, degradation, or destruction of which could affect interstate or foreign commerce. To comply with the Section 404 policy that there be no net loss of wetlands, discharge into wetlands must be avoided and minimized to the extent practicable. Dredge or discharge into waters of the U.S. is permitted under either individual or nationwide permits. Dredge or discharge into wetlands would be replaced through enhancement, restoration, or creation; or through compensatory mitigation to replace the loss of wetland functions in the watershed.

Federal Endangered Species Act (16 USC Section 153 et seq.) prohibits the "taking" of a species listed as endangered or threatened (16 USC 1532, 50 Code of Federal Regulations [CFR] 17.3). "Take" under federal definition includes "such acts may include significant habitat modification or degradation" (50 CFR 17.3). Species that are not listed as threatened or endangered are not protected by federal ESA; however, USFWS advises that a candidate species could be elevated to listed status at any time and, therefore, applicants should regard these species with special consideration. The designation of critical habitat directly affects only federal agencies, by prohibiting actions they fund, authorize, or carry out from destroying or adversely modifying critical habitat. Applicants for projects that could result in adverse impacts on any species listed as threatened or endangered under the ESA or their habitat are required to consult with and mitigate for potential impacts on these species in consultation with USFWS and/or National Marine Fisheries Service (NMFS). Adverse impacts or take, is authorized under Section 7 or Section 10 consultation or with the issuance of an Incidental Take Authorization.

Magnuson-Stevens Fishery Conservation and Management Act (Public Law 104-267) establishes procedures designed to identify, conserve, and enhance EFH for species regulated under a federal fisheries

management plan. The Magnuson-Stevens Fishery Conservation and Management Act (MSA) requires federal agencies to consult with NMFS on all actions, or proposed actions, authorized, funded, or undertaken by the agencies, that may adversely affect EFH (MSA Section 305[b][2]). In instances where MSA and ESA issues overlap, NMFS encourages an integrated approach to consultation.

Migratory Bird Treaty Act (16 USC Sections 703 to 711) protects all migratory birds, including nests and eggs. A violation of the Act can result in a fine imprisonment, or both.

5.2.8.2 State LORS

Clean Water Act of 1977, Section 401 requires a state water pollution control agency to certify that a USACE permit action (or any federal action that authorizes discharges into waters of the United States) meets state water quality standards. The RWQCB requires that a project proponent apply for and obtain a CWA Section 401 Water Quality Certification for any project that requires a CWA Section 404 permit from USACE or other federal approval for discharge.

California Endangered Species Act (Fish and Game Code Section 2050 et seq.) protects species listed as threatened or endangered under the Act and candidate species. Species listed under this act cannot be "taken" or harmed, except under specific permit. "Take" means to do or attempt to do the following: hunt, pursue, catch, capture, or kill. Take of protected species incidental to otherwise lawful activities may be authorized under Section 2081 of the California Fish and Game Code (Incidental Take Permit).

Fish and Game Code Section 3503 (Nesting Birds) states that it is unlawful to take, possess, or needlessly destroy the nest or eggs of any bird, except as otherwise provided by this code or any regulation made pursuant thereto.

Fish and Game Code Section 3503.5 (Birds of Prey) states it is unlawful to take, possess, or destroy any birds in the orders of Falconiformes or Strigiformes (birds of prey) or to take, possess, or destroy the nest or eggs of any such bird, except as otherwise provided by this code or any regulation adopted pursuant thereto.

Fish and Game Code Section 3513 (Migratory Birds) states it is unlawful to take or possess any migratory nongame bird as designated in the Migratory Bird Treaty Act or any part of such migratory nongame bird except as provided by rules and regulations adopted by the Secretary of the Interior under provisions of the Migratory Bird Treaty Act. Under Code Section 3513, the CDFW may considerer impacts similar to those described above under the Migratory Bird Treaty Act a significant impact.

Fish and Game Code Sections 3505, 3511, 4700, 5050, and 5515 (Fully Protected Species) lists bird, mammal, amphibian, and reptile species that are fully protected in California. These species cannot be "taken," even with an incidental take permit.

The Native Plant Protection Act (Fish and Game Code Sections 1900 et seq.) prohibits the taking, possessing, or sale within the state of any rare, threatened, or endangered plants, as defined by CDFW. This prohibition applies to any plants with a state designation of rare, threatened, or endangered.

California Species of Special Concern (Title 14, California Code of Regulations, Sections 670.2 and 670.5) lists animals designated as threatened or endangered in California. California Species of Special Concern is a category conferred by CDFW on those species that are indicators of regional habitat changes or are considered potential future protected species. Species of Special Concern do not have any special legal status, but are intended by CDFW for use as a management tool to take these species into special consideration when decisions are made concerning the future of any land parcel.

Lake and Streambed Alteration Agreement (Fish and Game Code Sections 1601 through 1607) prohibits alteration of any stream, including intermittent and seasonal channels and many artificial channels, without

an agreement with CDFW. CDFW jurisdiction is generally limited to areas within the 100-year floodplain. Within this zone, CDFW jurisdiction is subject to the judgment of the department. This applies to any channel modifications that would be required to meet drainage, transportation, or flood control objectives of a project. Permission to alter or modify a lake or stream is authorized through a Lake or Streambed Alteration Agreement.

Porter-Cologne Water Quality Control Act regulates activities that result in the discharge of fill material into "State waters" that are not otherwise under USACE jurisdiction (e.g., "isolated" wetlands without a commerce connection or significant nexus to navigable waters of the United States). The RWQCB regulates all pollutant or nuisance discharges that may affect either surface water or groundwater. The RWQCB may require issuance of a Waste Discharge Requirements permit pursuant to the Porter-Cologne Water Quality Control Act (January 1, 2006) and in compliance with the California Wetlands Conservation Policy (August 23, 1993). Authorization of a Waste Discharge Requirements permit by the RWQCB is contingent upon approval of a mitigation plan whereby it is demonstrated that impacts on wetlands will not result in a net loss in quantity and quality.

California Environmental Quality Act (Public Resources Code Section 15380) defines "rare" in a broader sense than the definitions of threatened, endangered, or species of special concern. Under this definition, CDFW can request additional consideration of species not otherwise protected. CEQA requires that the effects of a project on environmental resources must be analyzed and assessed using criteria determined by the lead agency.

Warren Alquist Act (Public Resources Code Section 25000, et seq.) is a CEQA-equivalent process implemented by the CEC. Preparation of this application will result in an assessment prepared by the CEC staff to fulfill the requirements of CEQA.

5.2.8.3 Local and Other Jurisdiction LORS

The San Joaquin County Multi-Species Habitat Conservation and Open-Space Plan allows Plan Permittees (such as San Joaquin County and the cities within the county) to issue incidental take permits or allow project applicants to mitigate for impacts on Plan-covered species resulting from projects that would convert open space to urban development and other non-agricultural activities occurring on agriculturally-zoned properties. Participation in the Plan is voluntary for project applicants except when conditioned to participate by a Permittee. Project applicants that opt out of the Plan are required to satisfy applicable ESA, CESA, NEPA, CEQA, and other applicable local, state, and federal laws and regulations.

San Joaquin County General Plan protects vegetation, fish and wildlife resources including wetlands, riparian areas, rare, threatened and endangered species and their habitats, commercially important species, significant oak groves, and heritage trees (San Joaquin County, 1992). Resource Protection and Management policies include no net loss of riparian or wetland habitat, and maximizing long-term protection of significant oak groves.

San Joaquin County Development Title (Ordinance 4368, Chapter 9-1500) requires an improvement plan and replacement plantings at specified ratios for the removal of significant tree resources (e.g., native oak trees, heritage trees and riparian habitat).

City of Lodi (Ordinance Number 1652) prohibits removal or damage to any City trees, shrubs, and plants; however, authorization to remove trees is not stipulated.

5.2.9 Agencies and Agency Contacts

Table 5.2-3 provides the contact information of the agencies may have involvement with the project depending on project design and funding.

TABLE 5.2-3
Agency Contact Information for Biological Resources

Issue	Agency	Location
River and Harbors Act Section 10 and CWA Section 404 permit to fill wetlands and waters of the United States	U.S. Army Corps of Engineers	Sacramento District 1325 J Street Sacramento, CA 95814-2922
CWA Section 401 Water Quality Certification	Regional Water Quality Control Board	Central Valley Regional District-Sacramento Office 11020 Sun Center Drive, Suite 200 Rancho Cordova, CA 95670-6114
San Joaquin County Multi-Species Habitat Conservation and Open Space Plan	San Joaquin Council of Governments	555 E. Weber Ave. Stockton, CA 95202-2804
ESA Section 7 or Section 10 Consultation	U.S. Fish and Wildlife Service	Bay Delta Fish & Wildlife Office 650 Capitol Mall Suite 8-300 Sacramento, CA 95814
ESA Section 7 or Section 10 Consultation for anadromous fish	National Marine Fisheries Service	West Coast Region 650 Capitol Mall, Suite 5-100 Sacramento, CA 95814
CESA Incidental Take Permit and Stream Alteration Agreement	California Department of Fish and Wildlife	Bay Delta Region 7329 Silverado Trail Napa, CA 94558

5.2.10 Permits, Authorizations, and Compensatory Mitigation

This section provides a comprehensive analysis of the potential permits, authorization, and compensatory mitigation that could be expected with the construction of the proposed project. Table 5.2-4 summarizes the discussion of potential permits required as well as data requirements, responsible agencies, regulatory nexus, permit timeline, mitigation measures, compensatory mitigation, and other fees. Approximate cost for compensatory mitigation and other fees are as of April 2015. The fee schedule for most agencies and organizations are revised annually.

5.2.10.1 U.S. Army Corps of Engineers

The HDD under Bishop Cut and Dredger Cut would require USACE authorization under Section 10 of the Rivers and Harbors Act. Authorization would likely be permitted under Nationwide Permit 12 (Utility Line Activities). Given the presence of listed species (i.e., salmon, steelhead, Delta smelt, giant garter snake), USACE would be required to consult with NMFS and USFWS. No other construction activities would result in a loss of wetlands, so no compensatory mitigation for wetland loss is anticipated.

5.2.10.2 Regional Water Quality Control Board

Authorization under Nationwide Permit 12 for Rivers and Harbors Act Section 10 would require the Central Valley RWQCB to certify that a USACE permit action meets state water quality objectives. The fees for water quality certification are $5,670 per acre or $13.50 per linear foot, whichever is greater (effective September 18, 2014).

The RWQCBs regulate wastewater discharges to surface waters under the National Pollutant Discharge Elimination System Wastewater Program; stormwater discharges are generally regulated under the *General*

Permit for Storm Water Discharges Associated with Construction Activities (General Permit). Because the proposed project would result in more than 1 acre of ground disturbance, a Notice of Intent must be submitted to be covered under the General Permit and a Stormwater Pollution Prevention Program must be prepared and implemented. The project may qualify for specific coverage as a Linear Underground/Overhead Project due to the acreage disturbed by the multiple pipelines associated with the project.

5.2.10.3 U.S. Fish and Wildlife Service and National Marine Fisheries Service

Due to the presence of habitat for species listed as threatened or endangered under the federal ESA, issuance of a permit under Section 10 of the Rivers and Harbors Act by the USACE would require consultation with the USFWS and NMFS to determine if the project would have adverse effects on listed species (i.e., salmon, steelhead, Delta smelt, giant garter snake). It is anticipated that the project would not result in adverse effects on these species, so the consultation is anticipated to be informal and a letter of concurrence from USFWS and NMFS is expected. The letter of concurrence would outline the avoidance and minimization measures to avoid impacts on listed species.

While it is anticipated habitat impacts will not exceed one season and will be restored, if the habitat cannot be restored or the work will require more than one season to complete, the programmatic Biological Opinion requires compensatory mitigation for habitat loss. USACE and USFWS have an existing programmatic Biological Opinion for giant garter snake. Trenching would be anticipated to result in only temporary impacts and to be completed within one season. For impacts that are temporary (e.g., restored to pre-construction conditions) and that are completed within one season, the compensatory mitigation under the programmatic Biological Opinion is limited to restoration of the habitat and one year of monitoring and reporting.

If the habitat cannot be restored or the work will require more than one season to complete, the programmatic Biological Opinion requires compensatory mitigation for habitat loss. Ratios for compensatory mitigation range from 1:1 to 3:1. Per acre fees range from $14,543 (effective January 1-December 31, 2015) (USFWS approves payment of SJMSCP fees, see below) to $50,000 (approximate rates, negotiable) (USFWS requires purchase of mitigation bank credits).

5.2.10.4 California Department of Fish and Wildlife

5.2.10.4.1 California Endangered Species Act

Given that Delta smelt, Chinook salmon, longfin smelt, giant garter snake, California black rail, and Swainson's hawk habitat, which are either listed as threatened or endangered under the CESA, are present in the project area, if the project were expected to take any species listed under the CESA, an incidental take permit issued by CDFW would be required. Avoidance and minimizations measures can be applied to avoid the take of a CESA-listed species and an incidental take permit is not expected.

Per acreage cost for the loss of foraging habitat for Swainson's hawk would be $7,000-10,000 per acre through a mitigation bank (approximate rates, negotiable) or could be mitigated through the SJMSCP at $14,543 per acre (effective January 1-December 31, 2015).

5.2.10.4.2 Streambed Alteration Agreement

The HDD under Bishop Cut, Dredger Cut, and White Slough WA would require notification to CDFW and may require a Streambed Alteration Agreement. CDFW assesses fees for reviewing notifications and issuing Streambed Alteration Agreements. Fees are assessed per crossing and are based on the cost of the work involved in the constructing the crossing. Fees are assessed by crossing and range from $246 (cost of crossing is less than $5,000) to $4,913 (cost of crossing is greater than $500,000) (per CDFW website fee schedule, April 2015).

5.2.10.5 San Joaquin Multi-Species Habitat Conservation and Open-Space Plan

Although the CEC would be lead agency for the project, the project proponent may seek coverage under the SJMSCP for most species except fish under NMFS jurisdiction. Additionally, the area in which the project is proposed is excluded from coverage under the SJMSCP for giant garter snake due to the proximity of the project to White Slough WA. To gain coverage under the SJMSCP for all other species included in the SJMSCP, the proponent applies for coverage, the technical committee reviews and approves the project for coverage, and the board makes the final approval. The SJMSCP provides coverage for effects on federal and State-listed species with implementation of the prescribed avoidance and minimization measures, and mitigation fees are assessed for habitat loss (other allowable options for compensatory mitigation include conservation easements, mitigation bank credits, and custom mitigation plans).

For all other species requiring coverage (e.g., Swainson's hawk), the fee for Agricultural Land is $14,543 or in lieu land could be purchased at a 1:1 to 3:1 ratio for project site acres depending on the agricultural land type, and an endowment fee of $5,116 (impacted land only). The project is estimated to result in the loss of approximate 30 acres of agricultural land (ECF site, King Island well pad expansion, new well pad), which could result in estimated SJMSCP fees for the project of $436,290 (based on January 2015 quotes).

5.2.10.6 Recommendations to Support Permitting and Other Authorizations

The following measures and/or studies are recommended or may be required to support permitting and other project authorizations.

- For most species, standard mitigation measures, and best management practices would be implemented to avoid impacts on these resources (e.g., special-status fish, giant garter snake, western pond turtle, and special-status birds and bats). Standard measures may include preconstruction surveys, construction monitoring, limited operating period, and resource avoidance by applying no-construction buffers around nests or other sensitive habitat (e.g., burrows).
- A formal determination of waters of the United States would also assist in project design to avoid impacts on waters of the United States, which could reduce or eliminate permitting or permit conditions. If it appears that potential waters of the United States cannot be avoided, a formal delineation of waters of the United States would be required to support the permit application for a CWA Section 404 and 401 authorizations by USACE and the RWQCB, respectively.
- Because the project design, permitting and construction period is undefined, CDFW may ask for additional or updated plant surveys.

TABLE 5.2-4

Summary of Permit and Authorization Requirements and Potential Mitigation Obligations

Permits/ Authorizations	Responsible Agency	Regulatory Framework	Data Requirements/ Analysis Required	Permit Timeline (approximate)	Avoidance and Mitigation Measures	Compensatory Mitigation or Other Fees (2015)
Nationwide Permit 12 (Utility Line Activities)	USACE	River and Harbors Act, Section 10 Potentially CWA, Section 404	Delineation of waters of the United States	45 days to acknowledge receipt of application	Standard water quality best management practices HDD frac-out contingency plan	$0 –Rivers & Harbors $130,000/ac for wetland permanent impacts—CWA 404
Water Quality Certification (only required if CWA Section 404 is required)	Central Valley RWQCB	CWA, Section 401 River and Harbors Act, Section 10 Nationwide Permit 12	Delineation of waters of the State	6–12 months – issued following CEC approval	N/A	$5,670/ac Or $13.50/lf whichever is greater.
Letter of Concurrence or Biological Opinion	USFWS	Endangered Species Act Magnuson-Stevens Fishery Conservation and Management Act	Evaluation of Effects on Listed Species or Biological Assessment	Undetermined	Preconstruction surveys Resource Avoidance Biological Monitoring	Compensatory mitigation not required for temporary impacts to upland habitat if completed within one year.
Incidental Take Permit	CDFW	California Endangered Species Act Section 2081	Protocol-level Swainson's hawk surveys	N/A	Implementation of mitigation measures for Swainson's hawk and California black rail would avoid the need for this permit.	$7,000–10,000/ac of lost foraging habitat (mitigation bank) $14,543/ac (SJMSCP)
Lake and Streambed Alteration Agreement	CDFW	Fish and Game Code 1602	Biological resources assessment	6–12 months-issued following CEC approval	Standard water quality best management practices HDD frac-out contingency plan Replace riparian trees at a 3:1 ratio if removed.	$246 (cost of crossing is < $5,000) 4,913 (cost of crossing is > $500,000)

TABLE 5.2-4

Summary of Permit and Authorization Requirements and Potential Mitigation Obligations

Permits/ Authorizations	Responsible Agency	Regulatory Framework	Data Requirements/ Analysis Required	Permit Timeline (approximate)	Avoidance and Mitigation Measures	Compensatory Mitigation or Other Fees (2015)
CEC-CEQA equivalent (Application for Certification)	CEC	Warren Alquist Act	Baseline biological conditions	Undetermined	Preconstruction surveys Resource Avoidance Biological Monitoring	N/A

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5.3 Cultural Resources

This section discusses the potential effects of the King Island CAES Project (KICP) on cultural resources. This section is consistent with state and federal regulatory requirements for cultural resources pursuant to the California Environmental Quality Act (CEQA), and Section 106 of the National Historic Preservation Act (Section 106). Cultural resources include prehistoric and historic-era archaeological sites such as districts and objects; standing historic structures, buildings, districts and objects; locations of important historic events, and sites of traditional/cultural importance to various groups. The study scope was developed according to California Energy Commission's (CEC) cultural resources guidelines and complies with *Instructions to the California Energy Commission Staff for the Review of and Information Requirements for an Application for Certification* (CEC, 1992) and *Rules of Practice and Procedure & Power Plant Site Certification Regulations* (CEC, 2007). This study was conducted by Brian Ludwig, Ph.D., North State Resources, Inc. (NSR) who meets the qualifications for Principal Investigator stated in the Secretary of the Interior's standards and guidelines for archaeology (U.S. National Park Service, 1983).

Appendix 5.3A provides the cultural resources technical report. Appendix 5.3B contains the California Historical Resources Information System (CHRIS) literature search results. Appendix 5.3C provides names and qualifications of personnel who directed this study, and Appendix 5.3D is a map showing the locations of cultural resources relative to the project site (the ECF site, well pads, and linear components, as described in Section 2.0, Project Description and shown on Figure 1.2-2). Appendixes 5.3A, 5.3B, and 5.3D would be filed with the CEC under a request for confidentiality and are not included with this document (access can be arranged to qualified personnel or on a need-to-know basis).

5.3.1 Affected Environment

In central California, cultural resources extend back in time for at least 11,500 years and written historical sources tell the story of the past 200 years. Archaeologists have reconstructed general trends of California prehistory including in the general vicinity of the project. Several chronologies have been proposed for central California archaeology. Generally, these chronologies are variations based on the general California chronology, which consists of an Early Horizon, a Middle Horizon, and a Late Horizon (Fredrickson, 1974; Elsasser, 1978). However, wide regional differences in central California, as well as significant temporal overlap between site types classified into these three horizons, prevented clear distinctions between horizons. Eventually, a model was proposed for central California that primarily emphasized the patterns of cultural identity and deemphasized associated occupation dates (Moratto, 1984).

5.3.1.1 Regional Setting

Human occupation in the Sacramento-San Joaquin Delta region may have occurred as early as 12,000 years ago, but few archaeological sites pre-dating 5,000 years before the present (BP) have actually been documented in the Delta or the broader Central Valley. It is possible that Holocene alluvial deposits buried many sites and the dynamic nature of the Delta and Central Valley waterways have obscured and destroyed earlier locales. For example, Moratto (1984:214) estimates that as much as 10 meters of sediment accumulated along the lower stretch of the Sacramento River drainage system during the last 5,000 to 6,000 years. One of the few early sites in the region is CA-CCO-637 in eastern Contra Costa County, which dates to approximately 8,500 BP and was found in an alluvial fan near present-day Kellogg Creek (Meyer and Rosenthal, 1998). Regardless of the location and age of archaeological deposits in the area, the Delta has been an attractive place for prehistoric, ethnographic, and historic-era settlement due to its ecologically diverse setting and general ease of access to the wider region.

5.3.1.2 Prehistory

California prehistory is divided into three periods that reflect similar cultural characteristics throughout the state: Paleo-Indian period (ca. 12,000–8,000 BP), Archaic period (8,000–1,500 BP), and Emergent period (1,500 BP–Euro-American contact) (Fredrickson, 1973 and 1974). The Archaic is divided further into Lower (8,000–5,000 BP), Middle (5,000–3,000 BP), and Upper (3,000 BP–1,500 BP) periods, which are defined by dramatic environmental changes and variability in subsistence, settlement, and technological systems seen in the archaeological record. No sites dating to the Paleo-Indian period have been discovered in the general vicinity of the project site.

Prehistoric material culture in central California subsequent to the Paleo-Indian and Lower Archaic periods has been categorized according to "horizons" or "patterns" that define broad technological, economic, social, and ideological elements over long periods of time and large areas. Fredrickson (1973, 1974) defined three regional patterns that are most relevant to the general region, three of which are specific to the prehistory of the project area. Referred to as the Windmiller, Berkeley, and Augustine patterns, each represents a general pattern of resource exploitation and cultural manifestations and occurred between about 4,500 BP and Euro-American contact around the year 1800.

5.3.1.2.1 Windmiller Pattern (4,500–2,500 BP)

Middle Archaic Windmiller Pattern sites date to as early as 4,500 BP and extend to as late as 2,500 years ago. Windmiller sites appear to indicate an extensive reliance on plant foods although a wide variety of faunal remains have been noted as well. The presence of fish hooks and probable net and line sinkers along with the remains of sturgeon, salmon, and smaller species, indicate that fishing was an additional and important source of food (Fredrickson, 1973; Heizer, 1949; Ragir, 1972). Items made of baked clay included net sinkers, pipes, and manufactured cooking "stones" in an environment where suitable natural cobbles were generally scarce. Ground and polished charmstones, impressions of twined basketry, shell beads, and bone tools also have been found at Windmiller Pattern sites. Some items, such as shell beads, obsidian tools, and quartz crystals, were obtained by trade. Windmiller people appear to have resided in the Sacramento Valley during the winter months but shifted to higher elevations during the summer (Moratto, 1984:206). Mortuary practices included the frequent addition of grave goods in the interments and the deceased were buried in cemeteries that were separate from the habitation sites.

5.3.1.2.2 Berkeley Pattern (2,500 BP–1,500 BP)

By around 2,500 BP, the archaeological record begins to show changes to more specialized adaptive patterns characteristic of the Berkeley Pattern. Acorns become a significant dietary staple and this shift can be seen in a dramatic increase in the occurrence of mortars and pestles on sites as opposed to manos and metates, which were far more common during the Windmiller. Mortars and pestles are better suited to crushing and grinding acorns, whereas manos and metates were used primarily for grinding wild grass grains and seeds (Moratto, 1984:209–210). The archaeological record, however, clearly indicates that hunting continued to be an important source of food and useful materials (Fredrickson, 1973:125–126). In addition, Berkeley Pattern sites adjacent to bay and coastal shorelines often include significant shell mounds and middens indicating an intensive use of both fresh and salt water aquatic resources.

Artifact assemblages and radiocarbon dates from Berkeley Pattern sites suggest the subsistence and technological patterns characteristic of this time may have developed in the San Francisco Bay region and later spread into central California. Moratto (1984:207–211) suggests the pattern may be associated with an expansion of Eastern Miwok populations from the San Francisco Bay area to the Central Valley and into the Sierra foothills.

5.3.1.2.3 Augustine Pattern (A.D. 500–historic contact)

The Augustine Pattern is marked by shifts in subsistence and land-use patterns that begin to resemble those noted in ethnographic observations. Tools and cooking implements include shaped mortars and pestles, hopper mortars, bone awls used for producing coiled baskets, and the bow and arrow. A type of pottery, referred to as *Cosumnes Brownware*, appears in some parts of the Central Valley and may have evolved from the baked clay industry so prominent during earlier times.

During this period, increased sedentism, social stratification, and the rise of elaborate ceremonies and social organizations can be seen. Exchange networks expanded and became more complex during this time (see Fredrickson, 1973; Moratto, 1984). Distinctive artifacts including flanged tubular pipes, harpoons, and Gunther barbed series projectile points are found on these sites. Moratto (1984: 211–214) suggests that these occurrences accompanied by the other notable aspects of the Augustine Pattern may represent a southward expansion of Wintu populations and territory.

5.3.1.3 Ethnography

The project area and surrounding area are situated within an area traditionally occupied by the Native American group known as the Eastern Miwok and, more specifically, the Plains Miwok. During later prehistoric and early historic times, the Plains Miwok resided in the lower Sacramento River Valley from just north of the Cosumnes River to the south including the lower San Joaquin River drainage and the western ends of the Mokelumne River. This area is roughly bounded by present-day Sacramento on the north and the Stockton area to the south. However, the northern boundary may not have been as firm as indicated in some ethnographic sources because archaeological evidence along the Cosumnes River suggests that the Nisenan may have displaced the Miwok in this region during later prehistoric times (Deis, 1996; Grantham, 1993).

While the Plains Miwok shared a common language and cultural background, they consisted of a number of separate and politically independent nations or “tribelets” with the *Guayapemne* tribelet probably having inhabited the project area and surrounding region early during the ethnographic era (see Kroeber, 1925). Each tribelet was an independent and essentially a sovereign nation comprising several lineages that were localized and named for specific geographical locations. Tribelets consisted of a number of permanently inhabited and seasonally occupied locales, with control of the natural subsistence and material resources contained within a bounded area (Levy, 1978:398). Subsistence targeted a broad spectrum of flora and faunal resources. Of the plant species, the valley oak was the most valued, with buckeye, laurel, and hazelnut also having been used. Wild oats and balsam root, several species of edible roots, and greens such as wild pea and miner’s lettuce, berries, and a number of different mushroom varieties were consumed. Tule elk and pronghorn antelope were the most important faunal species exploited for food and materials and various species of rabbit were hunted in the summer. Waterfowl and fish, especially salmon, were also extremely important food sources for the Eastern Miwok (Aginsky, 1943:397-398).

Spanish expeditions to the Sacramento-San Joaquin Valley in the latter eighteenth century had first contact with indigenous populations in the westernmost, delta portions of the Plains Miwok’s territory. Several names of Native Americans appear in the Book of Baptisms of Mission San Jose in 1811, indicating that Spanish raids resulted in the capturing of native peoples. Unfortunately, the large-scale depopulation of native peoples from the Central Valley in the early nineteenth century led to a loss of cultural ways and geographical knowledge among the Plains Miwok and other groups during this time. However, in later years, Eastern Miwok tribelets became united and allied with Yokuts groups to the south in an attempt to resist incursion by the Spanish military (see Kroeber, 1908; Merriam, 1907).

A subsequent phase of Euro-American impacts to the Plains Miwok consisted of the rapid influx of fur trappers, would-be miners, and settlers following the establishment of the Mexican land-grant ranchos and the Gold Rush. Plains Miwok people adapted as best they could and many hired on to the newly established ranches and farms as laborers. For example, members of the Ochehamne Plains Miwok tribelet were employed at Sutter's Fort (Forbes, 1969). By the early twentieth century, most Eastern Miwok resided on small parcels or *rancherias* and were largely marginalized from the predominant Euro-American population. In general, despite some organized resistance during the early and middle decades of the nineteenth century, most Eastern Miwok groups were no longer in existence as recognizable cultural and political entities. For example, Merriam apparently interviewed the last known Guayapemne individual in 1905 who was at the time living on Sherman Island in the Delta (Merriam, 1966-1967).

Despite their near-disappearance by the late nineteenth and early twentieth centuries, many Eastern Miwok continued to maintain some of their traditional ways and identity. Many of the rancherias established during earlier years were disbanded in 1958 following enactment of the California Rancheria Act, which was part of a federal policy intended to further assimilate California native peoples. The Wilton Rancheria, home to many Plains Miwok and other Miwok peoples, was one of those that was subject to the policy. However, in 2009, the Wilton Rancheria Indian Tribe was re-recognized and they were re-formed as the Wilton Rancheria Miwok and the Me-Wuk Indian Community of the Wilton Rancheria.

5.3.1.4 Historic Setting

The historic period in the Stockton/Lodi area and in San Joaquin County essentially began in 1813 when Lieutenant Gabriel Moraga led an expedition in search of new mission sites into the lower portion of the Central Valley. During this expedition, Moraga christened the large river he travelled on in honor of Saint Joachim and by 1810 the river was commonly referred to as the San Joaquin (Hoover et al., 2002:369). Little in the way of sustained European contact with the Plains Miwok occurred during the earliest years of the nineteenth century although later immigrants were attracted to the abundance of game and fur-bearing animals. In 1827, American explorer and trapper Jedediah Smith traveled through the San Joaquin Valley and others soon followed, including parties from the Hudson's Bay Company in 1832 (Hoover et al., 2002:370).

5.3.1.4.1 Stockton

Just as the region was being settled in earnest, San Joaquin County was designated in 1850 as one of the original 27 counties established in California (Hoover et al., 2002:369). The county's location in the center of the state between the Sierra Nevada to the east and San Francisco to the west made it an important center for the early development of California's transportation infrastructure and the agricultural industry. "Captain" Charles M. Weber was instrumental in developing the City of Stockton as the county seat and as a major port of overland and marine entry. This was fostered by the presence of the confluence of the Sacramento and San Joaquin rivers that constitute the major drainages of the northern and southern portions of the Central Valley. Ships today still deliver cargo to the Port of Stockton via the Stockton Channel, the deep-water slough that leads into the San Joaquin River, next to which Captain Weber laid out the town of Tuleburg (now Stockton) in 1847.

Prior to establishing the town, Weber tried his hand at mining, forming the Stockton Mining and Trading Company, but then realized that he could reap large rewards by establishing a town and supply center to cater to the miners. The town was resurveyed and the name was changed to Stockton, after Commodore Robert F. Stockton. By the winter of 1850, the population of Stockton had increased to 5,000 (Marvin, 1998). Following the Gold Rush, additional growth in the city and in San Joaquin County was spurred again by the arrival of rail transportation. Lines built in the Stockton area included the San Francisco & San

Joaquin Valley Railway Company, which began construction of a line from Stockton to Bakersfield in 1895 (Holterhoff, 1914).

5.3.1.4.2 Lodi

As people sought out new rich agricultural and farming lands, and disillusioned would-be miners returned to more stable endeavors, the population in the Central Valley increased dramatically during the 1850s. When one group of families in the vicinity of what would become Lodi decided to establish a school in 1859, they settled on a site near present-day Cherokee Lane and Turner Road thereby essentially marking the beginnings of a new town. Growth was apparently slow during this time but in 1869, the Central Pacific Railroad was in the process of creating a new route, and pioneer Lodi settlers Ezekiel Lawrence, Reuben Wardrobe, A.C. Ayers, and John Magley offered a townsite of 160 acres to the railroad as an incentive to build a station there. The railroad received a "railroad reserve" of 12 acres in the middle of the nascent town, and surveyors began laying out streets in the area between Washington to Church and Locust to Walnut. The new settlement was initially named the Town of Mokelumne and was planned to benefit from the railroad connection between Sacramento and Stockton. However, to avoid confusion with the previously established towns of Mokelumne Hills and Mokelumne City, the townspeople changed the name to Lodi in 1874 (Gudde, 1998).

The origins of the town name were never recorded although historians have suggested several possibilities. One suggests the town was named in honor of "Lodi," a locally stabled trotting horse that had set a 4-mile record in 1869, the year the town was formally established. However, more than likely, with some of the earliest settlers of the town apparently having originally hailed from Lodi, Illinois, they named the new town in honor of their old home.

5.3.1.4.3 Agriculture

A wide variety of crops were being grown in the Lodi area but by the 1880s, table and wine grapes were rapidly becoming prominent agricultural products. Japanese and German immigrants were instrumental in establishing grapes as a major crop including the famous Flame Tokay variety. The Flame Tokay was particularly significant in that it was seedless, had a relatively tough skin, and could withstand the rigors of packing and shipping to distant markets. By 1900 there were over two million grape vines planted just in the immediate Lodi area. In recognition of the grape's impact on the local economy, the town organized the Tokay Carnival in 1906 (Lodi was officially incorporated that same year) and the famous Lodi Arch, which covers the gateway entrance to downtown, was built to commemorate that event in 1907. The event has been held every year since although today it is called the Lodi Grape Festival.

The federal designation of Lodi as a wine grape growing district in 1956 and the city's continued growth led to the creation of numerous schools and public utilities and services throughout the second half of the twentieth century. Since the mid-1990s, the city has been involved in numerous restoration projects for historic resources throughout the city, including the City Hall, the Lodi Arch, and the Southern Pacific Lodi Train Station.

In Stockton, the economy has continued to grow and diversify. Today, Stockton is a hub of rail, water, and highway transportation linking the rich agricultural industries to world markets. The continued need for agricultural workers in particular has led to the ethnically diverse population that is present today (Johnston et al., 1993).

5.3.1.4.4 Land Reclamation: King Island and the Rio Blanco Tract

The project site is situated on King Island (Reclamation District 2044) and on the Rio Blanco Tract (Reclamation District 2114), both of which consisted almost entirely of marshes and wetlands reclaimed for agricultural purposes during the early twentieth century. Delta land reclamation techniques dating to as early as the middle decades of the nineteenth century consisted of constructing levees around an area

sometimes loosely defined by natural channels and then draining (typically by pumping) the water within the leveed terrain. Once the area had been sufficiently drained and dried, it was graded and used for agricultural purposes. The rich organic soils were largely derived from thousands of years of wetland vegetation build-up. The surrounding levees were typically constructed from dredge spoils removed from the natural and artificial channels such as Bishop Cut. King Island, as a dry landform, appears to have been created through the technique of levee construction and draining typically found in the Delta. Consequently, prior to its creation as a dry land mass in the early mid-twentieth century, King Island was a marsh and wetland likely inundated throughout the year. The western half (approximately) of the Rio Blanco Tract also appears to have constituted a wetland likely also inundated much of the time.

Reviews of historical mapping including U.S .geological Survey (USGS) topographic quadrangles, U.S. General Land Office plat maps, and other mapping, clearly indicates that prior to the 1920s, King Island and a portion of the Rio Blanco Tract were marshes and wetlands that had yet to be leveed and converted to agricultural land use. However, the beginnings of land reclamation activities can be seen in the initial development of a canal that would eventually become Bishop Cut, creating the eastern boundary of King Island. Subsequent USGS mapping dating to 1952 shows how King Island and the Rio Blanco Tract were developed and by this time had evolved into their present-day configurations.

According to mapping data provided by Whipple et al. (2012), major reclamation activities occurred on King Island starting in 1914 that eventually led to the island's boundaries being defined by the completion of Bishop Cut in the east, Honker Cut in the west, and the expanded and partially channelized Disappointment and White sloughs to the south and north, respectively. According to a 1915 map of San Joaquin County (San Joaquin Valley Counties Association,1915), Bishop Cut and Honker Cut were both complete at that time, although it is not clear as to what degree Disappointment and White sloughs had been channelized and modified.

Indirect information regarding the time by which King Island had been fully established as an agricultural property can be found in references dating to the early 1940s. During World War II, an agricultural branch prisoner-of-war (POW) camp housing approximately 251 German prisoners was established on King Island. This facility was associated with a larger U.S. Army depot and POW camp (Camp Stockton) located just to the east outside of the city of Stockton (California State Military Museum, 2011). Although little additional information about the POW camp and operations appears to be available, the presence of such a sizable agricultural labor force on the island clearly indicates the area had likely been reclaimed and farming established for some time.

5.3.1.5 Resources Inventory

All project components were subjected to a detailed cultural resources inventory. This inventory included archival research conducted through the Central California Information Center (CCIC) of the California Historical Resources Information System, a review of other sources including the USGS Historical Topographic Map Collection, and an intensive surface pedestrian survey.

Previous surveys conducted for previous phases of the KICP included a survey conducted for the KICP core drilling phase that included the east well pad and access roads (SWCA, 2012) included here as Appendix 5.3E, and a survey of the well pad expansion and 12-kilovolt (kV) distribution line conducted for the KICP compression testing phase (North State Resources [NSR], 2013) included here as Appendix 5.3F.

5.3.1.5.1 Archival Research

In order to determine if any documented cultural resources are known to exist within or near the project area and if any cultural resources studies have been previously conducted in the immediate area, the CCIC

performed a records search for the project area and within a 1-mile radius. This search included, but was not necessarily restricted to, a review of the following sources:

- National Register of Historic Places (NRHP)
- California Register of Historical Resources (CRHR)
- California Inventory of Historic Resources (1976 and updates)
- California Historical Landmarks (1996)
- California Points of Historical Interest (1992 and updates)
- Directory of Properties in the Historic Property Date File
- Archaeological Determinations of Eligibility (Office of Historic Preservation, 2012)
- Historical USGS maps
- General Land Office plat maps

According to the results of the CCIC record search, eight cultural resources features have been identified within the project area or in the vicinity (Table 5.3-1).

None of the resources identified by the CCIC or NSR research within or outside of the project area has been recommended eligible for inclusion in the NRHP or remain unevaluated for listing eligibility (see SWCA, 2012).

TABLE 5.3-1
Previously Identified Cultural Resources Situated within and near the Project Area

CCIC Site No.	Association	Type	Location
P-39-004492	Historic era	Southern Bishop Tract Farm	Outside project area
P-39-004540	Historic era	Bridge 29C-0219	Outside project area
P-39-005146	Historic era	Agricultural building	Outside project area
P-39-005147	Historic era	Agricultural building	Outside project area
P-39-005148	Historic era	Agricultural building	Outside project area
P-39-005149	Historic era	Bishop Cut	Air pipeline crosses Bishop Cut
n/a	Historic era	Bridge 29C-0114 over Bishop Cut	Outside project area
n/a	Historic era	Bridge 29C-0290 over Telephone Cut	Outside project area

Historical mapping shows early transportation and agricultural developments in the area, including irrigation ditches and roadways dating as early as 1853. These features indicate that the project vicinity and the larger present-day Stockton/Lodi area was being settled and the landscape was being modified largely for agricultural purposes in the years immediately following the Gold Rush. Although information provided by the CCIC does not indicate purchase or patent dates, by the early 1880s the Rio Blanco Tract area and lands immediately to the east appear to have been owned by Mrs. Isabel Treadway, B. V. Kettleman, and possibly a Mr. John C. White. No further information was available through the CCIC regarding these persons, although Mrs. Treadway appears to have died in 1889 and was interred in the Live Oak Cemetery that was established in 1860 in the Lodi area (Filbin, 2004). The Treadway, Kettleman, and White families were early and prominent residents of San Joaquin County and established some of the more significant commercial enterprises in the region. For example, John C. White appears to have operated a brick factory in Stockton as early as 1851 (Boynton, 1968).

Sixteen prior cultural resources investigations have been conducted in the project area and within the 1-mile study area radius (Table 5.3-2). Six of these studies included at least portions of the current project area.

TABLE 5.3-2
Cultural Resources Studies Previously Conducted in/near the Project Area

CCIC Study No. (SJ-)	Date	Title	Author
00767	1982	Cultural Resource Investigations of the Eight Mile Road Bridge No. 1043 over Bishop Cut, San Joaquin County, California	L. Kyle Napton, Ph.D.
00850	1990	A Cultural Resources Inventory of Four Alternative Power Plant Locations for the Northern California Power Agency Stand Alone Combined Cycle Project, Placer and San Joaquin Counties, California	Eric Wohlgemuth – Far Western Anthropological Research Group
02590	1995	An Archaeological study of the Proposed Spanos Park Golf Course located in portions of the Bishop Tract T3N/R5E, MDM, San Joaquin County, California	Jack Meyer, Ph.D. Sonoma State University Academic Foundation
05534	2003	A Cultural and Paleontological Resources Study for the Paradise Hill Development Project. Stockton, San Joaquin County, California	John Kelly, Susan Huster LSA Associates, Inc.
06354	2007	A cultural and Paleontological Resources Study for the Shin Kee Tract Wetland Restoration Project near Stockton, San Joaquin County, California.	Michael Konzak, Any Grass LSA Associates, Inc.
06410	2005	A Cultural and Paleontological Resources Study for the Spanos Parcel Project. Stockton, San Joaquin County, California	Kelley, et al. LSA Associates, Inc.
06687	2006	Archaeological and Historical Investigations for the White Slough Water Pollution Control Facility Improvement Project	Pacific Municipal Consultants
06701	2008	Archaeological Survey Report for the Interstate 5 North Stockton corridor Interchanges Improvements Project. Stockton, San Joaquin County, California	Karin Goetter LSA Associates, Inc.
06717	2008	Historic Property Survey Report for the Interstate 5 North Stockton Corridor Improvement Project, Stockton, San Joaquin County, California	Karin Goetter LSA Associates, Inc.
06770	2008	Lodi Energy Center Project (LEC); Cultural Resources Assessment	Natalie Lawson CH2M HILL
06791	2005	Cultural Resources PEAR section – Interstate 5 North Stockton Corridor Improvement Project.	Kaptain LSA Associates, Inc.
06843	2007	Stockton Delta Water Supply Project Cultural Resources Inventory Report.	ESA Associates
07085	2008	Draft Environmental Assessment for the North Area Right-of-Way Maintenance Program	Aspen Environmental Group
07445	2010	Archaeological Inventory Survey – Lodi EUD Transmission Line Project, c. Seven-Mile Linear Corridor, San Joaquin County, California.	Sean Michael Jensen Genesis Society
	2012	Cultural Resource Survey for the PG&E CAES-King Island Project, San Joaquin County, California.	Steven Treffers, John Dietler, SWCA Environmental Consultants
07781	2013	Cultural Resources Inventory and Evaluation Report – Compressed Air Energy Storage Compression Testing Project, King Island, San Joaquin County, California	Brian Ludwig, Ph.D. North State Resources, Inc.

Additional research conducted by NSR further indicated that no prehistoric or historic-era cultural resources have been documented within or near the project area. In addition, review of present-day and historical mapping does not suggest that any potentially sensitive landforms or landscape features, such as natural creek channels, appear to have existed in the project area or its vicinity prior to the large-scale landscape

modifications (grading for agricultural purposes and roadways) that have occurred since the nineteenth century. NSR also consulted the online soils mapping site developed by the Natural Resources Conservation Service (NRCS) (U.S. Department of Agriculture, 2013). In the Sacramento-San Joaquin Delta region, specific soil types can be associated with landforms that were once favored by early Native Americans for habitation. These landforms once constituted high, dry ground within a broader setting that was often flooded. Where these soil types ("Piper series" deposits) are found, in general, prehistoric materials and significant sites are also located. However, a review of the soils mapping and previous cultural resources management reports indicate that such deposits are not located in the project area or in the general vicinity.

Soil types found within and near the project site are those commonly associated with reclaimed marsh lands. For example, on King Island, Klingile muck and the Klingile-Ryde complex soils are derived from organic materials and some alluvial deposition. Prior to twentieth-century reclamation, King Island and lands to the east were inundated marsh. On the Rio Blanco Tract, deposits of Ryde clay loam and Guard clay loam also represent former marsh settings. In the area surrounding the White Slough Water Pollution Control Facility, Guard clay loam is also present along with Devries sandy loam. Devries sandy loam, while not derived from marsh deposits, is still a poorly drained soil and, along with the former marsh settings, may not have been ideal settings for early Native American occupation.

NSR research also included a review of ethnographic information discussed in Levy (1978), Merriam (1966–67), and Wallace (1978). These studies indicate that the project site is contained largely within the traditional lands of the Eastern Miwok although the Northern Valley Yokuts occupied lands immediately to the south including along the Calaveras River south of Lodi. The project site is located approximately 9 miles south of the Tuolumne River, 9 miles north of the Calaveras River, and several miles to the east and northeast of the numerous channels and sloughs of the Delta. Numerous Eastern Miwok and Northern Valley Yokuts ethnographic sites are located along these waterways but, as the project area is not adjacent to any of these or other waterways, it is unlikely that any ethnographic-period sites occur in or near the project site.

The SWCA and NSR surveys (August 2012 and April 2013, respectively) were prepared for the core well drilling and compression testing phases, respectively, of the CAES reservoir evaluation conducted under the U.S. DOE Smart Grid Demonstration Program, PG&E CAES Compression Testing Phase Project [DOE contract DE-OE0000198]. These studies, prepared to support the Final Environmental Assessment/Finding of No Significant Impact (FEA/FONSI) prepared by the DOE in compliance with the National Environmental Policy Act (NEPA), did not result in the identification of any significant (per NRHP/CRHR criteria) cultural resources within or immediately adjacent to the project site of potential effects (U.S. DOE, 2014). As part of the DOE approval of these phases, Section 106 Consultations were completed with the State Historic Preservation Officer (SHPO), who concurred with the DOE effects determinations of no historic properties affected pursuant to 36 Code of Federal Regulations (CFR) Part 800.4 (d)(1) for the compression testing project.

5.3.1.5.2 Archaeological Field Survey

NSR archaeologists conducted an intensive archaeological survey of the project area on April 16–18, 2014. This survey consisted of visual pedestrian transects spaced no greater than 10 meters apart. Most of the project area consisted of active fruit/nut orchards, a vineyard, and row crop fields. Ground surface visibility was excellent generally ranging between 75 and 90 percent or more; however, some small portions of the project area exhibited poor to zero percent ground visibility, which occurred on paved roadways (e.g., Thornton Road) and within the White Slough Water Pollution Control Facility at the eastern extent of the project area. Cultural resources encountered within the project area were mapped with a Trimble GPS unit, photographed with digital media, and recorded in the inventory and evaluation report. Figure 5.3-1 shows the areas surveyed.



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North State Resources, Inc.

PG&E King Island Compressed Air Energy Storage Project

Figure 5.3-1
Cultural Resources Survey Areas

Seven resources were documented during NSR's survey. These consisted of several isolated artifacts, a late 1960s livestock corral, and a recent refuse dump including the remains of a twentieth century sheep herder's wagon (Table 5.3-3). None of these is located at the ECF site. Five are located along the air pipeline routes, and two are located along the 12-kV power line route (see location notes in Table 5.3-3).

TABLE 5.3-3
Newly Identified Cultural Resources in the Project Area

Resource No.	Association	Type	Project Component Location
NSR-AFC-1	Historic era	Brown glass bottle base fragment	Air pipeline
NSR-AFC-2	Historic era	"Rockingham" ware ceramic fragment	12 kV line
NSR-AFC-3	Historic era	White glazed porcelain fragment – blue transfer print decoration	12 kV line
NSR-AFC-4	Historic era	White glazed porcelain fragment – green painted decoration	Air pipeline
NSR-AFC-5	Historic era	Clear glass gallon jug neck/handle	Alternative pipeline route
NSR-AFC-6	Historic era	Livestock corral	Air pipeline
NSR-AFC-7	Historic era	Refuse dump with sheep herder's wagon	Air pipeline

All of the isolated artifacts (NSR-AFC-1, -2, -3, -4, and -5) consisted of highly fragmented pieces of porcelain and glass possibly dating to as early as the late nineteenth century but are more likely associated with early mid-twentieth century occupation and use of the landscape. The brown glass bottle base (NSR-AFC-1), gallon jug neck/handle (NSR-AFC-5), and white glazed porcelain fragments all appear to date to the early or middle decades of the twentieth century and appear to represent the remains of household glass and ceramic vessels in common use during this period.

Although its use could certainly have extended well into the mid-late twentieth century, a single fragment of molded "Rockingham" ware could date as early as the middle decades of the nineteenth century. Rockingham is highly fired earthenware or stoneware, generally with a buff to yellow paste and a brown mottled and streaked glaze, often characterized by patches of the vessel's body showing through. Rockingham is generally not considered to be a specific ceramic type; rather simply a type of glaze applied to buff or yellow-bodied ceramics and typically exhibiting relief molded decoration. Rockingham glazed vessels were inexpensive, mass-produced wares of the mid-nineteenth to the early twentieth centuries, manufactured in both England and North America (Claney, 2004:xiii). One of the best known manufacturers of Rockingham glazed wares was Edwin Bennett of Baltimore, in production under several different firm names between circa 1848 and 1936 (Kille and Collier, 2011). With the example identified during the survey being so fragmentary, it is not possible to identify the maker or provide an accurate assessment of age.

Two isolated features, possibly related in terms of their indications of past land use, were documented by NSR archaeologists. These consist of a presently unused livestock corral and loading chute (NSR-AFC-6) and a refuse dump containing what appears to be the remains of an early twentieth century sheep herder's wagon. The corral is located at the edge of an agricultural field between an unpaved field access road and a concrete-lined east-west-trending irrigation ditch. Although partly dismantled and in generally poor condition, the corral/chute complex measures approximately 235 feet in length (east-west) and a maximum of about 35 feet in width. The loading chute is situated at the eastern end of the complex and all of the fence posts, planking, and rails are of commercially milled lumber including recycled railroad ties and probable recycled telephone poles. All of the hardware (wire nails and spikes, gate hinges, and barbed wire) suggests a manufacture and use date between the middle and latter decades of the twentieth century.

A narrow concentration of debris (NSR-AFC-7) was recorded immediately east of the livestock corral and is also situated between the same east-west-running concrete-lined irrigation ditch and unpaved field access road. This refuse dump appears to consist primarily of construction/demolition debris and includes sections of concrete piping, milled lumber and plywood, fencing wire, galvanized corrugated sheet metal, porcelain bathroom fixtures, and a wide variety of miscellaneous glass, wood, and metal debris. Contained within this scatter are the remains of a wooden sheep herder's wagon of the kind commonly employed by itinerant herders in the western states during the late 1800s and well into the late twentieth century. The "sheep wagon" probably developed from the mobile "Gypsy" wagons used by Gypsy and non-Gypsy people alike during the nineteenth century and the four-wheeled "shepherd's hut" of the British Isles. During the early years of the sheep ranching industry in California and elsewhere, these wagons were probably adapted farm wagons designed to accommodate herders in remote mountain pastures and meadows. As the sheep ranching industry grew, commercial models specifically designed for herders came on the market and by the late nineteenth century companies such as Studebaker were selling their own sheep wagons (often referred to as "sheep camps"). Although the basic wagon shell was of a standard design, Studebaker advertised their models as "built to order." These wagons typically included sleeping accommodations, shelving, storage cabinets, and a wood stove. As the nature of sheep ranching changed, the manufacture of industry-specific sheep wagons came to a close in the early decades of the twentieth century (Weidel, 2001). Today, "sheep wagons" are still being produced by Wilson Camps in Heber City, Utah although most buyers purchase them for recreational purposes rather than sheep herding (www.campwagons.com).

The sheep wagon documented in the project area appears to be of a later vintage than those manufactured by Studebaker or other early makers. The wagon's running gear consisting of the steel frame and wheels was probably manufactured by Packard Motor Car Company, which primarily built luxury automobiles between 1899 and 1958. The main body of the wagon was made from wood with steel bows that supported a canvas or sheet metal roof. Wood cabinets and shelving are still visible in the wagon's interior and the sheet steel flashing and chimney section for a wood stove are located within the collapsed and dilapidated wagon remains. Taken together with the livestock corral, the sheep wagon likely represents the remains of a recently passed mode of land use in the project area and immediate vicinity (livestock ranching).

5.3.1.5.3 Native American Community Outreach

In order to determine if any properties of concern to the Native American community are located within or near the project area, a search of the Native American Heritage Commission's (NAHC) Sacred Land File was conducted for the Compressed Air Energy Storage Compression Testing Project (NSR, 2013). The project mapping provided to the NAHC included the current project area. As a result of this outreach, consultation was initiated by the DOE with representatives from the Shingle Springs Band of Miwok Indians, the Buena Vista Rancheria of Me-Wuk Indians, the Ione Band of Miwok Indians, and the Wilton Rancheria. These tribal organizations provided input and monitoring during construction phases. For additional information on the tribal outreach efforts, refer to the DOE's FEA/FONSI (U.S. DOE, 2014). Although traditional cultural properties have not been identified to date in the project area, it is anticipated that coordination with these tribal organizations and their representatives may continue during the future development phase of the project.

Two conditions of approval in the DOE's FONSI resulting from tribal consultation required PG&E to prepare an ethnographic study and to conduct subsurface testing at the compression testing site. The ethnographic study (forecast to be completed in late 2015) will be conducted by Penny Rucks (the ethnographer requested by the Tribes) to evaluate the significance of King Island to several Native American Tribes. The study will likely include ethnographic and ethnohistoric research and interviews with relevant Tribes and specific individuals. The tribes expected to be studied include the Ione, Buena Vista, Shingle Springs, Wilton, United Auburn, and Santa Rosa. The subsurface testing at the compression testing site was completed in

June 2014 and consisted of 15 shovel test units, which were monitored by Native American representatives. No cultural resources were identified during this testing. The July, 2014 *Subsurface Identification Efforts for the CAES Compression Testing Project, King Island, San Joaquin County, California* report prepared by Far Western Anthropological Research Group Inc., (Far Western, 2014) is provided as Appendix 5.3G

5.3.2 Environmental Analysis

This section describes the environmental impacts of project construction and operation.

5.3.2.1 Significance Criteria

Appendix G, Environmental Checklist Form of the CEQA guidelines, addresses significance criteria with respect to cultural resources (Public Resources Code Sections 21000 et seq.). Appendix G (V)(a, b, d) indicates that an impact would be significant if the project would have the following affects:

- Cause a substantial adverse change in the significance of a historical resource
- Cause a substantial adverse change in the significance of an archaeological resource
- Disturb any human remains, including those interred outside of formal cemeteries

Project investigations included archival research; review of all cultural resources studies previously conducted within and near (1 mile) the project site, an examination of historical mapping and geological data, and an intensive field survey. These studies indicated that no "historical resources" (cultural resources present listed or recommended eligible for listing on the CRHR), no archaeological resources, or human remains are known to be present within or immediately adjacent to the project area.

Since the project will likely include a federal nexus (U.S. Environmental Protection Agency or U.S. Army Corps of Engineers permits), federal 36 CFR 800 regulations would apply. The 36 CFR Part 800 regulations, implementing Section 106 of the National Historic Preservation Act, call for evaluating adverse effects on historic properties, and consultation with the SHPO, Indian tribes, and interested members of the public throughout the Section 106 compliance process. Adverse effects on "historic properties" (cultural resources listed or determined eligible for listing on the NRHP) are often resolved through preparation of a memorandum of agreement (MOA) developed in consultation between the lead federal agency, the SHPO, Indian tribes, the Advisory Council on Historic Preservation (ACHP), and interested members of the public. The MOA stipulates procedures that treat historic properties to mitigate adverse effects (36 CFR Part 800.14[b]).

The NRHP is a register of districts, sites, buildings, structures, and objects of significance in American history, architecture, archaeology, engineering, and culture. The regulations provided in 36 CFR Part 60.4 describe the criteria to evaluate cultural resources for inclusion in the NRHP. Cultural resources can be significant on the national, State, or local level. Properties may be listed in the NRHP if they possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:

1. Are associated with events that have made a significant contribution to the broad patterns of our history;
2. Are associated with the lives of persons significant in our past;
3. Embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess an artistic value, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
4. Have yielded, or may be likely to yield, information important in prehistory or history.

5.3.2.2 Construction Impacts

As isolated artifacts with no significant associations or data potential, NSR-AFC-1, -2, -3, -4, and -5 are exempt from listing on the NRHP or CRHR. The two remaining properties in consideration (NSR-AFC-6 and -7) are located along the air pipeline route.

The livestock corral (NSR-AFC-6) appears to be typical of these kinds of ranching structures found throughout the Central Valley and elsewhere in California and it may be of fairly recent (1960s or later) construction. Archival and field research does not appear to indicate it is associated with any historically significant individuals or events and it is clearly not the work of a recognized master nor does it represent a particularly early or excellent example of its kind. In addition, its data potential has likely been realized through the current level of documentation. As such, it is recommended not eligible for NRHP or CRHR listing. Since none of these isolated artifacts constitute historic properties per Section 106 or historical resources per CEQA, there would be no construction impacts.

The refuse dump and sheep wagon (NSR-AFC-7) also do not appear to be associated with any historically important persons or specific events nor is it the work of a recognized master or the oldest or best example of its type. In addition, its full data potential has been realized through the current level of documentation. Consequently, neither the debris scatter nor the sheep wagon are recommended eligible for CRHR listing. Since none of these isolated artifacts constitute historic properties per Section 106 or historical resources per CEQA, there would be no construction impacts.

Archival research and an intensive cultural resources survey did not identify any significant (per NRHP/CRHR criteria) cultural resources within or near the project area. In addition, the nature of the project area as reclaimed land indicates that, prior to the early twentieth century, much of the project area and surrounding area was a marsh without elevated landforms suitable for early Native American or historic-era occupation or activities. Consequently, the probability that buried cultural resources would be found as a result of project-related construction activities is moderate to low. With the incorporation of mitigation described in Section 5.3.4, construction impacts on presently undocumented cultural resources would be less than significant.

5.3.2.3 Operation Impacts

No ground disturbances would be required during project operation and, as a result, adverse impacts to cultural resources are not anticipated. Ongoing project facility maintenance would also not result in impacts to prehistoric or historic-era sites, features, artifacts, or other sensitive properties or locations.

5.3.3 Cumulative Effects

Construction activities associated with the proposed project have the potential to adversely affect previously undocumented cultural sites, features, artifacts, or human remains. Mitigation included below would be implemented to address potential direct effects on these resources.

Because no known significant historical resources or human remains exist on the project area, the project would not be expected to contribute to any cumulative effects on similar types of cultural resources. Therefore, the project would not make a cumulatively considerable contribution to any significant effect on cultural resources or human interments.

5.3.4 Mitigation Measures

Although no historic properties, historical resources, or human remains were found within or near the project area, it is possible that project ground-disturbing construction activities could encounter buried cultural resources or human interments. For this reason, the project would include measures to mitigate

any potential adverse impacts that could occur if there were an inadvertent discovery of buried cultural resources. These measures consist of:

- Designation of an on-call qualified cultural resources specialist to investigate any finds made during construction
- Implementation of a construction worker training program
- Procedures for halting construction in the event that there is an inadvertent discovery of archaeological deposits or human remains
- Procedures for evaluating an inadvertent archaeological discovery
- Procedures to mitigate adverse impacts on any inadvertent archaeological discovery determined significant

5.3.4.1 Designated Cultural Resources Specialist

The Developer would retain a designated cultural resources specialist (CRS) who would be available during project-related ground-disturbing activities to inspect and evaluate any finds of buried cultural resources that might be encountered during the construction phase. If there is a discovery of prehistoric or historic-era cultural resources made during ground-disturbing activities, the CRS, in conjunction with the construction superintendent and environmental compliance manager, would make certain that construction activity stops in the immediate vicinity of the find until the find can be evaluated. The CRS would inspect the find and evaluate its potential significance per CRHR criteria.

The CRS would make a recommendation as to the significance of the find and any measures that would mitigate adverse impacts of construction on a historical resource. The CRS would meet the minimum qualifications for Principal Investigator on federal projects under the *Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation*.

5.3.4.2 Construction Worker Training

The Developer would prepare a construction worker training program to ensure implementation of procedures to follow in the event that cultural resources are discovered during construction. This training would be provided to each construction worker as part of their environmental, health, and safety training. The training would provide an overview of the kinds of buried cultural resources that could be encountered at the project area. This training session would also explain the importance of, and legal basis for, the protection of historical resources. The training would consist of an in-person session plus the production of printed materials for quick reference.

5.3.4.3 Emergency Discovery

If the archaeological monitor, construction staff, or others identify cultural resources during construction, they would immediately notify the CRS and the site superintendent, who would halt construction in the immediate vicinity of the find, if necessary. The archaeological monitor or CRS would use flagging tape, rope, or some other means as necessary to delineate the area of the find within which construction would halt. This area would include the excavation/grading area where the archaeological find occurred and any associated spoils piles. Construction would not occur within the delineated find area until the CRS can evaluate the character, integrity, and potential significance of the find.

5.3.4.4 Site Recording and Evaluation

The CRS would follow accepted professional standards in recording any find and would submit the standard Department of Parks and Recreation Series 523 forms to the CHRIS Central California Information Center. If

the CRS determines that the find is not significant per Section 106 and/or CEQA, construction can proceed without further delay. If the CRS determines that further information is needed to determine whether the find is significant, the designated CRS would prepare a plan and a timetable for evaluating the find.

5.3.4.5 Mitigation Planning

If the CRS determines that the find is significant, the CRS would prepare and conduct a mitigation plan in accordance with SHPO guidelines. This plan would emphasize the avoidance, if possible, of historic properties and historical resources. If avoidance is not possible, recovery of a sample of the deposit from which archaeologists can define scientific data to address archaeological research questions would be considered an effective mitigation measure for damage to or destruction of the deposit. The mitigation program, if necessary, would be carried out as soon as possible to avoid construction delays. Construction would resume at the site as soon as the field data collection phase of any data recovery efforts is completed.

5.3.4.6 Curation

The CRS would arrange for curation of archaeological materials collected during an archaeological data recovery mitigation program. Curation would be performed at a qualified curation facility meeting the standards of the California Office of Historic Preservation. The CRS would submit field notes, stratigraphic drawings, and other materials developed as part of the data recovery/mitigation program to the curation facility along with the archaeological collection, in accordance with the mitigation plan.

5.3.4.7 Report of Findings

If a data recovery program is planned and implemented during construction as a mitigation measure, the CRS would prepare a detailed scientific report summarizing results of the excavations to recover data from an archaeological site. This report would describe the site soils and stratigraphy, describe and analyze artifacts and other materials recovered, and draw scientific conclusions regarding the results of the excavations. This report would be submitted to the curation facility with the collection.

5.3.4.8 Inadvertent Discovery of Human Burials

If human remains are found during construction, project officials are required by the California Health and Safety Code (Section 7050.5) to contact the San Joaquin County Coroner. If the Coroner determines that the find is Native American, he or she must contact the NAHC. The NAHC, as required by the Public Resources Code (Section 5097.98) determines and notifies the Most Likely Descendant with a request to inspect the burial and make recommendations for their treatment and ultimate disposition.

5.3.5 Laws, Ordinances, Regulations and Standards

A number of federal, state, and local laws, ordinances, regulations, and standards (LORS) may apply to the project. These include the CEQA, Section 106, and San Joaquin and City of Lodi general plans. A summary of applicable LORS is provided in Table 5.3-4.

TABLE 5.3-4
Laws, Ordinances, Regulations, and Standards for Cultural Resources

Law, Ordinance, Regulation or Standard	Requirements/ Applicability	Administering Agency
Federal		
Section 106 – National Historic Preservation Act	Project construction may encounter cultural resources	SHPO

TABLE 5.3-4
Laws, Ordinances, Regulations, and Standards for Cultural Resources

Law, Ordinance, Regulation or Standard	Requirements/ Applicability	Administering Agency
State		
California Environmental Quality Act Guidelines	Project construction may encounter cultural resources	CEC
Health and Safety Code Section 7050.5	Construction may encounter Native American graves; coroner calls the NAHC	State of California
Public Resources Code Section 5097.98	Construction may encounter Native American interments; NAHC assigns Most Likely Descendant	State of California
Public Resources Code Section 5097.5/5097.9	Would apply only if some project land were acquired by the state (currently no state land)	State of California
Local		
San Joaquin Co. General Plan (1992)	Historical resources must be identified and protected from destruction. If resources appear after development begins, an assessment would be made to preserve or to remove.	San Joaquin County
City of Lodi General Plan (1991)	Requires consultation with CCIC on any project that could have an impact on cultural resources and implement the CCIC's recommended measures	City of Lodi

5.3.5.1 Federal

Section 106 of the National Historic Preservation Act of 1966 and its implementing regulations (36 CFR Part 800, as amended in 1999) requires federal agencies, or those they fund or permit, to consider the effects of their actions on the properties that may be eligible for listing or are listed on the NRHP. To determine whether an undertaking could affect NRHP-eligible properties, cultural resources (including archaeological, historical, and architectural properties) must be inventoried and evaluated for listing in the NRHP. Although compliance with Section 106 is the responsibility of the lead federal agency, the necessary steps can be conducted by a qualified representative of the lead agency.

The Section 106 review process involves a four-step procedure:

- Initiate the Section 106 process by establishing the undertaking, developing a plan for public involvement, and identifying other consulting parties.
- Identify historic properties by determining the scope of efforts, identifying cultural resources, and evaluating their eligibility for inclusion in the NRHP.
- Assess adverse effects by applying the criteria of adverse effect on historic properties (resources that are eligible for inclusion in the NRHP).
- Resolve adverse effects by consulting with the SHPO and other consulting agencies, including the Advisory Council on Historic Preservation if necessary, to develop an agreement that addresses the treatment of historic properties.

5.3.5.2 State LORS

CEQA requires review to determine if a project would have a significant effect on archaeological sites or a property of historic or cultural significance to a community or ethnic group eligible for inclusion in the CRHR (CEQA Guidelines). CEQA equates a substantial adverse change in the significance of a historical resource with a significant effect on the environment (Section 21084.1 of the Public Resources Code) and defines substantial adverse change as demolition, destruction, relocation, or alteration that would impair historical

significance (Section 5020.1). Section 21084.1 stipulates that any resource listed in, or eligible for listing in, the CRHR is presumed to be historically or culturally significant

Resources listed in a local historic register or recommended significant in a cultural resources study (as provided under Section 5024.1g) are presumed historically or culturally significant unless the preponderance of evidence demonstrates they are not. A resource that is not listed in or recommended to be eligible for listing in the CRHR is not included in a local register of historic resources, nor deemed significant in a cultural resources study may, nonetheless, be historically significant (Section 21084.1; see Section 21098.1).

CEQA requires a Lead Agency to identify and examine environmental effects that may result in significant adverse effects. Where a project may adversely affect a unique archaeological resource, Section 21083.2 requires the Lead Agency to treat that effect as a significant environmental effect and prepare an Environmental Impact Report. When an archaeological resource is listed in or is eligible to be listed in the CRHR, Section 21084.1 requires that any substantial adverse effect to that resource be considered a significant environmental effect. Sections 21083.2 and 21084.1 operate independently to ensure that potential effects on archaeological resources are considered as part of a project's environmental analysis. Either of these benchmarks may indicate that a project may have a potential adverse effect on archaeological resources. Other state-level requirements for cultural resources management appear in the California Public Resources Code Chapter 1.7, Section 5097.5 (Archaeological, Paleontological, and Historical Sites), and Chapter 1.75, beginning at Section 5097.9 (Native American Historical, Cultural, and Sacred Sites) for lands owned by the state or a state agency.

The disposition of Native American burials is governed by Section 7050.5 of the California Health and Safety Code and Sections 5097.94 and 5097.98 of the Public Resources Code, and falls within the jurisdiction of the NAHC. If human remains are discovered, the County Coroner must be notified within 48 hours and there should be no further disturbance to the site where the remains were found. If the coroner determines the remains to be Native American, the coroner is responsible for contacting the NAHC within 24 hours. The NAHC, pursuant to Section 5097.98, will immediately notify those persons it believes to be most likely descended from the deceased Native American so they can inspect the burial site and make recommendations for treatment or disposal. The project will comply with these requirements related to cultural resources through the implementation of the mitigation measures described previously in Section 5.3.4.

5.3.5.3 Local LORS

With regard to objectives relating to the preservation of cultural resources, The *San Joaquin County 2010 General Plan,* approved in 1992, aims to "protect San Joaquin County's valuable architectural, historical, archaeological, and cultural resources" (San Joaquin County 1992). Specific policies found in Volume 1 VI-37 include the following elements:

- The County will "encourage efforts" to preserve its historical and cultural heritage
- Significant archaeological and historical resources shall be identified and protected from destruction
- No significant architectural, historical, archaeological, or cultural resources shall knowingly be destroyed by the County
- Reuse of historical buildings will be encouraged
- The County will support historic preservation

The San Joaquin County 2010 General Plan contains implementation programs that address archaeological deposits. The most pertinent of these require that the County Title Development include archaeological and

historical preservation regulations that will specify procedures to be followed when significant resources are discovered during the planning process and the County will inventory heritage resources in unincorporated areas and encourage similar inventory in the cities.

The City of Lodi General Plan (1991) includes Section 10, Urban Designs and Cultural Resources Element. Goal J under this section states the City will "preserve and enhance the city's historical heritage." Policies affecting cultural resources under this section state the City will "develop a historic preservation ordinance," "coordinate with the State Office of Historical Preservation in developing this ordinance," and "work with property owners in seeking registration of historical structures as State Historic Landmarks or listing on the National Register of Historic Places." Additionally, the City will "consult with the California Archaeological Inventory, Central California Information Center at Stanislaus State University, on any project that could have an impact on cultural resources and implement the center's recommended mitigation measures." The KICP will comply with these requirements related to cultural resources through the implementation of the mitigation measures described in Section 5.3.4.

5.3.6 Agencies and Agency Contacts

Table 5.3-5 lists the state agencies involved in cultural resources management for the project. These agencies include the NAHC and, for federal undertakings, the California Office of Historic Preservation.

TABLE 5.3-5
Agency Contacts for Cultural Resources

Permit/Authorization	Agency	Contact
Native American cultural properties	Native American Heritage Commission	1550 Harbor Blvd, Suite 100 West Sacramento, CA 95691 nahc@nahc.ca.gov
Federal agency Section 106 compliance	California Department of Parks and Recreation – Office of Historic Preservation	State Historic Preservation Office 1416 9th Street, Room 1442, Sacramento, CA 95814

5.3.7 Permits and Permit Schedule

Other than certification by the CEC, no state, or local permits are required by the project for the management of cultural resources. Consultation with the State Historic Preservation Officer and Advisory Council on Historic Preservation by the lead federal agency would be required under Section 106 of the National Historic Preservation Act since the project will likely become a federal undertaking.

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5.4 Geologic Hazards and Resources

This section evaluates the geologic hazards and resources at and surrounding the King Island CAES Project (KICP) components, including the Energy Conversion Facility (ECF), well pads, and linear features.

5.4.1 Affected Environment

The ECF and well pad sites are located within a broader area of relatively flat topography typical of the California Central Valley that gently slopes toward the San Joaquin River to the west. Near-surface sediments in the greater vicinity of the KICP have been deposited primarily from the Sacramento, Mokelumne, and San Joaquin river systems. Surficial geology at the KICP ECF and well pads consists of Quaternary Modesto Formation deposits of undifferentiated alluvium and dune sand, forming a toe of Mokelumne alluvial fan, generally covered by Holocene intertidal deposits.

The KICP comprises two locations, plus linear features: the ECF is located west of Interstate 5 and approximately 3 miles north of Stockton, and the injection/withdrawal well field is located approximately 2.6 miles to the southwest on King Island. The well field will include two well pads, approximately 6 and 4 acres in size.

5.4.1.1 Regional Geology

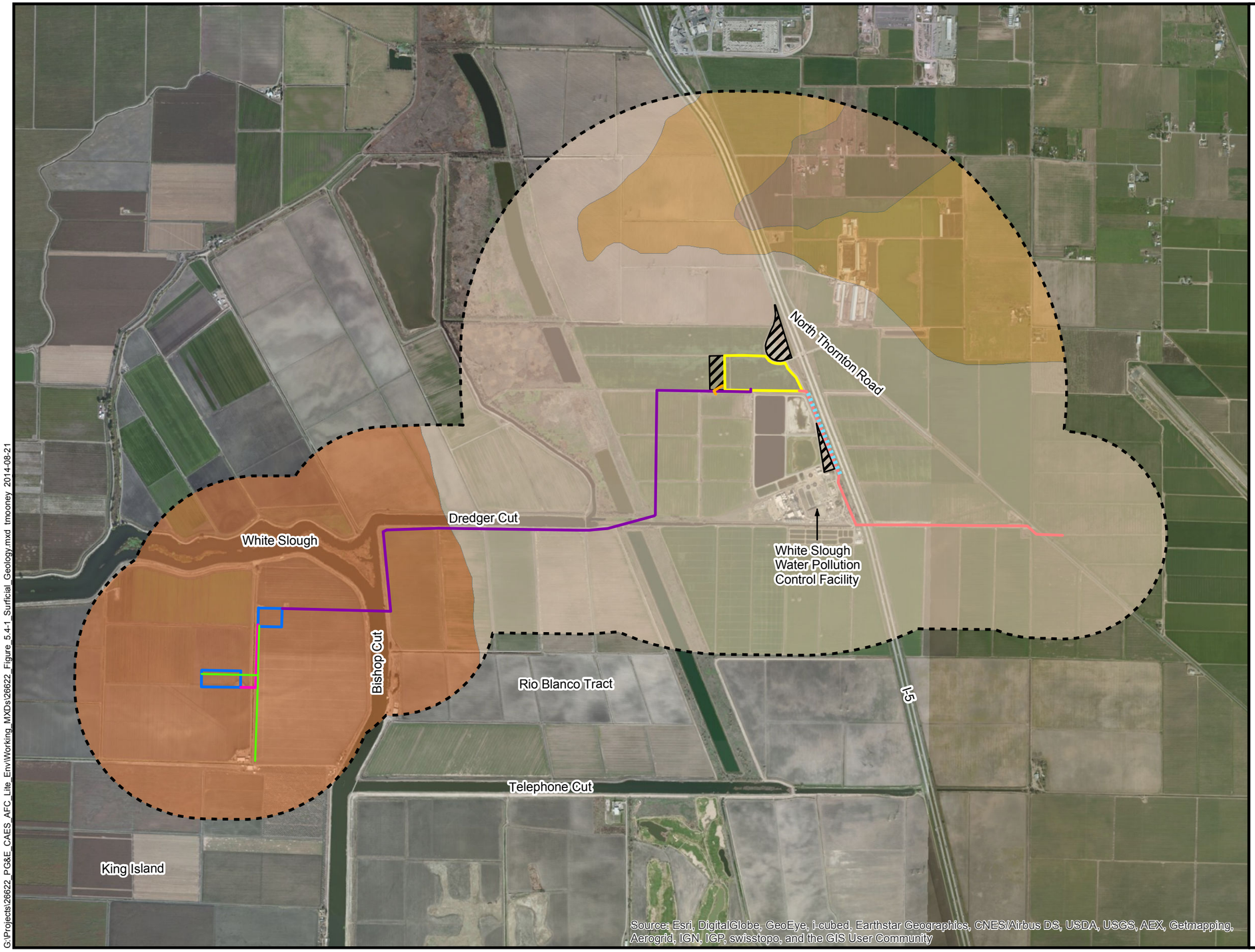
The project area is situated in the Great Valley Geomorphic Province. The Great Valley and the adjacent Sierra Nevada to the east form a relatively stable crustal block (Sierran block) composed of Mesozoic crystalline basement that dips gently to the west. The western edge of the Sierra Nevada block, beneath the sediments of the Great Valley, may be coincident with the western margin of the Great Valley (Anderson, 1943).

The Great Valley physiographic province separates the Coast Ranges to the west from the Sierra Nevada to the east. This province is composed of two elongated northwest- to southeast-trending basins: the Sacramento basin to the northwest and the San Joaquin basin to the southeast. The present-day basin evolved from a late Jurassic to middle Tertiary (40 to 150 million years ago) marine fore-arc basin. In the late Tertiary (25 to 30 million years ago), a change in the relative motion between the Pacific and North American plates resulted in the gradual uplift of the Coast Ranges and the eventual isolation of the basin from the ocean. More recent Miocene and lower Pliocene sediments were derived from the neighboring Coast Ranges and the Sierra Nevada. By the late Pliocene (2 to 3 million years ago), subaerial depositional conditions prevailed and Sierra Nevada–derived sediments were deposited in the basins (Olmsted and Davis, 1961).

The eastern flank of the northern San Joaquin Valley, where the King Island Gas Field is located, is underlain at depth by Sierran Basement complex of relatively impermeable metamorphic and plutonic rocks. These are overlain by marine sedimentary rocks, followed by non-marine volcanic and alluvial deposits derived from the Coast Ranges to the west and the Sierra Nevada to the east (Jacobs James & Associates [JJ&A], 2013).

5.4.1.2 Local Geology

The KICP is located in an area of relatively flat topography typical of the Central Valley. The surficial geology within a 1-mile radius of the project area is shown in Figure 5.4-1. The geologic units that are present within this 1-mile area are described below with details provided by *Preliminary Geologic Map of the Lodi, California 30'x60' Quadrangle,* (California Geological Survey [CGS], 2009). The KICP ECF and well pad sites have been mapped as being underlain by the undivided lower member of the Modesto Formation.



Water Supply Pipeline
Air Pipeline
Air Collection Pipeline
Gas Pipeline
ECF Generator Tie-Line
12kV Service Line
Energy Conversion Facility (ECF)
Well Pad
Staging
* Buffer

Surficial Geology

Qds - Dune Sand
Qm - Modesto Formation, Undivided
Qm2 - Modesto Formation, Upper Member, Undivided
Qm1 - Modesto Formation, Lower Member, Undivided

Notes:
1. * 1 mile around ECF site, 1/2 mile around project linears and well pads.

This map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

N

0 2,000 4,000

Feet

G:\Projects\26622_PG&E_CAES_AFC_Lite_Env\Working_MXDs\26622_Figure_5.4-1_Surficial_Geology.mxd tmooney 2014-08-21

North State Resources, Inc.

PG&E King Island Compressed Air Energy Storage Project

Figure 5.4-1
Surficial Geology

Groundwater at the ECF has been detected at depths ranging from approximately 7 to 9 feet below ground surface (Ninyo and Moore, 2014). Groundwater at the well pad sites is maintained at a level of approximately 6 to 8 feet below surface by a system of agricultural drains. Other surficial geologic deposits within 1 mile of the project features are described below.

Quaternary (Qds) deposits — This deposit consists of very well sorted, fine- to medium-grained eolian sand.

Quaternary Modesto (Qm) Formation deposits — This deposit consists of Arkosic alluvium sand with minor gravel and silt, forming low terraces, high floodplains, and alluvial fans along the Cosumnes and Mokelumne rivers.

Quaternary Modesto upper member (Qm2) Formation deposits — This deposit consists of Upper member, fine-grained, alluvium of flood basins, lower fans, and interdistributary fan areas.

Quaternary Modesto lower member (Qm1) Formation deposits — This deposit consists of Lower member, fine-grained, alluvium of flood basins, lower fans, and interdistributary fan areas.

5.4.1.3 Project Area Stratigraphy

The KICP ECF and well pad sites are underlain by a fairly complete stratigraphic section of Cretaceous, Tertiary, and Quaternary deposits. The sediments deposited prior to mid-Tertiary time were in a marine environment. Changes in sea level, valley filling, and uplift resulted in the deposition of continental sediments after Mid-Tertiary time (Kleinfelder, 1993).

Eventually, these sediments were compacted and formed the marine sandstones, siltstones and shales found deep beneath the valley. Depositional sequences were typically laid down during times when sea levels rose or the basin subsided (transgression), and then eroded during times of relative sea level falls or basin uplift (regression). Four distinct Tertiary-age submarine canyons developed during uplift cycles in the valley and were filled in with transgressional marine sequences during times of subsidence and relative sea level rise. The King Island Gas Field is an erosional remnant within the Meganos submarine canyon complex that was eroded and filled during Pleistocene time (JJ&A, 2013).

Deep wells drilled in the area penetrated into Upper Cretaceous Winters Formation shale that has been estimated to exceed 5,000 feet thick. Overlying the Winters Formation shale is a 1,650-foot-thick sequence of sandstone and shale belonging to the shallow marine Starkey Formation sands. Overlying the Starkey sands are the Upper Cretaceous and Paleocene fluvial deltaic sediment of the Mokelumne River Formation. The Mokelumne River Formation reaches nearly 1,700 feet in thickness and is predominately composed of thick interbedded sandstones and thin interbeds of mudstone and shale. Sands in the uppermost Mokelumne River Formation provide the reservoir for the gas accumulation at King Island (JJ&A, 2013).

During the Paleocene, the Mokelumne River Formation was deeply eroded by the Paleocene Meganos submarine canyon, As much as 1,300 feet of the Mokelumne River Formation was eroded on all sides of King Island. The erosional valley was subsequently filled by late Paleocene Meganos Formation marine sandstones and shales. The Mokelumne River Formation at King Island is an erosional remnant or island lying between two erosional arms of the Meganos submarine canyon system (JJ&A, 2013).

Overlying the Mokelumne River Formation and the younger Meganos Formation channel-fill sediments are the unconformably Eocene-age Capay Formation shale that ranges from 90 to 120 feet thick in the King Island vicinity. This unit forms the seal or cap rock for gas trapping. The Eocene-age Domengine Formation sandstone conformably overlies the Capay Formation shale and is approximately 800 feet thick. Overlying the Domengine Formation is the Nortonville Shale Formation and then the Eocene-age Markley Formation.

Over 3,000 feet of non-marine sediments unconformably overlie the Eocene sediments and represent the final stages of basin filling (JJ&A, 2013).

5.4.1.4 Seismic Setting

The project site is located in central California and within the Coast Ranges-Sierran Block Basement Zone. The modern tectonic setting of central California is dominated largely by the transform plate boundary contact between the Pacific and North American plates south of the Mendocino triple junction. The Pacific plate is slipping in a north-northwest direction (N35°W to N38°W) at a rate of about 1.81 to 1.95 inches per year (46 to 47 millimeters per year) with respect to the North American plate. Right-lateral strike-slip displacement along the major branches of the San Andreas Fault system accommodates most of this plate motion, with the remainder generating Holocene tectonism and seismicity at the western continental margin and to the east in the Sierra Nevada and Basin and Range Provinces.

The seismicity of the project area can be characterized as an area of potentially large-magnitude earthquakes. Active faults (within Holocene time) within 50 miles of the KICP ECF site include Concord-Green Valley, Greenville, Los Positas, Calaveras, and Hayward. These faults are capable of generating maximum credible earthquake (MCE) (or probable maximum magnitude earthquake) moment magnitudes up to 7.3 (Jennings, 2010). No active faults have been mapped crossing any of the KICP components (ECF, linears, well pads) and none of the project components crosses an Alquist-Priolo Special Studies Zone (CGS, 2007). The locations of principal faults relative to the KICP are shown in Figure 5.4-2.

5.4.1.5 Potential Geologic Hazards

The following subsections discuss the potential geologic hazards that might occur in the KICP area.

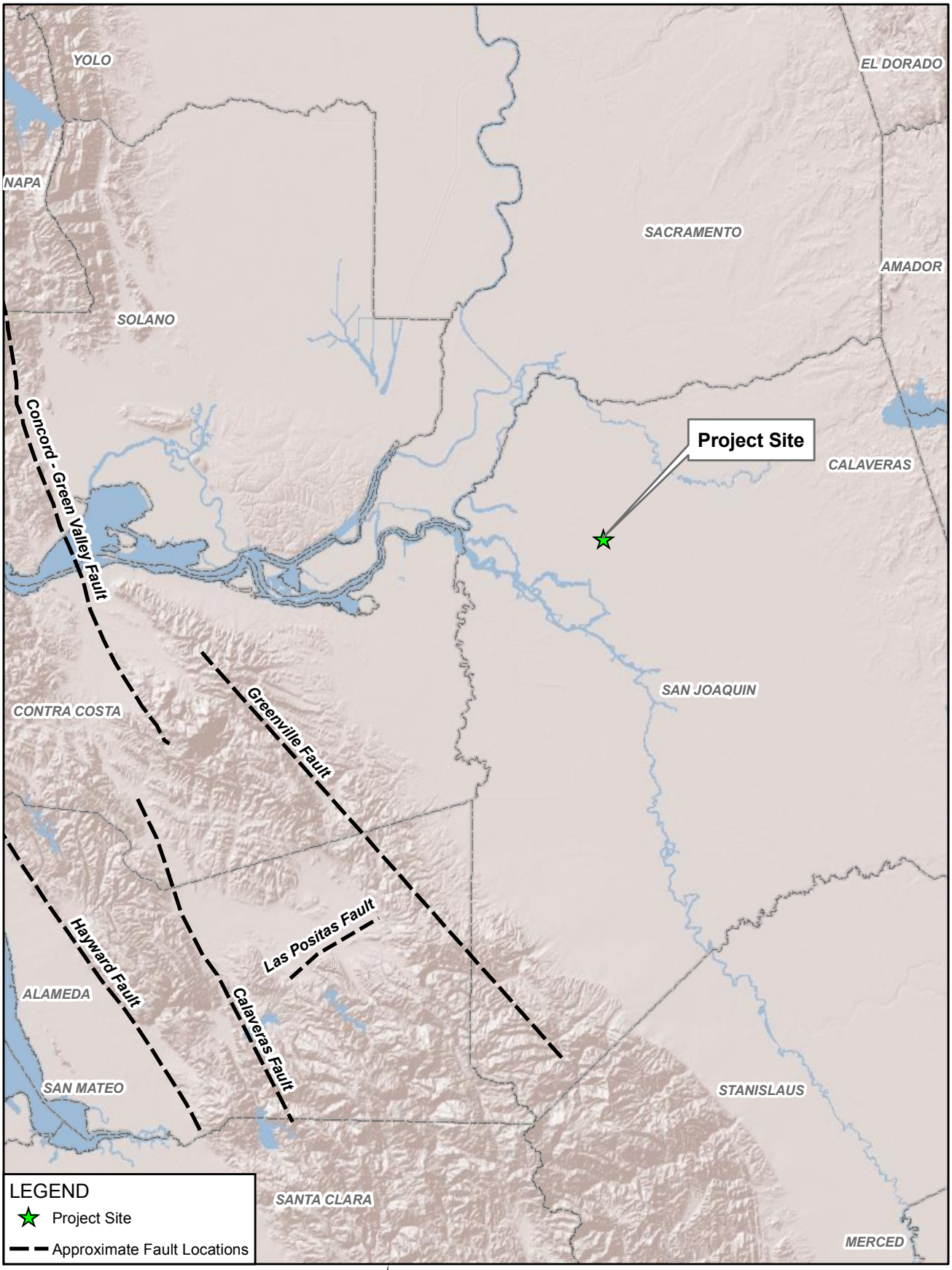
5.4.1.5.1 Ground Rupture

Ground rupture is caused when an earthquake event along a fault creates rupture at the surface. Because no known active faults cross the KICP components, the likelihood of ground rupture to occur is considered low.

5.4.1.5.2 Seismic Shaking

The project area has experienced seismic activity with strong ground motion during past earthquakes, and it is likely that strong earthquakes causing seismic shaking will occur in the future. The significant geologic hazard to KICP is strong ground shaking due to an earthquake. Ground shaking from a magnitude 7.3 earthquake could occur within an approximately 50-mile radius of the KICP (Blake, 2004). This could affect structures at the ECF or well pads. The project is located in seismic zone 3.

The 2013 California Building Code recommends that structures be designed to withstand a local horizontal peak ground acceleration (PGA_M) (ground shaking) having a 1 percent probability of exceedance in 50 years. According to the preliminary geotechnical evaluation for the ECF, the statistical return period for the risk-targeted PGA_M is approximately 4,975 years. The PGA_M for the ECF, adjusted for site class effects, was calculated as 0.364g based on the mapped maximum considered mean PGA_G of 0.305g using the U.S. Geological Survey (USGS) 2013 ground motion calculator and ASCE 7-10 Standard (Ninyo and Moore, 2014). This much ground shaking approximates an earthquake of Modified Mercalli Intensity VII to VIII (very strong to severe).



Notes:
1. Source: Jennings, 2010.

This map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

N

0 5 10
Miles

FIGURE 5.4-2
PROJECT SITE IN RELATION TO PRINCIPAL FAULTS
PG&E KING ISLAND CAES PROJECT
LODI, CALIFORNIA

CH2MHILL

SAC\\ZION\SACGIS\PROJ\LODIENERGYCENTER_371322\MAPFILES\FAULTS.MXD MHASKELL 6/25/2008 16:36:05
ES081114063856SAC Figure_5.4-2.ai 08.19.2014 tdaus

5.4.1.5.3 Liquefaction

During a strong ground earthquake, loose, saturated, cohesionless soils can experience a temporary loss of shear strength and act as a fluid. This phenomenon is known as liquefaction. Liquefaction is dependent on the depth to groundwater, grain size distribution, relative density of the soils, degree of saturation, intensity, and duration of the earthquake. The potential hazard associated with liquefaction is seismically induced settlement. Liquefaction can also generate sand boils, which occur when water under pressure wells up through a bed of sand.

The groundwater depth was measured at about 7 feet at the time of a recent geotechnical evaluation study of the ECF site (Ninyo and Moore, 2014). A copy of the geotechnical report is provided in Appendix 2C. The soil units below groundwater consist of isolated pockets of loose, near-surface, sandy and silty soils. Therefore, the likelihood that liquefaction will occur is considered moderate. Note that a geotechnical evaluation study was not conducted at the well pad sites because no significant structures or foundations are proposed at these locations.

5.4.1.5.4 Mass Wasting

Mass wasting depends on steepness of the slope, underlying geology, surface soil strength, and moisture in the soil. Significant excavating, grading, or fill work during construction might introduce mass wasting hazards at the KICP. Because the KICP component locations are relatively flat and no significant excavation is planned during construction, the potential for direct impact from mass wasting at the site is considered low to negligible.

5.4.1.5.5 Subsidence

Subsidence can be a natural or man-made phenomenon resulting from tectonic movement, consolidation, fluid removal (oil, gas, or water), or rapid sedimentation or oxidation of organic-rich soil. The Sacramento-San Joaquin Delta has a history of subsidence, but the majority of the Delta's subsidence has occurred on the west end where subsidence greater than 15 feet has been noted (USGS, 2000) as having taken place since the construction of levees and reclamation of Delta islands for agriculture after the turn of the twentieth century. On the eastern end of the Delta, subsidence is typically less (0- to 10-foot range) (USGS, 2000).

At the KICP ECF site, organic soils with significant collapse potential were not encountered during the geotechnical evaluation (Ninyo and Moore, 2014). Also, subsidence has not been identified as a geologic hazard at the site according to the seismic and geological hazards section of the San Joaquin County General Plan. (San Joaquin County, 2010). The potential for subsidence as a hazard that could affect the ECF is considered low.

5.4.1.5.6 Expansive Soils

Expansive soils shrink and swell with wetting and drying. The shrink-swell capacity of expansive soils can result in differential movement beneath foundations. According to the San Joaquin County General Plan, the KICP ECF site lies in an area mapped where the potential for expansive soils to be present is high (San Joaquin County, 2010). The recent geotechnical evaluation also indicated that clay-rich soils may be present at the ECF (Ninyo and Moore, 2014).

5.4.1.5.7 Flooding

The Federal Emergency Management Agency (FEMA) maintains a collection of flood insurance rate maps, which cover the entire United States. These maps identify those areas that may be subjected to 100-year floods. Based on review of the map for the KICP site (map ID 0602990260C), both the ECF and well pad areas lie within the mapped 100-year flood plain (FEMA, 2008). The potential for a 100-year flood event to

impact the ECF site is medium to high. However, under the 100-year scenario flooding of the ECF site would be limited to 1 to 2 feet, which has been taken into account in the ECF design criteria for foundation elevations, access, etc. See Section 2.0, Project Description, for further details. Although the King Island Gas Field and well pad sites are protected by levees, should the Delta levees fail during severe storms or during a significant seismic event, there could be potential flooding of the well pad areas by as much as 10 feet. Delta levees as a whole are currently being evaluated by the State of California and the U.S. Army Corps of Engineers. The well pad design criteria have been based on safe shut-down and preservation of critical equipment to protect against the hazards posed by a levee breach. Corresponding design features include elevated platforms where equipment critical for safe-shutdown would be located. See general arrangement drawings for further details.

5.4.1.6 Geologic Resources of Recreational, Commercial, or Scientific Value

There are no known geologic resources that provide a significant scientific or recreational value near the KICP components. According to online maps of the State of California Division of Oil, Gas and Geothermal Resources (CDOGGR, 2014), the KICP is located in an area where oil and gas exploration and/or production has occurred. Gas fields of potential value are present within 5 miles of the ECF and well pads. The air reservoir, the King Island Gas Field, is nearly depleted of native gas reserves and prior to air injection testing had two active producing wells (Citizen Green 1 and Piacentine 1-27). To the extent practicable, a significant portion of the remaining recoverable gas reserves will be produced prior to the conversion of the reservoir to air storage. Although various wells have been drilled within 2 miles of the KICP well pads, most are now designated as "plugged and abandoned – dry hole" according to the CDOGGR maps. The Lodi Airport Gas Field, approximately 2.5 miles to the southeast of the ECF, is present, but this field contains no completed wells. The abandoned Harte Gas Field is approximately 3 miles to the south-southwest of the ECF. The East Island Gas Field is 2.2 miles west of the ECF site and active wells are located there.

5.4.2 Environmental Analysis

The potential environmental effects from construction and operation of the KICP on geologic resources and risks to life and property from geologic hazards are presented in the following sections.

5.4.2.1 Significance Criteria

According to Appendix G of the California Environmental Quality Act (CEQA) statues, the project would have a significant environmental impact in terms of geologic hazards and resources if it would do the following:

- Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:
  - Rupture of a known earthquake fault (Alquist-Priolo Fault Zone)
  - Strong seismic ground shaking
  - Seismic-related ground failure, including liquefaction
- Be located on a geologic unit or soil that is unstable or that would become unstable as a result of the project, and potentially result in on- or offsite landslide, lateral spreading, subsidence, liquefaction, or collapse
- Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state

- Result in the loss of availability of a locally important mineral resource recovery site delineated on a local plan, specific plan, or other land use plan

5.4.2.2 Geologic Hazards

There is significant potential for seismic ground shaking to affect the project ECF and well pad sites in the event of a large-magnitude earthquake occurring on fault segments near the project. None of the project components, however, are located within an Alquist-Priolo Earthquake Fault Zone or within the trace of any known active fault. The project would thus not be likely to cause direct human exposure to ground rupture. Seismic and expansive soils risks would be minimized by conformance with the recommended seismic design and building criteria of the most current version California Building Code (CBC) at the time of permitting. In addition, as stated previously, the probability of mass wasting occurring at the KICP ECF or well pads is low.

The project structures would be designed in accordance with CBC, County of San Joaquin, and City of Lodi requirements. Compliance with the CBC seismic requirements would minimize the exposure of people to the risks associated with large seismic events. In addition, major structures would be designed to withstand the strong ground motion of an MCE event that is used for evaluating the earthquake resistance of a particular structure. Earthquake-induced levee damage could cause flooding of King Island (Worley Parsons, 2015).

5.4.2.3 Geologic Resources

There are no known geologic resources of recreational or scientific value at the project component sites or in the project vicinity.

5.4.3 Cumulative Effects

A cumulative impact refers to a proposed project's incremental effect together with other closely related past, present, and reasonably foreseeable future projects whose impacts may compound or increase the incremental effect of the proposed project (Public Resources Code § 21083; California Code of Regulations, title 14, § 15064(h), 15065(c), 15130, and 15355).

Because the KICP would not result in significant adverse impacts that cannot be mitigated, and because the ECF and well pad locations are removed from the developed parts of the cities of Lodi and Stockton, impacts from the project would not likely combine with those from the projects being processed in the city limits to result in cumulative significant impacts.

As described above, the KICP would not cause any adverse impacts to geological resources and would not cause an exposure of people or property to geological hazards. There are no minor impacts, in addition, that could combine cumulatively with those of other projects.

5.4.4 Mitigation Measures

The following mitigation measures are proposed for the project:

- Structures would be designed to meet seismic requirements of the CBC in effect at the time of application. Moreover, the design of plant structures and equipment would be in accordance with CBC seismic requirements to withstand the ground motion of an MCE event. In addition, special design considerations would be made for proposed facilities, if warranted, by the findings from any geotechnical investigation that would be conducted prior to construction.

- A geotechnical engineer would be assigned to the project to assess geologic conditions prior to and during construction and approve actual mitigation measures used to protect the facility from geologic hazards.
- If expansive soils are identified at a construction site, they can be mitigated by either removal or replacement with non-expansive soil or by blending with non-expansive soil under the supervision and direction of a geotechnical engineer.
- The base case design assumes elevated structures would be used for the well-pad control building and critical equipment needed for safe shutdown or reliable ongoing operations during a flood event.

With the implementation of these mitigation measures, the KICP would not result in significant direct, indirect, or cumulative geology-related impacts.

5.4.5 Laws, Ordinances, Regulations, and Standards

The laws, ordinances, regulations, and standards (LORS) that may apply to geologic resources and hazards are summarized in Table 5.4-1. The local LORS discussed in this section are certain ordinances, plans, or policies of San Joaquin County and the City of Lodi.

TABLE 5.4-1
Laws, Ordinances, Regulations, and Standards for Geologic Hazards and Resources

LORS	Requirements/ Applicability	Administering Agency
State/Local		
CBC, as amended by San Joaquin County and the City of Lodi	Acceptable design criteria for structures with respect to seismic design and load-bearing capacity	California Building Standards Commission, State of California, County of San Joaquin, and the City of Lodi
Alquist-Priolo Earthquake Fault Zoning Act (Title 14, Division 2, Chapter 8, Subchapter 1, Article 3, California Code of Regulations)	Identifies areas subject to surface rupture from active faults	California Building Standards Commission, State of California, County of San Joaquin, and the City of Lodi
The Seismic Hazards Mapping Act (Title 14, Division 2, Chapter 8, Subchapter 1, Article 10, California Code of Regulations.)	Identifies non-surface fault rupture earthquake hazards, including liquefaction and seismically induced landslides	California Building Standards Commission, State of California, County of San Joaquin, and the City of Lodi
County of San Joaquin (2010)	Compliance of the Safety Element of the General Plan (section 14), County of San Joaquin General Plan	County of San Joaquin
City of Lodi (2010)	Compliance of the Safety Element of the General Plan (Section 8), City of Lodi General Plan	City of Lodi

5.4.6 Agencies and Agency Contacts

Compliance of building construction with CBC standards is covered under engineering and construction permits for the project. There are no other permit requirements that specifically address geologic

resources and hazards. However, excavation/grading and inspection permits may be required prior to construction and would be included in the overall project construction permit (see Section 5.6, Land Use).

5.4.7 Permits

Compliance of building construction to CBC standards is covered under engineering and construction permits for the project that are within the exclusive jurisdiction of the CEC. Since the project would involve the drilling and installation of wells that extend into the depleted gas reservoir, permits would be required to be obtained from the CDOGGR and the U.S. Environmental Protection Agency (EPA). The EPA Underground Injection Control well permit process is described in Appendix 2A. The process for obtaining permits from CDOGGR is fairly straightforward and is detailed (including all forms) on the CDOGGR website at: http://www.conservation.ca.gov/dog/Pages/WellPermitting.aspx#drillnewwells.

The basic CDOGGR permitting process is:

- Designate an agent (an individual) to serve as the company contact for all correspondence with DOGGR
- Submit a completed permit request form entitled *Notice of Intention to Drill New Well*
- Comply with the requirements of the CEC (or local agency and CEQA process) prior to submitting *Notice of Intention to Drill New Well*
- Submit an individual or cash bond with the *Notice of Intention to Drill New Well*
- Receive CDOGGR approval (permit) through CEC licensing process

5.4.8 References

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5.5 Hazardous Materials Handling

This section evaluates the potential effects on human health and the environment from the storage and use of hazardous materials in conjunction with the proposed King Island CAES Project (KICP). This section assesses the need for catastrophic release modeling associated with the use of aqueous ammonia for air pollution control, and the hazardous materials associated with the project, including the air cycling and the process to manage the potential entrainment of native natural gas in the reservoir compressed air.

Hazardous waste management, including handling of potentially contaminated soil and groundwater, is addressed in Section 5.14, Waste Management. Regulations and procedures pertaining to the analysis of worker safety hazards and avoidance of them are covered in Section 5.16, Worker Health and Safety.

5.5.1 Affected Environment

5.5.1.1 Local Land Use

Land use in the area surrounding the ECF and well pad sites (discussed in detail in Section 5.6, Land Use) is primarily rural agricultural. Sensitive receptors within a 3-mile radius of the ECF site include daycare centers (mainly small, in-home locations), and one school. No hospitals, long-term health care facilities, or nursing homes are located within 3 miles of the project site. The nearest non-residential sensitive receptor is a small-capacity in-home daycare center approximately 2 miles south of the ECF site. The nearest school is Manlio Silva Elementary, approximately 2.8 miles south-southeast of the ECF site. The nearest hospital is Lodi Memorial Hospital at 975 South Fairmont Avenue, Lodi, which is approximately 8 miles northeast of the ECF site.

5.5.1.2 KICP Hazardous Materials Use

The KICP would use hazardous materials both during construction and project operation. Most of the hazardous materials used for the project are required for facility operations and maintenance, such as lubrication of equipment, or would be contained within transformers and electrical switches. The project would comply with applicable laws and regulations for the storage of these materials to minimize the potential for a release of hazardous materials and would conduct emergency response planning to address public health concerns regarding hazardous materials storage and use. The following sections describe this use, followed by tables detailing the hazardous materials used, their characteristics, the quantities of use, and use locations.

5.5.1.2.1 Construction Phase

The quantities of hazardous materials on site during construction are small relative to the quantities used during operation. They would be limited to gasoline, diesel fuel, motor oil, hydraulic fluid, solvents, cleaners, sealants, welding flux, various lubricants, paint, and paint thinner. There are no feasible alternatives to vehicle fuels and oils for operating construction equipment. The types of paint required are dictated by the types of equipment and structures that must be coated and by the manufacturers' requirements for coating.

Regulated substances, as defined in California Health and Safety Code, Section 25531, would not be used during construction of the project. Therefore, no discussion of regulated substances storage or handling is included in this section.

5.5.1.2.2 Operations Phase

Storage locations for the hazardous materials that would be used during operation are described in Table 5.5-1. Table 5.5-2 presents information about these materials, including trade names, chemical names,

Chemical Abstract Service (CAS) numbers, maximum quantities onsite, reportable quantities (RQ), California Accidental Release Program (CalARP) threshold planning quantities (TPQs), and status as a Proposition 65 chemical (a chemical known to be carcinogenic or cause reproductive problems in humans). Health hazards and flammability data are summarized for these materials in Table 5.5-3.

Most of the hazardous substances that would be used by the project are required for oxides of nitrogen (NO_X) emissions control (i.e., ammonia), facility maintenance and lubrication of equipment, or contained within transformers and electrical switches. The only regulated substance that would be used for the project is aqueous ammonia; toxicity characteristics and the exposure level criteria for this regulated substance are included in Table 5.5-4.

The compressed air stream returning from the air reservoir may contain some entrained native natural gas during the initial operating period, which may be an explosive/fire hazard under higher concentrations and certain conditions. To control for this possibility, each of the I/W wells should be continuously monitored and shut down if natural gas concentrations approach an unsafe level.

Compressed air at high pressure could be considered a hazard in itself if released in the atmosphere in public areas. The potential for exposure of members of the public to KICP compressed air is very low, however, because the air pipeline will be buried in public access areas and above-surface compressed air piping would be located only with in the ECF and well pad fence lines. KICP worker exposure to compressed air hazards is addressed in Section 5.16, Worker Health and Safety.

5.5.2 Environmental Analysis

Construction and operation of the KICP would involve the use of various hazardous materials and one regulated substance. The use of these materials and their potential to cause adverse environmental and human health effects are discussed in this section.

5.5.2.1 Significance Criteria

The project could have a significant effect on the environment in terms of hazardous materials handling if it would do the following (CEQA Guidelines Section 15002[g], Appendix G):

- Create a significant hazard to the public or the environment through the routine transport or use of hazardous materials.
- Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment.
- Emit hazardous emissions or handle hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school.

5.5.2.2 Transportation of Hazardous Materials

Project operation would require regular transportation of hazardous materials to the ECF site (see also Section 5.12, Traffic and Transportation). Transportation of hazardous materials would comply with all California Department of Transportation (Caltrans), U.S. Environmental Protection Agency (EPA), California Department of Toxic Substances Control (DTSC), California Highway Patrol (CHP), and California State Fire Marshal regulations. Aqueous ammonia (approximately 19%), a regulated substance, would be delivered to the ECF and transported in accordance with Vehicle Code Section 32100.5, which regulates the transportation of hazardous materials that pose an inhalation hazard.

Ammonia would only be transported along approved transportation routes to the ECF. The recommended routes to the ECF, subject to Caltrans approval, are as follows:

TABLE 5.5-1
Use and Location of Hazardous Materials

Chemical	Use	Quantity (gallons, lbs)	Storage Location	State	Type of Storage
Aqueous Ammonia (19% NH_3 by weight)	Control oxides of nitrogen (NO_x) emissions through selective catalytic reduction	10,000 gallons [a]	ECF storage tank	Liquid	Continuously Onsite
Anti-scalant NALCO PC-191T, NALCO PC-510T	Prevent scale formation	400 gallons	Portable Storage Tote – ECF	Liquid	Continuously on site
Biocide NALCO 3980	Injection well biological control	55 gallons	Energy Conversion Facility	Liquid	Continuously on site
Biocide NALCO 73551	Water biological penetrant	400 gallons	Energy Conversion Facility	Liquid	Continuously on site
Biocide NALCO 7330	Water biological control	400 gallons (totes)	Energy Conversion Facility	Liquid	Continuously on site
Caustic NALCO 8735	Water pH control	25 gallons	Energy Conversion Facility	Liquid	Continuously on site
Citric Acid	Non-chemical cleaning of interior piping	5,000 gallons	Pallet supported chemical storage bags in protected temporary storage location on site.	Solid Powder	Initial startup and periodically on site
Cleaning chemicals/detergents (including PC 98, PC-11, and PC 56)	Periodic cleaning	1,000 gallons	Portable Storage Totes/Drums – Energy Conversion Facility	Liquid	Continuously on site
Corrosion Control NALCO 3DT-184	Corrosion inhibitor	1,000 gallons	Energy Conversion Facility	Liquid	Continuously on site
Diesel No. 2	Small equipment refueling	55 gallons	Onsite 55 gallon drums	Liquid	Continuously on site
Dispersant NALCO 3DT-191	Mineral dispersant	1,000 gallons	Energy Conversion Facility	Liquid	Continuously on site
Glutamine	Injection well biological control	55 gallons	Energy Conversion Facility	Liquid	Continuously on site

TABLE 5.5-1
Use and Location of Hazardous Materials

Chemical	Use	Quantity (gallons, lbs)	Storage Location	State	Type of Storage
Hydraulic Oil	Hydraulic equipment	820 gallons	Onsite 55 gallon drums	Liquid	Continuously on site
Laboratory reagents	Water/wastewater laboratory analysis	22 gallons	Laboratory chemical storage cabinets (stored in original chemical storage containers/bags)	Liquid and Granular Solid	Continuously on site
Lithium Bromide	Refrigerant	75 gallons	Energy Conversion Facility	Liquid	Continuously on site
Lubrication Oil	Lubricate rotating equipment	1800 gallons	Lubricating oil reservoirs and 55 gallon drums	Liquid	Continuously on site
Mineral Insulating Oil	Transformers/switch yard	3,500 gallons	Transformer tanks and 55 gallon drums	Liquid	Continuously on site
Oxygen Scavenger (e.g., NALCO ELIMIN-OX)	Water conditioning	400 gallons	Energy Conversion Facility	Liquid	Continuously on site
Amine NALCO 5711	Water pH control	400 gallons	Energy Conversion Facility	Liquid	Continuously on site
Sodium Nitrite NALCO 2536 Plus	Corrosion inhibitor	55 gallons	Energy Conversion Facility	Solid	Continuously on site
Sulfur Hexaflouride (SF_6)	230 kV breaker insulating medium	200 lbs (500 ft^3)	Switchyard	Gas	Continuously on site
Sulfuric Acid (93%)	Water pH control	3,000 gallons	Energy Conversion Facility	Liquid	Continuously on site
NALCO BT3000	Water pH control	400 gallons	Energy Conversion Facility	Liquid	Continuously on site
Acetylene	Welding gas	540 ft^3	Maintenance / Warehouse Building	Gas	Continuously on site
Oxygen	Welding gas	540 ft^3	Maintenance / Warehouse Building	Gas	Continuously on site

TABLE 5.5-1
Use and Location of Hazardous Materials

Chemical	Use	Quantity (gallons, lbs)	Storage Location	State	Type of Storage
Propane	Torch gas	200 ft^3	Maintenance / Warehouse Building	Gas	Continuously on site
EPA Protocol Gases	Calibration gases	1,000 ft^3	CEMS (continuous emissions monitoring system) Enclosure	Gas	Continuously on site
Cleaning Chemicals	Cleaning	Varies (less than 25 gallons liquids or 100 lbs solids for each chemical)	Admin / Control Building, Maintenance / Warehouse Building	Liquid or Solid	Continuously on site
Paint	Touchup of painted surfaces	Varies (less than 25 gallons liquids or 100 lbs solids for each type)	Maintenance / Warehouse Building	Liquid	Continuously on site

[a] Ammonia tank capacity is 10,000 gallons; however, the tank is only filled to 85% of its capacity, or 17,000 gallons.

TABLE 5.5-2
Chemical Inventory, Description of Hazardous Materials Stored Onsite, and Reportable Quantities

Trade Name	Chemical Name	CAS Number	Maximum Quantity Onsite	CERCLA SARA RQ[a]	RQ of Material as Used Onsite[b]	EHS TPQ[c]	Regulated Substance TQ[d]	Prop 65
Aqueous Ammonia (19% NH_3 by weight)	Aqueous Ammonia	7664-41-7	10,000[g] gals	100 lbs	526 lbs	500 lbs	500 lbs	No
Anti-scalant NALCO PC191T, PC510T	Anti-scalant	Various	400 gallons	[e]	[e]	[e]	[e]	No
Biocide NALCO 3980	5-Chloro-2-Methyl-4-Isothiazolin-3-one (1-5%)	26172-55-4	55 gallons	[e]	[e]	[e]	[e]	No
	2-Methyl-4-Isothiazolin-3-one (0.1-1%)	2682-20-4		[e]	[e]	[e]	[e]	No
	Magnesium Nitrate (1-5%)	10377-60-3		[e]	[e]	[e]	[e]	No
Biocide NALCO 73551	None	None	400 gallons	[e]	[e]	[e]	[e]	No
Biocide NALCO 7330	5-Chloro-2-Methyl-4-Isothiazolin-3-one (1-5%)	26172-55-4	400 gallons	[e]	[e]	[e]	[e]	No No
	2-Methyl-4-Isothiazolin-3-one (0.1-1%)	2682-20-4		[e]	[e]	[e]	[e]	No
	Magnesium Nitrate (1-5%)	10377-60-3		[e]	[e]	[e]	[e]	
Caustic NALCO 8735	Sodium Hydroxide (30-60%)	1310-73-2	25 gallons	1,000 lbs	1,667 lbs	[e]	[e]	No
	Potassium Hydroxide (10-30%)	1310-58-3		1,000 lbs	3,333 lbs	[e]	[e]	No
Citric Acid	Citric Acid	77-92-9	5,000 gallons	[e]	[e]	[e]	[e]	No
Cleaning chemicals/ detergents	Various	None	1,000 gallons	[e]	[e]	[e]	[e]	No
Corrosion Control NALCO 3DT-184	Phosphoric Acid (30-60%)	7664-38-2	1,000 gallons	5,,000 lbs	8,333 lbs	[e]	[e]	No
Diesel No. 2	Diesel No. 2	68476-34-6	55 gallons	[e]	[e]	[e]	[e]	No
Dispersant NALCO 3DT-191	None	None	1,000 gallons	[e]	[e]	[e]	[e]	No
Glutamine	Glutamine	56-85-9	55 gallons	[e]	[e]	[e]	[e]	No

TABLE 5.5-2
Chemical Inventory, Description of Hazardous Materials Stored Onsite, and Reportable Quantities

Trade Name	Chemical Name	CAS Number	Maximum Quantity Onsite	CERCLA SARA RQ[a]	RQ of Material as Used Onsite[b]	EHS TPQ[c]	Regulated Substance TQ[d]	Prop 65
Hydraulic Oil	Oil	None	700 gallons	42 gal [f]	42 gal [f]	[e]	[e]	No
Laboratory reagents	Various	Various	10 gallons	[e]	[e]	[e]	[e]	No
Lubrication Oil	Oil	None	1,800 gallons	42 gal [f]	42 gal [f]	[e]	[e]	No
Mineral Insulating Oil	Oil	8012-95-1	3,500 gallons	42 gal [f]	42 gal [f]	[e]	[e]	No
Oxygen Scavenger (e.g., NALCO ELIMIN-OX)	Oxygen Scavenger	None	400 gallons	[e]	[e]	[e]	[e]	No
Amine NALCO 5711	Ammonia (10-30%)	7664-41-7	400 gallons	100 lbs	333 lbs	500 lbs	20,000 lbs	No
	Monoethanolamine (5-10%)	141-43-5		[e]	[e]	[e]	[e]	No
Sodium Nitrite NALCO 2536 Plus	Sodium Nitrite (1-5%)	7632-00-0	30 gallons	100 lbs	100 lbs	[e]	[e]	No
	Sodium Metasilicate (1-5%)	6834-92-0		[e]	[e]	[e]	[e]	No
	Sodium Tetraborate (1-5%)	1330-43-4		[e]	[e]	[e]	[e]	No
	Sodium Nitrate (1-5%)	7631-99-4		[e]	[e]	[e]	[e]	No
	Sodium Mercaptobenzothiazole (0-0.1%)	2492-26-4		[e]	[e]	[e]	[e]	No
Sulfur Hexafluoride	Sulfur Hexafluoride	2551-62-4	200 lbs	[e]	[e]	[e]	[e]	No
Sulfuric Acid (93%)	Sulfuric Acid	7664-93-9	3,000 gallons	1,000 lbs	1,075 lbs	1,000 lbs	1,000 lbs	Yes
NALCO BT-3000	Sodium Hydroxide (1-5%)	1310-73-2	400 gallons	1,000 lbs	20,000 lbs	[e]	[e]	No
	Sodium Tripolyphosphate (1-5%)	7758-29-4		[e]	[e]	[e]	[e]	No
Acetylene	Acetylene	47-86-2	540 ft^3	[e]	[e]	[e]	[e]	No
Oxygen	Oxygen	7782-44-7	540 ft^3	[e]	[e]	[e]	[e]	No
Propane	Propane	74-98-6	200 ft^3	[e]	[e]	[e]	[e]	No

TABLE 5.5-2
Chemical Inventory, Description of Hazardous Materials Stored Onsite, and Reportable Quantities

Trade Name	Chemical Name	CAS Number	Maximum Quantity Onsite	CERCLA SARA RQ[a]	RQ of Material as Used Onsite[b]	EHS TPQ[c]	Regulated Substance TQ[d]	Prop 65
EPA Protocol Gases	Various	Various	1,000 ft^3	[e]	[e]	[e]	[e]	No
Cleaning Chemicals	Various	Various	Varies (less than 25 gallons liquids or 100 lbs solids for each chemical)	[e]	[e]	[e]	[e]	No
Paint	Various	Various	Varies (less than 25 gallons liquids or 100 lbs solids for each type)	[e]	[e]	[e]	[e]	No

[a] RQ for a pure chemical, per the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Superfund Amendments and Reauthorization Act (SARA) (Ref. 40 Code of Federal Regulations [CFR] 302, Table 302.4). Release equal to or greater than RQ must be reported. Under California law, any amount that has a realistic potential to adversely affect the environment or human health or safety must be reported.

[b] RQ for materials as used onsite. Since some of the hazardous materials are mixtures that contain only a percentage of an RQ, the RQ of the mixture can be different than for a pure chemical. For example, if a material only contains 10% of a reportable chemical and the RQ is 100 lbs, the RQ for that material would be (100 lbs)/(10%) = 1,000 lbs.

[c] Extremely Hazardous Substance (EHS) TPQ (Ref. 40 CFR Part 355, Appendix A). If quantities of extremely hazardous materials equal to or greater than the TPQ are handled or stored, they must be registered with the local Administering Agency.

[d] TQ is from 19 California Code of Regulations (CCR) 2770.5 (state) or 40 CFR 68.130 (federal)

[e] No reporting requirement. Chemical has no listed threshold under this requirement.

[f] State RQ for oil spills that would reach California state waters [Ref. California Water Code Section 13272(f)]

[g] Existing Ammonia tank capacity is 10,000 gallons;

TABLE 5.5-3
Toxicity, Reactivity, and Flammability of Hazardous Substances Stored Onsite

Hazardous Materials	Physical Description	Health Hazard	Reactive & Incompatibles	Flammability*
Aqueous Ammonia	Colorless liquid with pungent odor	Corrosive; irritation to permanent damage from inhalation, ingestion, and skin contact	Acids, halogens (e.g., chlorine), strong oxidizers, salts of silver and zinc	Liquid is incombustible; vapor is combustible, but difficult to burn
Anti-scalant NALCO PC-510T	Amber liquid	May cause slight irritation to the skin and moderate irritation to the eyes	None	Non flammable
Anti-scalant NALCO PC-191T	Yellow liquid	May cause irritation with prolonged contact.	Strong oxidizing agents, strong acids	Slightly flammable
Biocide NALCO 3980	Light green/Light yellow Liquid	Corrosive: Causes irreversible eye damage or skin burns. Harmful if inhaled, swallowed or absorbed through the skin.	Strong oxidizers may generate heat, fires, explosions and/or toxic vapors	Non-flammable
Biocide NALCO 73551	Colorless Liquid	May cause irritation with prolonged contact	Freezing temperatures	Slightly flammable
Biocide NALCO 7330	Light green/Light Yellow Liquid	Corrosive: Causes irreversible eye damage or skin burns. Harmful if inhaled, swallowed or absorbed through skin.	Strong oxidizers may generate heat, fires, explosions and/or toxic vapors	Non-flammable
Caustic NALCO 8735	Colorless Liquid, no odor	Corrosive: Causes eye and skin burns. May cause severe respiratory tract irritation with possible burns. May cause severe digestive tract irritation with possible burns.	Aluminum, tin, zinc, and zinc alloys and strong acids	Not flammable
Citric Acid	Odorless, white granules	Causes irritation to the skin, gastrointestinal tract, and respiratory tract	Metal nitrates (potentially explosive reaction), alkali carbonates and bicarbonates, potassium tartrate. Will corrode copper, zinc, aluminum and their alloys.	Slightly flammable
Cleaning chemicals/detergents	Liquid	Refer to individual chemical labels	Refer to individual chemical labels	Refer to individual chemical labels
Corrosion Control NALCO 3DT-184	Liquid, Clear Amber Brown	Corrosive: May cause tissue damage	None	Non-flammable
Diesel No. 2	Oily, light liquid	May be carcinogenic	Sodium hypochlorite	Flammable
Dispersant NALCO 3D-191	Clear orange liquid	May cause irritation with prolonged contact	Strong oxidizers may generate heat, fires, explosions and/or toxic vapors	Slightly flammable

TABLE 5.5-3
Toxicity, Reactivity, and Flammability of Hazardous Substances Stored Onsite

Hazardous Materials	Physical Description	Health Hazard	Reactive & Incompatibles	Flammability*
Glutamine	Liquid	Causes irritation to skin and eyes	None known	Non flammable
Hydraulic Oil	Oily, dark liquid	Hazardous if ingested	Sodium hypochlorite. Oxidizers	Combustible
Laboratory reagents	Liquid and solid	Refer to individual chemical labels	Refer to individual chemical labels	Refer to individual chemical labels
Lubrication Oil	Oily, dark liquid	Hazardous if ingested	Sodium hypochlorite. Oxidizers	Flammable
Mineral Insulating Oil	Oily, clear liquid	Minor health hazard	Sodium hypochlorite. Oxidizers	Can be combustible, depending on manufacturer
Oxygen Scavenger NALCO ELIMIN-OX	Light yellow liquid with sulfurous odor	May cause asthma like attack if ingested. Can cause mild irritation. Causes asthmatic signs and symptoms in hyper-reactive individuals.	None	Not flammable
Amine NALCO 5711	Clear, pale yellow liquid with phenolic-amine odor	Harmful if swallowed. Causes irreversible eye damage.	Hazardous polymerization would not occur	Not flammable
Sodium Nitrite NALCO 2536 Plus	White to slightly yellowish. Solid (powdered solid), odorless	Very hazardous in case of eye contact (irritant), of ingestion, of inhalation. Hazardous in case of skin contact (irritant). Slightly hazardous in case of skin contact (permeator). Prolonged exposure may result in skin burns and ulcerations. Over-exposure by inhalation may cause respiratory irritation. Severe over-exposure can result in death. Inflammation of the eye is characterized by redness, watering, and itching.	Highly reactive with combustible materials, organic materials. Reactive with reducing agents, metals, acids. Slightly reactive to reactive with moisture.	Not flammable
Sulfur Hexaflouride	Colorless gas with no odor	Hazardous if inhaled	Disilane	Non flammable

TABLE 5.5-3
Toxicity, Reactivity, and Flammability of Hazardous Substances Stored Onsite

Hazardous Materials	Physical Description	Health Hazard	Reactive & Incompatibles	Flammability*
Sulfuric Acid (93%)	Oily, colorless to slightly yellow, clear to turbid liquid. Odorless.	Causes severe skin burns. Causes severe eye burns. Causes burns of the mouth, throat, and stomach.	Nitro compounds, carbides, dienes, alcohols (when heated): causes explosions. Oxidizing agents, such as chlorates and permanganates: causes fires and possible explosions. Allyl compounds and aldehydes: undergoes polymerization, possibly violent. Alkalies, amines, water, hydrated salts, carboxylic acid anhydrides, nitriles, olefinic organics, glycols, aqueous acids: causes strong exothermic reactions.	Not flammable
NALCO BT-3000	Light Yellow Liquid	Corrosive. Would cause eye burns and permanent tissue damage	Strong acids	Not flammable
Acetylene	Colorless gas	Asphyxiant gas	Oxygen and other oxidizers including all halogens and halogen compounds. Forms explosive acetylide compounds with copper, mercury, silver, brasses containing >66 percent copper and brazing materials containing silver or copper.	Flammable
Oxygen	Colorless, odorless, tasteless gas	Therapeutic overdoses can cause convulsions. Liquid oxygen is an irritant to skin.	Hydrocarbons, organic materials	Oxidizing agent; actively supports combustion
Propane	Propane gas (odorant added to provide odor)	Asphyxiant gas. Causes frostbite to area of contact.	Strong oxidizing agents and high heat	Flammable
EPA Protocol Gases	Gas	Refer to individual chemical labels	Refer to individual chemical labels	Refer to individual chemical labels
Cleaning Chemicals	Liquid	Refer to individual chemical labels	Refer to individual chemical labels	Refer to individual chemical labels
Paint	Various colored liquid	Refer to individual container labels	Refer to individual container labels	Refer to individual container labels

Notes:

Data were obtained from Material Information Sheets (MISs), Material Safety Data Sheets (MSDSs) and Lewis, 1991.

Per Department of Transportation regulations, under 49 CFR 173: “Flammable” liquids have a flash point less than or equal to 141 degrees Fahrenheit; “Combustible” liquids have a flash point greater than 141° F.

TABLE 5.5-4
Toxic Effects and Exposure Levels of Regulated Substance

Name	Toxic Effects	Exposure Levels-Pure NH_3
Aqueous Ammonia (19% NH_3 by weight))	Contact with pure liquid or vapor causes eye, nose, and throat irritation, skin burns, and vesiculation. Ingestion or inhalation causes burning pain in mouth, throat, stomach, and thorax, constriction of thorax, and coughing followed by vomiting blood, breathing difficulties, convulsions, and shock. Other symptoms include dyspnea, bronchospasms, pulmonary edema, and pink frothy sputum. Contact or inhalation overexposure can cause burns of the skin and mucous membranes, headache, salivation, nausea, and vomiting. Other symptoms include labored breathing, bloody mucous discharge, bronchitis, laryngitis, hemmoptysis, and pneumonitis. Damage to eyes may be permanent, including ulceration of conjunctiva and cornea and corneal and lenticular opacities.	Occupational Exposures: PEL = 35 mg/m^3 OSHA TLV = 18 mg/m^3 ACGIH TWA = 25 mg/m^3 NIOSH STEL = 35 mg/m^3 Hazardous Concentrations: IDLH = 500 ppm LD_{50} = 350 mg/kg – oral, rat ingestion of 3 to 4 ml may be fatal Sensitive Receptors: ERPG-1 = 25 ppm ERPG-2 = 200 ppm ERPG-3 = 1,000 ppm

ERPG = Emergency Response Planning Guideline
ERPG-1 = Maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing other than mild transient adverse health effects
ERPG-2 = Maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without developing irreversible or serious health effects
ERPG-3 = Maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing life-threatening health effects
IDLH = Immediately dangerous to life and health
LD_{50} = Dose lethal to 50 percent of those tested
mg/kg = milligrams per kilogram
mg/m^3 = milligrams per cubic meter
mL = milliliters
PEL = OSHA-permissible exposure limit for 8-hour workday
ppm = parts per million
STEL = Short-term exposure limit, 15-minute exposure
TLV = ACGIH threshold limit value for 8-hour workday
TWA = NIOSH time-weighted average for 8-hour workday

- From I-5 exit at SR 12 interchange then turn south onto North Thornton Road, and west on Frontage road
- From I-5 exit at West Eight Mile Road interchange then turn north onto North Thornton Road, and west on Frontage road

The ECF site is located west of Interstate 5, approximately 2.5 miles north of the northernmost portions of the Stockton. Outbound trucks would proceed on I-5 to access hazardous waste facilities throughout the state. Hauling would be carried out in accordance with local, state, and federal regulations that include the Resource Conservation and Recovery Act (42 U.S. Code 6901 et seq.) and the California Integrated Waste Management Act (Public Resources Code Sections 40000 et seq.).

5.5.2.3 Hazardous Materials Use

5.5.2.3.1 Construction Phase

Construction would involve the transport of limited quantities of hazardous materials to the ECF and well pad sites and along the air and gas pipeline and would pose minor hazards associated with their use. Small spills may occur during onsite during refueling of construction equipment. Equipment refueling would be performed away from any water bodies to prevent contamination of water in the event of a fuel spill. Therefore, the potential environmental effects from fueling operations are expected to be limited to small areas of contaminated soil. If a fuel spill occurs on soil, the contaminated soil would be placed into containers for offsite disposal as a hazardous waste. The worst-case scenario for a chemical release from fueling operations would be a vehicle accident involving a service or refueling truck.

The quantities of hazardous materials that would be handled during construction are relatively small and Best Management Practices (BMPs) would be implemented by contractor personnel. Therefore, the potential for environmental effects is expected to be small.

5.5.2.3.2 Project Operation

As stated previously, the KICP would use hazardous materials both during construction and during project operation. Most of the hazardous substances that would be used by the project are required for NO_x emission controls (i.e., 19% ammonia), facility maintenance, and lubrication of equipment, or would be contained within transformers and electrical switches at the ECF site. Their storage would be carefully contained within designated hazardous materials storage areas and their use would be carefully prescribed in terms of site-specific planning documents.

The project would comply with applicable laws and regulations for the storage of these materials to minimize the potential for a release of hazardous materials and would conduct emergency response planning to address public health concerns regarding hazardous materials storage and use. For the non-CalARP regulated materials, therefore, the risk of public exposure and serious hazard is low and would not be significant. The only regulated substance that would be used for the project at quantities larger than the federal Threshold Quantity (TQ) is aqueous ammonia.

The KICP facility would use aqueous ammonia (19% NH_3 by weight), stored in a single stationary aboveground storage tank (AST). The capacity of the tank would be 10,000 gallons; The tank would be surrounded by a secondary containment structure capable of holding the full contents of the tank and accumulated precipitation. The aqueous ammonia storage tank would be equipped with a continuous tank level monitor, automated leak detection system, temperature and pressure monitors and alarms, and emergency block valves.

Sulfur hexafluoride (SF_6) gas would be used as an insular and arc suppressor for circuit breakers in the ECF switchyard. SF_6 is non-toxic but is a greenhouse gas. Please see the discussion of this topic in Section 5.1 Air Quality.

5.5.2.4 Accidental Release Hazards

If a chemical release were to occur without proper engineering controls in place, the public could be exposed to harmful vapors, and incompatible chemicals could mix, causing vapors that could also potentially have harmful effects. In addition, an uncontrolled release of liquid chemicals could run off and drain into the stormwater system and potentially degrade water quality. However, the California Fire Code, Articles 79 and 80, includes specific requirements for the safe storage and handling of hazardous materials that would reduce the potential for a release of hazardous materials, and mixing of incompatible materials. The design of the project would incorporate state-of-the-art chemical storage and handling facilities in compliance with the current California Fire Code and other applicable federal, state, and local regulations.

5.5.2.4.1 Ammonia Release

Because of its hazardous properties, ammonia is classified as a regulated substance, and an accidental release of the aqueous ammonia solution could present a human health hazard. Pure ammonia (NH_3) is a volatile substance that is very soluble in water. Aqueous ammonia consists of a solution of ammonia and water. For the KICP, 19% NH_3 by weight would be used. If the aqueous ammonia solution were to leak or be released without proper controls, the ammonia in solution could escape or evaporate as a gas into the atmosphere.

Ammonia gas can be toxic to humans at sufficient concentrations. Potential toxic effects of ammonia and acceptable exposure levels are summarized in Table 5.5-4. The odor threshold of ammonia is about 5 ppm, and minor irritation of the nose and throat occurs at 30 to 50 ppm. Ammonia concentrations greater than 140 ppm will cause detectable effects on lung function even for short-term exposures (0.5 to 2 hours). At higher concentrations of 700 to 1,700 ppm, ammonia gas will cause severe effects; death occurs at concentrations of 2,500 to 6,000 ppm (Smyth, 1956).

The hazard to facility workers would be mitigated by facility safety equipment, hazardous materials training, and emergency response planning (see Section 5.16, Worker Health and Safety). In a catastrophic accident, toxic ammonia gas could migrate off site and affect the health of humans at locations surrounding the facility (see below, Section 5.5.2.4.2). Facility design would minimize the potential for harm to humans located off site.

5.5.2.4.2 Offsite Consequences Analysis

Because there is human activity in the vicinity of the proposed ECF site, an Offsite Consequences Analysis (OCA) would be required for the Application for Certification (AFC) process. The analysis would assess the risk to humans at various distances from the site if a spill or rupture of the aqueous ammonia storage tank were to occur or if a spill from the supply truck were to occur while refilling the storage tank, and would assess the project in relation to the California Energy Commission's (CEC) significance threshold of 75 ppm. The modeling protocol for the OCA for ammonia is presented in Appendix 5.5A.

5.5.2.5 Fire and Explosion Hazards

Table 5.5-3 describes the flammability for the hazardous materials that will be on site. Article 80 of the California Fire Code requires all hazardous materials storage areas to be equipped with a fire extinguishing system and also requires ventilation for all enclosed hazardous material storage areas.

Aqueous ammonia, which constitutes the largest quantity of hazardous materials stored onsite, is a colorless, non-flammable liquefied gas. Under normal storage conditions, ammonia would not evaporate to the atmosphere because it is contained in a sealed tank that maintains the ammonia in a state that precludes evaporation. In the unlikely event that a release were to occur, ammonia could evaporate directly to the atmosphere. Ammonia vapor is combustible only within a narrow range of concentrations in air. It will ignite at a temperature of 1204°F within vapor concentration limits between 15% and 28% and the presence of a strong ignition source. Outside conditions that would support these vapor concentrations are rare. The evaporation rate of ammonia is similar to water, which is sufficiently low that the lower explosive limit of 15 percent (or 15,000 ppm) will not be reached.

The plant machinery lubrication oil is flammable. In accordance with Article 80 of the California Fire Code, the storage area for the lubrication oil will be equipped with a fire extinguishing system and the lubrication oil will be handled in accordance with regulations and planning documents approved by the San Joaquin County Environmental Health Department, the San Joaquin County Office of Emergency Services, and the CEC. With proper storage and handling of flammable materials in accordance with the California Fire Code and the site-specific documents, the risk of fire and explosion at the generating facility would be minimal.

The KICP will require construction of a natural gas pipeline which will interconnect to PG&E's distribution pipeline. Natural gas is composed mostly of methane, but also may contain ethane, propane, nitrogen, butane, isobutene, and isopentane. It is colorless, odorless, tasteless, and is lighter than air in its native state. Odorant is added to native natural gas as a safety measure before it is placed in pipelines. Methane is flammable when mixed in air at concentrations of 5 to 14 percent, which is also the detonation range. Natural gas, therefore, poses a risk of fire and explosion if an accidental release were to occur. However, the risk of a fire and/or explosion would be reduced through compliance with applicable codes, regulations, and industry design/construction standards. The project's pipeline will be designed to meet Class 1 service and California Public Utilities Commission (CPUC) standards, in addition to the federal requirements for gas pipeline construction and safety.

The compressed air pipeline coming from the air storage reservoir may initially entrain traces of residual native natural gas that remains in the reservoir. As stated above, natural gas can be flammable at concentrations starting at approximately 5 percent. To mitigate the risk of fire or explosion due to releases of an air-gas mixture from the reservoir, the I/W wells will be continuously monitored. If any well approaches an unsafe concentration threshold the well will be shut in (isolated) until the next air injection cycle. At that point, the injected air into the reservoir will dilute the air-gas mixture in the well thereby reducing the concentrations to safe levels. The small amounts of natural gas that are entrained into the compressed air pipeline back to the ECF will be consumed with pipeline gas in the combustors and the concentrations of gas in the combustors will be controlled at the combustors.

The Woodbridge Fire Protection District has a total of four stations in its system. The closest fire station to the KICP project ECF site is Woodbridge Station No. 4 at 6365 W. Capitol Avenue, Lodi, California 95242. The station is approximately 1.25 miles by road north of the KICP ECF site located in the highway commercial complex at North Thornton Road and Highway 12, and would provide the first response to the project. Response time would be approximately 7 to 10 minutes to the ECF and 20-30 minutes to the well pad area. If hazardous materials were involved in the incident, Woodbridge Station No. 4 would be the first on site, requesting additional resources from the other Woodbridge stations, the City of Stockton and the City of Lodi Fire Departments. Any mutual aid response for major incidents would also come from the other Woodbridge stations, the City of Stockton and the City of Lodi Fire Departments, depending on situation and need.

The San Joaquin County Office of Emergency Services operates and manages a county-wide Hazardous Materials (Haz Mat) Response Team. Woodbridge Station No. 4 has hazardous material (hazmat) response capabilities, with equipment and trained personnel. Additionally, the Stockton Fire Department hazmat capabilities are located at Station No. 10, with trained hazmat personnel and equipment. Stockton Station No. 10 is approximately 7.75 miles south of the ECF site, at 2903 W. March Lane, Stockton, California 95219.

5.5.2.6 Schools

The nearest school is Manlio Silva Elementary, which is approximately 2.8 miles south-southeast of the ECF site at 6250 Scott Creek Drive, Stockton, California. The proposed transportation routes for delivery of regulated materials such as aqueous ammonia, as well as for all other hazardous materials used at the KICP, would not pass in the vicinity of the school. The recommended routes travel along the highways and access the ECF site from North Thornton Road.

5.5.3 Cumulative Effects

A cumulative impact refers to a proposed project's incremental effect together with other closely related past, present, and reasonably foreseeable future projects whose impacts may compound or increase the incremental effect of the proposed project (Public Resources Code § 21083; California Code of Regulations, title 14, § 15064(h), 15065(c), 15130, and 15355).

Existing laws and regulations address the handling of hazardous materials and the transportation and use of aqueous ammonia, an acutely hazardous material, and would ensure that all hazardous materials at the KICP are safely managed. Existing laws and regulations would ensure that the proposed project's incremental effect is not cumulatively considerable.

5.5.4 Mitigation Measures

The following sections present measures included in the project to mitigate potential public health and environmental impacts of handling hazardous materials and regulated substances during construction and operation.

5.5.4.1 Construction Phase

The hazardous materials that would be used during construction present a relatively low public health risk, but could contaminate surface water or groundwater if a release occurred. Use of BMPs would reduce the potential for the release of construction-related fuels and other hazardous materials to stormwater and receiving waters as discussed in Section 5.15, Water Resources. BMPs prevent sediment and stormwater contamination from spills or leaks, control the amount of runoff from the site, and require proper disposal or recycling of hazardous materials.

Construction service personnel would follow general industry health, safety, and environmental standards for filling and servicing construction equipment and vehicles. The standards are designed to reduce the potential for incidents involving the hazardous materials.

In the unlikely event of a spill, the spill may need to be reported to the appropriate regulatory agencies and cleanup of contaminated soil could be required. Small spills would be contained and cleaned up immediately by trained, onsite personnel. Larger spills would be reported via emergency phone numbers to obtain help from offsite containment and cleanup crews. Personnel working on the project during the construction phase would be trained in handling hazardous materials and the dangers associated with hazardous

materials. An onsite health and safety person would be designated to implement health and safety guidelines and to contact emergency response personnel and the local hospital, if necessary.

If there is a large spill from a service or refueling truck, contaminated soil would be placed into containers by service personnel for offsite disposal at an appropriate facility in accordance with regulations. If a spill involves hazardous materials quantities equal to or greater than the specific RQ (42 gallons for petroleum products), all federal, state, and local reporting requirements would be followed. In the event of a fire or injury, the local fire department would be called.

5.5.4.2 Operation Phase

During facility operation, various hazardous materials and one regulated substance, aqueous ammonia, would be stored on site as shown in Table 5.5-1. Table 5.5-2 presents information about these materials, including trade names, chemical names, CAS numbers, maximum quantities onsite, RQs, CalARP TPQs, and status as a Proposition 65 chemical (a chemical known to be carcinogenic or cause reproductive problems in humans). Health hazards and flammability data are summarized for these materials in Table 5.5-3. Table 5.5-4 describes the toxicity of the regulated substance and hazardous materials. Listed below are mitigation measures for minimizing the public health risks associated with hazardous material and regulated substance handling during facility operation.

5.5.4.2.1 Hazardous Materials

All hazardous materials would be handled and stored in accordance with applicable codes and regulations specified in Section 5.5.6. Required site-specific planning documents would be filed with the San Joaquin County Environmental Health Department, the designated Certified Unified Program Agency (CUPA) for the project site, and would be updated annually in accordance with applicable regulations.

In accordance with emergency response procedures, designated personnel would be trained in appropriate methods to mitigate and control accidental spills. In the event of a chemical emergency, plant personnel would defer to the San Joaquin County Environmental Health Department and the San Joaquin County Office of Emergency Services.

For emergency spills and hazardous materials, the Woodbridge Fire Protection District and the City of Stockton and Lodi Fire Departments have firefighters who have completed formal training in Hazardous Materials Incident Response. These firefighters are members of a countywide Hazardous Materials (Haz Mat) Team, managed by the San Joaquin County Office of Emergency Services. The Haz Mat Team would identify the type and source of the hazardous material, oversee evacuation of people, and confine the spilled material, if possible. Cleanup of the material is the responsibility of the facility causing the spill.

5.5.4.2.2 Petroleum Products

Federal and California regulations require a Spill Prevention Control and Countermeasures (SPCC) plan if petroleum products above certain quantities are stored. Both federal and state laws apply only to petroleum products that might be discharged to navigable waters. If stored quantities are equal to or greater than 660 gallons for a single container, or equal to or greater than 1,320 gallons total (including tanks, oil-filled equipment, and drums), an SPCC plan must be prepared.

5.5.4.2.3 Entrained Natural Gas

As stated above, the compressed air pipeline coming from the air reservoir may initially entrain traces of residual native natural gas that remains in the reservoir. The I/W wells will be continuously monitored and if any well approaches an unsafe concentration the well will be shut in (isolated) until the next air injection cycle. At that point, the air injected into the reservoir will dilute the air-gas mixture in the well thereby

reducing the concentrations to levels below the safe threshold. The small amounts of natural gas that are entrained into the compressed air pipeline back to the ECF will be consumed with pipeline gas in the combustors and the concentrations of gas in the combustors will be controlled at the combustors.

5.5.4.2.4 Transportation/Delivery of Hazardous Materials and Regulated Substances

Hazardous materials and aqueous ammonia, a regulated substance, would be delivered periodically to the facility. As discussed in Section 5.12, Traffic and Transportation, transportation of hazardous materials would comply with all Caltrans, EPA, DTSC, CHP, and California State Fire Marshal regulations. Under the California Vehicle Code, the CHP has the authority to adopt regulations for transporting hazardous materials in California. The CHP can issue permits and specify the route for hazardous material delivery. Aqueous ammonia would be delivered to the facility, and transported in accordance with Vehicle Code Section 32100.5, which regulates the transportation of hazardous materials that pose an inhalation hazard. In addition, ammonia would only be transported along approved transportation routes.

5.5.4.2.5 Security Plan

In addition to standard industrial business security measures, the KICP would prepare a security plan that would include the following elements:

- Descriptions of the site fencing and security gate
- Evacuation procedures
- A protocol for contacting law enforcement in the event of conduct endangering the facility, its employees, its contractors, or the public
- A fire alarm monitoring system
- Measures to conduct site personnel background checks, including employee and routine onsite contractors consistent with state and federal law regarding security and privacy
- A site access protocol for vendors
- A protocol for hazardous materials vendors to prepare and implement security plans as per 49 CFR 172.800 and to ensure that all hazardous materials drivers are in compliance with personnel background security checks as per 49 CFR Part 172, Subpart I

The plan would also include a demonstration that the perimeter security measures would be adequate. The demonstration may include one or more of the following:

- Security guards
- Security alarm for critical structures
- Perimeter breach detectors and onsite motion detectors
- Video or still camera monitoring system

5.5.4.3 Monitoring

In accordance with applicable federal, state, and local regulations, site personnel would regularly inspect all hazardous materials handling facilities for compliance with applicable regulations and would ensure that any deficiencies were promptly repaired. In addition, the facility would be subject to regular inspections by the Woodbridge Fire Protection District and San Joaquin County Environmental Health Department, which would ensure compliance with appropriate regulatory requirements for hazardous materials and regulated substances handling.

Entrained native natural gas would be continuously monitored by instruments at the I/W wells and the wells would be shut in (isolated) if natural gas concentrations approach hazardous levels.

5.5.5 Laws, Ordinances, Regulations, and Standards

The storage and use of hazardous materials and regulated substances at the facility are governed by federal, state, and local laws. Applicable laws and regulations address the use and storage of hazardous materials to protect the environment from contamination, and to protect facility workers and the surrounding community from exposure to hazardous and regulated substances.

The design, engineering, construction, and operation of hazardous materials storage and dispensing systems at KICP would be in accordance with all applicable federal, state, and local laws, ordinances, regulations, and standards.

5.5.6 Agencies and Agency Contacts

Several agencies regulate hazardous materials, and they would be involved in regulating the hazardous materials stored and used at KICP. At the federal level, the EPA would be involved; at the state level, the California Environmental Protection Agency would be involved. However, local agencies primarily enforce hazardous materials laws. For KICP, the primary local agencies with jurisdiction would be the San Joaquin County Environmental Health Department, the San Joaquin County Office of Emergency Services, and the Woodbridge Fire Protection District.

5.5.7 Permits and Plans Required and Permit Schedule

The San Joaquin County Environmental Health Department requires that project developers submit the required reports and obtain the permits listed in Table 5.5-5 before storing hazardous materials on site.

TABLE 5.5-5
Permits and Plans Required and Permit Schedule for Hazardous Materials Handling

Permit	Agency Contact	Schedule
Hazardous Materials Business Plan	San Joaquin County Environmental Health Department 600 E. Main Street Stockton, CA 92505	Approximately 60 days before any regulated substance comes on site.
Risk Management Plan	San Joaquin County Environmental Health Department Program Coordinator 600 E. Main Street Stockton, CA 92505	Approximately 60 days before any regulated substance comes on site

5.5.8 References

CH2MHILL, 2014. *Final Environmental Assessment for the Pacific Gas and Electric Company Compressed Air Energy Storage (CAES) Compression Testing Phase Project, San Joaquin County, California.* U.S. Department of Energy National Energy Technology Laboratory. Prepared on behalf of Pacific Gas and Electric Company, San Francisco, California.

Lewis, Richard J., Sr. 1991. *Hazardous Chemical Desk Reference*, 2nd Edition.

Smyth H F., Jr. 1956. Improved Communication: Hygienic Standards for Daily Inhalation. *Am. Ind. Hyg. Assoc.* Q *17*(2):129-185.

5.6 Land Use

This section provides an inventory of existing and designated land uses, including agricultural uses, for the King Island CAES Project (KICP) and discusses the project's compatibility with existing General Plan land use designations, zoning designations, and land uses. Section 5.10, Socioeconomics, discusses population and growth trends of the City of Lodi and San Joaquin County. In this section, "project site" is intended to include the ECF site, well pads and all linear features as described in Section 2.0, Project Description. The "project area" is the general vicinity surrounding the project site.

5.6.1 Affected Environment

5.6.1.1 Existing Land Uses within the Project Site and Immediate Area

The proposed 20.3-acre KICP Energy Conversion Facility (ECF) site is located on land owned and incorporated by the City of Lodi and in San Joaquin County. The ECF site is approximately 5 miles southwest of the westernmost portion of Lodi and approximately 3 miles north of the northernmost portions of Stockton. The ECF facility is on the west side of Interstate 5 (I-5), approximately 1.5 miles south of State Route 12, and adjacent to the City of Lodi's White Slough Water Pollution Control Facility (WPCF). The WPCF's treatment and holding ponds are located immediately to the south of the proposed ECF site. Further south of the proposed ECF site is the Lodi Energy Center (LEC), the Northern California Power Agency Combustion Turbine Project #2, and the San Joaquin County Mosquito and Vector Control District facility.

The two well pads on King Island total 10 acres (6 and 4 acres, respectively). The temporary acreage disturbed would total approximately 13.7 acres for staging areas at the ECF site. The project linears would include an approximately 1,500-foot-long air collection pipeline between well pads, an approximately 2.6-mile-long air pipeline connecting the well pads with the ECF site, an approximately 1.36-mile-long natural gas pipeline, an approximately 270-foot-long generator tie-line, and an approximately 3,000-foot-long, 12-kilovolt (kV) supply line serving the well pads. Table 5.6-1 lists the locations of specific project components, either the City of Lodi or San Joaquin County. Figure 5.6-1 shows project components with City of Lodi and San Joaquin County boundaries, displaying specifically which portions of the linears would be within either the City or County.

TABLE 5.6-1
Project Components, by Local Jurisdiction

Location	Project Components
City of Lodi	ECF, ECF generator tie-line, three staging areas, water supply pipeline, a portion of the air pipeline (approximately 4,500 feet), and a portion of the gas pipeline (approximately 6,750 feet)
San Joaquin County	Two well pads (east and west), air collection pipeline, 12-kV service line, a portion of the air pipeline (approximately 9,000 feet), and a portion of the gas pipeline (approximately 450 feet)

The proposed project area is currently agricultural land and open space. The White Slough Wildlife Area (WA) is a strip of land parallel to I-5 that is owned by the California Department of Water Resources, but managed for wildlife by the California Department of Fish and Wildlife. The ECF and staging area west of the ECF are currently corn fields, and the well pads are located within walnut orchards. The ECF staging areas along I-5 are currently open spaces that have previously been used for equipment storage. The ECF project vicinity is developed primarily into agricultural land uses with rural residences, I-5 and local roadways, and irrigation canals. Three residences are located approximately 0.5 mile to the north of the

ECF site; these are the closest residences. Approximately a dozen residences are located further north along W. Kingdon Rd. between 0.75 mile and 1 mile from the ECF project site. Two farm residences are located just south of the proposed well pads, but no other residences are near the air pipelines. The proposed natural gas pipeline route would extend to the south and east from the ECF site, initially following I-5 southward and then turning east and passing under the I-5 freeway in the vicinity of an existing undercrossing near the southeast corner of the WPCF, connecting with the existing gas pipeline on the east side of North Thornton Road. The Kingdon Airport is located to the east of the ECF site and east of I-5. Figure 5.6-1 shows existing land uses surrounding the proposed project site.

A search determined there are no schools (elementary, middle, and high), churches, child care/day centers, parks and recreation centers, historic areas, or mines and quarries located within 1 mile of the proposed project features (Mapquest, 2014).

5.6.1.2 Agricultural Lands within the Study Area

The Farmland Mapping and Monitoring Program (FMMP) of the California Department of Conservation (CDC) provides statistics on conversion of farmland to nonagricultural uses in San Joaquin County. A review of the Important Farmlands map prepared by the FMMP shows that the ECF site, the ECF generator tie-line, the staging area to the west of the ECF, and the portion of the gas pipeline east of I-5 are designated as Unique Farmland. The well pads, air collection pipeline, and 12-kV service line are in locations designated as Prime Farmland. The staging area to the north of the ECF is designated as Farmland of Local Importance. The staging area to the south of the ECF, the water supply pipeline, and the portion of the gas line that parallels I-5 are designated Urban and Built-Up Land. Lastly, the air pipeline that runs from the ECF to the well pads crosses through areas designated as Unique Farmland, Prime Farmland, and Farmland of Local Importance (CDC, 2012). Figure 5.6-2 shows the designated Important Farmlands near the project site.

The west well pad, and the portions of the air collection pipeline and 12-kV service line that turn west are located on a Williamson Act parcel. The portion of the air pipeline that runs from west to east and then turns south, paralleling a water canal is located on a Williamson Act parcel, designated Non-Renewal. No other project elements are under Williamson Act contract (ECF site, east well pad, etc.). None of the proposed project components are located on designated Farmland Security Zones (CDC, 2013).

5.6.1.3 Current Land Use Plans for the Project Area

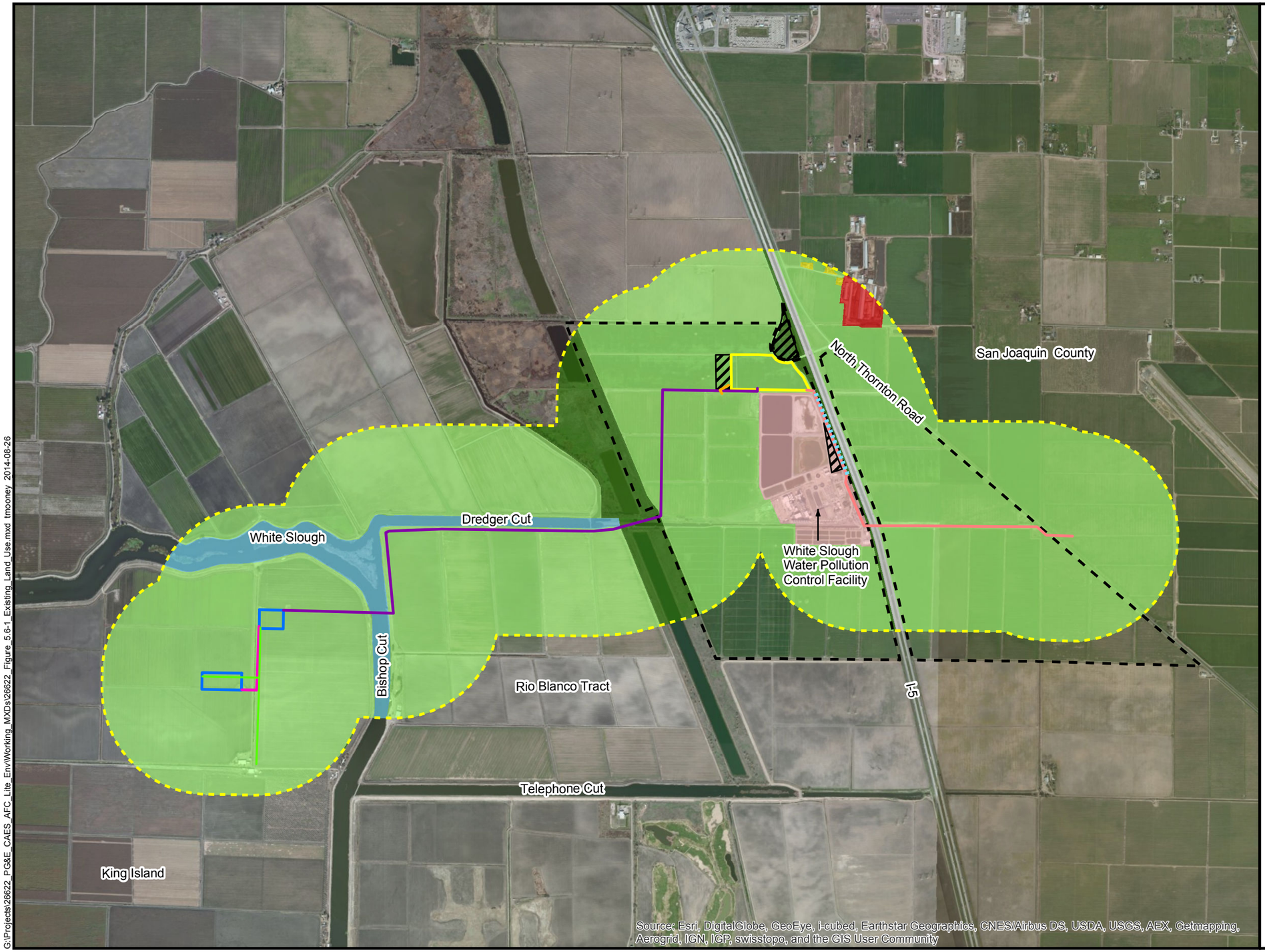
The project components are sited on land that includes areas located within the Lodi city limit and also areas in unincorporated San Joaquin County.

5.6.1.3.1 City of Lodi

Lands, including the ECF site, that are within the City of Lodi are located on an "island" of city land that is separated from the City of Lodi proper by a little more than 4 miles. The City purchased this land in 1964 as the site of its WPCF. Other project facilities (well pads and air pipeline route) are located in unincorporated San Joaquin County. Applicable City of Lodi plans and policies governing physical development include the City of Lodi General Plan and City of Lodi Development Code (Title 17 of the Municipal Code, addressing zoning).

5.6.1.3.2 San Joaquin County

San Joaquin County plans and policies governing physical development with the project study include the San Joaquin County General Plan, San Joaquin County Title 9 Zoning, the San Joaquin County Multi-Species Habitat Conservation and Open-Space Plan, and the San Joaquin County Council of Governments Airport



Air Pipeline
Air Collection Pipeline
Gas Pipeline
ECF Generator Tie-Line
12kV Service Line
Water Supply Pipeline
Energy Conversion Facility (ECF)
Well Pad
Staging
1/2 Mile Buffer Around Project Site
City of Lodi

Existing Land Use

Agricultural
Dairy
Freeway
Open Space
Residential
Wastewater Treatment Plant
Water

Source: San Joaquin County District Viewer, http://sjmap.org/website/DistrictViewer/Disclaimer.htm. Accessed on August 15, 2014.

This map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

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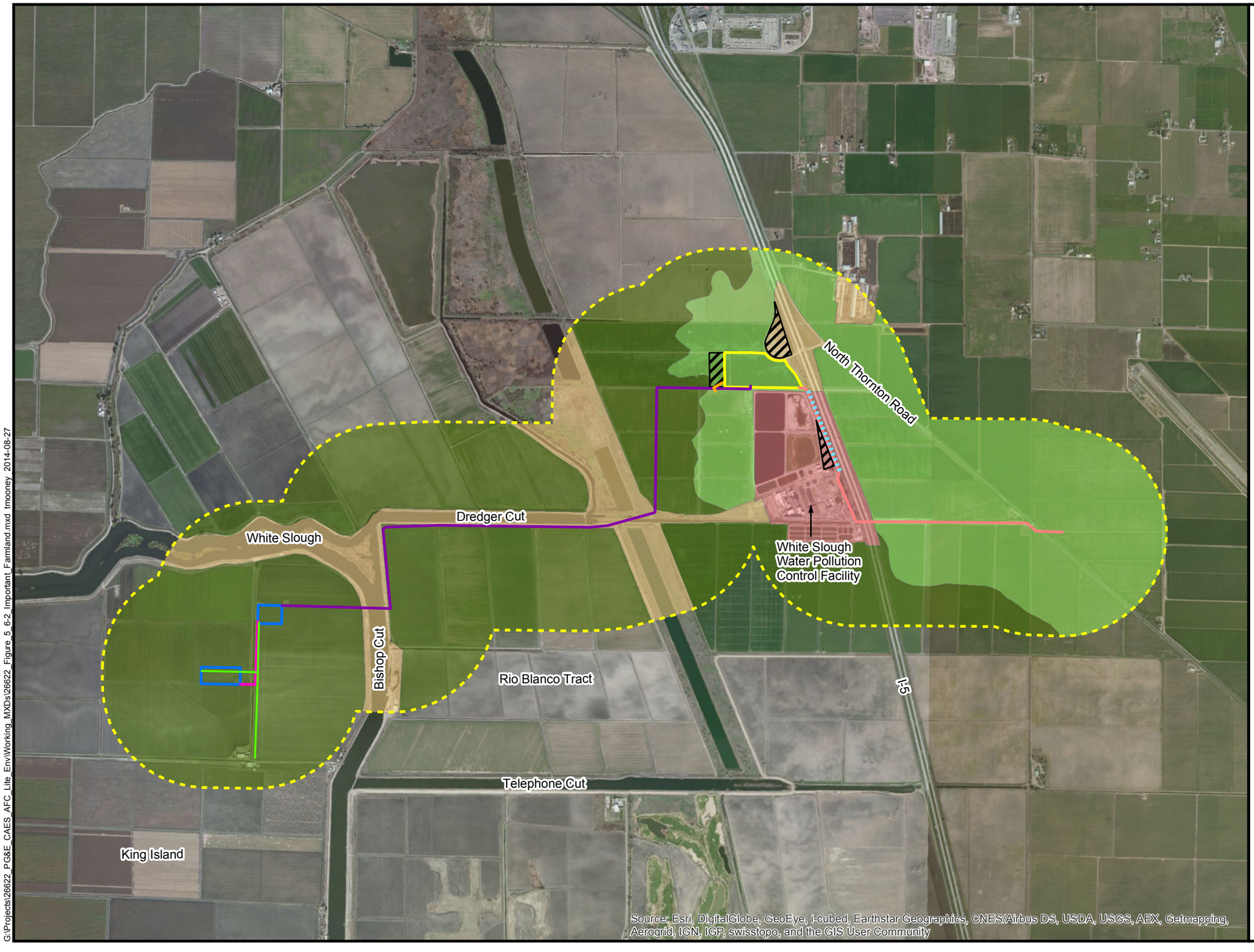
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North State Resources, Inc.

PG&E King Island Compressed Air Energy Storage Project

Figure 5.6-1
Existing Land Use Within One-Half Mile of Site



Air Pipeline
Air Collection Pipeline
Gas Pipeline
ECF Generator Tie-Line
12kV Service Line
Water Supply Pipeline
Energy Conversion Facility (ECF)
Well Pad
Staging
1/2 Mile Buffer Around Project Site

FMMP Designation

Prime Farmland
Unique Farmland
Farmland of Local Importance
Urban and Built-Up Land

Source: California Department of Conservation, Division of Land Resource Protection, Farmland Mapping and Monitoring Program, San Joaquin County Important Farmland, 2012 (GIS data only; not from publicly available PDF). Downloaded on August 15, 2014.

This map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

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North State Resources, Inc.

PG&E King Island Compressed Air Energy Storage Project

Figure 5.6-2
Important Farmland Within One-Half Mile of Site

Land Use Compatibly Plan (ALUCP). Project conformity with current land use plans, policies and regulations is addressed in a later section (Table 5.6-4).

5.6.1.4 General Plan Land Use Designations within the Project Area

Land use provisions included in every California city and county General Plan (California State Planning Law, Government Code §65302 et seq.) reflect the goals and policies that guide the physical development of land in their jurisdiction. The project components located in the City of Lodi, as specified in Table 5.6-1, are proposed for lands designated by the City of Lodi as Public/Quasi-Public (City of Lodi, 2010 and Hoffman, 2014). The project components located on land in San Joaquin County, as specified in Table 5.6-1, are proposed for lands designated as General Agriculture by San Joaquin County, except for the portions of the air pipeline adjacent to White Slough and Bishop Cut, which are designated as Open Space/Resource Conservation (San Joaquin County, 2014b). Nearly all land adjacent to the project features is designated General Agriculture and Open Space by San Joaquin County.

Table 5.6-2 lists the City of Lodi and San Joaquin County General Plan designations and allowable uses for land within and surrounding the proposed project site. Figure 5.6-3 shows the General Plan designations surrounding the proposed project site.

TABLE 5.6-2
General Plan Land Use Designations and Allowable Uses Surrounding the Project

Land Use Designation	Allowable Uses
City of Lodi – Applicable to ECF, ECF Generator Tie-Line, Staging Areas, Water Supply Pipeline, a portion of the Air Pipeline (approximately 4,500 feet), and a portion of the Gas Pipeline (approximately 6,500 feet)	
Public/Quasi-Public	This classification is applied to properties owned by government entities or quasi-public users. This designation provides for government facilities, public and private schools, and libraries. The floor area ratio shall not exceed 1.0 (City of Lodi, 2010).
San Joaquin County – Applicable to Well Pads, Air Collection Pipeline, 12 kV Service Line, a portion of the Air Pipeline (approximately 9,150 feet), and a portion of the Gas Pipeline (approximately 450 feet)	
General Agriculture	Areas generally committed to agriculture with viable commercial agricultural enterprises that require large land areas to efficiently produce their crops (San Joaquin County, 1992). Typical uses include crop production, feed and grain storage and sales, aerial crop spraying, and animal raising and sales. Additional activities such as resource recovery, dairy and canning operations, stockyards, and animal feedlots and sale yards require permits (San Joaquin County, 2002).
Open Space/Resource Conservation	Those areas with significant resources that generally are to remain in open space (San Joaquin County, 1992). All waterways are designated Resource Conservation and are for waterway dependent uses only (San Joaquin County, 2002).

Sources: City of Lodi, 2010; San Joaquin County, 1992, 2002, 2014b.

5.6.1.4.1 Zoning Designations within the Project Area

The zoning ordinance is a regulatory tool used to implement the General Plan. It defines zones that dictate permitted uses, and can include design requirements such as setbacks and height limits. The city and county zoning ordinances are enforced by their respective planning and building departments.

The project components located in the City of Lodi, as specified in Table 5.6-1, are proposed for lands zoned Public and Community Facilities (PF) by the City of Lodi Municipal Code Zoning and Subdivision Ordinance (Hoffman, 2014). In lands designated for public uses, the City determines development standards during the project review process (City of Lodi, 2013).

The project components located on land in San Joaquin County, as specified in Table 5.6-1, are proposed for lands zoned General Agriculture, 40-acre minimum parcel size (AG-40) by San Joaquin County in its Development Title (San Joaquin County, 2014b). Minor utility services are a permitted use in the General Agriculture zone; major utility uses are permitted, subject to site approval in the General Agriculture zone (San Joaquin County, 2014a).

The zoning designations for lands within and surrounding the proposed project site are listed in Table 5.6-3. The distribution of the zoning relative to the proposed project site is shown in Figure 5.6-4.

TABLE 5.6-3
Zoning Designations and Allowable Activities Surrounding the Project

Zoning Designation	Allowable Uses
City of Lodi – Applicable to ECF, ECF Generator Tie-Line, Staging Areas, Water Supply Pipeline, a portion of the Air Pipeline (approximately 4,500 feet), and a portion of the Gas Pipeline (approximately 6,500 feet)	
Public and Community Facility (PF)	Applied to areas suitable for public land uses including government offices, schools, and libraries, and other related public uses. The PF zoning district is consistent with the Public/Quasi Public and the Detention Basins and Parks land use designations of the General Plan. A Utility Facility is an allowable use in the PF zone.
San Joaquin County – Applicable to Well Pads, Air Collection Pipeline, 12 kV Service Line, a portion of the Air Pipeline (approximately 9,150 feet), and a portion of the Gas Pipeline (approximately 700 feet)	
General Agriculture (AG-40)	Utility Services are a permitted use or a use that is permitted subject to site approval, depending on the utility use. Parcels containing less than two acres in the General Agriculture zone may be created for the purpose of providing a separate lot for an existing use or a use granted by permit (such as Utility Services).

Sources: City of Lodi, 2013; San Joaquin County, 2014a.

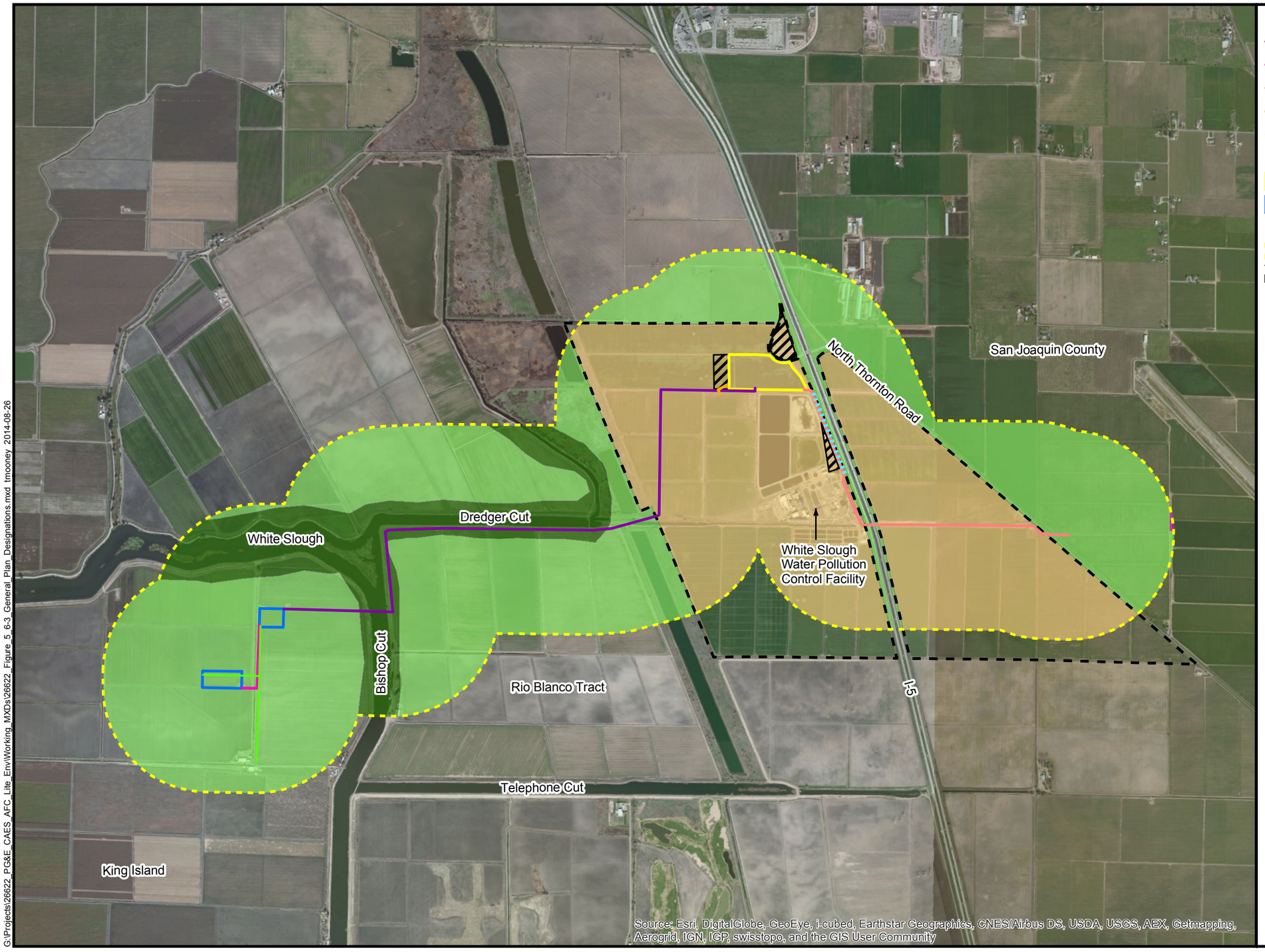
5.6.1.4.2 San Joaquin County Multi-Species Habitat Conservation and Open-Space Plan

The San Joaquin County Multi-Species Habitat Conservation and Open-Space Plan (Plan) allows Plan participants, called Permittees (permitting agencies such as San Joaquin County and the cities within the County) to issue Incidental Take Permits or allow project applicants to mitigate for impacts to Plan-covered species resulting from projects that convert open space to urban development and other non-agricultural activities occurring on agriculturally zoned properties. Participation in the Plan is voluntary for proposed new projects except when a Public Permittee/permitting agency requires it. Project applicants that opt out of the Plan are required to satisfy applicable Endangered Species Act (ESA), California Endangered Species Act (CESA), National Environmental Policy Act (NEPA), California Environmental Quality Act (CEQA), and other applicable local, state, and federal laws and regulations through consultations with the appropriate parties.

The process for an applicant to follow is: (1) submit a project application to the Lead Agency, (2) fill out the Land Development Form, (3) arrange with the San Joaquin County Council of Governments (SJCOG) for a biologist to conduct a pre-construction survey of the property prior to ground disturbance, (4) sign the Incidental Take Minimization Measures document, (5) pay applicable fees or choose another participation option in the plan, and (6) receive a Certificate of Payment (San Joaquin County, 2005).

5.6.1.4.3 San Joaquin Council of Governments Airport Land Use Plans

California state statutes require every county with an airport served by one or more commercial air carriers to have an Airport Land Use Commission (ALUC). For San Joaquin County, the SJCOG Board of Directors is



Air Pipeline
Air Collection Pipeline
Gas Pipeline
ECF Generator Tie-Line
12kV Service Line
Water Supply Pipeline
Energy Conversion Facility (ECF)
Well Pad
Staging
1/2 Mile Buffer Around Project Site
City of Lodi

General Plan Designations - City of Lodi

PUBLIC/QUASI-PUBLIC

General Plan Designations - San Joaquin County

AGRICULTURE/GENERAL
OPEN SPACE/RESOURCE CONSERVATION
PUBLIC

Sources:
1. San Joaquin County District Viewer, http://sjmap.org/website/DistrictViewer/Disclaimer.htm, General Plan Data. Downloaded on August 15, 2014.

2. City of Lodi. 2010. City of Lodi General Plan Map, April 2010.

This map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

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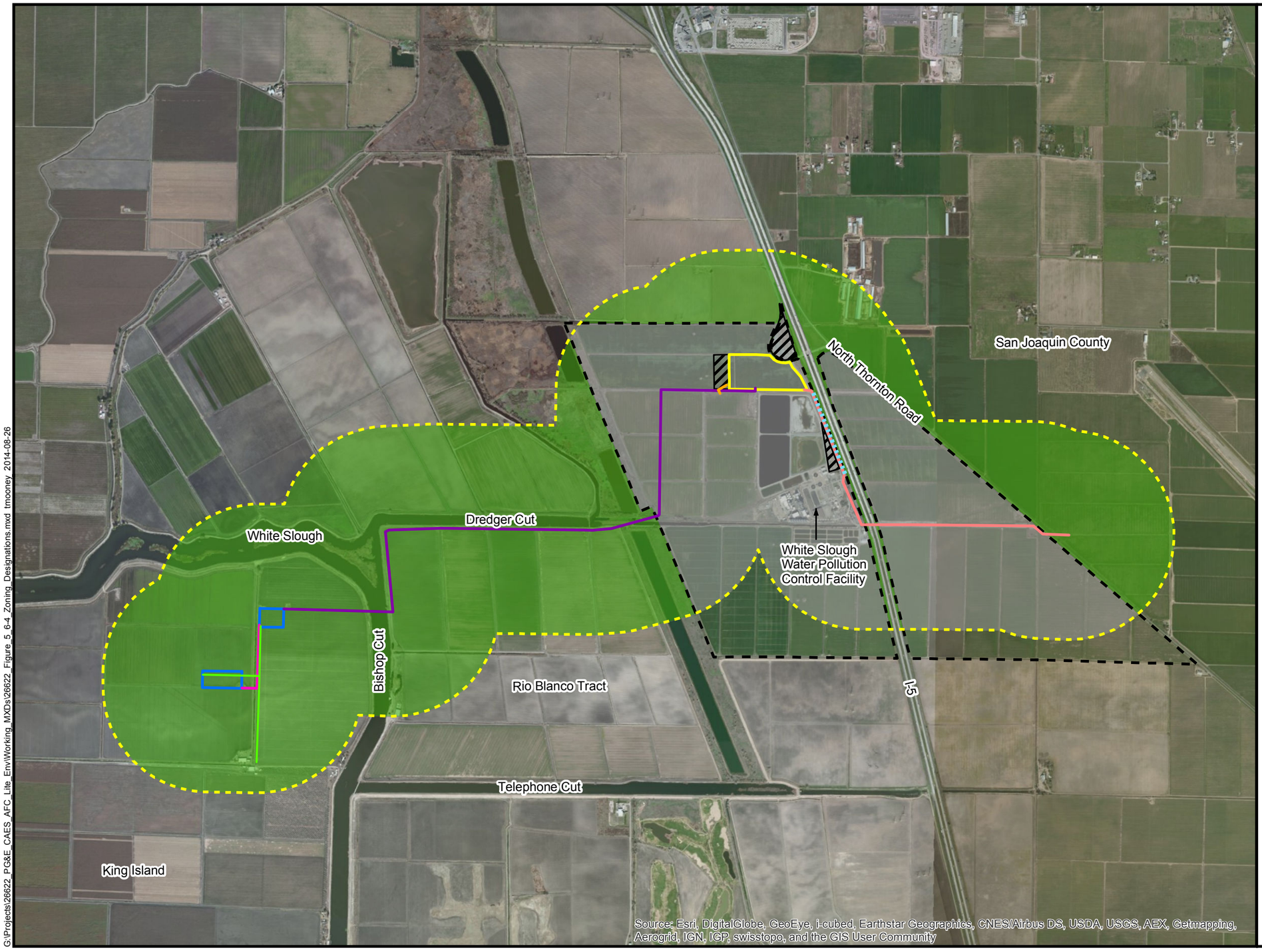
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North State Resources, Inc.

PG&E King Island Compressed Air Energy Storage Project

Figure 5.6-3
General Plan Designations Within One-Half Mile of Site



Air Pipeline
Air Collection Pipeline
Gas Pipeline
ECF Generator Tie-Line
12kV Service Line
Water Supply Pipeline
Energy Conversion Facility (ECF)
Well Pad
Staging
City of Lodi

Zoning Designations - City of Lodi

Public and Community Facility

Zoning Designations - San Joaquin County

General Agriculture (AG-40)

Source: San Joaquin County District Viewer, http://sjmap.org/website/DistrictViewer/Disclaimer.htm, Zoning Data. Downloaded on August 15, 2014.

This map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

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North State Resources, Inc.

PG&E King Island Compressed Air Energy Storage Project

Figure 5.6-4
Zoning Designations Within One-Half Mile of Site

the designated ALUC. The ALUCP for San Joaquin County's Aviation System was prepared and adopted in 1983, and was revised and updated in 1993 and 2009. In 2013, SJCOG prepared Project Review Guidelines for the ALUC.

The 2009 ALUCP incorporates airport surfaces from the 1993 ALUCP and land use compatibility zone criteria from the 2002 California Land Use Planning Handbook. The ALUCP includes use restrictions, intensity restrictions that limit the number of people that may congregate within a specific area, and other development conditions.

The privately owned Kingdon Airport is located to the east of the proposed ECF site and to the east of I-5. The ECF, the ECF generator tie-line, staging areas, water supply pipeline, a portion of the air pipeline (as it heads west from its connection to the ECF), and a portion of the gas pipeline are located within/under the Conical Surface 1993 ALUCP Existing Compatibility Zone. The remaining portion of the gas pipeline heading east (approximately 2,500 feet) is located within the Horizontal Surface 1993 ALUCP Existing Compatibility Zone. This same portion of the gas pipeline is also located in a safety zone, the Traffic Protection Zone (TPZ), as defined by the 2002 California Land Use Planning Handbook. The Horizontal and Conical Surfaces have no prohibited uses or intensity restrictions (SJCOG, 2009; Table B2). Figure 5.6-5 shows airport surface information for the proposed project.

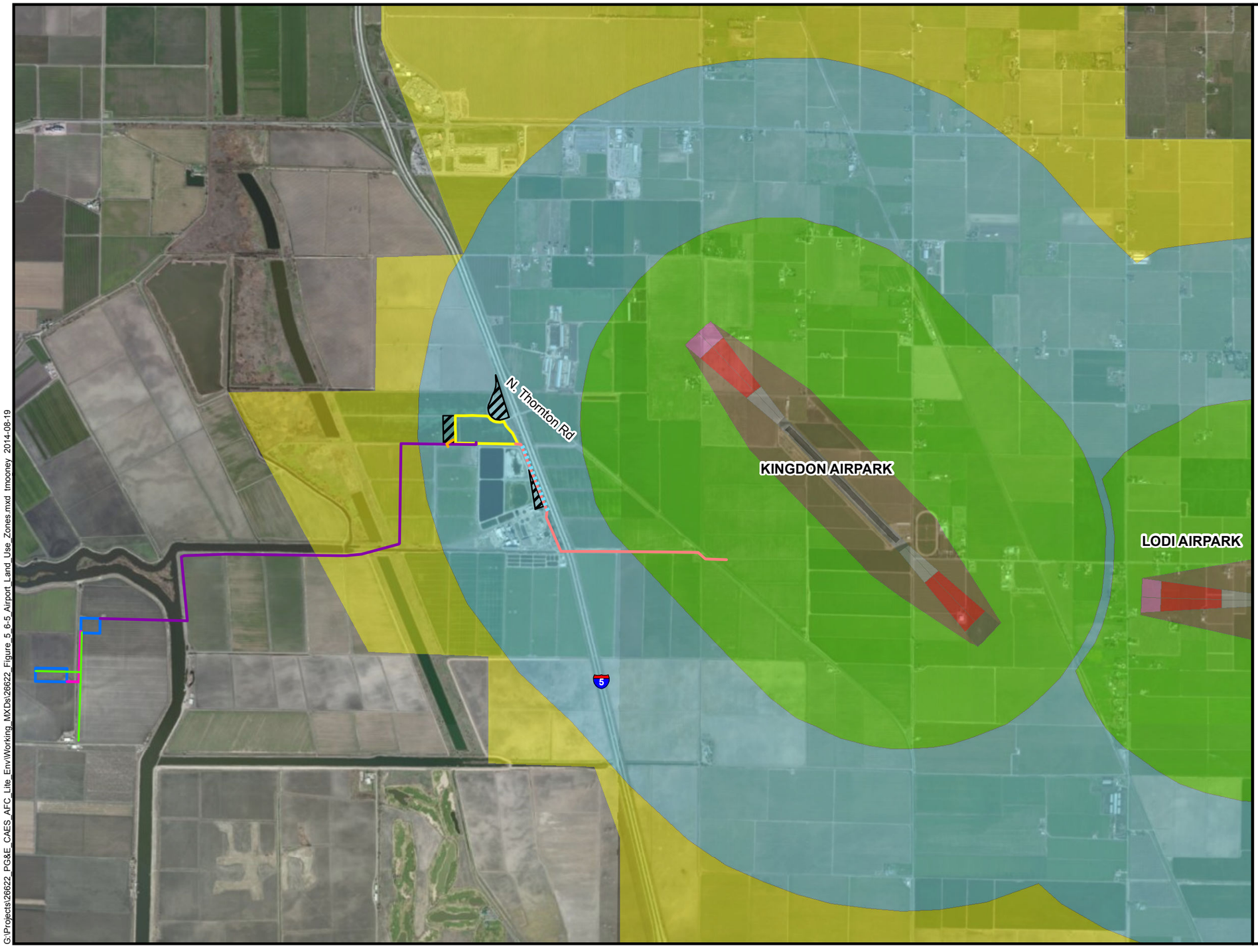
A portion of the gas pipeline is also located in the Traffic Protection Zone (TPZ) (Often called Zone 6 or 7) as defined by the 2002 California Land Use Planning Handbook. None of the other proposed project features fall within the six safety zones defined by the 2002 California Land Use Planning Handbook based on Short General Aviation Runway airport safety zone configurations. However, all project features within the City of Lodi boundaries, plus an additional approximate 2,500 feet of the air pipeline in San Joaquin County, are located in the Airports Influence Area (AIA), which is occasionally referred to as Zone 8 (AIA).

Prohibited uses in the TPZ and AIA include hazards to flights, which include physical (e.g., tall objects), visual, and electronic forms of interference with the safety of aircraft operations. Land use development that may increase the attraction of birds is also prohibited. Other development conditions that the County and FAA might impose for the TPZ and AIA zones would involve airspace review for objects taller than 100 feet. 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. (SJCOG, 2009; Table 3A and SJCOG, 2013).

Delta Protection Commission

The Delta Protection Commission (Commission), established under the Delta Protection Act of 1992, is required to prepare and adopt a Land Use and Resource Management Plan for the Delta. The Delta is divided into a Primary Zone, which comprises the principal jurisdiction of the Commission, and a Secondary Zone, which is outside of the Primary Zone, but still within the legal Delta, that is not within the planning area of the Commission. The ECF site is within the Secondary Zone and, the well pad sites are located within the Primary Zone, placing them within the planning area of the Commission and its Land Use and Resource Management Plan. The Utilities and Infrastructure element of the Delta Land Use and Resource Management Plan contains the following statement, part of Policy P-1 that is relevant to the KICP (Delta Protection Commission, 2014):

Pipelines in utility corridors or existing rights-of-way shall be buried to avoid adverse impacts to terrestrial wildlife. Pipelines crossing agricultural areas shall be buried deep enough to avoid conflicts with normal agricultural or construction activities. Utilities shall be designed and constructed to minimize any





- Water Supply Pipeline
- Air Pipeline
- Air Collection Pipeline
- Gas Pipeline
- ECF Generator Tie-Line
- 12kV Service Line
- Energy Conversion Facility (ECF)
- Well Pad
- Staging

Airport Surface Information

- Area of Influence
- Conical
- Horizontal
- Transitional
- Outer Approach
- Inner Approach
- Runway Protection
- Primary
- Runway

This map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

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North State Resources, Inc.

PG&E King Island Compressed Air Energy Storage Project

Figure 5.6-5
Airport Land Use Zones

detrimental effect on levee integrity or maintenance, agricultural uses and wildlife within the Delta. Utilities shall consult with communities early in the planning process for the purpose of creating an appropriate buffer from residences, schools, churches, public facilities and inhabited marinas.

5.6.2 Environmental Analysis

5.6.2.1 Significance Criteria

Potential impacts from proposed projects related to land use are determined through review of applicable state and local regulations. Because of the CEC Site Certification Process pursuant to the Warren-Alquist Act, a certified agency program pursuant to CEQA, the following criteria developed from the CEQA Guidelines and the CEQA Checklist were used to evaluate the potential environmental impacts of the project:

- Would the project physically divide an established community?
- Would the project conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to, the General Plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?
- Would the project conflict with any applicable habitat conservation plan or natural community conservation plan?
- Would the project convert prime farmland, unique farmland, or farmland of statewide importance (Farmland), as shown on the maps prepared pursuant to the FMMP of the California Resources Agency, to nonagricultural use?
- Would the project involve other changes in the existing environment which, given their location and nature, could result in conversion of Farmland to nonagricultural use?

5.6.2.2 Potential Effects on Land Use during Project Construction and Operation

5.6.2.2.1 Divide an Established Community

The presence of the proposed project would not physically divide any community within the City of Lodi or San Joaquin County. The project would not involve the displacement of any existing development; nor would it result in new development that would physically divide an existing neighborhood.

5.6.2.2.2 Conflict with an Applicable Land Use Plan, Policy, or Regulation

City of Lodi General Plan

Although a power plant (the ECF) and its linears are not specifically listed as a City of Lodi permitted use on land that is General Plan-designated as Public/Quasi-Public, a power plant and its ancillary facilities that are sited on City land may be considered a quasi-public use. Therefore, the project would be consistent with the City of Lodi General Plan designations for the project. The LEC was permitted based on the same determination of consistency with the General Plan.

San Joaquin County General Plan

The well pads and linears are not specifically listed as a San Joaquin County permitted use on land that is General Plan-designated as General Agriculture; however, disturbance of the land for the linears would be temporary after which time the existing agricultural uses could resume. The permanent well pads are allowable on General Agricultural designated land, as long as they satisfy the San Joaquin County General Plan's criteria for the Preservation of Agricultural Lands and Compatible Uses (Volume I, Chapter VI Resources.). The proposed project would comply with all of these agricultural policies, except for where

agricultural land would be converted to non-agricultural uses. Table 5.6-4 outlines all applicable criteria and the manner in which the project is consistent with criteria.

City of Lodi Zoning Regulations

A power plant and its linears (Utility Facility) are allowable uses in the City of Lodi's Public and Community Facility (PF) zoning designation. Therefore, the project would be consistent with the City of Lodi Zoning designations for the project. The CEC Final Commission Decision on the LEC says (page 128):

> The PF zoning district applies to areas suitable for public land uses, and allows power plants and gas pipelines under the category of "Utility Facility." (*Lodi Municipal Code Title 17, Chapter 17.26, Table 2-8*.)

San Joaquin County Zoning Regulations

Utility Services are a permitted use on land that is zoned General Agriculture, according to San Joaquin County Development Title (zoning ordinance). The following special use regulations apply to power-generating facilities on San Joaquin County General Agriculture zoned land: (1) the source of the power requires locating the use in an area designated as Agriculture or Resource Conservation in the General Plan; (2) the use would not have a significantly detrimental effect on agricultural activities in the vicinity; and (3) the location of the use can be rehabilitated for agricultural production or a permitted use in the AG zone if the power source is temporary (San Joaquin County Title 9 Division 6; 9-605.6[d]). The proposed project would comply with regulations 1 and 2, and regulation 3 does not apply to the proposed project. Therefore, the project would be consistent with the San Joaquin County zoning designations for the project.

Federal Aviation Administration 49 CFR 77

The project would be required to file form 7460a *Notice of Proposed Construction or Alteration* with the Federal Aviation Administration (FAA) under 49 CFR Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace*. This is because the ECF stacks, two total at 100 feet high each, would be taller than an imaginary surface extending at a 100:1 slope from the nearest point of the Kingdon Airport runway. The stacks would be approximately 100 feet high and the imaginary surface would be approximately 75 feet high at the location of the stacks. This filing would trigger an analysis of the stack height in relation to the FAA's airport imaginary airspace surfaces. The applicable imaginary surfaces are the horizontal surface, which extends outward to a distance of 5,000 feet (for a visual or utility runway) from the runway edge at a height of 150 feet and the conical surface, which extends upwards at slope of 20:1 from the outer edge of the horizontal surface. The height of this conical surface would be approximately 262 feet at the ECF, given the distance from the runway (approximately 7,250 feet). The 100-foot tall KICP ECF stacks would be underneath the conical surface at ground elevation of 19 feet above sea level. Therefore, the ECF stacks would not penetrate the conical surface and would not pose a structural hazard to air navigation.

In some recent cases before the CEC (Blythe II, Russell City, Mariposa), pilots have raised concerns about thermal exhaust plumes from power plant stacks posing a possible air turbulence hazard to small aircraft for projects sited near airport runways. This is an issue that must be evaluated on a case-by-case basis, depending on the distance from the runway, location in relationship to the takeoff and landing approaches, power plant technology and exhaust gas velocity, and local meteorology and is a potentially critical issue for permitting the KICP. As these cases are, for the most part, more recent than the LEC, it was not considered during the LEC licensing process.

San Joaquin ALUCP

As stated previously, portions of the project are located in/under the horizontal and conical surfaces of the Kingdon Airport; however, the horizontal and conical surfaces have no prohibited uses or intensity

restrictions. A portion of the gas pipeline is located in the TPZ compatibility zone, however, this is not one of the airport protection zones for which flammable pipelines are prohibited unless buried at least 36 inches below ground. Portions of the project are located in the AIA compatibility zone. The AIA zone prohibits uses that are hazards to flights and requires airspace review for objects taller than 100 feet. The ECF stacks, however, are not located in this zone.

Delta Land Use and Resource Management Plan

As stated previously, the ECF site is within the Secondary Zone and the well pad sites are located within the Delta Land Use and Resources Management Plan Primary Zone, placing them within the planning area of this Plan. Policy P-1 of the Plan states that pipelines in utility corridors should be buried and that, in agricultural areas, they should be buried deep enough to avoid "conflicts with normal agricultural or construction activities" Delta Protection Commission 2014). The KICP would be consistent with this policy.

State Lands Commission - Sovereign Lands Lease/Right-of-Way

The California State Lands Commission (CSLC) has jurisdiction and management control over certain public lands of the State that were received by the State from the United States (CSLC, 2014a). For the proposed base case routing of the air pipeline, PG&E has obtained a jurisdictional determination from CSLC that the two proposed crossings at White Slough and Bishop Cut are not in CSLC jurisdiction (CSLC, 2014b). In the event that the final routing does cross river banks that are considered sovereign lands, CSLC may consider this to be State property. In that scenario the project would need to apply for a General Lease – Right of Way transaction from the CSLC per Article 2, Section 2002(a)(3) (CSLC, 2014c).

Rivers and Harbors Act, Section 10

EPA Section 10 of the Rivers and Harbors Act implemented by the U.S. Army Corps of Engineers (USACE) in 33 CFR Parts 320-332, authorizes certain structures or work in or affecting navigable waters of the United States. The air pipeline, as is turns east towards the ECF, would pass under Bishop Cut, which is considered a navigable water of United States (USACE, 2014). There are multiple activities that would require a permit issued by USACE, including a tunnel or other structure or work under or over a navigable water of the United States per 33 CFR part 322.2 (USACE, 2011); therefore, the project would require a Section 10 Nationwide 12 Permit (Utility Line Activities) from USACE.

Conflict with an Applicable Habitat Conservation Plan

The proposed project would be located within the San Joaquin County Multi-Species Habitat Conservation and Open-Space Plan area. The project would not conflict with the Plan's requirements for identifying potential impacts to covered species from project development, and associated mitigation requirements included in the Plan. The project was sited and is designed to be compatible with its adjacent developed land uses. Project implementation would not adversely affect SJCOG's ability to implement the Plan.

Convert Farmland to Non-agricultural Uses

Development of the proposed ECF and well field would result in the long-term conversion of 30 acres of CDC-designated Unique Farmland and Prime Farmland to a utility use. The west well pad is located on a Williamson Act contract parcel, designated Prime Agricultural Land, which would be converted to a utility use. However, the use of the site for a well pad accessing a known natural gas field may be considered a compatible use under the contract. If not, the contract for the parcel would need to be amended (or similar procedure) as part of a County review and approval process to cancel the contract for the affected portion of the parcel.

Development of the project linears and staging areas would result in a temporary conversion of CDC-designated Urban and Built-Up Land and Farmland of Local Importance to a temporary construction use. A

portion of the air pipeline is located on a Williamson Act parcel, designated Non-Renewal, which would temporarily be disturbed. The agricultural land that the ECF would be developed on is adjacent to Urban and Built-Up Land; and would therefore, not result in the division of continuous agricultural land.

Cause Changes in the Environment Resulting in Conversion of Farmland

The CAES project would be one of the first of its kind to use a depleted natural gas well field as a geological reservoir for the storage of compressed air for later release to generate electrical power. The ECF would be located near LEC and would not be likely to result in additional development of similar projects, and therefore, should not result in additional conversion of farmland to nonagricultural uses.

5.6.2.3 Compatibility with Existing and Designated Land Uses and Applicable Planning Policies

Table 5.6-4 lists applicable local plans and policies and describes the project's conformity with them.

TABLE 5.6-4
Project Conformity with Local Land Use Plans and Policies

Goal/Objective/Policy	Project Consistency
City of Lodi General Plan	
Section 3 Land Use and Growth Management Element	
GM-G2: Provide infrastructure—including water, sewer, stormwater, and solid waste/recycling systems—that is designed and timed to be consistent with projected capacity requirements and development phasing.	The project would meet this policy by adding applicable infrastructure to the City.
San Joaquin County General Plan	
Chapter VI Resources	
Agricultural Lands Objectives 1. To protect agricultural lands needed for the continuation of commercial agricultural enterprises, small-scale farming operations, and the preservation of open space.	Development of the proposed ECF and well field would result in the long-term conversion of 30 acres of CDC-designated Unique Farmland and Prime Farmland to a utility use.
3. To minimize the impact on agriculture in the transition of agricultural areas to urban development.	Development of the proposed ECF and well field would result in the transition of agricultural areas to a utility use.
Agricultural Policies 5. Agricultural areas shall be used principally for crop production, ranching, and grazing. All agricultural support activities and non-farm uses shall be compatible with agricultural operations and shall satisfy the following criteria:	
(a) The use requires a location in an agricultural area because of unusual site area requirements, operational characteristics, resource orientation, or because it is providing a service to the surrounding agricultural area;	The proposed project is located in an agricultural area because of its operational characteristics, which require the use of a depleted natural gas well field as a geological reservoir for the storage of compressed air
(b) The operational characteristics of the use will not have a detrimental impact on the management or use of surrounding agricultural properties;	Development of the proposed ECF and well field would result in the transition of agricultural areas to a utility use; however, operating the ECF and well pad would have no effect on surrounding agricultural operations.

TABLE 5.6-4
Project Conformity with Local Land Use Plans and Policies

Goal/Objective/Policy	Project Consistency
(c) The use will be sited to minimize any disruption to the surrounding agricultural operations; and	Development of the proposed ECF and well field would result in the transition of agricultural areas to a utility use; however, siting of the ECF and well pad would have no effect on surrounding agricultural operations.
(d) The use will not significantly impact transportation facilities, increase air pollution, or increase fuel consumption.	The project would have no effect on transportation facilities. Refer to the Air Quality chapter for a discussion of project air emissions and measures to minimize potential air quality impacts. The project would require the use of natural gas; however, if the proposed project is not constructed, other electric generation facilities would be required, which could also consume fuel.
7. There shall be no further fragmentation of land designated for agricultural use, except in the following cases:	
(a) Parcels for home sites may be created, provided that the General Plan density is not exceeded.	Constructing and operating the project would not require the creation of parcels of land.
(b) A parcel may be created for the purpose of separating existing dwellings on a lot, provided the Development Title regulations are met.	Constructing and operating the project would not require the creation of parcels of land. Development of the proposed ECF and well field would result in the transition of agricultural areas to a utility use
(c) A parcel may be created for a use granted by permit in the A-G zone, provided that conflicts with surrounding agricultural operations are mitigated.	Constructing and operating the project would not require the creation of parcels of land.
8. To protect agricultural land, non-agricultural uses which are allowed in the agricultural areas should be clustered, and strip or scattered development should be prohibited.	Siting the ECF adjacent to the existing wastewater treatment plant and mosquito and vector control district meets this requirement.
10. Non-agricultural land uses at the edge of agricultural areas shall incorporate adequate buffers (e.g., fences and setbacks) to prevent conflicts with adjoining agricultural operations.	Agricultural uses would continue on parcels to the west and north of the ECF site, but the project site would be fenced.

Sources: City of Lodi, 2010; San Joaquin County, 2002.

5.6.3 Laws, Ordinances, Regulations and Standards

This subsection lists and discusses the land use LORS that apply to the project. The project site, including all project components are located in the City of Lodi and San Joaquin County, and are subject to all of the City of Lodi's and San Joaquin County's General Plan policies and objectives, as well as all policies or regulations of an agency with jurisdiction over the project. Table 5.6-5 lists the LORS, the agencies that administer them, and the section that discusses the project's conformance with the LORS.

TABLE 5.6-5
Laws, Ordinances, Regulations, and Standards for Land Use

LORS	Requirements/Applicability	Administering Agency
Federal		
EPA Section 10 of the Rivers and Harbors Act implemented by USACE in 33 CFR Parts 320-332	Authorizes certain structures or work in or affecting navigable waters of the United States	USACE
49 CFR Part 77 – Safe, Efficient Use, and Preservation of Navigable Airspace	Notification of construction activity for structures within 20,000 feet of a public or military airport having a runway more than 3,200 feet in length	Federal Aviation Administration
State		
CEQA California Public Resources Code, Sections 21000-21178.1, including Guidelines for implementation of CEQA are codified in the CCR Sections 15000-15387.	Establishes policies and procedures for review of proposed power plants in California	California Energy Commission
Warren-Alquist Act (Public Resources Code Section 25000 et seq.)	Legislation that created and gives statutory authority to the California Energy Commission.	California Energy Commission
Local		
City of Lodi General Plan (2010)	Comprehensive long-range plan to serve as the guide for the physical development of the City.	City Of Lodi Community Development Department, Planning Division 221 West Pine Street P.O. Box 3006 Lodi, California 95241-1910
City of Lodi Title 17 Zoning (2013)	Establishes zoning districts governing land use and the placement of buildings and district improvements.	City Of Lodi Community Development Department, Planning Division 221 West Pine Street P.O. Box 3006 Lodi, California 95241-1910
San Joaquin County General Plan (1992, 2002)	Comprehensive long-range plan to serve as the guide for the physical development of the County.	San Joaquin County Community Development Department, Planning/Development Services 1810 E Hazelton Avenue Stockton, CA 95205
San Joaquin County Zoning Regulations (Title 9) (2014)	Establishes zoning districts governing land use and the placement of buildings and district improvements.	San Joaquin County Community Development Department, Planning/Development Services 1810 E Hazelton Avenue Stockton, CA 95205

5.6.3.1 Federal LORS

EPA Section 10 of the Rivers and Harbors Act implemented by the U.S. Army Corps of Engineers (USACE) in 33 CFR Parts 320-332, authorizes certain structures or work in or affecting navigable waters of the United States.

5.6.3.2 State LORS

The AFC process is the CEQA-equivalent pursuant to the Warren-Alquist Act and would therefore fulfill the requirements of CEQA. CEQA is codified in the California Public Resources Code, Section 21000-21178.1. Guidelines for implementation of CEQA are codified in the California Code of Regulations (CCR) Sections 15000-15387.

The CSLC maintains a multiple use management policy to assure the greatest possible public benefit is derived from public lands of the State.

5.6.3.3 Local LORS

Land use provisions that are included in every California city and county General Plan (California State Planning Law, Government code §65302 et seq.) reflect the goals and policies that guide the physical development of land in their jurisdiction. The city and county zoning ordinances are enforced by their respective planning and building departments.

5.6.4 Agency Contacts and Permits

Table 5.6-6 lists the agencies with land use authority related to the proposed project.

TABLE 5.6-6
Agency Contacts and Permit for Land Use

Issue	Agency	Contact	Permit Schedule
Land Use Plans and Permits	City of Lodi	Planning Secretary City of Lodi Community Development Department, Planning Division 221 West Pine Street P.O. Box 3006 Lodi, California 95241-1910	Prior to Construction
Building Permits	City of Lodi	Building Official City of Lodi Community Development Department, Building Division 221 West Pine Street P.O. Box 3006 Lodi, California 95241-1910	Prior to Construction
Airport Land Use Commission	San Joaquin County Council of Governments	Planner 555 E. Weber Avenue Stockton, CA 95202	NA
Building Permits	San Joaquin County	Architect/Plan Checker San Joaquin County Community Development Department, Building Division 1810 E Hazelton Avenue Stockton, CA 95205	Prior to Construction

TABLE 5.6-6
Agency Contacts and Permit for Land Use

Issue	Agency	Contact	Permit Schedule
Nationwide 12 Section 10 Permit	USACE	US Army Engineer District, Sacramento 1325 J Street Sacramento, CA 95814 916-557-7461	Prior to Construction
Bishop Cut Levee Encroachment Permit for Air Pipeline	Reclamation District 2044	421 South El Dorado, Suite "E", Stockton, CA 95203	Prior to Construction
White Slough WA Encroachment Permit for Air Pipeline	Department of Water Resources	Division of Engineering P.O. Box 942836 1416 9th Street, Room 425 Sacramento, California 94236-0001	Prior to Construction

5.6.5 References

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5.7 Noise

This section presents an assessment of potential noise effects related to the proposed KICP, including noise from construction and operation of the Energy Conversion Facility (ECF) site, pipelines, and I/W wells.

5.7.1 Fundamentals of Acoustics

Acoustics is the study of sound, and noise is defined as unwanted sound. Airborne sound is a rapid fluctuation or oscillation of air pressure above and below atmospheric pressure creating a sound wave. Acoustical terms used in this section are summarized in Table 5.7-1.

The most common metric is the overall A-weighted sound level measurement that has been adopted by regulatory bodies worldwide. The A-weighting network measures sound in a similar fashion to the way in which a person perceives or hears sound. In this way, it provides a good measure for evaluating acceptable and unacceptable sound levels.

A-weighted sound levels are typically measured or presented as equivalent sound pressure level (L_{eq}), which is defined as the average noise level, on an equal energy basis for a stated period of time, and is commonly used to measure steady-state sound or noise that is usually dominant. Statistical methods are used to capture the dynamics of a changing acoustical environment. Statistical measurements are typically denoted by L_{xx}, where "xx" represents the percentile of time the sound level is exceeded. The L_{90} is a measurement that represents the noise level that is exceeded during 90 percent of the measurement period and is considered to represent the noise in the background, with intermittent noises (spikes such as airplanes passing overhead) removed. Similarly, the L_{10} represents the noise level exceeded for 10 percent of the measurement period, which removes only the loudest intermittent noises.

Some metrics used in determining the impact of environmental noise consider the differences in response that people have to daytime and nighttime noise levels. During the nighttime, exterior background noises are generally lower than the daytime levels. However, most household noise also decreases at night and exterior noise becomes more noticeable. Furthermore, most people sleep at night and are sensitive to intrusive noises. To account for human sensitivity to nighttime noise levels, the Day-Night Sound Level (L_{dn} or DNL) was developed. L_{dn} is a noise index that accounts for the greater annoyance of noise during the nighttime hours.

L_{dn} values are calculated by averaging hourly L_{eq} sound levels for a 24-hour period, and apply a weighting factor to nighttime L_{eq} values. The weighting factor, which reflects the increased sensitivity to noise during nighttime hours, is added to each hourly L_{eq} sound level before the 24-hour L_{dn} is calculated. For the purposes of assessing noise, the 24-hour day is divided into two time periods, with the following weightings:

- Daytime: 7 a.m. to 10 p.m. (15 hours), weighting factor of 0 decibel (dB)
- Nighttime: 10 p.m. to 7 a.m. (9 hours), weighting factor of 10 dB

The Community Noise Equivalent Level (CNEL) is similar to the L_{dn} and uses the same day and nighttime weightings but adds an additional evening weighting of 5 dB for the hours between 7 p.m. and 10 p.m. The Ldn and CNEL values are typically within 1 A-weighted dB (dBA) of each other.

The two time periods are then averaged to compute the overall L_{dn} value. For a continuous noise source, the L_{dn} value is easily computed by adding 6.4 dB to the overall 24-hour noise level (L_{eq}). For example, if the

expected continuous noise level from the ECF were 60.0 dBA, the resulting L_{dn} from the ECF would be 66.4 dBA.

TABLE 5.7-1
Definitions of Acoustical Terms

Term	Definition
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise or sound at a given location. The ambient level is typically defined by the L_{eq} level.
Background Noise Level	The underlying ever-present lower level noise that remains in the absence of intrusive or intermittent sounds. Distant sources, such as traffic, typically make up the background. The background level is generally defined by the L_{90} percentile noise level.
Intrusive	Noise that intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends on its amplitude, duration, frequency, time of occurrence, tonal content, and the prevailing ambient noise level as well as the sensitivity of the receiver. The intrusive level is generally defined by the L_{10} percentile noise level.
Sound Pressure Level Decibel (dB)	A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure, which is 20 micropascals (20 micronewtons per square meter).
A-Weighted Sound Pressure Level (dBA)	The sound level in dB as measured on a sound-level meter using the A-weighted filter network. The A-weighted filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise. All sound levels in this report are A-weighted.
Equivalent Noise Level (L_{eq})	The average A-weighted noise level, on an equal energy basis, during the measurement period.
Percentile Noise Level (L_n)	The noise level exceeded during "n" percent of the measurement period, where "n" is a number between 0 and 100 (e.g., L_{90})
Community noise equivalent level (CNEL)	The average A-weighted noise level during a 24-hour day, obtained after the addition of 5 dB to sound levels from 7 p.m. to 10 p.m. and after the addition of 10 dB to sound levels between 10 p.m. and 7 a.m.
Day-Night Noise Level (L_{dn} or DNL)	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 dB from 10:00 p.m. to 7:00 a.m.

The effects of noise on people can be listed in three general categories:

- Subjective effects of annoyance, nuisance, and dissatisfaction
- Interference with activities such as speech, sleep, and learning
- Physiological effects such as startling and hearing loss

In most cases, environmental noise produces effects in the first two categories only. However, workers in industrial plants may experience noise effects in the last category. No completely satisfactory way exists to measure the subjective effects of noise, or to measure the corresponding reactions of annoyance and dissatisfaction. This lack of a common standard is primarily due to the wide variation in individual thresholds of annoyance and habituation to noise. Thus, an important way of determining a person's subjective reaction to a new noise is by comparing it to the existing or "ambient" environment to which that person has adapted. In general, the more the level or the tonal (frequency) variations of a noise exceed the previously existing ambient noise level or tonal quality, the less acceptable the new noise would be, as judged by the exposed individual.

Table 5.7-2 shows the relative A-weighted noise levels of common sounds measured in the environment and in industry for various sound levels.

TABLE 5.7-2
Typical Sound Levels Measured in the Environment and Industry

Noise Source at a Given Distance	A-Weighted Sound Level in dB	Noise Environments	Subjective Impression
Shotgun (at shooter's ear)	140	Carrier flight deck	Painfully loud
Civil defense siren (100 feet)	130		
Jet takeoff (200 feet)	120		Threshold of pain
Loud rock music	110	Rock music concert	
Pile driver (50 feet)	100		Very loud
Ambulance siren (100 feet)	90	Boiler room	
Pneumatic drill (50 feet)	80	Noisy restaurant	
Busy traffic; hair dryer	70		Moderately loud
Normal conversation (5 feet)	60	Data processing center	
Light traffic (100 feet); rainfall	50	Private business office	
Bird calls (distant)	40	Average living room, library	Quiet
Soft whisper (5 feet); rustling leaves	30	Quiet bedroom	
	20	Recording studio	
Normal breathing	10		Threshold of hearing

Source: Beranek, 1998.

5.7.2 Affected Environment

5.7.2.1 Local Land Use and Noise Sources

The proposed KICP ECF site is located on land owned and incorporated by the City of Lodi and the well pads are located in unincorporated San Joaquin County, California. Portions of the gas pipeline and air pipeline would also be located in the City of Lodi limit, but these features would not be sources of operational noise.

The City of Lodi is unique because it consists of two distinct City boundaries separated by unincorporated San Joaquin County land. The main portion of the City is generally located along the intersection of Highway 99 (Hwy 99) and SR-12. The proposed ECF project site is located in the smaller portion of the City which is approximately 5 miles southwest of the westernmost boundary of the main portion of the City, and approximately 3 miles north of the northernmost portions of the City of Stockton, California. Therefore, the proposed ECF site located within the boundary of the smaller portion of incorporated City land is completely surrounded by unincorporated County land. This land was acquired by the City as the site of its WPCF and is a reserve for utility uses.

The ECF site is on the west side of Interstate 5 (I-5), approximately 1.5 miles south of SR-12, just north of the City of Lodi's White Slough WPCF. The treatment and holding ponds associated with the WPCF are located immediately to the south of the proposed CAES project site. The existing Lodi Energy Center (LEC) is located further south of the proposed CAES project site.

The KICP project site is currently used for agricultural land and open space. The ECF and staging area west of the ECF are currently corn fields, and the well pads are located within orchards. The area in the general project vicinity is developed primarily into agricultural land uses with rural residences, I-5 and local

roadways, and irrigation canals. The air pipeline runs through agricultural areas planted in orchards and field crops.

There are three residences located approximately 0.36 mile to the north-northeast of the ECF site; these are the closest residences. There are approximately a dozen residences located further north along West Kingdon Road between 0.75 mile and 1 mile from the project site (Figure 5.7-1). Ambient noise monitoring was conducted in July 2008 for the LEC AFC at two locations within 1 mile of the ECF site. These included LEC-M1, which is the nearest residential receptor to the ECF site, at 0.36 mile to the northeast and LEC-M2, which is located approximately 0.87 mile east-northeast of the ECF site.

With the exception of the residences identified above, noise-sensitive receptors are not located within 1 mile of the proposed CAES project site. A search to determine if schools (elementary, middle, and high), churches, child care/day centers, parks and recreation centers, historic areas, and mines and quarries are located in the vicinity of the proposed project site revealed that no such facilities are located within 1 mile of the proposed site (Mapquest, 2014).

5.7.2.2 Ambient Noise Survey for Licensing

To meet CEC AFC data adequacy requirements, the project developer would be required to conduct a 25-hour ambient noise survey at nearby sensitive receptors, such as the two or three nearest residences shown on Figure 5.7-1. This type of study is normally conducted with ANSI Type 1 (precision), statistical sound level meters. As this study is not for the actual licensing of the facility, 24-hour ambient noise monitoring was not conducted. The results of the 2008 monitoring are briefly discussed, below, for receptors LEC-M1 and LEC-M2.

5.7.3 Environmental Analysis

The construction and operation of the KICP would produce noise. However, the final design of the facility is anticipated to include noise-control measures that would result in compliance with the applicable requirements and result in a less-than-significant impact. Noise also would be produced at the site during the construction of the project. Potential noise impacts from construction and operation activities are assessed in this subsection.

5.7.3.1 Significance Criteria

Following the California Environmental Quality Act (CEQA) guidelines (CCR, Title 14, Appendix G, Section XI), the project would cause a significant impact if it would result in the following:

- Exposure of people to noise levels in excess of standards established in the local General Plan or noise ordinance
- Exposure of people to excessive ground-borne noise levels or vibration
- Substantial permanent increase in ambient noise levels in the project vicinity
- Substantial temporary or periodic increase in ambient noise levels in the project vicinity

Potential noise impacts to biota are considered in the Biological Resources section (5.2).



Residence
Air Pipeline
Air Collection Pipeline
Gas Pipeline
ECF Generator Tie-Line
12 kV Service Line
Water Supply Pipeline
Energy Conversion Facility (ECF)
Well Pad
Staging
1 Mile Buffer
City of Lodi

This map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

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North State Resources, Inc.

PG&E King Island Compressed Air Energy Storage Project

Figure 5.7-1
Sensitive Noise Receptors Within One Mile

Generally, the design basis for noise control is the minimum, or most stringent, noise level required by any of the applicable LORS. Therefore, noise from the project is evaluated against the requirements of the jurisdiction the noise source resides in. The City has established quantitative guidelines for determining appropriate noise levels for various land uses in in the Noise Element of its General Plan in addition to a noise ordinance that governs nuisance noise. Noise from the construction and operation of the air pipeline and well pads is evaluated against San Joaquin County standards. The CEC has previously determined that an increase in background noise levels up to 5 dBA in a residential setting is insignificant; an increase of more than 10 dBA is considered significant, and an increase between 5 and 10 dBA may be either significant or insignificant, depending on the particular circumstances of a case.

The CEC also has concluded that construction noise is typically insignificant if the construction activity is temporary, use of heavy equipment and noisy activities is limited to daytime hours, and all feasible noise-abatement measures are implemented for noise-producing equipment.

5.7.3.2 Construction Impacts

5.7.3.2.1 Plant Construction Noise

Construction of the major components of the KICP includes the ECF, a well field facility consisting of two well pad areas, each with several air injection wells and ancillary equipment; an air pipeline to convey compressed air to and from the well field; pipelines to convey water and natural gas supplies; and an electrical interconnection with the wider electrical grid. Construction is expected to be typical of power plants and their ancillary facilities (such as gas pipelines and electrical transmission lines) in terms of schedule, equipment used, and other types of activities. The noise level would vary during the construction period, depending on the construction phase. Construction can generally be divided into several distinct phases that use different types of construction equipment. The five phases applicable to the KICP are site preparation and excavation, concrete pouring, steel erection, mechanical, and clean-up (Miller, et al., 1978). In addition to ECF and pipeline construction, the KICP will involve well field construction noise from well drilling rigs at the east and west well pads. There may be up to 30 wells installed. The well drilling activities that generate the most noise will be the periodic venting and blowing of the wells and air pipe.

The EPA Office of Noise Abatement and Control and the Empire State Electric Energy Research Company have extensively studied noise from individual pieces of construction equipment as well as from construction sites of power plants and other related types of facilities (EPA, 1971; Barnes, et al., 1976). Because specific information on types, quantities, and operating schedules of construction equipment is not available at this point in project development, information from these documents for similarly sized industrial projects would be used. Use of these data is conservative because the evolution of construction equipment has been toward quieter designs to protect operators from exposure to high noise levels since these data were developed.

The loudest equipment types generally operating at a power plant construction site, such as the ECF site, during each phase of construction are presented in Table 5.7-3. The composite average or equivalent site noise level, representing noise from all equipment, also is presented for each phase.

TABLE 5.7-3
ECF Construction Equipment and Composite Site Noise Levels

Construction Phase	Loudest Construction Equipment	Equipment Noise Level (dBA) at 50 feet	Composite Site Noise Level (dBA) at 50 feet
Demolition, site clearing, and excavation	Dump truck backhoe	91 85	89

TABLE 5.7-3
ECF Construction Equipment and Composite Site Noise Levels

Construction Phase	Loudest Construction Equipment	Equipment Noise Level (dBA) at 50 feet	Composite Site Noise Level (dBA) at 50 feet
Concrete pouring	Truck	91	78
	concrete mixer	85	
Steel erection	Derrick crane	88	87
	jack hammer	88	
Mechanical	Derrick crane	88	87
	pneumatic tools	86	
Cleanup	Rock drill	98	89
	truck	91	

Source: EPA, 1971; Barnes, et al., 1976.

Average or equivalent construction noise levels projected at various distances from the ECF construction site are presented in Table 5.7-4. These results are conservative because the only attenuating mechanism considered was divergence of the sound waves in open air. The noisiest construction activities would be confined to the daytime hours. The noisiest construction activities would be confined to the daytime hours, although well drilling will be a 24 hours per day and 7 days per week activity. Table 5.7-5 presents noise levels from common construction equipment at various distances.

TABLE 5.7-4
Average Construction Noise Levels at Various Distances

	Sound Pressure Level (dBA)		
Construction Phase	375 feet	1,500 feet	4,000 feet
Demolition, site clearing, and excavation	71	59	50
Concrete pouring	60	48	39
Steel erection	69	57	48
Mechanical	69	57	48
Cleanup	71	59	50

TABLE 5.7-5
Noise Levels from Common Construction Equipment at Various Distances

Construction Equipment	Typical Sound Pressure Level at 50 feet (dBA)	Typical Sound Pressure Level at 1,500 feet (dBA)	Typical Sound Pressure Level at 4,000 feet (dBA)
Pile drivers (20,000-32,000 ft-lbs/blow)	104	74	65
Dozer (250-700 hp)	88	58	49
Front-end loader (6-15 yd^3.)	88	58	49
Trucks (200-400 hp)	86	56	47
Grader (13- to 16-foot. blade)	85	55	46
Shovels (2-5. yd^3)	84	54	45
Portable generators (50-200 kW)	84	54	45
Derrick crane (11-20 tons)	83	53	44

TABLE 5.7-5
Noise Levels from Common Construction Equipment at Various Distances

Construction Equipment	Typical Sound Pressure Level at 50 feet (dBA)	Typical Sound Pressure Level at 1,500 feet (dBA)	Typical Sound Pressure Level at 4,000 feet (dBA)
Mobile crane (11-20 tons)	83	53	44
Concrete pumps (30-150 yd^3)	81	51	42
Tractor (3/4 to 2 yd^3.)	80	50	41
Unquieted paving breaker	80	50	41
Quieted paving breaker	73	43	34

Notes:
Ft-lbs/blow = foot pound(s) per blow (of pile driver)
Hp = horsepower
Yd3 = cubic yards
kW = kilowatt

Noise generated during the testing and commissioning phase of the KICP is not expected to be substantially different from that produced during normal full-load operation. Starts and abrupt stops are more frequent during this period, but they are usually short lived. Air blows are anticipated to be limited to daytime hours and include silencing to achieve levels similar to those for identified above.

5.7.3.2.2 Construction Vibration

Construction vibrations can be divided into three classes, based on the wave form and its source (Table 5.7-6). Pile driving, if required, would be limited to daytime hours. Given the distances to the closet residences, vibration from construction equipment is not anticipated to approach the Federal Transit Administration (FTA) guidelines referenced by CEC staff.

TABLE 5.7-6
Construction Vibrations

Wave Form	Example Source
Impact	Impact pile driver or blasting
Steady state	Vibratory pile driver
Pseudo steady state	Double-acting pile hammer

5.7.3.2.3 Worker Exposure to Noise

Worker exposure levels during construction of the KICP would vary depending on the phase of the project and the proximity of the workers to the noise-generating activities. Construction noise is potentially harmful to the health and hearing of construction workers. As required on all projects licensed by the CEC, the KICP would develop a Hearing Protection Plan, which complies with California Occupational Safety and Health Administration (Cal-OSHA) requirements. This Hearing Protection Plan would be incorporated into the project construction Health and Safety Plan. The plan would require appropriate hearing protection for workers and visitors throughout the duration of the construction period.

5.7.3.3 Operational Impacts

5.7.3.3.1 Worker Exposure

No permanent or semi-permanent workstations would be located near any piece of noisy plant equipment. Signs requiring the use of appropriate hearing protection devices will be posted in all areas where noise

levels commonly exceed 85 dBA and requirements for double hearing protection inside turbine or compressor buildings or acoustical enclosures will be identified. As required on all projects licensed by the CEC, the project will comply with applicable Cal-OSHA requirements. Outdoor levels throughout the plant will typically range from 90 dBA near certain equipment to roughly 65 dBA in areas more distant from any major noise source.

5.7.3.3.2 Transmission Line and Switchyard Noise Levels

One of the electrical effects of high-voltage transmission lines is corona. Corona is the ionization of the air that occurs at the surface of the energized conductor and suspension hardware due to high electric field strength at the surface of the metal during certain conditions. Corona may result in radio and television reception interference, audible noise, light, and production of ozone. Corona is generally a principle concern with transmission lines of 345 kV and higher. Corona noise is also generally associated with foul weather conditions. As stated in Section 3.0, Electric Transmission, the new transmission line will only extend about 600 feet to the Gold Hill-Eight Mile Substation. Because of the transmission line's close proximity to the interconnection, 230-kV transmission system, and large distance to the nearest receptors, it is expected that no corona-related design issues will be encountered.

5.7.3.3.3 ECF Operational Noise Levels

Operational noise from the KICP ECF will vary depending on the primary mode of operation: air compression or turbo-expansion/power generation. Only rarely would both sets of equipment be in operation at the same time; nevertheless, noise from simultaneous operational of both modes has been estimated as the worst case.

A conceptual noise model of the proposed ECF facility has been developed using preliminary unmitigated source input levels provided by PG&E and their design engineer. Because acoustic mitigation design details were not available at the time this report was written, the model included an assumption that major equipment would be located in an acoustically designed building (compressor, turbo-expander), including silenced ventilation. The sound propagation factors used in the model have been adopted from ISO 9613-2 (1996) *Acoustics - Sound Attenuation During Propagation Outdoors*. The model divides the proposed facility into a list of individual point and area noise sources representing each piece of equipment that produces a significant amount of noise. The model calculates the sound pressure level that would occur at each receptor from each source after losses from distance, air absorption, and blockages, and so on, are considered. The sum of all these individual levels is the total plant level at the modeling point.[1]

Table 5.7-7 identifies the data used for the noise sources and the noise attenuation measures applied in the model and Figure 5.7-2 shows the modeling results as noise iso-contours for the worst-case operating scenario (simultaneous compression and expansion). The model is an example of how noise attenuation measures might be applied for the KICP project, although other configurations are possible. The KICP engineering design as described in the engineering report (Worley Parsons, 2015) does not incorporate these or other attenuation measures, which have been applied in this noise modeling effort to provide an example of a noise mitigation approach for permitting the KICP. Appendix 5.7 contains noise iso-contour

[1] Data and calculations were provided and developed to support this permitting analysis effort and do not reflect final design, and should not be relied on. CH2M HILL assumes no liability or risk associated with subsequent use of this information.



Residence
Air Pipeline
Air Collection Pipeline
Gas Pipeline
ECF Generator Tie-Line
12 kV Service Line
Water Supply Pipeline
Energy Conversion Facility (ECF)
Well Pad
Staging
1 Mile Buffer
City of Lodi

DB

30	42	54
31	43	55
32	44	56
33	45	57
34	46	58
35	47	59
36	48	60
37	49	61
38	50	62
39	51	63
40	52	64
41	53	65

This map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

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North State Resources, Inc.

PG&E King Island Compressed Air Energy Storage Project

Figure 5.7-2
Noise Contours, Compression, and Expansion Operating Simultaneously

maps as modeled using these assumptions for the other two modes of operation (compression and expansion).

TABLE 5.7-7
Summary of Anticipated Equipment Sound Power Levels

Source	Sound Power Level (dBA at 1 meter)	Noise Attenuation Modeled
Stack	139	Silenced to 110 dBA
Cooling tower	116	None
GSU transformers	105	None
Compressor inlet filter	112	None
IP compressor	119	Inside Acoustical Building
LP compressor	130	Inside Acoustical Building
Compressor gearbox	108	Inside Acoustical Building
HP compressor	111	Inside Acoustical Building
LP expander	133	Inside Acoustical Building
HP expander	133	Inside Acoustical Building
Fuel gas compressor	96	Acoustical enclosure
Air-cooled heat exchanger	60	None

Table 5.7-8 shows the modeled noise attributable to the project during the three operational modes at two nearby noise receptors. These are LEC-M1, a residence located approximately 1,900 feet (0.36 mile) northeast (NE) of the ECF boundary; and LEC-M2, located approximately 4,590 feet (0.87 mile) east-northeast (ENE) of the ECF boundary. As stated previously, these are receptor locations for which ambient noise was measured for the LEC AFC in 2008. Ambient noise may have changed at these locations since then. Freeway noise from I-5 may have increased or decreased and the LEC has come on line, 1 mile (LEC-M2) or less (LEC-M1) from the receptors, possibly adding to the ambient noise in these locations. To license the KICP, it will be necessary to conduct a 24-hour ambient noise monitoring study and compare the current ambient noise with noise attributable to the project to determine compliance status in relation to final project design, including noise-attenuation measures adopted. The LEC values are used here as a rough approximation of ambient noise at the nearest receptors.

TABLE 5.7-8
Modeled Operational Noise Levels at Known Receptors

	Noise Level (dBA) at LEC Sensitive Receptor	
	LEC-M1 (1,900 feet NE)	**LEC-M2 (4,590 feet ENE)**
Ambient noise measured July 2008[a]:		
Average of all nighttime[b] hours, L_{eq}	64.9	50.5
Average 4 quietest nighttime[b] hours, L_{90}	56.0 (12:00 to 4:00 a.m.)	47.5 (1:00 to 5:00 a.m.)
KICP Operation Mode[c]:		
Compression Mode	45	33
Generation Mode	49	39
Both Modes in Operation Simultaneously	49	39

Notes:
[a]Source: LEC AFC, CH2M HILL (2008)
[b]Hours of 10:00 p.m. to 7:00 a.m.
[c]Noise attributable to project operation

The sensitive receptor locations show relatively high ambient noise levels for nighttime, likely because of their close proximity to I-5 traffic, which apparently was more or less continual through the night in 2008. Receptor LEC-M1 is 1,000 feet from I-5 and LEC-M2 is 4,500 feet away. The KICP would contribute some additional noise to these already high levels, but it would be a small contribution. Using logarithmic noise addition (e.g., adding 49 dBA from the KICP [generation mode or both modes] to 56 dBA [four quietest nighttime L_{90} hours]) results in an ambient plus project noise level at LEC-M1 of 56.8 dBA, for an increase of less than 1 dBA. Adding 39 dBA from the KICP (generation mode or both modes) to the ambient nighttime four quietest L_{90} hour average of 47.5 dBA results in a noise level at LEC-M2 of 48.1 dBA, for an increase of 0.6 dBA.

This level of noise increase would be consistent with the City of Lodi's significance threshold of 5 dBA increase over nighttime ambient (L_{eq}) levels (in both cases less than 0.5 dBA). It also would be less than the CEC's significance threshold of 5 dBA increase over the ambient average of the four quietest nighttime L_{90} hours. The specifications for the requisite noise controls to reach noise standard-compliant levels will be refined during the detailed project design phase and may include silencers, barriers or enclosures.

In addition, although the expansion/generation mode could be in operation at any time; in most cases, generation will not be occurring during the late nighttime hours. It is more likely that the quieter compression mode will be in operation during the nighttime hours. The predicted levels and identified mitigation shown in the modeling should be considered preliminary and additional design measures may be required to realize these levels. Conversely, given the substantially lower noise levels above in relation to the applicable significance thresholds, fewer (or more moderate) design measures than those assumed for modeling may be sufficient. Final design measures should be considered during detailed design, following measurement/analysis of current ambient noise levels/receptors and in consultation with major equipment vendors to obtain the most accurate modeling results.

5.7.3.3.4 Well Pad Operational Noise Levels

Noise from the I/W wells is expected to be relatively low as much of the piping will be underground. In addition, the well pads will be surrounded by 4-foot-high berms that will help to block noise sources that are close to the ground. Operational noise at the well pads will also result from small motors operating the wastewater injection well pumps. In general, operational noise at the well pads is expected to be minimal and well controlled. Final design will determine measures necessary to comply with County and CEC noise requirements. The nearest sensitive receptor is a rural residence approximately 0.28 mile to the south of the western well pad.

5.7.3.4 Tonal Noise

The project developer would anticipate the potential for audible tones in the final design and specification of the plant's equipment. As is typical on all projects licensed by the CEC, if audible pure tones at residential locations are realized additional mitigation will be employed.

5.7.3.5 Ground and Airborne Vibration

It would be PG&E's intention to anticipate the potential for low-frequency noise in the design and specification of the plant's equipment and take necessary steps to prevent ground or airborne vibration impacts. Potential seismic considerations have been discussed in Section 5.4.

The equipment that would be used in the proposed project is well balanced and would be designed to produce low vibration levels throughout the life of the project. An imbalance could contribute to ground vibration levels in the vicinity of the equipment. However, vibration-monitoring systems installed in the

equipment are designed to ensure that the equipment remains balanced. Should an imbalance occur, the event would be detected and the equipment would automatically shut down. Given these protective measures, impacts related to ground and airborne vibrations would be less than significant.

5.7.4 Cumulative Effects

A cumulative impact refers to a proposed project's incremental effect together with other closely related past, present, and reasonably foreseeable future projects whose impacts may compound or increase the incremental effect of the proposed project [Public Resources Code § 21083; CCR, Title 14, § 15064(h), 15065(c), 15130, and 15355]. Cumulative effects must be evaluated in relation to other reasonably foreseeable projects at the time a project applies for authorization to construct and are not evaluated here because this document is not an application for authorization to construct.

5.7.5 Mitigation Measures

The KICP project developer could propose to implement the following measures to ensure that any potential noise impacts of the KICP project are mitigated below the level of significance.

5.7.5.1 Noise Hot Line

The project developer and operator would establish a telephone number for use by the public to report any significant undesirable noise conditions associated with the construction and operation of the project. If the telephone is not staffed 24 hours per day, the project developer and operator would include an automatic answering feature, with date and time stamp recording, to answer calls when the phone is unattended. This telephone number would be posted at the project site during construction in a manner visible to passersby. This telephone number would be maintained until the project has been operational for at least 1 year.

5.7.5.2 Noise-Complaint Resolution

Throughout the construction and operation of the project, the project developer and operator would document, investigate, evaluate, and attempt to resolve all legitimate project-related noise complaints.

The applicant or authorized agent would:

- Use the Noise Complaint Resolution Form typically suggested by CEC or functionally equivalent procedure to document and respond to each noise complaint.
- Attempt to contact the person(s) making the noise complaint within 24 hours.
- Conduct an investigation to attempt to determine the source of noise related to the complaint.
- If the noise complaint is legitimate, take all feasible measures to reduce the noise at its source.

5.7.5.3 Equipment Noise Controls

Haul trucks and other engine-powered equipment shall be equipped with adequate mufflers. Haul trucks shall be operated in accordance with posted speed limits. Truck engine exhaust brake use shall be limited to emergencies.

5.7.6 Laws, Ordinances, Regulations, and Standards

Table 5.7-9 presents the LORS that apply to noise.

TABLE 5.7-9
Laws, Ordinances, Regulations, and Standards for Noise

LORS	Requirements/Applicability	Administering Agency
Federal		
EPA	Guidelines for state and local governments	EPA
OSHA	Exposure of workers over 8-hour shift limited to 90 dBA	OSHA
State		
Cal-OSHA, 8 CCR Article 105 Sections 095 et seq.	Exposure of workers over 8-hour shift limited to 90 dBA	Cal-OSHA
California Vehicle Code Sections 23130 and 23130.5	Regulates vehicle noise limits on California highways	Caltrans, California Highway Patrol, and County Sheriff's Office
Local		
California Government Code Section 65302	Requires local government to prepare plans that contain noise provisions	California Office of Planning and Research
City of Lodi General Plan	The General Plan provides quantitative compatibility goals and policy	City of Lodi
City of Lodi Municipal Code	The Municipal Code allows a 5 dBA increment over existing nighttime levels	City of Lodi
San Joaquin County Development Regulations	The County Development Regulations provides quantitative limits	San Joaquin County

5.7.6.1 Federal Laws, Ordinances, Regulations, and Standards

5.7.6.1.1 EPA

Guidelines are available from the EPA (1974) to assist state and local government entities in development of state and local LORS for noise. Because there are local LORS that apply to this project, these guidelines are not applicable.

5.7.6.1.2 OSHA

Onsite noise levels are regulated through OSHA. The noise exposure level of workers is regulated at 90 dBA, over an 8-hour work shift to protect hearing (29 CFR 1910.95). Areas above 85 dBA would be posted as high noise level areas and hearing protection would be required. It is anticipated that a hearing conservation program would be developed for applicable employees.

5.7.6.2 State Laws, Ordinances, Regulations, and Standards

5.7.6.2.1 Cal-OSHA

The California Department of Industrial Relations, Division of Occupational Safety and Health enforces Cal-OSHA regulations, which are the same as the federal OSHA regulations described previously. The regulations are contained in Title 8 of the CCR, General Industrial Safety Orders, Article 105, Control of Noise Exposure, Sections 5095, et seq.

5.7.6.2.2 California Vehicle Code

Noise limits for highway vehicles are regulated under the California Vehicle Code, Sections 23130 and 23130.5. The limits are enforceable on the highways by the California Highway Patrol and the County Sheriff offices.

5.7.6.3 Local Laws, Ordinances, Regulations, and Standards

The California State Planning Law (California Government Code Section 65302) requires that all cities, counties, and entities (such as multi-city port authorities) prepare and adopt a General Plan to guide community development. The Noise Element in the City of Lodi's General Plan (City of Lodi, 2010) established community noise exposure guidelines depicted in Table 5.7-9. The Noise Element also identifies noise-sensitive uses which include residences, hospitals, schools, libraries, and rest homes (City of Lodi, 2010). This states that noise levels of less than 60 dBA CNEL are normally acceptable at low density, single family residential uses and that levels between 60 and 70 dBA CNEL are conditionally acceptable. Table 5.7-9 also states that noise levels of less than 65 dBA CNEL are normally acceptable at multi-family residential uses and that levels between 65 and 70 dBA CNEL are conditionally acceptable.

Section 9.24 of the Lodi Municipal Code (LMC) is generally a nuisance based noise ordinance. The most restrictive and applicable portion of this code states that "it is unlawful for any person, firm or corporation to cause, permit, or generate any noise or sound as described herein between the hours of 10 p.m. and 7 a.m. which exceeds the ambient noise level at the property line of any residential property (or, if a condominium or apartment house within any adjoining apartment) as determined at the time of such reading by more than five decibels. This section shall be applicable whether such noise or sound is of a commercial or noncommercial nature" (LMC 9.24.030). The ambient noise level is defined as "the all-encompassing noise associated with a given environment, usually being a composite of sounds with many sources near and far as determined at any specific point" (LMC 9.24.010) which is typical defined by the L_{eq} statistic.

As described in Section 5.6, Land Use, the project site is in the City of Lodi but borders San Joaquin County, and the closest residences are in the County. The applicable noise regulations are those of the City, because the source of the noise would be located in Lodi.

The San Joaquin County Development Regulations (Section 9-1025.9) establish noise limits in terms of hourly average L_{eq} and maximum levels at noise sensitive outdoor activity areas. The daytime (7 a.m. to 10 p.m.) hourly average and maximum limits are 50 and 70 dBA, respectively. The nighttime (10 p.m. to 7 a.m.) hourly and maximum levels are 45 and 65 dBA, respectively. These standards may be applied at the property line of the receiving noise-sensitive use and shall be reduced by 5 dBA for impulsive, single-tone noise or noise consisting primarily of speech or music. In addition, the County code exempts construction noise from these limitations between the hours of 6 a.m. and 9 p.m. The County General Plan requirements are consistent with the numeric limits described above.

TABLE 5.7-10
City of Lodi Community Noise Exposure Matrix (CNEL, dBA)

Land Use Category	Normally Acceptable	Conditionally Acceptable	Normally Unacceptable	Clearly Unacceptable
Residential - Low Density Single Family, Duplex, and Mobile Homes	<60	60–70	70–75	75+
Residential – Multi-family	<65	65-70	70–75	75+
Transient Lodging – Motels, Hotels	<65	65–70	70–75	75+

TABLE 5.7-10
City of Lodi Community Noise Exposure Matrix (CNEL, dBA)

Land Use Category	Normally Acceptable	Conditionally Acceptable	Normally Unacceptable	Clearly Unacceptable
Schools, Libraries, Churches, Hospitals, Nursing Homes	<65	65–70	70–75	75+
Auditoriums, Concert Halls, Amphitheaters	-	<70	-	70+
Sports Arena, Outdoor Spectator Sports	-	<75	-	75+
Playgrounds, Neighborhood Parks	<67.5	67.5-72.5	-	72.5+
Golf Courses, Riding Stables, Water Recreation, Cemeteries	<70	70-80	80-85	-
Office Buildings, Business Commercial and Professional	<70	70-75	75-85	-
Industrial, Manufacturing Utilities, Agriculture	<70	70-80	80-85	-

Source: City of Lodi, 2010

5.7.7 Agencies and Agency Contacts

No agencies were contacted directly to specifically discuss project noise.

5.7.8 Permits and Permit Schedule

No permits are required; therefore, there is no permit schedule.

5.7.9 References

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5.8 Paleontological Resources

5.8.1 Introduction

This section evaluates the potential effect to paleontological resources (fossils) from the construction and operation of the King Island CAES Project (KICP). In this section, "project site" is intended to include the ECF site, well pads and all linear features as described in Section 2.0, Project Description. The "project area" is the general vicinity surrounding the project site.

5.8.2 Affected Environment

5.8.2.1 Physiographic Setting

The project site is located within the northern and lowest portion of the San Joaquin Valley of California, along the eastern margin of the vast Sacramento-San Joaquin Delta area. The Coast Ranges lie about 20 miles to the west and south. The Great Valley (also known as the Central Valley) physiographic province includes elongated northwest- to southeast-trending basins: the Sacramento basin to the northwest and the San Joaquin basin to the southeast (Fenneman, 1931). The Great Valley describes the surface of a geologically long-lived structural trough approximately 435 miles (700 kilometers) long and 44 to 56 miles (70 to 90 kilometers) wide. The present-day basin evolved from a late Jurassic to late Cretaceous (85 to 170 million years ago) marine fore-arc basin. During the early Cenozoic marine sediments continued to accumulate in this basin until, in the late Tertiary (25 to 30 million years ago), a change in the relative motion between the Pacific and North American plates resulted in the gradual uplift of the Coast Ranges and the eventual isolation of the basin from the ocean. More recent Miocene and lower Pliocene sediments were derived from the neighboring Coast Ranges and the Sierra Nevada. By the late Pliocene (2 to 3 million years ago), subaerial depositional conditions prevailed and Sierra Nevada–derived sediments were deposited in the basin east of the valley axis (Wahrhaftig and Birman, 1965).

While the sedimentary sequence of the Great Valley is commonly thought to be relatively continuous, this is not necessarily the case for the project area. Glacioeustatic lowering of sea level by as much as 400 feet during Quaternary glacial advances over the last approximately 700,000 years (e.g., Bloom, 1983) caused stream entrenchment and hydrographic isolation of the current floodplains (Shlemon, 1971). Concurrent with this entrenchment was the westward expansion of the Sierran alluvial fans, and concurrent western retreat of delta systems. A general lack of glacial-age sedimentation on the interglacial floodplains was the result (ibid.). Conversely, during interglaciations such as the current Holocene (the last 10,000 years), sea-level rises to near present elevations, and the fan-delta system extends farther to the east, inland. Fluvial sedimentation in the project area occurred during overbank floods and from simple river meander after sea level had reached near its present elevation, and before the historical channelization of the delta (Lettis and Unruh, 1991). Marchand and Atwater (1979) mapped the historical limit of the autumnal high tides of the Delta only about 0.7 mile west of the ECF Site.

5.8.2.2 Resource Inventory Methods

To develop a baseline paleontological resource inventory of the project site and surrounding lands, and to assess the potential paleontological productivity of the stratigraphic units that may be present, published as well as available unpublished geological and paleontological literature was reviewed. Sources included geological maps, satellite and aerial photography, and technical and scientific reports. For the KICP, an updated paleontological resources records review was conducted for the project using the online database maintained by the University of California at Berkeley Museum of Paleontology (UCMP).

5.8.2.3 Resource Inventory Results

5.8.2.3.1 Geological Units in the Vicinity

Below a layer of as much as 10 feet of Holocene eolian deposits and alluvium, Late Quaternary sediments beneath the project area are chiefly of fluvial origin, attributable to the Mokelumne River, and perhaps the San Joaquin River as well (Marchand and Atwater, 1979; Kleinfelder, 1993). As appropriate to a site near the margin of the great Sacramento-San Joaquin Delta, the lay of the land is nearly flat with the surface sloping very gently at less than a two percent grade to the west. Local drainage is currently directed by a complex series of canals and drains that usually terminate in one of the sloughs of the delta system. The elevation of the site varies from approximately 10 feet above mean sea level (MSL) at the Energy Conversion Facility (ECF) area to as low as 10 feet below MSL at the well pads.

The local area is underlain by a complex series of sedimentary and volcanic rocks ranging in age from Jurassic to Tertiary. A thick sequence of fluvial deposits and some estuarine clays and silts comprises the shallower sedimentary package of the Great Valley province in the Lodi area. These sedimentary deposits consist of interbedded sand, silt, and clay. A brief description of the stratigraphy of the project area is presented here.

The most detailed mapping of the surficial geology of the project area was completed by Marchand and Atwater (1979) and they recognized five mapping units of the Modesto Formation within the area. These mapping units, which are considered here to be facies of the Modesto Formation, are identified by symbols alone:

The following geological units identified by Marchand and Atwater (1979) occur within 2 miles of the project site:

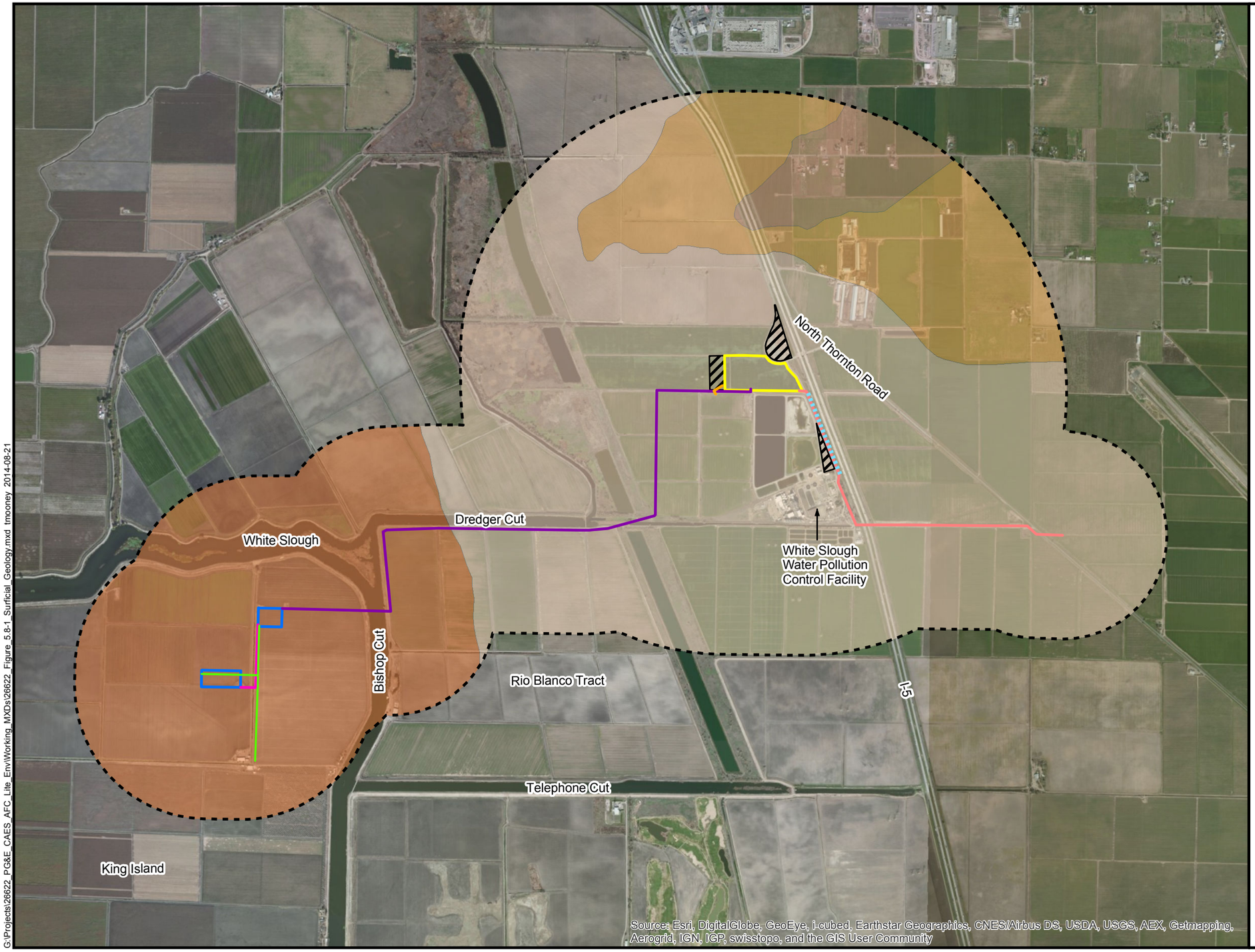
Qm	Undifferentiated Modesto Formation. Moderately consolidated silty clay, silt, sand and gravel deposits of alluvial origins.
Qm_l	Lower member of the Modesto Formation consisting of arkosic alluvium of the Mokelumne River alluvial fan; chiefly sand; probably glacial outwash
Qm_2	Upper member of the Modesto Formation, undifferentiated
Qds	Quaternary aeolian sand deposits

The mapped distribution of these geological units following Marchand and Atwater (1979) is displayed in Figure 5.8-1.

Throughout the project area there is also an overburden of disturbed soils and artificial fill that relates to the long history of agricultural and industrial development in the area. These disturbed soils and fill extend to varying depths depending on the activity area but, as a rule, the underlying undisturbed Modesto Formation is encountered at a depth of approximately 4 feet below ground surface.

5.8.2.3.2 Results of the Resource Inventory

A search of the UCMP database on August 20, 2014, yielded records of 97 fossil localities within San Joaquin County; 35 of these are invertebrate collections or microfossil samples. The rest of the localities have yielded plant and vertebrate fossils. Many are from the fossiliferous Tertiary units exposed in the Coast Range foothills more than 20 miles to the southwest; additional records come from the foothills of the Sierra Nevada that start to rise about 10 miles to the east. Very few records appear to come from the axial portion of the Great Valley at these low elevations immediately adjacent to the Delta. A solitary fossil coral specimen belonging to the genus *Terbinolia* was recovered at the Lodi Energy Center from sediment brought to the surface during drilling of a deep injection well, which is positioned within the Lodi Airport



Water Supply Pipeline
Air Pipeline
Air Collection Pipeline
Gas Pipeline
ECF Generator Tie-Line
12kV Service Line
Energy Conversion Facility (ECF)
Well Pad
Staging
* Buffer

Surficial Geology

Qds - Dune Sand
Qm - Modesto Formation, Undivided
Qm2 - Modesto Formation, Upper Member, Undivided
Qm1 - Modesto Formation, Lower Member, Undivided

Notes:
1. * 1 mile around ECF site, 1/2 mile around project linears and well pads.

This map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

N

0 2,000 4,000

Feet

G:\Projects\26622_PG&E_CAES_AFC_Lite_Env\Working_MXDs\26622_Figure_5.8-1_Surficial_Geology.mxd tmooney 2014-08-21

North State Resources, Inc.

PG&E King Island Compressed Air Energy Storage Project

Figure 5.8-1
Surficial Geology

Gas Field. The specimen was recovered from the Eocene Domengine Sandstone at a depth of 4,230 feet below ground surface. The specimen was accessioned into the University of California at Berkeley Museum of Paleontology as a significant find because prior to this discovery no specimens of *Turbinolia* sp. had been reported from the Domengine Sandstone in San Joaquin County.

No known vertebrate paleontological sites occur within 1 mile of the project site including its linears.

5.8.2.3.3 Paleontological Sensitivity of the Project Site

Paleontological sensitivity is the qualitative assessment made by a professional paleontologist taking into account the paleontological potential of the stratigraphic units present, the local geology and geomorphology, and any other local factors that may be germane. According to the Society of Vertebrate Paleontology (SVP, 1995) standard guidelines sensitivity comprises (1) the potential for a geological unit to yield abundant or significant vertebrate fossils or for yielding a few significant fossils, large or small, vertebrate, invertebrate, or paleobotanical remains, and (2) the importance of recovered evidence for new and significant taxonomic, phylogenetic, paleoecological, or stratigraphic data (Table 5.8-1).

TABLE 5.8-1
Paleontological Sensitivity Ratings Employed

	Definition
High	Assigned to geological formations known to contain paleontological resources that include rare, well-preserved, and/or fossil materials important to ongoing paleoclimatic, paleobiological and/or evolutionary studies. They have the potential to produce or have produced vertebrate remains that are the particular research focus of many paleontologists, and can represent important educational resources as well.
Moderate	Stratigraphic units that have yielded fossils that are moderately well-preserved, are common elsewhere, and/or that are stratigraphically long-ranging would be assigned a moderate rating. This evaluation can also be applied to strata that have an unproven but strong potential to yield fossil remains based on its stratigraphy and/or geomorphologic setting.
Low	Sediment that is relatively recent or that represents a high-energy subaerial depositional environment where fossils are unlikely to be preserved. A low abundance of invertebrate fossil remains, or reworked marine shell from other units, can occur but the paleontological sensitivity would remain low due to their lack of potential to serve significant scientific or educational purposes.
Marginal and Zero	Stratigraphic units with marginal potential include pyroclastic flows and soils that might preserve traces or casts of plants or animals. Most igneous rocks, however, have zero paleontological potential. Other stratigraphic units deposited subaerially in a high energy environment (such as alluvium) may also be assigned a marginal or zero sensitivity rating. Manmade fill is also considered to possess zero (no) paleontological potential.

As noted above, a limited suite of surficial geological units occurs within 1 mile of the project area, and is restricted to different facies of the Modesto Formation and overlying disturbed sediment. No paleontological localities have been recorded within a mile of the site from these facies.

No paleontological localities are known from the Modesto Formation in San Joaquin County. Although some vertebrate localities from undifferentiated Quaternary sediments could be from the Modesto Formation, based on the absence of fossils records from this unit, the Modesto Formation in this area is assigned low paleontological sensitivity. The low paleontological sensitivity of the Modesto Formation in this area is also supported by the recent geomorphic history of the fan-delta region. Due to drastically lower sea level during the last glacial age (Bloom, 1983), sediments did not begin aggrading at present elevations until after about 10,000 B.P. (Schlemon, 1971), while the end of the Rancholabrean Land

Mammal Age can now be dated at about 10,900 B.P. (Martin, 2005). Therefore, megafaunal remains of the Rancholabrean would not be expected in the sediments mapped as Modesto Formation in the project area.

Further demonstrating the low paleontological sensitivity of the Modesto Formation are excavations in in Modesto Formation sediments at the Lodi Energy Center, located 0.5 mile south from the KICP ECF site, which yielded no scientifically significant vertebrate fossils during paleontological monitoring (CH2M HILL, 2012). Additionally, sediments mapped as the Modesto Formation occur within 20 feet of river level on the south bank of the San Joaquin River, about 21 miles west-southwest of the project site near Antioch. These have yielded no scientifically significant paleontological materials despite more than 3 years of episodic monitoring (CH2M HILL, n.d.). Approximately 50 miles to the southeast, near Turlock, in Stanislaus County, recent investigations found the Modesto Formation to be devoid of fossils. The underlying upper Riverbank Formation yielded vertebrate fossils (Spaulding and Naidu, 2006). The Riverbank Formation has not been mapped in the vicinity of the project site, and given the project's location at the toe of the Mokelumne River alluvial fan, the Riverbank Formation is expected at depths far exceeding what construction-related excavations would reach (e.g. more than 80 feet; Atwater et al., 1986).

5.8.3 Environmental Analysis

The environmental impacts on paleontological resources from both construction and operation of the project are presented in the following sections.

5.8.3.1 Paleontological Resource Significance Criteria

In its standard guidelines for assessment and mitigation of adverse impacts to paleontological resources, the SVP (1995) notes that an individual fossil specimen is considered scientifically important and significant if it is: (1) identifiable, (2) complete, (3) well preserved, (4) age-diagnostic, (5) useful in paleoenvironmental reconstruction, (6) a type or topotypic specimen, (7) a member of a rare species, (8) a species that is part of a diverse assemblage, or (9) a skeletal element different from, or a specimen more complete than, those now available for that species. For example, identifiable land mammal fossils are considered scientifically important because of their potential use in determining the age and providing input to paleoenvironmental reconstructions for the sediments in which they occur. Moreover, vertebrate remains are comparatively rare in the fossil record. Fossil plants are also important in this regard and, as sedentary organisms, are actually more sensitive indicators of their paleoenvironment and, thus, more important than mobile mammals for paleoenvironmental reconstructions. For marine sediments, invertebrate fossils, including marine microfossils, are scientifically important for the same reasons that land mammal and/or land plant fossils are valuable in terrestrial deposits. The value or importance of different fossil groups varies depending on the age and depositional environment of the stratigraphic unit that contains the fossils, their abundance in the record, and their degree of preservation.

Using the criteria of the SVP (1995) and the sensitivity ratings provided above, the significance of potentially adverse impacts of earth moving on the paleontological resources was assessed. Any unmitigated impact on a fossil site or a fossil-bearing rock unit of high or moderate sensitivity would be considered significant.

5.8.3.2 Paleontological Resource Impact Assessment

Excavations including drilling and trenching extending to depths below 4 feet are likely to affect alluvium of the Modesto Formation, the stratigraphic unit estimated to underlay the entire project site. For the reasons described above, this unit has low paleontological sensitivity. Identifiable and *in situ* fossils of scientific significance are unlikely to be present at depth in this unit, and therefore excavations within this unit would not constitute an adverse impact.

Therefore, significant impacts to paleontological resources are not expected to occur from subsurface excavations associated with KICP construction nor from project operation.

5.8.4 Cumulative Effects

Widespread development in the San Francisco Bay and Delta areas has resulted in proportionately extensive impacts to paleontological resources, and this is anticipated to continue. The extensive nature of these cumulative impacts is due to this extensive development combined with the widespread presence of a number of fossiliferous sedimentary units in the area. However, measures typically implemented pursuant to State statutes serve to mitigate these impacts through the recovery of the scientific and educational potential of the affected paleontological resources. Although not all projects are subject to California Environmental Quality Act (CEQA) review, and only a small proportion of those incorporate paleontological protection measures, application of paleontological monitoring and mitigation measures is common and, therefore, mitigates the cumulative as well as direct impacts of continued development.

The potential contribution to cumulative impacts to paleontological resources from project-related ground disturbance would be limited, given the limited extent of the current project and the locally unproven paleontological potential of the Quaternary alluvium at the project site. Thus, the proposed project is not expected to contribute measurably to cumulative negative impacts to paleontological resources in the absence of mitigation. With the mitigation described below, however, the contribution of the project to cumulative negative impacts to paleontological resources would be negligible. Moreover, the application of controlled scientific recovery methods to discovered paleontological resources is typically thought of as constituting a beneficial impact to the extent that new scientific specimens and knowledge are generated.

5.8.5 Mitigation Measures

Guidelines for the Implementation of CEQA (Public Resources Code Sections 15000 et seq.) include among the questions to be answered in the Environmental Checklist (Section 15023, Appendix G) the following: "*Would the project directly or indirectly destroy a unique paleontological resource or site*?" and "*Does the project have the potential to ... eliminate important examples of the major periods of California ... pre-history*?" These questions are answered in the negative based on the data and considerations provided above. Because construction of the KICP does not have appreciable potential to adversely impact significant paleontological resources, mitigation measures beyond worker education are not necessary.

In the event that resources with potentially moderate or high paleontological sensitivity are discovered and could be impacted as a result of the project, a paleontological resources monitoring and mitigation plan (PRMMP) would be developed to identify general and specific measures to minimize potential impacts to significant paleontological resources. The PRMMP, one of potentially several mitigation measures, would be developed in accordance with SVP guidelines and would include, but not be limited to, the following, as summarized:

- Assurance that the performance and sequence of project-related tasks, such as any literature searches, pre-construction surveys, worker environmental training, fieldwork, flagging or staking, construction monitoring, mapping and data recovery, fossil preparation and collection, identification and inventory, preparation of final reports, and transmittal of materials for curation will be performed according to PRMMP procedures
- Identification of the person(s) expected to assist with each of the tasks identified within the PRMMP and the names and qualifications of paleontological resource monitors (PRMs)

- Thorough discussions of the anticipated geologic units expected to be encountered in terms of their location, depth and known sensitivity, along with location of where monitoring of project construction activities is deemed necessary (including a proposed plan for monitoring and sampling) and explanation of sampling activities and procedures
- A discussion of procedures to be followed in the event of a significant fossil discovery, halting construction, resuming construction, and how notifications will be performed and a list of equipment and supplies necessary for collection of fossil materials and any specialized equipment needed to prepare, remove load, transport, and analyze large-sized fossils or extensive fossil deposits
- Procedures for inventory, preparation, and delivery for curation into a retrievable storage collection in a public repository or museum, which meet SVP standards and requirements for the curation of paleontological resources, and identification of the institution that will be approached to receive data and fossil materials collected (likely the University of California Museum of Paleontology in Berkeley), along with requirements or specifications for materials delivered for curation, and how they will be met, and the name and phone number of the contact person at the institution

5.8.5.1 Construction Personnel Education

Prior to working on the site for the first time, all personnel involved in earth-moving activities would be provided with Paleontological Resources Awareness Training. This training would ideally be provided as a module in their worker environmental awareness training. They would be informed that, while fossils are unlikely to be encountered, they are nevertheless of scientific importance and should be reported immediately if they are encountered. The training would provide information on the appearance of fossils, their importance in understanding the prehistory of California, and on proper notification procedures. This worker training would be prepared and initially presented by the Paleontological Resources Specialist. Subsequent training may be conducted using recorded and hard copy training materials.

5.8.5.2 Significant Unavoidable Adverse Impacts

No significant unavoidable adverse impacts on paleontological resources are anticipated as a result of construction or operation of the project.

5.8.6 Laws, Ordinances, Regulations, and Standards

Paleontological resources (fossils) are the remains or traces of prehistoric plants and animals. They may range from the actual bones and shells of ancient organisms, to mineral replacements of a once-living organism, to simple impressions of plants or animals in soft sediments later transformed to rock. They range in size and abundance from many thousands per cubic centimeter for microfossils such as pollen, diatoms, and radiolaria, to very rare large-mammal bones exceeding a meter in length. Fossils are important scientific and educational resources because of their use in (1) documenting the presence and evolutionary history of particular groups of now-extinct organisms, (2) reconstructing the environments in which these organisms lived, and (3) in determining the relative ages of the strata in which they occur and the geologic events that resulted in the deposition of the sediments that formed these strata. In the project area, the fossils of marine organisms as well as those of terrestrial animals and plants are important in the paleontological record. They have helped define the age and sequences of deposition and uplift along the Great Valley, where fossiliferous marine and terrestrial sedimentary rock provide important data on the development and tectonics of California's complex geology.

Paleontological resources are non-renewable scientific resources and are protected by several federal and state statutes (California Office of Historic Preservation, 1983; see also Marshall, 1976; Fisk and Spencer,

1994), most notably by the 1906 Federal Antiquities Act and other subsequent federal legislation and policies, and by State of California's environmental regulations (CEQA, Section 15064.5). Professional standards for assessment and mitigation of adverse impacts to paleontological resources have been established by the SVP (1991, 1995, 1996). Design, construction, and operation of the KICP would be conducted in accordance with all laws, ordinances, regulations, and standards (LORS) applicable to paleontological resources. Federal, state, and local LORS applicable to paleontological resources are summarized in Table 5.8-2 and discussed briefly below, along with professional standards for paleontological resources assessment and impact mitigation.

TABLE 5.8-2
Laws, Ordinances, Regulations, and Standards for Paleontological Resources

LORS	Applicability	Project Conformity
Antiquities Act of 1906	Would be applicable if federal funding or federal entitlement applies	—
CEQA, Appendix G	Applicable – Fossil remains may be encountered by earth-moving activities	Yes

5.8.6.1 Federal LORS

Federal protection for significant paleontological resources would apply to the project only if any construction or other related project impacts occur on federally owned or managed lands, or if a federal entitlement or other permit were required. Federal legislative protection for paleontological resources stems from the Antiquities Act of 1906 (PL 59-209; 16 United States Code 431 et seq.; 34 Stat. 225), which calls for protection of historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest on federal lands. In addition, the National Environmental Policy Act of 1969 (United States Code, section 4321 et seq.; 40 Code of Federal Regulations, section 1502.25), as amended, requires analysis of potential environmental impacts to important historic, cultural, and natural aspects of our national heritage. If federal funds or a federal permit would be required for full build-out of the project, these statutes would extend to paleontological resources (see Table 5.8-2).

5.8.6.2 State LORS

The California Energy Commission (CEC) environmental review process under the Warren-Alquist Act is considered functionally equivalent to that of CEQA (Public Resources Code Sections 21000 et seq.). CEQA requires that public agencies and private interests identify the environmental consequences of their proposed projects on any object or site of significance to the scientific annals of California (Division I, California Public Resources Code Section 5020.1 [b]). *Guidelines for the Implementation of CEQA* (Public Resources Code Sections 15000 et seq.) defines procedures, types of activities, persons, and public agencies required to comply with CEQA. Appendix G in Section 15023 provides an Environmental Checklist of questions that a lead agency should normally address if relevant to a project's environmental impacts. One of the questions to be answered in the Environmental Checklist (Section 15023, Appendix G, Section V, part c) is the following: "Would the project directly or indirectly destroy a unique paleontological resource or site…?"

The CEQA lead agency having jurisdiction over a project, in this case the CEC, is responsible for ensuring paleontological resources are protected in compliance with CEQA and other applicable statutes. The lead agency with the responsibility to ensure that fossils are protected during construction of the proposed

project would be the CEC. California Public Resources Code Section 21081.6, entitled Mitigation Monitoring Compliance and Reporting, requires that the CEQA lead agency demonstrate project compliance with mitigation measures developed during the environmental impact review process.

5.8.6.3 Local LORS

The City of Lodi Community Development Department and the San Joaquin County Community Development Department were contacted regarding the existence of regulations pertaining to paleontological resources. Neither City of Lodi nor San Joaquin County have specific regulations; both follow CEQA and federal regulations relevant to paleontological resources.

5.8.6.4 Professional Standards

The SVP, an international organization of professional paleontologists, has established standard guidelines (SVP, 1991; 1995; 1996) that outline acceptable professional practices in the conduct of paleontological resource assessments and surveys, monitoring and mitigation, data and fossil recovery, sampling procedures, and specimen preparation, identification, analysis, and curation. Most practicing paleontologists in the nation adhere to the SVP's guidelines, and extend those to address other types of fossils of scientific significance, such as invertebrate fossils and paleobotanical specimens. Many federal and state regulatory agencies, including the CEC, have informally adopted the SVP standard guidelines.

5.8.7 Agencies and Agency Contacts

There are no agencies having blanket jurisdiction over paleontological resources. The CEC has jurisdiction over paleontological resources for this project.

5.8.8 Permits and Permit Schedule

No state, county, or city agency requires a paleontological collecting permit to allow for the recovery of fossil remains discovered as a result of construction-related earth moving on this project site.

5.8.9 References

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5.9 Public Health

This section addresses the potential public health effects of constructing and operating the King Island CAES Project (KICP). It presents the methodology of a human health risk assessment that may be performed to assess potential impacts and public exposure associated with airborne emissions from the construction and operation of the facility. PG&E has not conducted this analysis for the KICP and has not conducted full meteorological modeling of the ECF facility's emissions in the preliminary design. PG&E anticipates that the project developer would conduct this modeling and risk assessment as part of preparing the Application for Certification (AFC), using modeling and design data current to the time of application.

Human health and safety risks potentially associated with accidental releases of hazardous materials at the KICP are discussed in Section 5.5, Hazardous Materials Handling. These include the offsite risk of a release of aqueous ammonia stored in onsite storage tanks and the potential risk of explosion or fire from release of native natural gas entrained in the air withdrawal stream from the air reservoir, through the air pipeline, and to the Energy Conversion Facility (ECF). Hazards to onsite workforce and applicable regulations and plans for mitigating these hazards are discussed in Section 5.16, Worker Health and Safety. The management of wastes, including potentially hazardous wastes, is discussed in Section 5.14, Waste Management.

5.9.1 Introduction

Air will be the dominant pathway for potential public exposure to non-criteria pollutants released by the KICP ECF. Emissions to the air will consist primarily of combustion by-products produced by the turbo-expander generator units. Potential health risks from combustion emissions will occur almost entirely by direct inhalation. To be conservative, additional pathways for dermal absorption, soil ingestion, home-grown vegetable consumption, and mother's milk ingestion are included in the health risk modeling methodology. The health risk assessment would be conducted in accordance with guidance established by the California Office of Environmental Health Hazard Assessment (OEHHA, 2005), the California Air Resources Board (CARB, 2008), and the San Joaquin Valley Air Pollution Control District (SJVAPCD, 2007).

KICP will use an optimized stack height to reduce ground-level concentrations of the emissions, thus reducing potential effects on public health. Combustion byproducts with established national and California ambient air quality standards (referred to as "criteria pollutants") are addressed in Section 5.1, Air Quality.

5.9.2 Affected Environment

Sensitive receptors are locations where groups of individuals—including infants, children, the elderly and chronically ill—who may be more susceptible than the general population to health risks from air pollution may be found. Schools, daycare facilities, convalescent homes and hospitals are of particular concern.

The nearest residences to the KICP ECF site are less than 0.5 mile to the north. The nearest residence to the well pad site is a rural residence about 0.28 mile to the south if the western well pad. Sensitive receptors within a 3-mile radius of the ECF site include several daycare centers (mainly small, in-home locations), and one school. No hospitals, long-term health care facilities, or nursing homes are located within 3 miles of the ECF or well pad sites. The nearest sensitive receptor is a small-capacity in-home daycare center approximately 2 miles south of the ECF. The nearest school is Manlio Silva Elementary, approximately 2.8 miles south-southeast of the ECF site. The nearest hospital is Lodi Memorial Hospital at 975 South Fairmont Avenue, Lodi, which is approximately 8 miles northeast of the ECF site.

Beneficial aspects of the KICP regarding protection of public health include the following:

- Use of clean-burning natural gas fuel
- Use of electricity for compression that is generated using a high percentage of non-emitting renewable power
- Low-sulfur content of the natural gas, which reduces sulfate fine particulate and sulfur dioxide (SO_2) generation
- Selective catalytic reduction (SCR) technology to control nitrogen oxides (NO_x) emissions
- Oxidation catalyst technology to control carbon monoxide (CO) emissions, and to reduce emissions of various Toxic Air Contaminants (TACs)
- Optimized stack height to reduce ground-level concentrations of exhaust pollutants below public health-related significance thresholds

Air quality and health risk data presented by CARB in the 2008 Almanac of Emissions and Air Quality for the San Joaquin Valley Air Basin show that over the period 1990 through 2005, the average concentrations for the top ten TACs have been substantially reduced, and the associated health risks for the San Joaquin Valley Air Basin are showing a steady downward trend as well. CARB-estimated emissions inventory values for the top ten TACs for 2006 and ambient levels and associated potential risks are presented in Table 5.9-1 for the air basin.

TABLE 5.9-1
Top Ten TACs Emitted by All Sources in the San Joaquin Valley Air Basin

		SJVAB 2007 Levels and Risks	
TAC	**SJVAB 2007 Emissions (tons/year)**	**Annual Average Concentration (ppbv)**	**Potential Carcinogenic Risk (in 1 million)**
Acetaldehyde	1603	1.15	6
Benzene	1,680	0.32	29
1,3-Butadiene	515	0.07	24
Carbon tetrachloride	<.01	0.10 (2003)	26 (2003)
Chromium, hexavalent	0.12	0.08 ng/m^3	12
Para-Dichlorobenzene	156	0.15 (2006)	10 (2006)
Formaldehyde	4,065	2.5	18
Methylene chloride	423	0.1	<1
Perchloroethylene	617	0.3	1
Diesel PM	6,073	1.3 μg/m^3 (2000)	390 (2000)

Source: CARB. The California Almanac of Emissions and Air Quality, 2009 Edition, http://www.arb.ca.gov/aqd/almanac/almanac08/almanac2009all.pdf

μg/m^3 = micrograms per cubic meter

ng/m^3 = nanograms per cubic meter

ppbv = parts per billion by volume

A variety of studies have been published regarding cancer and respiratory illnesses and diseases in San Joaquin County and in the broader San Joaquin Valley area. Asthma diagnosis rates in the San Joaquin Valley are higher overall than average rates throughout the state. In San Joaquin County, the percentage of

adults who have been diagnosed with asthma has increased from 12.1% in 2001 to 19.5% in 2014[1]. Rates for children are slightly higher, at 22.9% in 2014[2]. Cancer death rates in the county have decreased from around 180 per 100,000 population in 2008 to 171.9 over the time period 2007-2011. This is slightly lower than the national rate of 173.8, but higher than the statewide average of 157.7[3]. The San Joaquin County Public Health Services maintains an epidemiology website for information regarding public health issues for residents in the vicinity of the KICP[4].

5.9.3 Environmental Analysis

This section is organized to discuss the sources and different kinds of air emissions associated with construction and operation of KICP (see Section 5.1, Air Quality) and the methodology appropriate for human health risk assessment of airborne pollutants. Other potential public health risks associated with the project are discussed in different sections of the AFC as follows:

- Potential exposure to the native natural gas entrained in the withdrawal air is discussed in Section 5.5, Hazardous Materials Handling
- Potential exposure to the hypothetical accidental release of anhydrous ammonia onsite or during offsite transport is discussed in Section 5.5, Hazardous Materials Handling
- Potential exposure to wastes generated by the project is discussed in Section 5.14, Waste Management
- Potential safety and health impacts relative to the work environment of project employees are discussed in Section 5.16, Worker Health and Safety
- Potential exposure to transmission line electric and magnetic fields is discussed in Section 3.3, Transmission Line Safety and Nuisances

Project emissions to the air will consist of combustion by-products from the natural-gas-fired turbo-expanders and of particulate matter from cooling tower drift. After dispersion to ground-level, inhalation is the main pathway by which air pollutants can potentially cause public health impacts. Other pathways, including ingestion of soil, homegrown vegetables, and mother's milk, and dermal absorption, also are evaluated for potential exposure.

To evaluate potential health risks, the measures of these risks are first described in terms of the types of public health effects and the significance criteria and thresholds for those effects.

5.9.3.1 Significance Criteria

Significance criteria have been established for both carcinogenic and non-carcinogenic risks, and are discussed separately, as follows.

5.9.3.1.1 Cancer Risk

Cancer risk is the probability or chance of contracting cancer over a human life span (assumed to be 70 years). Carcinogens are assumed to have no threshold below which there would be no human health

[1] Healthier San Joaquin County Community Assessment – 2008. California Breathing San Joaquin County Asthma Profile – 2014. http://www.californiabreathing.org/asthma-data/county-asthma-profiles/san-joaquin-county-asthma-profile

[2] California Breathing San Joaquin County Asthma Profile – 2014, op cit.

[3] National Cancer Institute, State Cancer Profiles. http://statecancerprofiles.cancer.gov/cgi-bin/ratetrendbycancer/data.pl?001&0&06&6&1&0&3

[4] http://www.sjcphs.org/Disease/Epidemiology.aspx

impact. In other words, any exposure to a carcinogen is assumed to have some probability of causing cancer; the lower the exposure, the lower the cancer risk (i.e., a linear, no-threshold model). Under state and SJVAPCD regulations, an incremental cancer risk greater than 10-in-one million due to a project is considered to be a significant impact on public health if the emitting units are determined by the District to be using Toxics Best Available Control Technology (T-BACT)[5]. The 10-in-one-million risk level is also used by the Air Toxics "Hot Spots" (AB 2588) program and California's Proposition 65 as the public notification level for air toxic emissions from existing sources.

5.9.3.1.2 Non-Cancer Health Impact

Non-cancer health effects can be either long-term (chronic) or short-term (acute). In determining potential non-cancer health risks from air toxics, it is assumed there is a dose of the TAC below which there would be no impact on human health. The air concentration corresponding to this dose is called the Reference Exposure Level (REL). A non-cancer health impact is measured in terms of a health hazard quotient for each TAC, which is the calculated maximum exposure (concentration) of each TAC divided by its REL. Health hazard quotients for TACs affecting the same target organ are typically summed with the resulting totals expressed as health hazard indices for each organ system. A health hazard index of less than 1.0 is considered to be a less-than-significant health risk.

Chronic toxicity is defined as adverse health effects from prolonged chemical exposure, caused by chemicals accumulating in the body. Because chemical accumulation to toxic levels typically occurs slowly, symptoms of chronic effects usually do not appear until long after exposure commences. The lowest no-effect chronic exposure level for a non-carcinogenic air toxic is the chronic REL. Below this threshold, the body is capable of eliminating or detoxifying the chemical rapidly enough to prevent its accumulation. The chronic health hazard index is calculated as the sum of the chronic health hazard quotients, each of which is calculated as the chronic TAC annual concentration divided by the chronic REL of the TAC.

Acute toxicity is defined as adverse health effects caused by a brief chemical exposure of no more than 24 hours. For most chemicals, the air concentration required to produce acute effects is higher than the level required to produce chronic effects because the duration of exposure is shorter. Because acute toxicity is predominantly manifested in the upper respiratory system at threshold exposures, all acute health hazard quotients are typically summed to calculate the acute health hazard index. The maximum one-hour average concentration of each TAC with acute health effects is divided by the specific TAC's acute REL to obtain a health hazard quotient for health effects caused by relatively high, short-term exposure to air toxics. An additional conservative procedure in this health risk assessment methodology is that the health hazard quotients for all TACs having potential acute impacts are summed regardless of target organ. This method leads to an upper bound assessment. RELs used in the hazard index calculations are those published in the CARB/OEHHA listings dated September 2014.

5.9.3.2 Construction Impacts

No significant public health effects are expected during construction of the ECF or wells and well pads. Strict construction practices that incorporate safety and compliance with applicable LORS will be followed. In addition, mitigation measures to reduce air emissions from construction impacts will be implemented as described in Section 5.1.

[5] The threshold would be 1 in one million if the emitting units were determined not to be applying T-BACT.

Detailed HRA calculations would be conducted as part of the final license application to evaluate the potential cancer risk of Diesel particulate (DPM) emissions during project construction in relation to the significance threshold of 10 in one million, based on adjusting the 70-year lifetime risk for a period of 9 years in accordance with OEHHA (2003) guidance. Construction-related emissions are temporary and localized, resulting in no long-term significant impacts to the public.

Small quantities of hazardous waste may be generated during the life of the project. Hazardous waste management plans will be in place so the potential for public exposure is minimal. Refer to Section 5.14, Waste Management, for more information. No acutely hazardous materials will be used or stored onsite during construction (see Section 5.5, Hazardous Materials Handling). To assure worker safety during construction, safe work practices will be followed (see Section 5.16, Worker Health and Safety).

5.9.3.3 Operations Impacts

Potential human health impacts associated with KICP result from exposure to air emissions from operation of the natural gas-fired turbo-expander units to a much lesser extent, the cooling tower, at the ECF. The non-criteria pollutants emitted from the project include certain volatile organic compounds and polycyclic aromatic hydrocarbons (PAH) from the combustion of natural gas and ammonia from the SCR NOx control systems. These pollutants are listed in Table 5.9-2. Human health impacts from operations air emissions at the well pads are not anticipated.

Emissions of criteria pollutants will not cause violations of the national or California ambient air quality standards as discussed in Section 5.1, Air Quality. The project will include Best Available Control Technology (BACT) as required under SJVAPCD rules.

TABLE 5.9-2
Pollutants Emitted to the Air from KICP

Criteria Pollutants:	
Carbon monoxide	Particulate matter
Oxides of nitrogen	Volatile organic compounds
Oxides of sulfur	
Non-criteria (Toxic) Pollutants:	
Ammonia	Toluene
Acetaldehyde	Xylene
Acrolein	Hexane
1,3-Butadiene	PAHs
Benzene	Benzo(α)anthracene
Dichlorobenzene	Benzo(α)pyrene
Ethylbenzene	Benzo(β)fluoranthene
Formaldehyde	Benzo(k)fluoranthene
Hexane	Chrysene
Naphthalene	Dibenz(a,h)anthracene
Propylene	Indeno(1,2,3-cd)pyrene
Propylene oxide	

Air dispersion modeling would be conducted for the final license application to demonstrate that emissions will not result in ambient concentrations of criteria pollutants that exceed ambient air quality standards.

For the state PM_{10} and federal $PM_{2.5}$ standards, existing 24-hour and annual average PM_{10} and $PM_{2.5}$ background concentrations already exceed ambient standards, so modeling will determine whether the project would add a significant contribution.

5.9.3.4 Public Health Impact Study Methods

Emissions of non-criteria pollutants from the project would be estimated for the final license application using emission factors approved by the SJVAPCD, CARB, and EPA. Air dispersion modeling would combine the emissions with site-specific terrain and meteorological conditions to estimate short-term and long-term arithmetic mean concentrations in air for use in the health risk assessment. The EPA-recommended air dispersion model, AERMOD, would be used along with five years of compatible meteorological data assembled and provided by the staff of the SJVAPCD. The following paragraphs describe procedures used to prepare this type of risk assessment.

5.9.3.4.1 Risk Analysis Method

The screening analysis for the criteria pollutant modeling would be performed using the AERMOD model, the Stockton meteorological data (5 consecutive years), specific receptor grids, and stack parameters for operating cases at three different ambient temperatures. The results of the screening modeling analysis would be used to determine the maximum impact operating conditions in modeling the annual and 1-hour averaging periods, and these modeling results would be used in determining cancer risk and chronic HHI, and acute HHI, respectively. The total weighted risk "rate" for each equipment unit, as described in the previous section, would be used in place of emission rates in the modeling analysis. The value then calculated by the AERMOD model would be the total risk at each receptor. Health risks potentially associated with the estimated concentrations of pollutants in air would be characterized in terms of potential lifetime cancer risk (for carcinogenic substances), or comparison with RELs for non-cancer health effects (for non-carcinogenic substances).

Health risks would be evaluated for a hypothetical maximum exposed individual (MEI) located at the Point of Maximum Impact (PMI). Human health risks associated with emissions from the project are unlikely to be higher at any other location than at the PMI. If there is no significant impact associated with concentrations in air at the PMI location, it is assumed to be unlikely that there would be significant impacts in any other location. The Maximally Exposed Individual Resident (MEIR) is an individual assumed to be located at the MEIR point (i.e., a residential receptor) where the highest concentrations of air pollutants associated with facility emissions are predicted to occur, based on air dispersion modeling.

Health risks potentially associated with concentrations of carcinogenic pollutants in air would be calculated as estimated excess lifetime cancer risks. The total carcinogenic risk at any specific location is found by summing the contributions from each carcinogen.

Potential non-cancer health effects from exposure to short-term and long-term concentrations in air would be evaluated by comparing modeled concentrations in air with the RELs. An REL is a concentration in air at or below which no adverse health effects are anticipated. RELs are based on the most sensitive adverse effects reported in the medical and toxicological literature. Potential non-cancer effects were evaluated by calculating a ratio of the modeled concentration in air and the REL. This ratio is referred to as a hazard quotient. The inhalation cancer potency factors and RELs used to characterize health risks associated with modeled concentrations in air are found in the *Consolidated Table of OEHHA/CARB Approved Risk Assessment Health Values* (CARB, July 3, 2014).

5.9.3.5 Characterization of Risks from Toxic Air Pollutants

Cancer risks potentially associated with the project also would also be assessed in terms of cancer burden. Cancer burden is a hypothetical upper-bound estimate of the additional number of cancer cases that could be associated with emissions from the project. Cancer burden would be calculated as the maximum product of any potential carcinogenic risk greater than 1 in one million and the number of individuals at that risk level. If the MICR is less than 1 in one million, the potential cancer burden would be zero. If the potential MICR substantially exceeds 1 in one million, then the worst-case estimate of cancer burden would be calculated based on the assumptions described below.

The MICR concentration would be applied to all affected portions of identified census tracts within the radius area defined by the distance to the 1st high (MIR) concentration. A detailed listing and map of affected census tracts and year 2010 population estimates would then be provided. Figures would be presented to show the 1-, 2-, and 3-mile radius plots in relationship to the census tract locations and site. This procedure, if needed, would result in a conservatively high estimate of cancer burden. However, as described above, if the calculated MICR for the project is less than 1 in one million, this procedure would not be required.

By definition, human health risks associated with emissions from the project cannot be higher elsewhere than at the location of the MICR. Therefore, the potential cancer risk elsewhere also would be lower than the maximum modelled value. If the potential cancer burden were less than one, the emissions from the project would not be associated with any increase in cancer cases in the defined population.

Historically, exposure to any level of a carcinogen has been considered to have a finite risk of inducing cancer. In other words, there is no threshold for carcinogenicity. Because risks at low levels of exposure cannot be quantified directly by either animal or epidemiological studies, mathematical models have estimated such risks by extrapolation from high to low doses. This modeling procedure is designed to provide a highly conservative estimate of cancer risks based on the most sensitive species of laboratory animal for extrapolation to humans (i.e., the assumption being that humans are as sensitive as the most sensitive animal species). Therefore, the true risk is not likely to be higher than risks estimated using inhalation cancer potency factors and is most likely lower, and could even be zero (EPA, 1986; EPA, 1996).

The analysis of potential cancer risk described in this section employs methods and assumptions generally applied by regulatory agencies for this purpose. Given the importance of assuring public health, these methods and assumptions are highly conservative. Conservative methodology and assumptions are outlined below.

- The analysis includes representative weather data over a period of five years to assure that the least favorable conditions producing the highest ground-level concentration of power plant emissions are included.
- KICP is assumed to operate at hourly, daily, and annual emission conditions that produce the highest ground-level concentrations.
- The location of the highest ground-level concentration of KICP emissions is identified and the analysis then assumes that a sensitive individual resides at this location constantly over the entire 70-year period.

Taken together, these methods and assumptions create a scenario that cannot exist in the real world. For example, if the worst-case weather conditions occur on a winter evening, but the worst-case emission rates occur on a summer afternoon, the analysis nonetheless assumes that these events occur at the same time.

The point of using these unrealistic assumptions is to consciously overstate the potential impacts. No one individual will experience exposures as great as those assumed for this analysis. By determining that even this highly overstated exposure would not be significant, the analysis enables a high degree of confidence that the much lower exposures that actual persons will experience will not result in any significant increase in cancer risk. In short, the analysis assures that there would not be any significant public health impacts at any location, under any weather condition, under any operating condition.

5.9.3.6 Hazardous Materials

Hazardous materials will be used and stored at the KICP site. The hazardous materials stored in significant quantities onsite and descriptions of their uses are presented in Section 5.5. Use of chemicals at the project site will be in accordance with standard practices for storage and management of hazardous materials. Normal use of hazardous materials, therefore, will not pose significant impacts to public health. While mitigation measures will be in place to prevent releases, if an accidental release migrated offsite, potential impacts to the public could result.

The California Accidental Release Program (CalARP) regulations and Code of Federal Regulations (CFR) Title 40 Part 68 under the Clean Air Act establish emergency response planning requirements for acutely hazardous materials. These regulations require preparation of an RMP, which is a comprehensive program to identify hazards and predict the areas that may be affected by a release of a program-listed hazardous material, such as aqueous ammonia, which will be used for air pollution control.

The compressed air stream returning from the air reservoir may contain some entrained native natural gas during the initial operating period, which may be an explosive/fire hazard under higher concentrations and certain conditions. To control for this possibility, each of the I/W wells will be continuously monitored and shut down if natural gas concentrations approach an unsafe level. Monitoring sensors will also be placed at the ECF and in the turbo-expander train, at the common manifold at the reservoir and at intervals along the gas pipeline to detect any high localized concentrations of native natural gas in the pipe. Operational safety procedures will be developed for proper monitoring, purging, isolation, etc. This topic is discussed in greater detail in Section 5.5, Hazardous Materials Handling and in Section 2.0, Project Description, as well as in the project engineering report (Worley Parsons, 2015).

5.9.3.7 Operation Odors

A small amount of ammonia used to control NO_x emissions can “slip” past the SCR catalyst and be emitted from the exhaust stack, but this amount is less than that required to produce an odor off site. The expected exhaust gas ammonia concentration, known as ammonia “slip,” will be less than 10 ppmv. After mixing with the atmosphere, the concentration at ground level will be far below the detectable odor threshold of 5 ppmv that the Compressed Gas Association has determined to be acceptable, as well as being below the American Congress of Government Industrial Hygienists Threshold Limit Value and Short-term Exposure Level values of 25 and 35 ppm respectively (adopted 2003). Therefore, potential ammonia emissions would not create a significant odor. Other combustion contaminants are not present at concentrations that could produce a significant odor.

5.9.3.8 Electromagnetic Field Exposure

KICP will connect from a new switchyard to the Gold Hill-Eight Mile 230-kV transmission line. Based on findings of the National Institute of Environmental Health Sciences (NIEHS, 1999), electromagnetic field exposures from the electric power handling equipment would not result in a significant impact on public health. The NIEHS report to the U.S. Congress found that “the probability that EMF exposure is truly a

health hazard is currently small. The weak epidemiological associations and lack of any laboratory support for these associations provide only marginal scientific support that exposure to this agent is causing any degree of harm"(NIEHS, 1999).

5.9.4 Cumulative Effects

An analysis of potential cumulative public health impacts that may result from the KICP and other reasonably foreseeable projects is required by the CEC. This analysis would be conducted at the time that an AFC is developed for the KICP and the meteorological and HHRA modeling is done.

5.9.5 Mitigation Measures

The need for additional mitigation measures (beyond BACT and other air quality measures) would be assessed at the time the HHRA is performed.

5.9.6 Laws, Ordinances, Regulations and Standards

An overview of the regulatory process for public health issues is presented in this section. The relevant LORS that affect public health and are applicable to KICP are identified in Table 5.9-3. The compliance of the project with each of the LORS applicable to public health is also presented in this table.

TABLE 5.9-3
Laws, Ordinances, Regulations, and Standards for Public Health

LORS	Requirements/ Applicability	Administering Agency
Clean Air Act	Protect public health by limiting emissions and resulting exposure to air pollutants	U.S. Environmental Protection Agency (EPA) Region 9 CARB SJVAPCD
Health and Safety Code 25249.5 et seq. (Safe Drinking Water and Toxic Enforcement Act of 1986—Proposition 65)	Inform public at a facility of potential exposure to chemicals known to cause cancer or reproductive toxicity	OEHHA
40 CFR Part 68 (Risk Management Plan)	Public exposure to acutely hazardous materials	EPA Region 9 San Joaquin County Office of Emergency Services
Health and Safety Code, Article 2, Chapter 6.95, Sections 25531 to 25541; CCR Title 19 (Public Safety), Division 2 (Office of Emergency Services), Chapter 4.5 (California Accidental Release Prevention Program)	Public exposure to regulated substances	San Joaquin County Office of Emergency Services
Health and Safety Code Sections 44360 to 44366 (Air Toxics "Hot Spots" Information and Assessment Act—AB 2588)	Limit public exposure to toxic air contaminants based on a priority rating system.	SJVAPCD CARB

5.9.7 Agencies and Agency Contacts

Table 5.9-4 provides contact information for agencies involved with public health.

TABLE 5.9-4
Agency Contacts for Public Health

Issue	Agency	Contact
Public exposure to air pollutants	EPA Region 9	EPA Region 9 75 Hawthorne Street San Francisco, CA 94105
Public exposure to air pollutants	CARB	Project Assessment Branch California Air Resources Board 1001 I Street Sacramento, CA 95812
Public exposure to air pollutants	San Joaquin Valley Air Pollution Control District	Permit Services Manager Northern Region 4800 Enterprise Way Modesto, CA 95356-8718
Public exposure to chemicals known to cause cancer or reproductive toxicity	Cal-EPA, Office of Environmental Health and Hazard Assessment (OEHHA)	Office of Environmental Health Hazard Assessment 1001 I Street, Sacramento, CA 95814
Public exposure to accidental releases of hazardous materials	EPA Region 9	EPA Region 9 75 Hawthorne Street San Francisco, CA 94105
Public exposure to accidental releases of hazardous materials	California Office of Emergency Services	Governor's Office of Emergency Services 3650 Schriever Avenue Mather, CA 95655

5.9.8 Permits and Permit Schedule

Agency-required permits related to public health are listed in Table 5.9-5, and include a Risk Management Plan for hazardous materials, and the SJVAPCD Final Determination of Compliance (FDOC). Upon approval of KICP by the CEC, the FDOC serves as the SJVAPCD Authority to Construct. A Permit to Operate would be issued by the SJVAPCD after construction and commencement of operation. These requirements are discussed in detail in Sections 5.1 (Air Quality) and 5.5 (Hazardous Materials Handling).

TABLE 5.9-5
Permits and Permit Schedule for Public Health

Permit	Agency Contact	Schedule
Determination of Compliance / Authority to Construct/ Permit to Operate	San Joaquin Valley APCD 4800 Enterprise Way, Modesto, CA 95356-8718	District must issue a Preliminary DOC within 180 days after issuing the Application Completeness Determination Letter.
Risk Management Plan (CalARP)	San Joaquin County Environmental Health Department Program Coordinator 600 E. Main Street Stockton, CA 92505	Approximately 60 days before any regulated substance comes on site

5.9.9 References

California Air Resources Board (CARB). 2014. Consolidated table of OEHHA/CARB approved risk assessment health values. Available online at: http://arbis.arb.ca.gov/toxics/healthval/contable.pdf). Accessed July 3, 2014

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5.10 Socioeconomics

5.10.1 Introduction

This section documents the potential economic effects of the King Island CAES Project (KICP). It provides a brief analyses of the availability of labor and worker housing and evaluates whether there is an environmental justice community within a 6-mile radius of the project site (which for purposes of this discussion includes the ECF site and the well field, as well as all project linears).

5.10.2 Affected Environment

For purposes of the socioeconomics discussion, the study area or region of influence for this analysis is San Joaquin County.

5.10.2.1 Population

San Joaquin County is bordered by Alameda and Contra Costa counties to the west, Sacramento County to the north, Stanislaus County to the south, and Calaveras and Amador counties to the east. There are seven incorporated cities in San Joaquin County: Stockton, Tracy, Manteca, Lodi, Lathrop, Ripon and Escalon.

San Joaquin County's estimated population, as of January 1, 2014, was 710,731 (California Department of Finance [DOF], 2014a). Historical, current, and projected population for San Joaquin County and the State of California are summarized in Table 5.10-1. Annual average compounded population growth rates are summarized in Table 5.10-2. During the 2000s, San Joaquin County's population increased at an average annual rate of about 2 percent which was double the rate for the state (DOF, 2014b). The county's average annual growth rate so far for the current decade (2010 to 2014) is slightly less than one percent and is close to the state's average annual growth rate of 0.7 percent. San Joaquin County is expected to continue to have annual population growth rates double those for the state for each of the decades from 2020 through 2040.

TABLE 5.10-1
Historical, Current, and Projected Populations*

Area	2000	2010	2014	2020(p)	2030(p)	2040(p)
San Joaquin County	563,598	685,306	710,731	810,800	1,004,100	1,213,700
California	33,873,086	37,253,956	38,340,074	40,643,600	44,279,400	47,690,200

* Population projections rounded to nearest 100.
Source: Department of Finance (DOF), 2014a; 2014b; 2014c.
(p) = projected

TABLE 5.10-2
Historical and Projected Annual Average Compounded Population Growth Rates

Area	2000-2010 Percent	2010-2014 Percent	2014-2020 Percent	2020-2030 Percent	2030-2040 Percent
San Joaquin County	2.0	0.9	2.2	2.2	1.9
California	1.0	0.7	1.0	0.9	0.7

5.10.2.2 Housing

As shown in Table 5.10-3, housing stock for San Joaquin County as of January 1, 2014, was about 236,943 units. Single-family homes accounted for about 77.8 percent of these units, multiple-family dwellings for 16.6 percent, and mobile homes for 3.6 percent (DOF, 2014a). New housing authorizations for San Joaquin County in 2010 totaled about 960 units; about 84 percent were single-family units and 16 percent were multi-family units. These authorizations were valued at $209.7 million (DOF, 2014d). As of June 2014, the median home price in San Joaquin County was $265,000 (DataQuick, 2014). This is an increase in median home price of about 14 percent during the 12-month period.

San Joaquin County's vacancy rate has remained at about 8 percent since January 2010. Prior to that time, the vacancy rates were lower. The vacancy rate is based on both owner-occupied and renter-occupied housing units and as such is an indicator of the availability of housing. Because the vacancy rate is higher than the federal standard vacancy rate of 5 percent, housing supply in the county is not considered limited.

TABLE 5.10-3
Housing Estimates by City, County, and State, January 1, 2014

Area	Total Units	Single-Family	Multi-Family	Mobile Homes	Percent Vacant
San Joaquin County	236,943	184,338	44,020	8,585	8.01
California	13,845,281	9,011,193	4,274,082	560,000	8.05

Source: DOF, 2014a.

5.10.2.3 Economy and Employment

Between 2010 and 2013, employment in San Joaquin County or the Stockton Metropolitan Statistical Area (MSA) increased by 9,300 jobs, or about 5 percent. This 5 percent increase is lower than California's net increase (about 7 percent) during the same period (California Employment Development Department [CEDD] 2014a). As shown in Table 5.10-4, on a percent increase basis, the construction sector experienced the largest increase in employment, followed by the transportation, warehousing, and utilities sector. Although the percentage increase in the construction sector was the highest between 2010 and 2013, the contribution of this sector to the Stockton MSA economy remained small (about 4 percent). By contrast, during the same 3-year period, the workforce in the services sector increased by about 5,100 workers to a total of 75,400 workers. The jobs in the construction sector increased by only 1,100 during the 2010–2013 period. Employment losses were experienced in the agriculture, information, financial activities and the government sectors.

TABLE 5.10-4
Employment Distribution in Stockton MSA, 2010 to 2013

	2010		2013		2010–2013	
Industry	Number of Employees	Employment Share (%)	Number of Employees	Employment Share (%)	Percentage Change (%)	Average Annual Compound Growth Rate (%)
Agriculture	15,700	7.6	15,600	7.2	-0.6	-0.2
Natural Resources, Mining	100	0.0	100	0.0	0.0	0.0
Construction	7,600	3.7	8,700	4.0	14.5	4.6
Manufacturing	17,600	8.5	17,800	8.2	1.1	0.4

TABLE 5.10-4
Employment Distribution in Stockton MSA, 2010 to 2013

Industry	2010		2013		2010–2013	
	Number of Employees	Employment Share (%)	Number of Employees	Employment Share (%)	Percentage Change (%)	Average Annual Compound Growth Rate (%)
Wholesale Trade	10,000	4.8	10,900	5.0	9.0	2.9
Retail Trade	23,700	11.5	25,700	11.9	8.4	2.7
Transportation, Warehousing and Utilities	13,800	6.7	15,400	7.1	11.6	3.7
Information	2,100	1.0	1,900	0.9	-9.5	-3.3
Financial Activities	7,700	3.7	7,600	3.5	-1.3	-0.4
Services	70,300	34.0	75,400	34.9	7.3	2.4
Government	38,200	18.5	37,000	17.1	-3.1	-1.1
Total Employment	**206,900**	**100.0**	**216,200**	**100.0**	**4.5**	**1.5**

Source: CEDD, 2014a

Table 5.10-5 provides details on the characteristics of the County labor force. It shows 2013 employment data for San Joaquin County compared to California. Although San Joaquin County's unemployment rate has been declining from the highs of a few years ago (it was at 17 percent in 2010), it is still higher than the state average. CEDD does not project future unemployment rates.

TABLE 5.10-5
Employment Data, 2013

Area	Labor Force	Employment	Unemployment	Unemployment Rate (%)
San Joaquin County	298,800	260,400	38,400	12.8
California	18,596,800	16,933,300	1,663,500	8.9

Source: CEDD, 2014a.

5.10.3 Environmental Analysis

This section assesses the potential environmental impacts of the proposed project on availability of labor, worker housing, and the potential for environmental justice impacts.

5.10.3.1 Availability of Labor

Typically, the available skilled labor in San Joaquin County would be evaluated by surveying local labor unions and contacting CEDD. In the current analysis, no labor unions were contacted. Table 5.10-6 shows the available labor by skill in the Stockton MSA for crafts that are typically employed on power plant, pipeline, and natural gas well construction projects. Based on the information in Table 5.10-6 and the MSA's prevailing unemployment rate (Table 5.10-5), there would likely be adequate labor to fulfill KICP's construction labor requirements. Therefore, project construction will likely not place an undue burden on the local workforce. In addition, as shown in Table 5.10-4, the construction workforce within the County has been growing at an average annual rate of 4.6 percent per year. In 2013, the construction workforce was estimated at 8,700 workers.

TABLE 5.10-6
Available Labor by Skill in Stockton Metropolitan Statistical Area (MSA), 2010 to 2020

Occupational Title	Annual Averages		Absolute Change	Percentage Change	Average Annual Compounded Growth Rate (%)
	2010	2020			
Carpenters	2,410	3,050	640	26.6	2.4
Cement Masons & Concrete Finishers	640	830	190	29.7	2.6
Painters, Construction & Maintenance	890	1,100	210	23.6	2.1
Sheet Metal Workers	220	290	70	31.8	2.8
Electricians	1,230	1,550	320	26.0	2.3
Welders, Cutters, Solderers, & Brazers	970	1,120	150	15.5	1.4
Industrial Truck & Tractor Operators	2,600	3,060	460	17.7	1.6
Operating Engineers and Other Construction Equipment Operators	590	710	120	20.3	1.9
Helpers, Construction Trades	600	760	160	26.7	2.4
Construction Laborers	2,300	2,570	270	11.7	1.1
Plumbers, Pipefitters, & Steamfitters	1,190	1,560	370	31.1	2.7
Administrative Services Managers	230	290	60	26.1	2.3
Mechanical Engineers	110	140	30	27.3	2.4
Engineering Technicians	310	370	60	19.4	1.8
Plant and System Operators	430	510	80	18.6	1.7

Source: CEDD, 2014b.

5.10.3.1.1 Population Impacts

It is anticipated that most of the construction workforce will be drawn from San Joaquin County. Construction workforce could also be drawn from other nearby counties especially those in the Bay Area or from out of state, if necessary. Thus, it is unlikely that the project will result in an increase in the population of the area. Therefore, the project will likely result in a less-than-significant impact to the local population.

5.10.3.1.2 Housing Impacts

The construction workforce will most likely commute daily to the project site; however, if needed, there are numerous hotels/motels in San Joaquin County that could accommodate workers who may choose to commute to the project site on a workweek basis. Additionally, housing supply is more than adequate within the County for any construction workers who may choose to rent. Since the proposed project site is close to the Bay Area, some of the workers could choose to seek accommodation in the Bay Area. As a result, construction of the proposed project is not expected to increase the demand for housing. Therefore, the project will likely have a less-than-significant impact on housing.

5.10.4 Environmental Justice

President Clinton's Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" was signed on February 11, 1994. The purpose of this Executive

Order is to consider whether the project may result in disproportionately high and adverse human health or environmental effects on any minority or low-income population.

The federal guidelines set forth a three-step screening process:

1. Identify which impacts of the project are high and adverse.
2. Determine whether minority or low-income populations exist within the high and adverse impact zones.
3. Examine the spatial distribution of high and adverse impact areas to determine whether these impacts are likely to fall disproportionately on the minority and/or low-income population.

According to the guidelines established by U.S. Environmental Protection Agency (1996) to assist federal agencies to develop strategies to address this circumstance, a minority and/or low-income population exists if the minority and/or low-income population percentage of the affected area is 50 percent or more of the area's general population. The guidance suggests using two or three standard deviations above the mean as a quantitative measure of disparate effects.

A screening-level analysis of Environmental Justice is presented in Appendix 5.10A. According to that analysis, more than 50 percent of the census tracts within 6 miles of the project site have more than 50 percent minority population (Figure 5.10-1). None of the census tracts contains a poverty population. Therefore, an Environmental Justice circumstance could exist if the project were to create high and adverse impacts that would fall disproportionately on minority and/or low-income members of the community after all mitigation measures have been implemented. However, a final determination of the potential for high and adverse human health and environmental impact to occur cannot be made at this time because the project's environmental impacts have not been completely analyzed.

5.10.5 References

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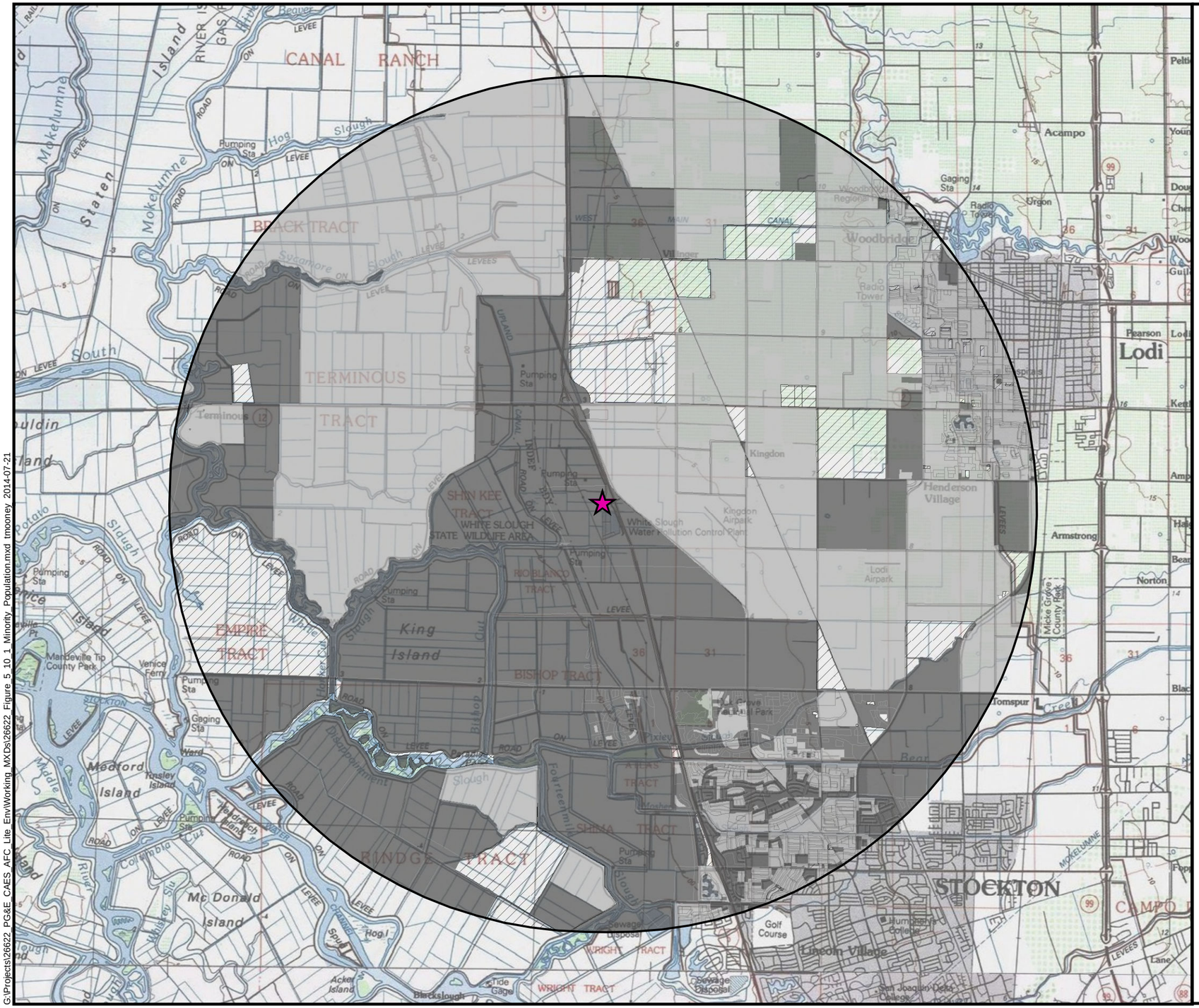
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U.S. Environmental Protection Agency. 1996. Guidance for Incorporating Environmental Justice Concerns in EPA's NEPA Compliance Analyses, July 12, 1996.



PROJECT LOCATION

SIX MILE BUFFER

PERCENTAGE OF MINORITY POPULATION

NO MINORITY

0 - 50 PERCENT MINORITY

50 - 100 PERCENT MINORITY

Notes:
1. Source: American Fact Finder, U.S. Census Bureau, 2010 Census, Summary File 1, 100 - Percent Data.

N

0 8,000 16,000

Feet

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North State Resources, Inc.

PG&E King Island Compressed Air Energy Storage Project

Figure 5.10-1
Minority Population Distribution By Census Blocks Within Six Miles of Site

5.11 Soils

This section describes the potential effects of the construction and operation of the King Island CAES Project (KICP) on soil resources.

5.11.1 Affected Environment

A description of the soils in the proposed project area was developed using the online and published Soil Survey of San Joaquin County, California (USDA-Natural Resources Conservation Service [USDA-NRCS], 2014; 1992). Descriptions of the soil map units were developed from the soil survey and the official soil series descriptions (OSDs; Soil Survey Staff, 2014).

Soil map units for the project area are identified in Figure 5.11-1. Soil map unit characteristics for the area potentially affected by project construction are summarized in Table 5.11-1.

The project area includes the proposed Energy Conversion Facility (ECF) site, well pads, and linear features (i.e., air, water, and gas pipelines and the overhead electrical lines). In addition, geotechnical borings will be required along the air pipeline route at and near the crossings of major water bodies such as Bishop Cut. Table 5.11-1 summarizes soil depth, texture, drainage, permeability, water runoff, and items related to revegetation potential. Actual soil conditions in the project area could differ from what is described in the generalized soil descriptions because of the potential for previous grading at the site and natural soil variation. For example, Devries is the dominant soil series in map unit 149 (85 percent); other soil components occupy up to 15 percent of the map unit, and these soils may have characteristics other than those described for the map unit.

TABLE 5.11-1
Soil Map Unit Descriptions and Characteristics

Map Unit	Description	
149	Devries sandy loam, drained, 0 to 2 percent slopes: The ECF, staging areas, ECF generator tie-line, gas pipeline, and portions of the air pipeline are located within this soil unit.	
	Formation:	On basin rims of the San Joaquin Delta, in alluvium derived from mixed rock sources
	Typical profile:	Sandy loam over indurated hardpan
	Shrink-swell capacity:	Low
	Depth and drainage:	Moderately deep to hardpan; somewhat poorly drained
	Permeability:	Moderately rapid
	Runoff:	Slow
	Hydric Soil:	Yes
	Water Erosion:	Slight
	Wind Erosion:	Moderate
	Farmland Class:	Not prime farmland
	Storie Index:	Grade 4 - poor
	Capability class:	3w (irrigated); 4w (non-irrigated)
	Taxonomic class:	Coarse-loamy, mixed, superactive, thermic Typic Duraquolls
168	Guard clay loam, 0 to 2 percent slopes: The air pipeline crosses this soil unit.	
	Formation:	On basin rims of the San Joaquin Delta, in alluvium derived from mixed rock sources
	Typical profile:	Clay loam throughout
	Shrink-swell capacity:	Moderate
	Depth and drainage:	Very deep; poorly drained
	Permeability:	Slow
	Runoff:	Slow
	Hydric Soil:	Ye”
	Water Erosion:	Slight

TABLE 5.11-1
Soil Map Unit Descriptions and Characteristics

Map Unit	Description	
	Wind Erosion:	Slight
	Farmland Class:	Prime farmland if irrigated and drained
	Storie Index:	Grade 3 - fair
	Capability class:	3w (irrigated), 4w (non-irrigated)
	Taxonomic class:	Fine-loamy, mixed, superactive, calcareous, thermic Duric Endoaquolls
169	Guard clay loam, drained, 0 to 2 percent slopes:	
	The air pipeline crosses this soil unit.	
	Formation:	On basin rims of the San Joaquin Delta, in alluvium derived from mixed rock sources
	Typical profile:	Clay loam throughout
	Shrink-swell capacity:	Moderate
	Depth and drainage:	Very deep; poorly drained
	Permeability:	Slow
	Runoff:	Slow
	Hydric Soil: Yes	
	Water Erosion:	Slight
	Wind Erosion:	Slight
	Farmland Class:	Prime farmland if irrigated
	Storie Index:	Grade 3 - fair
	Capability class:	2w (irrigated); 4w (non-irrigated)
	Taxonomic class:	Fine-loamy, mixed, superactive, calcareous, thermic Duric Endoaquolls
190	Kingile muck, partially drained, 0 to 2 percent slopes:	
	The air pipeline and a well pad are located within this soil unit.	
	Formation:	In highly decomposed organic material underlain by fine textured alluvium
	Typical profile:	Muck over clay
	Shrink-swell capacity:	Moderate
	Depth and drainage:	Very deep; very poorly drained
	Permeability:	Rapid in organic layers and slow in the mineral substratum
	Runoff:	Very slow
	Hydric Soil:	Yes
	Water Erosion:	Slight
	Wind Erosion:	High
	Farmland Class:	Prime farmland if irrigated
	Storie Index:	Not rated
	Capability class:	3w (irrigated); 4w (non-irrigated)
	Taxonomic class:	Clayey, mixed, euic, thermic Terric Haplosaprists
191	Kingile-Ryde complex, partially drained, 0 to 2 percent slopes:	
	The 12-kV service line, air collection pipeline, and well pads are located within this soil unit.	
	Formation:	In alluvium from mixed rock sources and decomposed vegetative matter
	Typical profile:	Muck over clay loam, stratified muck, and silty clay loam
	Shrink-swell capacity:	Moderate
	Depth and drainage:	Very deep; very poorly drained
	Permeability:	Moderately slow
	Runoff:	Very slow
	Hydric Soil:	Yes
	Water Erosion:	Slight
	Wind Erosion:	Slight to high
	Farmland Class:	Prime farmland if irrigated
	Storie Index:	Grade 3 - fair
	Capability class:	3w (irrigated); 4w (non-irrigated)
	Taxonomic class:	Clayey, mixed, euic, thermic Terric Haplosaprists
		Fine-loamy, mixed, superactive, thermic Cumulic Endoaquolls

TABLE 5.11-1
Soil Map Unit Descriptions and Characteristics

Map Unit	Description
230	Ryde clay loam, partially drained, 0 to 2 percent slopes: The air pipeline crosses this soil unit. Formation: On nearly level river deltas and flood plains, in alluvium from mixed rock sources and decomposed vegetative matter Typical profile: Clay loam over stratified muck and silty clay loam Shrink-swell capacity: Moderate Depth and drainage: Very deep; very poorly drained Permeability: Moderately slow Runoff: Very slow Hydric Soil: Yes Water Erosion: Slight Wind Erosion: Slight Farmland Class: Prime farmland if irrigated Storie Index: Grade 3 - fair Capability class: 3w (irrigated); 4w (non-irrigated) Taxonomic class: Fine-loamy, mixed, superactive, thermic Cumulic Endoaquolls
233	Ryde-Peltier complex, partially drained, 0 to 2 percent slopes: The air collection pipeline, 12-kV service line, and a well pad are located within this soil unit. Formation: On islands on deltas, floodplains, and backswamps of the Sacramento-San Joaquin Delta, in alluvium from mixed sources and decomposed plant matter Typical profile: Mucky clay loam over silty clay loam, silty clay, and clay Shrink-swell capacity: Moderate to high Depth and drainage: Very deep; poorly and very poorly drained Permeability: Moderately slow and slow Runoff: Very slow Hydric Soil: Yes Water Erosion: Slight Wind Erosion: Slight to moderate Farmland Class: Prime farmland if irrigated Storie Index: Grade 3 - fair Capability class: 3w (irrigated); 4w (non-irrigated) Taxonomic class: Fine-loamy, mixed, superactive, thermic Cumulic Endoaquolls Fine, mixed, superactive, thermic Cumulic Endoaquolls
284	Water The air pipeline crosses this unit.

Soil characteristics are based on soil mapping descriptions provided in the online soil survey (NRCS, 2014); in the published soil survey (NRCS, 1992); and in the online OSDs (Soil Survey Staff, 2014).

5.11.2 Environmental Analysis

The following sections describe the potential environmental effects on soils during the construction and operation phases of the project.

5.11.2.1 Significance Criteria

The potential for impacts to soils resources and their uses (such as agriculture) were evaluated with respect to the criteria described in the Appendix G checklist of the California Environmental Quality Act (CEQA). An impact is considered potentially significant if it would:

- Involve changes in the existing environment which, because of their location or nature, could result in conversion of farmland to non-agricultural use

- Impact jurisdictional wetlands and waters of the United States
- Result in substantial soil erosion
- Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (International Code Council, 1997), creating substantial risks to life or property

The following sections briefly describe the anticipated environmental impacts on agricultural production and soils during project construction and operation.

5.11.2.2 Farmland Conversions

Much of the land immediately surrounding the KICP facilities is used for agricultural production. The western well pad and some lands along the air pipeline are under Williamson Act contracts. The ECF site would convert approximately 20 acres of farmland but the site is not under Williamson Act and is in an area designated for public and utility uses. This issue is discussed in more detail and addressed in Section 5.6, Land Use. Underground linear installation would likely be considered a temporary impact because the land above the linear feature would be restored to its preconstruction agricultural use.

5.11.2.3 Jurisdictional Wetlands and Waters of the United States

Irrigation ditches, natural sloughs and other delta waterways exist throughout the project area and could potentially qualify as waters of the United States. In addition, the majority of the soils within the KICP project area are somewhat poorly to poorly drained and have the potential to be classified as wetlands. This issue is addressed in greater detail in Section 5.2, Biological Resources.

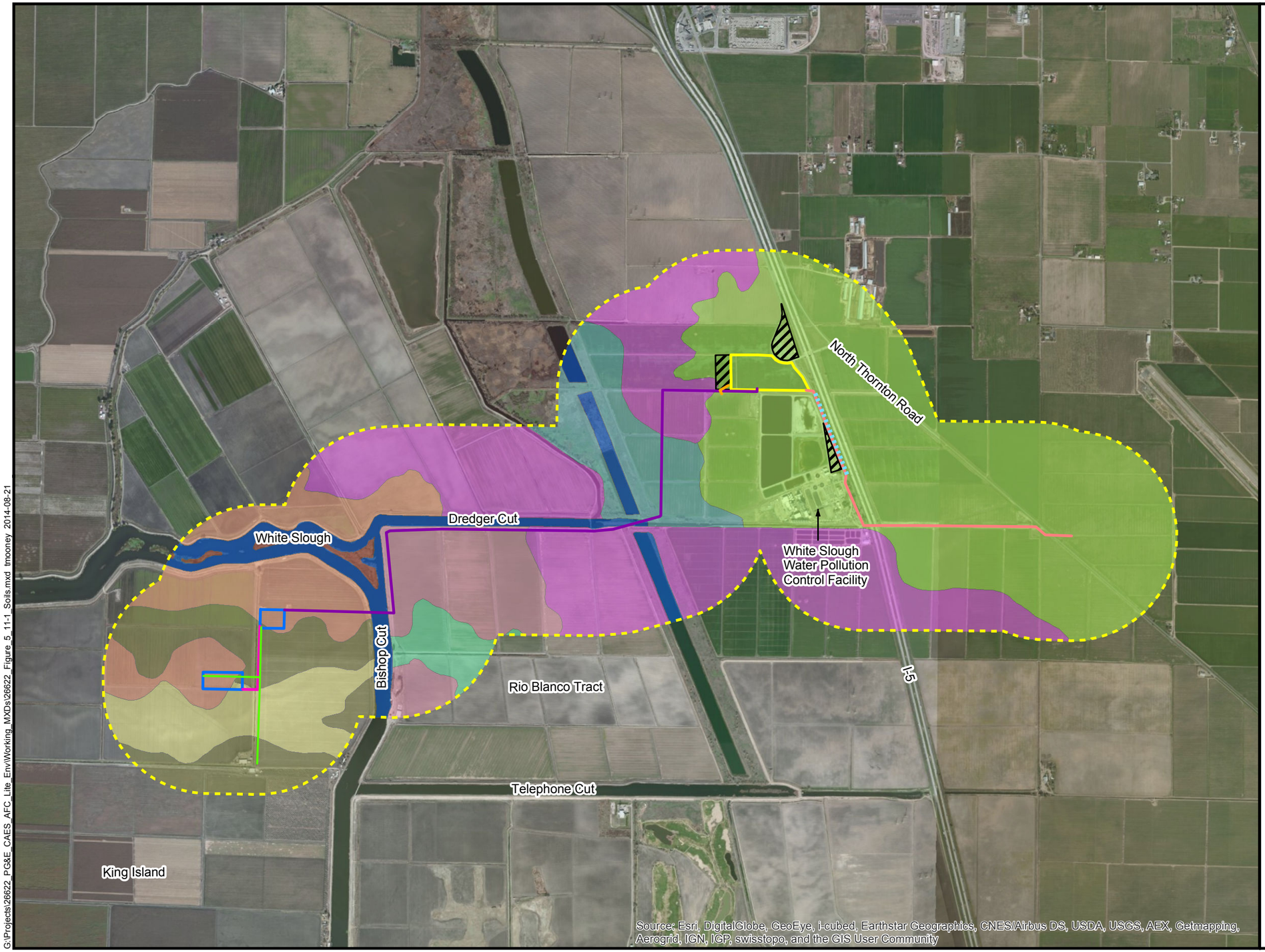
5.11.2.4 Potential for Soil Erosion during Construction

Construction impacts on soil resources can include increased soil erosion and soil compaction. Soil erosion causes the loss of topsoil and can increase the sediment load in surface receiving waters downstream of the construction site. The magnitude, extent, and duration of construction-related impacts depends on the erodibility of the soil; the proximity of the construction activity to the receiving water; and the construction methods, duration, and season.

The factors that have the largest effect on soil loss include long, steep slopes; lack of vegetation; and erodible soils with high proportions of silts and very fine sands. The soils found in the proposed KICP area (ECF, air pipeline, and well pads) are nearly level, with an estimated average slope of less than two percent. Soils are medium to fine textured, with a high concentration of organic material. The erosion potential of these soils would vary based on the wetness of the soil, soil compaction, sizes of soil particles, and other site-specific properties. Based on the soil survey information, the soils in the proposed KICP project area are expected to have a slight water erosion potential and a slight to high wind erosion potential.

5.11.2.5 Expansive Soils

An important characteristic of the KICP area is the potential for soils with moderate to high shrink-swell potential. The majority of the mapped soils in the area have a moderate shrink-swell potential, with soil map unit 233 (Ryde-Peltier complex) having a moderate to high shrink-swell potential. The presence of expansive clays in the soil may affect the suitability of the soil as a bearing surface for foundations and pipelines because expansive clays have the potential to shrink or swell in volume with changing moisture content. The ECF site does not occupy map unit 233. A small segment of the air pipeline connecting the two well pads, a small part of the eastern well pad, and a portion of the 12-kV service line are located within this soil unit.



Air Pipeline
Air Collection Pipeline
Gas Pipeline
ECF Generator Tie-Line
12kV Service Line
Water Supply Pipeline
Energy Conversion Facility (ECF)
Well Pad
Staging
1/2 Mile Buffer Around Project Site

Soil Map Units

149 - Devries sandy loam, drained, 0 to 2 percent slopes

159 - Fluvaquents, 0 to 2 percent slopes, frequently flooded

168 - Guard clay loam, 0 to 2 percent slopes

169 - Guard clay loam, drained, 0 to 2 percent slopes

190 - Kingile muck, partially drained, 0 to 2 percent slopes

191 - Kingile-Ryde complex, partially drained, 0 to 2 percent slopes

230 - Ryde clay loam, partially drained, 0 to 2 percent slopes

232 - Ryde clay loam, sandy substratum, partially drained, 0 to 2 percent slopes

233 - Ryde-Peltier complex, partially drained, 0 to 2 percent slopes

284 - Water

This map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

N

0 2,000 4,000

Feet

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Figure 5.11-1
Soils

5.11.2.6 Other Significant Soil Characteristics

Soil map unit 149 (Devries sandy loam, drained, 0 to 2 percent slopes) may be subject to rare flooding events, particularly during years of abnormally high precipitation. These soils are characterized by an indurated hardpan at a depth of 20 to 40 inches. This characteristic may cause the soils above the hardpan to remain saturated after periods of prolonged precipitation. The hardpan will also limit the effective plant rooting depth, which will affect efforts to revegetate cleared soil areas. This hardpan will also affect the difficulty of excavation for the pipeline installation. The entire ECF site and a small portion of the air pipeline are found in this soil type.

In addition, all of the soils within the KICP area are rated by the NRCS as hydric soils. Hydric soils are soils that formed under conditions of saturation, flooding, or ponding long enough to develop anaerobic conditions in the upper part. The majority of the soils within the project area have been at least partially drained, but areas without drainage will likely have saturation during part of the year. Additional verification of the affected soils as wet soils is found in their drainage class (somewhat poorly to very poorly drained) and taxonomic classification (aquoll suborder; meaning wet soils high in organic matter).

The wet and organic nature of the soils within the KICP area have the potential for subsidence when drained and subsequent oxidation occurs. Soil map units 190 (Kingile muck, partially drained, 0 to 2 percent slopes), 191 (Kingile-Ryde complex, partially drained, 0 to 2 percent slopes), 230 (Ryde clay loam, partially drained, 0 to 2 percent slopes), and 233 (Ryde-Peltier complex, partially drained, 0 to 2 percent slopes) are rated by the NRCS as having the potential for subsidence. The western portion of the air pipeline and both well pads are found in this soil type.

5.11.3 Mitigation Measures

The ECF site (including temporary construction work areas), the air and gas pipeline routes, and the well pads are hydrologically isolated and do not have significant potential to drain into receiving waters of the state. Regardless, Best Management Practices (BMP) would be used to minimize erosion at the site during construction. These BMPs would be developed as part of the Stormwater Pollution Prevention Plan (SWPPP) prepared for the State Water Resources Control Board and the Drainage Erosion and Sedimentation Control Plan, prepared for the California Energy Commission. These erosion-control measures would be required to help maintain water quality, protect property from erosion damage, and prevent accelerated soil erosion or dust generation that removes topsoil and destroys soil productivity. Temporary and permanent erosion and sediment control measures are described below. With implementation of control measures, soil erosion losses after construction are expected to be negligible.

5.11.3.1 Temporary Erosion Control Measures

Temporary erosion control measures would be implemented before construction begins, and would be evaluated and maintained during construction. These measures typically include revegetation, mulching, physical stabilization, dust suppression, berms, ditches, and sediment barriers. These measures would be removed from the site after the completion of construction.

During construction of the project, dust erosion control measures would be implemented to minimize the wind-blown loss of soil from the site. Water of a quality equal to or better than existing surface runoff would be sprayed on the soil in construction areas to control dust prior to completion of permanent control measures.

Sediment barriers slow runoff and trap sediment. Sediment barriers include straw bales, sand bags, straw wattles, and silt fences. They are generally placed below disturbed areas, at the base of exposed slopes,

and along streets and property lines below the disturbed area. Sediment barriers are often placed around sensitive areas to prevent contamination by sediment-laden water near areas such as wetlands, creeks, or storm drains.

The KICP facilities would be constructed on relatively level ground; therefore, it is not considered necessary to place barriers around the entire site perimeter. If used, sediment barriers would be properly installed (staked and keyed), then removed or used as mulch after construction. Runoff detention basins, drainage diversions, and other large-scale sediment traps are not considered necessary due to the small site size, level topography, and surrounding paved areas. Any soil stockpiles, including sediment barriers around the base of the stockpiles, would be stabilized and covered.

Mitigation measures, such as watering exposed surfaces, are used to reduce PM_{10} emissions during construction activities. The PM_{10} reduction efficiencies are taken from the South Coast Air Quality Management District (SCAQMD) CEQA Handbook (1993) and were used to estimate the effectiveness of the mitigation measures. Table 5.11-2 summarizes the mitigation measures and PM_{10} reduction efficiencies. Additional fugitive dust mitigation measures are discussed in Section 5.1, Air Quality.

TABLE 5.11-2
Mitigation Measures for Fugitive Dust Emissions

Mitigation Measure	PM_{10} Emission Reduction Efficiency (%)
Water active sites at least twice daily	34–68
Enclose, cover, water twice daily, or apply non-toxic soil binders, according to manufacturer's specifications, to exposed piles (i.e., gravel, sand, dirt) with 5 percent or greater silt content	30–74

Source: SCAQMD CEQA Handbook, Table 11-4 (1993)

5.11.3.2 Permanent Erosion Control Measures

Permanent erosion control measures on the site would include graveling, paving, and drainage systems, as well as revegetating to stabilize land surfaces.

5.11.4 Laws, Ordinances, Regulations, and Standards

Federal, state, county, and local LORS applicable to soils are discussed below and summarized in Table 5.11-3. Note that the ECF and portions of the natural gas pipeline are in City of Lodi jurisdiction, and the well pads and air pipeline are in San Joaquin County jurisdiction.

TABLE 5.11-3
Laws, Ordinances, Regulations, and Standards for Soils

LORS	Requirements/Applicability	Administering Agency
Federal		
Federal Water Pollution Control Act of 1972; Clean Water Act of 1977 (including 1987 amendments)	Regulates stormwater discharge from construction and industrial activities	Central Valley Regional Water Quality Control Board (RWQCB) under State Water Resources Control Board. The U.S. Environmental Protection Agency may retain jurisdiction at its discretion.
Natural Resources Conservation Service (1983), *National Engineering Handbook*, Sections 2 and 3	Standards for soil conservation	Natural Resources Conservation Service

TABLE 5.11-3
Laws, Ordinances, Regulations, and Standards for Soils

LORS	Requirements/Applicability	Administering Agency
State		
Porter-Cologne Water Quality Control Act	Regulates stormwater discharge	SWRCB and Central Valley RWQCB
Table 18-1-B of the Uniform Building Code (International Code Council, 1997)	Sets standards for defining expansive soils	California Energy Commission
County		
San Joaquin County General Plan 2010, Section II - Community Development & Section IV – Resources	Regulates transmission lines; puts limits on development of agricultural soils	San Joaquin County Community Development Department
Title 9 - Development Title of San Joaquin County	Provides requirements for alteration of land within county	San Joaquin County Community Development Department
Improvement Standards for San Joaquin County	Provides design standards for improvements within county	San Joaquin County Department of Public Works
San Joaquin County Standard Specifications and Special Provisions	Provides the County's minimum requirements for excavation safety, dust control, earthwork, and erosion and pollution control, and more.	San Joaquin County Department of Public Works
San Joaquin County Stormwater Pollution Prevention Program	Regulates BMPs for construction activities	San Joaquin County Department of Public Works
City		
Lodi Municipal Code – Title 15	Outlines potential development impact fees added to permit costs.	City of Lodi Community Development Department
Lodi Municipal Code – Title 17	Regulates and provides requirements for development of land within the city limits.	City of Lodi Community Development Department

5.11.4.1 Federal LORS

5.11.4.1.1 Federal Clean Water Act

The 1972 Amendments to the Federal Water Pollution Control Act, commonly referred to as the Clean Water Act, establish requirements for discharges of stormwater or wastewater from any point source that would affect the beneficial uses of waters of the United States. The Clean Water Act effectively prohibits discharges of stormwater from construction sites unless the discharge is in compliance with an NPDES permit. The State Water Resources Control Board (SWRCB) is the permitting authority in California and has adopted a statewide general permit for stormwater discharges associated with construction activity (Construction General Permit; SWRCB, 2009) that applies to projects resulting in 1 or more acres of soil disturbance. The proposed project would result in disturbance of more than 1 acre of soil, therefore, the project would be covered under the Construction General Permit and would develop and implement a site-specific SWPPP to meet permit requirements. Requirements are described in greater detail in Section 5.15, Water Resources.

The Clean Water Act's primary requirement for soils in the project area consists of control of soil erosion and sedimentation during construction, including the preparation and execution of erosion and sedimentation control plans and measures for any soil disturbance during construction.

5.11.4.1.2 U.S. Department of Agriculture Engineering Standards

Sections 2 and 3 of the U.S. Department of Agriculture, Natural Resources Conservation Service National Engineering Handbook (NRCS, 1983) provide standards for soil conservation during planning, design, and construction activities. Adherence to these standards during construction of the proposed KICP should reduce soil erosion from grading and construction activities.

5.11.4.2 State LORS

5.11.4.2.1 California Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act of 1972 (California Water Code, Division 7) is the state equivalent of the federal Clean Water Act, and its effect on the KICP would be similar. The California Water Code requires protection of water quality by appropriate design, sizing, and construction of erosion and sediment controls. The discharge of soil into surface waters resulting from land disturbance may require filing a report of waste discharge (see Water Code Section 13260a). The Central Valley RWQCB, which controls surface water discharges in the proposed project area, may become involved indirectly if soil erosion threatens water quality.

5.11.4.3 Local LORS

5.11.4.3.1 San Joaquin County

Applicable San Joaquin County regulations include the General Plan 2010 (San Joaquin County, 1992), the Development Title (LexisNexis Municipal Codes, 1995), the Improvement Standards (San Joaquin County Department of Public Works, 1997), as well as the Standard Specifications and Special Provisions document (San Joaquin County Department of Public Works, 2008).

Sections of the General Plan that may be relevant to this project include Resources (Section IV), and Community Development (Section II). Policies regarding soil conservation are found in the Agricultural Lands Section of the Resources portion of the plan. Policies regarding transmission lines are found in the Utilities Section of the Community Development portion of the plan.

The Development Title for the County describes the requirements for land alteration within the county. Several of the Development Title divisions that may apply to this project include Division 6 (Agricultural Zones), Division 14 (Grading and Excavation Regulations), Division 15 (Natural Resources Regulations), and Division 18 (Williamson Act Regulations).

The County Improvement Standards document describes design standards for roads, storm drains, water systems, sewer systems, and fire access that would apply to construction on the site. The San Joaquin County Standard Specifications and Special Provisions document provides the County's minimum requirements for excavation safety, dust control, earthwork, watering, erosion control and pollution control.

5.11.4.3.2 City of Lodi

The City of Lodi General Plan discusses soils and agriculture in several elements. Of interest are the policies outlined in the Conservation Element, including C-P6, requiring new development to implement measures that would minimize soil erosion from wind and water related to construction; and C-P32, requiring implementation of a Grading Plan, Erosion Control Plan, and Pollution Prevention Plan during the construction of any new development and redevelopment projects. In addition, several policies in the

Safety Element relate to soils: S-P20, requiring soils reports for new projects to determine permitting requirements; and S-P22, requiring new development to include grading and erosion control plans prepared by a qualified engineer.

Prior to construction of the proposed site, a site preparation grading permit is required in accordance with Lodi Municipal Code – Title 17. The code includes information on the required grading design plan (Chapter 17.30), information for application filling and processing (Chapter 17.50), permit approval (Chapter 17.52), and permit implementation, time limits, and extensions (Chapter 17.54). The applicable codes and permit package are provided at the City of Lodi website (www.lodi.gov) on the Community Development Page.

In addition to the permit fee, a development impact fee may be attached to the grading permit (Chapter 15.64). BMPs are required to be implemented to prevent, control, and reduce stormwater pollution for all construction within the City limits.

5.11.5 Agencies and Agency Contacts

Permits required for the KICP along with agency contacts are shown in Table 5.11-4. A grading permit application and permit approval would be obtained from San Joaquin County and from the City of Lodi before construction begins. Other permits would be obtained from the County if design plans warrant. Coverage under the General Construction Permit would need to be obtained prior to any construction disturbance on the site.

TABLE 5.11-4
Permits and Agency Contacts for Soils

Permit or Approval	Agency Contact	Applicability
Grading Permit Application & Permit	Department, Building Division 221 West Pine Street P.O. Box 3006 Lodi, California 95241-1910	Grading of site surfaces
General Construction Permit Notice of Intent and Stormwater Pollution Prevention Plan	San Joaquin Delta Unit, Central Valley RWQCB 11020 Sun Center Drive #200 Rancho Cordova, CA 95670	Regulation of stormwater discharge from site facilities during construction
Site Preparation Grading Permit	Building Official City of Lodi Community Development Department 221 West Pine Street PO Box 3006 Lodi, CA 95670	Permit forms, applications, and guidelines

5.11.6 Permits and Permit Schedule

It is expected that all the required permits for grading and stormwater discharge can be secured as long as applications are provided to the appropriate agency a maximum of 6 months prior to construction. The Notice of Intent to use the General Stormwater Permit for construction must be submitted at least 30 days before construction begins.

5.11.7 References

International Code Council. 1997. Uniform Building Code (International Building Code), 75th ed., published by the International Conference of Building Officials.

LexisNexis Municipal Codes. 1995. Title 9 Development Code of San Joaquin County. Available online at: http://www.sjgov.org/commdev/cgi-bin/cdyn.exe?grp=planning&htm=developmenttitle9 (verified August 7, 2014).

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San Joaquin County. 2003. San Joaquin County Storm Water Management Program. Available online at: http://www.sjcleanwater.org/PDF%20Documents/san%20joaquin%20SWMP%209_30_03.pdf (verified August 7, 2014).

San Joaquin County Department of Public Works. 2008. San Joaquin County Standard Specifications and Special Provisions (Online). Available online at: http://www.sjgov.org/pubworks/Docs/San%20Joaquin%20County%20-%20Specifications%20and%20Special%20Provisions.pdf (verified August 7, 2014).

Soil Survey Staff. 2014. Official Soil Series Descriptions (Online). Available online at: https://soilseries.sc.egov.usda.gov/osdname.asp (verified August 7, 2014).

South Coast Air Quality Management District (SCAQMD). 1993. *CEQA Air Quality Handbook*. Diamond Bar, California.

State Water Resources Control Board (SWRCB). 2009. Construction General Permit (Online). Available online at: http://www.swrcb.ca.gov/water_issues/programs/stormwater/constpermits.shtml. Accessed August 7, 2014.

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USDA-NRCS. 1992. Soil Survey of San Joaquin County, California. In cooperation with the Regents of the University of California (Agricultural Experiment Station) and the California Department of Conservation. October.

USDA-NRCS. 2014. Web Soil Survey. Available online at http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm. Accessed August 5, 2014.

5.12 Traffic and Transportation

This section includes an evaluation of the existing road network in the vicinity of the King Island CAES Project (KICP) site and describes the potential truck regulations and routes, existing air traffic, and mitigation and transportation permits potentially required for the project. The purpose of this analysis is to identify potential roadway and intersection deficiencies and other potential transportation constraints for future construction logistics planning. The analysis focuses on existing conditions only. The "with project" conditions would be evaluated when the construction schedule and workforce and truck traffic estimates are further defined.

5.12.1 Affected Environment

The project's Energy Conversion Facility (ECF) is located west of Interstate 5 (I-5), approximately 5 miles southwest of the westernmost portion of Lodi and approximately 3 miles north of the northernmost portions of Stockton. The storage reservoir and well pads are located approximately 2 miles southwest of the ECF on King Island. These two locations are referred to in this section collectively as the project site. The project and its vicinity is referred to as the project area.

5.12.1.1 Surrounding Road Network

The surrounding regional and local roadway networks are shown in Figures 5.12-1 and 5.12-2. Freeway access to the ECF site is provided from the north and south via I-5, and to the east and west via State Route (SR) 12. Local access to the project site is provided by the I-5 Frontage Road, via North Thornton Road.

Based on estimates from San Joaquin County, approximately 13 percent of daily vehicle miles traveled (VMT) within the county occurred on local county roadways, 24 percent occurred within the incorporated area local roadways, 61 percent occurred on the state highway system, and the remaining 2 percent occurred on state park service roadways

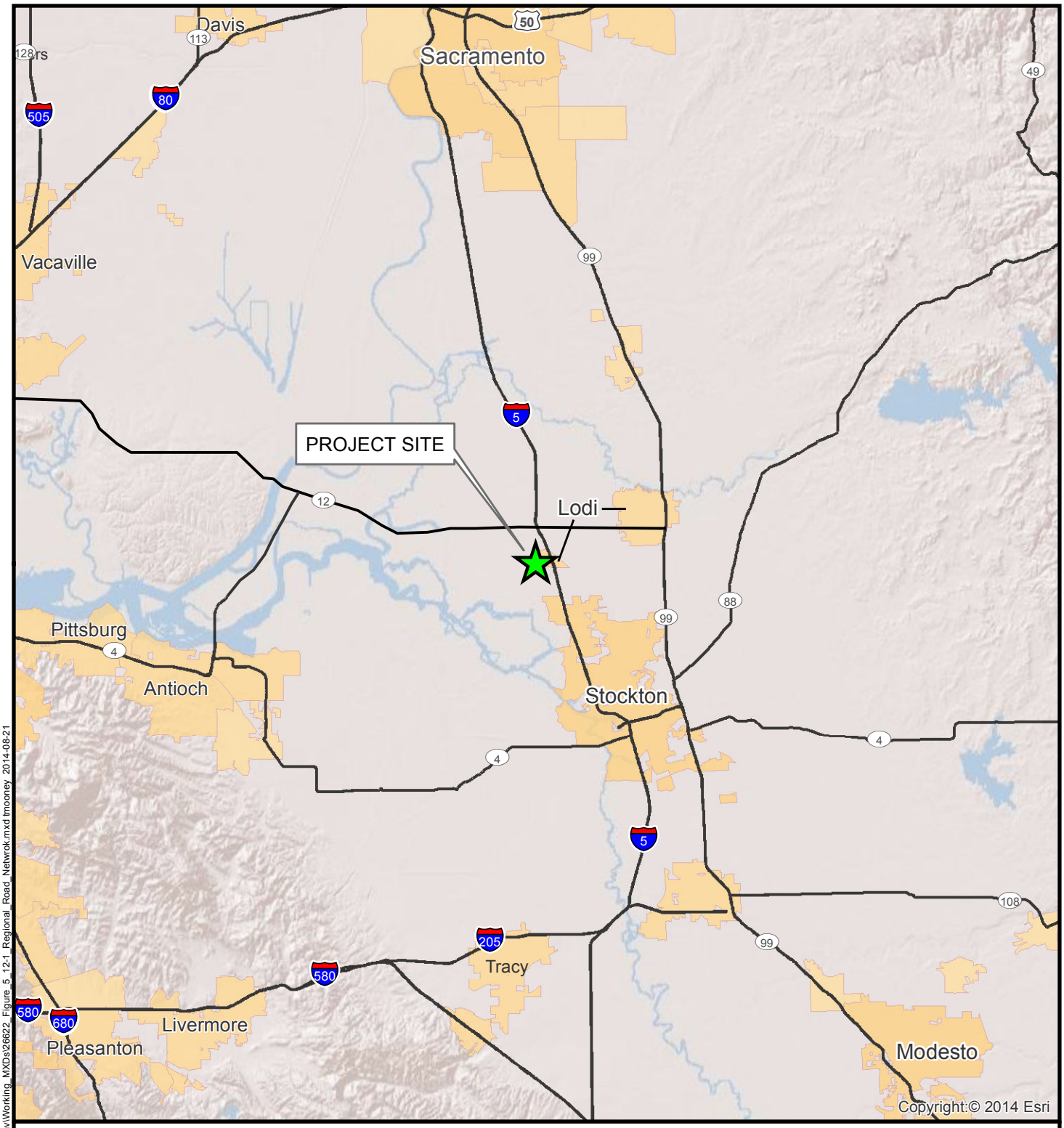
Although the state highway system makes up only 8 percent of the maintained centerline miles of roadway in the County, 61 percent of daily travel occurs on the state highway system. These data indicate the importance of the state highway system for ground transportation in San Joaquin County (San Joaquin County, 2009).

KICP traffic (delivery trucks and construction worker and employee vehicles) traveling to the site may affect the following roadways:

- **SR-4** outside of Stockton is a two-lane east-west facility that traverses the central part of San Joaquin County. SR-4 is functionally classified as a Minor Arterial in the rural area from the Contra Costa County line to west of Roberts Island Road in San Joaquin County. It is then classified as an Urban Principal Arterial through the Stockton urbanized area to SR-99. East of SR-99, SR-4 is classified as a Rural Minor Arterial through the end of the route.

  The SR-4 2020 Concept Facility would provide four lanes starting at the Contra Costa County and San Joaquin County border to its southern juncture with I-5; five lanes from the I-5 juncture to the Stockton Port facility; eight lanes from the I-5 Junction North to SR-99 Junction North; and four lanes from South Junction SR-99 to the San Joaquin County and Stanislaus County line (San Joaquin County, 2009).

- **I-5** is a north-south freeway located east of the project site. I-5 generally serves the Central Valley, connecting the major population centers of northern and southern California. Locally, I-5 connects the communities of Lodi, Stockton, and Sacramento. Access from I-5 to the site is provided from the south

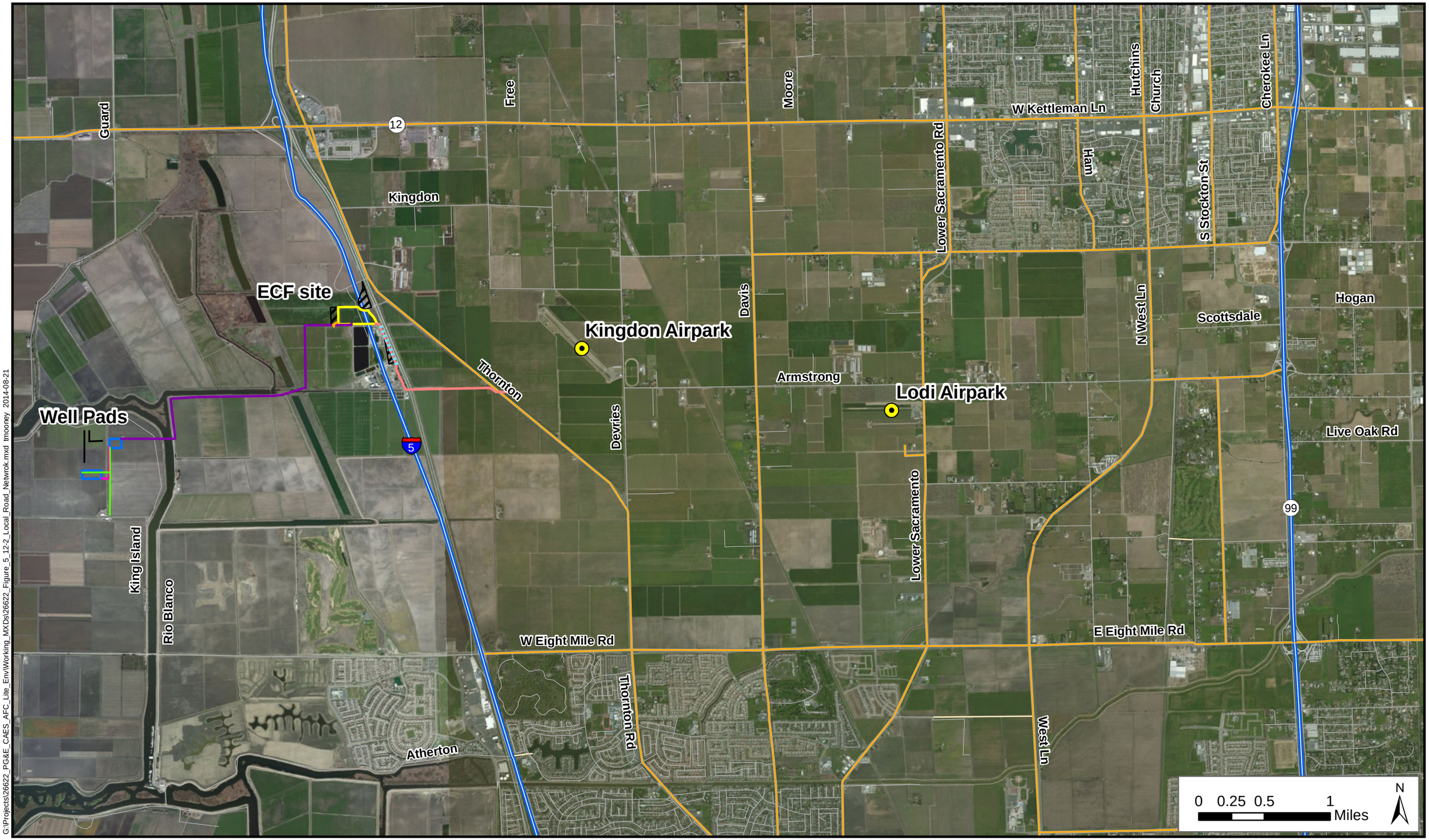


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Figure 5.12-1
Regional Road Network



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PG&E King Island Compressed Air Energy Storage Project

Figure 5.12-2
Local Road Network

using North Thornton Road via West Eight Mile Road, and from the north using North Thornton Road via SR-12. From North Thornton Road access is from the I-5 Frontage Road. In the immediate vicinity of the proposed project, I-5 has three lanes in each direction, and two lanes in each direction north of SR-12. I-5 carries 82,000 average annual daily traffic (AADT) near the interchange at West Eight Mile Road and 79,000 AADT near the SR-12 interchange (Caltrans, 2014). Within the project vicinity, trucks represent approximately 16 to 20 percent of all traffic on I-5.

- **SR-99** is a major north-south roadway in San Joaquin County that connects Stanislaus County in the south and Sacramento County in the north. SR-99 parallels I-5 to the east. SR-99 is four to eight lanes and is functionally classified as a Principal Arterial. Within the study area, trucks represent approximately 13 percent of all traffic on SR-99.

  The SR-99 2020 Concept Facility would provide eight lanes starting at the Stanislaus County and San Joaquin County line to the juncture with SR-12 in Lodi, and six lanes from the SR-12 juncture to the San Joaquin County and Sacramento County line. The Ultimate Transportation Corridor concept requires eight lanes for the entire corridor of SR-99 within San Joaquin County (San Joaquin County, 2009).

- **SR-12** is an east-west conventional highway. SR-12 has two travel lanes in each direction and carries 15,000 AADT between I-5 and North Thornton Road (Caltrans, 2012). Within the project vicinity, trucks represent approximately 15 percent of all traffic on SR-12.

- **West Eight Mile Road** is an east-west roadway located between Empire Tract Road on the west and Duncan Road on the east. It varies from two to five lanes. Within the project study area, West Eight Mile Road connects I-5 to North Thornton Road. West Eight Mile Road carries approximately 1,600 vehicles per day near I-5 (San Joaquin County, 2009). This road is the primary access to the well pads on King Island.

- **North Thornton Road** is a two-lane, north-south, undivided roadway that parallels I-5 on the east. North Thornton Road provides local access between Stockton to the south and smaller communities to the north. Within the project study area, North Thornton Road connects West Eight Mile Road on the south to SR-12 to the north. North Thornton Road carries approximately 400 vehicles per day between SR-12 and West Eight Mile Road (San Joaquin County, 2009).

5.12.1.2 Level of Service

The analysis of traffic operations at roadways and intersections is typically based on level of service (LOS). LOS is a qualitative measure used to describe operational conditions, represented by letter designations from A to F, with A representing the best conditions (minimal delay) and F representing the worst (heavy delay). LOS is determined based on evaluating such factors as traffic volume, roadway geometrics, speed, delay, and maneuverability.

5.12.1.2.1 Highways and Local Roadways

For the study area roadways, the LOS was calculated using a volume/capacity (V/C) ratio. The capacity on State highway was based on a planning-level estimate of 20,000 vehicles/lane/day. For local roadways, the roadway capacity was based on San Joaquin County's established Average Daily Traffic (ADT) thresholds. The ADT thresholds are based on the County's local roadway functional classification relative to the total number of lanes (for both directions) of the roadway. The LOS standard for local roadways in San Joaquin County is LOS C. Therefore, County roadways are evaluated using the capacity volume corresponding to LOS C as summarized in Table 5.12-1.

TABLE 5.12-1
San Joaquin County Threshold Capacity Volumes (LOS C)

Roadway Classification	Through Lanes	Capacity
Major Arterial	2	15,000
	4	35,000
	6	45,000
Minor Arterial	2	12,500
	4	25,000
Collector		
Commercial/Industrial	2	10,000
Residential	2	7,000
Local		
Commercial/Industrial	2	7,000
Residential	2	2,000

Source: San Joaquin County, 2009

Table 5.12-2 summarizes the corresponding V/C ratios for multi-lane highway and local roadway segments.

TABLE 5.12-2
Level of Service Criteria for Multi-lane Highway and Local Roadway Segments

LOS	V/C	Traffic Flow Characteristics
A	0.000 – 0.600	Free flow; insignificant delays
B	0.601 – 0.700	Stable operation; minimal delays
C	0.701 – 0.800	Stable operation; acceptable delays
D	0.801 – 0.900	Approaching unstable flow; queues develop rapidly but no excessive delays
E	0.901 – 1.000	Unstable operation; significant delays
F	> 1.000	Forced flow; jammed conditions

Source: Transportation Research Board. 2010. Highway Capacity Manual
V/C = traffic volume (demand) / roadway capacity

5.12.1.2.2 Intersections

San Joaquin County evaluates LOS for signalized and unsignalized intersections based on seconds of delay, as summarized in Table 5.12-3.

TABLE 5.12-3
Level of Service Criteria for Intersection Operations

	Delay per Vehicle (Seconds)		
LOS	Signalized	Un-Signalized	Traffic Flow Characteristics
A	≤ 10.0	≤10.0	Insignificant delays
B	>10.0 and ≤20.0	>10.0 and ≤15.0	Stable operation; minimal delays
C	>20.0 and ≤35.0	>15.0 and ≤25.0	Stable operation; acceptable delays
D	>35.0 and ≤55.0	>25.0 and ≤35.0	Below average operating conditions. Drivers may wait more than one cycle to proceed through an intersection.
E	>55.0 and ≤80.0	>35.0 and ≤50.0	"At-capacity"

TABLE 5.12-3
Level of Service Criteria for Intersection Operations

	Delay per Vehicle (Seconds)		
LOS	**Signalized**	**Un-Signalized**	**Traffic Flow Characteristics**
F	>80.0	>50.0	Jammed conditions

Source: Transportation Research Board, 2010

5.12.1.3 Traffic Impact Thresholds

5.12.1.3.1 Caltrans

Based on the Caltrans (2002) *Guide for the Preparation of Traffic Impact Studies*, "Caltrans endeavors to maintain a target LOS at the transition between LOS C and LOS D on state highway facilities, however, Caltrans acknowledges that this may not always be feasible and recommends that the lead agency consult with Caltrans to determine the target LOS. If an existing State highway facility is operating at less than the appropriate target LOS, the existing LOS should be maintained."

5.12.1.3.2 San Joaquin County

The current County General Plan, adopted in 1992 and updated in 2005, contains a Transportation section in its Community Development Element that sets forth policies related to transportation and circulation. Based on the County's policies, all county roadways shall operate at LOS C or better (except in a City sphere of influence where the City has adopted LOS D); intersections shall operate at an overall LOS D or better on minor arterials and roadways of higher classification; and LOS C on all other roads. All freeways and State highways shall operate at LOS D.

San Joaquin County is in the process of conducting a comprehensive update to the General Plan to meet the changing housing, environmental, economic, and growth needs of the county. The update process began in June 2008 and is expected to conclude by the end of 2014. It is assumed that the LOS thresholds will remain the same in the new General Plan.

5.12.1.3.3 City of Lodi

The LOS requirements as specified in the Circulation Element of the City of Lodi General Plan are LOS C as the minimum to achieve on all roadway links and intersections.

5.12.1.4 Existing Conditions Analysis

Roadway volumes were obtained from the best available sources at the time this analysis was prepared. These sources include the Caltrans Traffic Data Branch Average Daily Traffic Volumes (Caltrans, 2014), the San Joaquin County General Plan Public Review Draft Background Report (San Joaquin County, 2009), and the Draft Environmental Impact Report (EIR) for the Love's Travel Stops (at the northeast corner of SR-12 and I-5) (Kleinfelder, 2012). Daily roadway LOS was calculated based on the volumes contained in these reports. The peak hour roadway and intersection LOS was not calculated as part of this analysis, but is based on previous LOS calculations contained in the Public Review Draft Background Report and the Love's Travel Stop EIR.

Table 5.12-4 summarizes the existing daily roadway segment LOS. All local roadway segments operate at an acceptable LOS and only one highway segment is operating below the County's thresholds. I-5, between March Lane and Benjamin Holt Drive (approximately 5 miles south of the project site) is currently operating at LOS E, partly due to construction slowdowns.

In addition to obtaining the daily traffic volumes, available peak hour LOS data for the state highways was reviewed. Table 5.12-5 summarizes the LOS for highway segments in the study area that are currently

TABLE 5.12-4
Existing Roadway Segment Level of Service

Roadway	Between	And	Divided	Number of Lanes	AADT	Truck Percentage	Daily Capacity	Daily V/C	LOS	Exceed County Threshold?
Local Roadways										
W. Eight Mile Road	I-5	Stockton West City Limit	Undivided	2	1,600	N/A	12,500	0.128	A	No
	SR-99	Pearson Lane	Undivided	2	1,500	N/A	12,500	0.120	A	No
North Thornton Road	SR-12	W. Eight Mile Road	Undivided	2	400	N/A	7,000	0.057	A	No
	South of Walnut Grove Lane	—	Undivided	2	1,800	N/A	7,000	0.257	A	No
Davis Road	South of Peltier Road	—	Undivided	2	900	N/A	10,000	0.090	A	No
	South of Armstrong Road	—	Undivided	2	3,800	N/A	7,000	0.543	A	No
	North of Eight Mile Road	—	Undivided	2	4,100	N/A	7,000	0.586	A	No
Freeways										
SR-4	North Junction I-5	Stanislaus Street	Divided	6	79,000	10%	120,000	0.658	B	No
	Stanislaus Street	Wilson Way	Divided	6	91,000	10%	120,000	0.758	C	No
	Wilson Way	Filbert Street	Divided	6	89,000	10%	120,000	0.742	C	No
	Filbert Street	SR-99	Divided	6	84,000	13%	120,000	0.700	B	No
SR-99	SR-4 West	SR-26 East	Divided	6	99,000	13%	120,000	0.825	D	No
	SR-26 East	SR-88	Divided	6	105,000	13%	120,000	0.875	D	No
	SR-88	Cherokee Lane	Divided	6	91,000	13%	120,000	0.758	C	No
	Cherokee Lane	Wilson Way	Divided	6	86,000	13%	120,000	0.717	C	No
	Wilson Way	Hammer Lane	Divided	8	96,000	13%	160,000	0.600	B	No
	Hammer Lane	Morada Lane	Divided	6	64,000	13%	120,000	0.533	A	No
	Morada Lane	South Lodi	Divided	6	75,000	13%	120,000	0.625	B	No
	South Lodi	SR-12 West	Divided	4	67,000	13%	80,000	0.838	D	No
SR-12	Junction SR-160	Terminous Road	Undivided	2	17,100	15%	40,000	0.428	A	No
	Terminous Road	County line	Undivided	2	17,500	14%	40,000	0.438	A	No
	County line	Glasscock Road	Undivided	2	15,200	14%	40,000	0.380	A	No

TABLE 5.12-4
Existing Roadway Segment Level of Service

Roadway	Between	And	Divided	Number of Lanes	AADT	Truck Percentage	Daily Capacity	Daily V/C	LOS	Exceed County Threshold?
	Glasscock Road	Guard Road	Undivided	2	16,000	14%	40,000	0.400	A	No
	Guard Road	Junction I-5	Undivided	2	16,400	14%	40,000	0.410	A	No
	Junction I-5	North Thornton Road	Divided	4	15,000	15%	80,000	0.188	A	No
	North Thornton Road	Lower Sacramento Road	Undivided	2	12,200	9%	40,000	0.305	A	No
	Lower Sacramento Road	South Ham Lane	Divided	4	23,500	9%	80,000	0.294	A	No
	South Ham Lane	South Hutchins	Divided	4	24,400	9%	80,000	0.305	A	No
	South Hutchins	Central Avenue	Divided	4	26,500	9%	80,000	0.331	A	No
	Central Avenue	Cherokee Lane	Divided	4	20,900	10%	80,000	0.261	A	No
	Cherokee Lane	SR-99	Divided	4	19,700	10%	80,000	0.246	A	No
I-5	March Lane	Benjamin Holt Drive	Divided	6	113,000	23%	120,000	0.942	**E**	**Yes**
	Benjamin Holt Drive	Hammer Lane	Divided	6	105,000	23%	120,000	0.875	D	No
	Hammer Lane	Eight Mile Road	Divided	6	82,000	23%	120,000	0.683	B	No
	Eight Mile Road	Junction SR-12	Divided	6	79,000	16%	120,000	0.658	B	No
	Junction SR-12	Peltier Road	Divided	6	54,000	20%	120,000	0.450	A	No

Notes:
Segments operating at an unacceptable LOS are shown in bold.

N/A= Not Available

operating below the County's thresholds. As shown in Table 5.12-5, segments of SR-4 and I-5 are currently operating at LOS E and F.

TABLE 5.12-5
Existing State Highway Peak Hour Level of Service

	AM Peak Hour				PM Peak Hour			
	NB/EB		SB/WB		NB/EB		SB/WB	
Roadway Segment	LOS	V/C Density*	LOS	V/C Density*	LOS	V/C Density*	LOS	V/C Density*
SR-4								
Roberts Island Road to Fresno Avenue	C	0.21	D	0.52	E	0.65	C	0.26
Fresno Avenue to Navy Drive	F	0.47	F	1.04	F	1.42	F	0.54
I-5								
French Camp IC to Eighth Street	F	>45.0	D	33.5	F	>45.0	D	34.2
Eight Street to SR-4 South	F	>45.0	E	38.6	F	>45.0	E	39.5
SR-4 South to SR-4 North	F	>45.0	D	32.7	E	37.8	D	28.2
SR-4 North to Pershing Avenue	C	22.0	D	32.7	E	36.2	D	27.7
Country Club Boulevard to Plymouth Road	D	28.0	F	>45.0	F	>45.0	E	37.7
Plymouth Road to March Lane	C	19.2	D	27.9	D	32.2	C	25.3
March Lane to Benjamin Holt Drive	C	24.0	E	38.5	F	>45.0	D	34.7
Hammer Lane to Eight Mile Road	C	18.4	D	27.0	E	38.0	D	26.3
Eight Mile Road to SR-12	B	14.3	C	20.7	D	26.4	C	23.4
SR-12 to Peltier Road	F	>45.0	A	7.9	F	>45.0	C	19.7

*LOS calculations obtained from San Joaquin County. Volume-to-capacity ratio (V/C) reported for two-lane highway facilities. LOS for freeway and multi-lane highway facilities are based on density, which is measured in passenger cars per mile per lane (pc/mi/ln).

Source: San Joaquin County, 2009

Traffic analysis conducted for the Application for Certification (AFC) should consider total workforce traffic to both the ECF and well pad sites. Construction access to the well pads and the air pipeline corridor would be similar to that for the ECF. Workers heading for the well pads would exit I-5 at Eight Mile Road and continue west to King Island Road. Workers on the air pipeline would access the pipeline right-of-way via agricultural roads either from the ECF location or from King Island via Eight Mile Road. Distribution of workforce journeys to the well pad area for the construction traffic impacts analysis should consider the timing and volume of traffic needed for well pad construction.

Table 5.12-6 summarizes LOS for the critical intersections in the project vicinity. All of the intersections are operating at an acceptable LOS.

TABLE 5.12-6
Existing Intersection Level of Service

	AM Peak Hour		PM Peak Hour	
Intersection	Delay (Seconds)	LOS	Delay (Seconds)	LOS
SR-12 at I-5 SB Ramps	5.5	A	5.3	A
SR-12 at I-5 NB Ramps	15.5	B	15.3	B
SR-12 at North Thornton Road/Star Street	23.1	C	24.3	C

TABLE 5.12-6
Existing Intersection Level of Service

Intersection	AM Peak Hour		PM Peak Hour	
	Delay (Seconds)	LOS	Delay (Seconds)	LOS
I-5 NB Ramps at W. Eight Mile Road	15.0	B	16.3	B

Notes:
LOS for intersections on SR-12 are based on traffic counts collected in May 2012.
LOS for intersection at I-5 are based on traffic counts collected in 2008.

Source: San Joaquin County, 2009 and Kleinfelder, 2012

5.12.1.5 Truck Regulations and Potential Routes

5.12.1.5.1 Weight and Load Limitations

San Joaquin County has its own restrictions on county roads in addition to the California Vehicle Code (CVC) Sections 35550–35559. In 35 mph zones, the weight limitation is seven tons, and in 25 mph zones the restriction drops to five tons. No map or list of roads is available. Coordination with the County would be required at the time the construction truck routes are identified.

5.12.1.5.2 Hazardous Materials

Standards for the transport of hazardous materials are contained in the Code of Federal Regulations (CFR), Title 49 and enforced by the U.S. Department of Transportation. These laws and ordinances place requirements on various aspects of hazardous waste hauling, from materials handling to vehicle signs and a means of ensuring public safety.

Additionally, the State of California has rules for hazardous waste transport that can be found in the California Code of Regulations, Title 26. Additional regulations for the transportation of hazardous materials are outlined in the CVC (Sections 2500–505, 12804–804.5, 31300, 3400, and 34500–501). The two state agencies with primary responsibility for enforcing federal and state regulations governing the transportation of hazardous wastes are the California Highway Patrol (CHP) and Caltrans. Transport of hazardous materials to and from the project site would be required to comply with all applicable requirements.

5.12.1.5.3 Heavy Haul Routes to the ECF

Based on the project location, the recommended routes to the ECF, for consideration and subject to Caltrans and County approval, are as follows.

- From Sacramento and points north: from I-5 exit at SR-12 interchange, turn left on SR-12 (eastbound), turn right onto North Thornton Road (southbound) to I-5 Frontage Road. Turn right on I-5 Frontage Road (westbound) and then left on I-5 Frontage Road (southbound) until reaching the site.
- From Stockton and points south: from I-5 exit at West Eight Mile Road interchange, turn right on West Eight Mile Road (eastbound), turn left onto North Thornton Road (northbound) to I-5 Frontage Road. Turn left on I-5 Frontage Road (westbound) and then left on I-5 Frontage Road (southbound) until reaching the site.
- From the Bay Area: SR-4 northbound to SR-160 northbound and SR-12 eastbound, turn right onto North Thornton Road (southbound) to I-5 Frontage Road. Turn right on I-5 Frontage Road (westbound) and then left on I-5 Frontage Road (southbound) until reaching the site.
- From Lodi and the foothills: from SR-12 (westbound) turn left onto North Thornton Road (southbound) to I-5 Frontage Road. Turn left on I-5 Frontage Road (westbound) and then left on I-5 Frontage Road (southbound) until reaching the site.

5.12.1.5.4 Heavy Haul Routes to the Well Pads

True heavy haul (turbo-expanders and major equipment) is unlikely to be needed for the well pad sites, although it would be necessary to transport some bulky and heavy items (such as drill rigs) to the well pads. Access from both north and south on I-5 would be from the Eight Mile Road interchange, west on Eight Mile Road, north on King Island Road and agricultural access roads to the site.

Hauling should be carried out in accordance with local, state, and federal regulations that include the Resource Conservation and Recovery Act (42 U.S. Code 6901 et seq.) and the California Integrated Waste Management Act (Public Resources Code Sections 40000 et seq.).

5.12.1.6 Air Traffic

There are two small private airports in the vicinity of the project site: Lodi Airpark (FAA identifier: L53) 4.0 miles to the southeast and Kingdon Airpark (FAA identifier: O20) approximately 1.4 miles to the east. Information regarding the airparks is summarized in Table 5.12-7.

TABLE 5.12-7
Airports in the Vicinity of the KICP

Parameter	Kingdon Airpark[a]	Lodi Airpark[b,c]
FAA Identifier	O20	L53
Location (Lat/Long)	38.0915864 / -121.3593931	38.0840869 / -121.3163369
Elevation (above mean sea level)	15 ft (5 m)	25 ft (8 m)
Number of runways	1 (bidirectional)	1 (bidirectional)
Runway Length	3,705 ft (1,120 m)	1,875 ft (572 m)
Aircraft Operations, avg	22/day	33/day

[a]Data from AirNav.com, 2014a; average operations for 12-month period ending January 28, 2014.
[b]Data from AirNav.com, 2014b; average operations for 12-month period engine February 6, 2013.
[c]Lodi Airpark is also referred to a Precissi Airpark.

The project site is located in the conical surface of the Kingdon Airpark; however, it is anticipated that the construction of the project would not conflict with the Airport Land Use Compatibility Plan for San Joaquin County.

The Lodi Airpark is used predominantly for crop duster airplane traffic and has a 1,875-foot-long runway. Because the runway is less than 3,200 feet long, the restricted space extends for only 10,000 feet (1.7 nautical miles) from the airpark. The KICP ECF site is therefore beyond the restricted airspace for the Lodi Airpark and is not required to be included in an assessment of potential impacts. Further, because this airpark is more than 3 miles away from the project, the KICP ECF site is not within any of the airpark-specific zones.

There are also several low-altitude airways in the project area, located east and south of the Kingdon Airpark. However, these airways are at an altitude of 3,000 feet, far above any altitude where structures or exhaust plumes from the project could have any effect.

5.12.1.7 Key Findings

The following is a summary of the key findings of the existing conditions analysis:

- All of the local roadways in the study area are operating at an acceptable level of service (LOS) based on Caltrans, San Joaquin County and the City of Lodi traffic impact thresholds.
- All of the nearby intersections (where data was available) are operating at LOS C or better.

- Several segments of SR-4 and I-5 currently operate at LOS E or F during at least one peak hour. As a result, construction traffic travelling on these roads would likely be required to arrive and depart outside of peak hours.
- I-5 between March Lane and Benjamin Holt Drive (5 miles south of the project site) is currently operating at LOS E on a daily basis (which includes hours in addition to the standard peak hours).
- Between 1990 and 2007, the annual average growth rate of vehicular travel has occurred at approximately 3 percent per year on the state highway system and at approximately 1.5 percent per year on the local roadway system. The growth rate should be taken into consideration when the "with project" conditions are evaluated.

5.12.2 Environmental Consequences

Although this document provides estimates of the construction workforce that would be needed to construct the KICP, detailed construction design information is not available (personnel by month) and, in any case, the exact dates of construction are not certain and construction could begin several years in the future. For this reason, this document does not include a standard AFC traffic impact analysis for construction and operation (effects on LOS at key intersections and roadway segments). Traffic density and LOS could significantly change by the time a project owner submits the final AFC for the KICP. Instead, the purpose of this analysis has been to assess the current roadway system to identify intersections and segments that are operating at poor or unacceptable LOS now, prospective heavy haul routes, and potential conflicts with air navigation and other transportation uses, as an aid to planning construction transportation in the future.

5.12.3 Potential Mitigation Measures

Once the "with project" conditions (construction traffic, future LOS conditions) are evaluated, specific measures would be identified to mitigate potential project impacts. However, at a minimum, it is expected that the project would be required to prepare and implement a construction traffic control plan and construction management plan, also known as a Transportation Management Plan (TMP). The TMP should address construction hours, timing of heavy equipment and building material deliveries, potential street and/or lane closures, signing, lighting, and traffic control device placement. Damage to any roadway caused by project construction traffic would be required to be restored to or near its preexisting condition. The construction contractor should work with the local agency's engineer to prepare a schedule and mitigation plan that includes appropriate traffic control measures for the roadways along the construction routes.

5.12.4 Permits and Permit Schedule

Table 5.12-8 lists the potential traffic and transportation permits that may be required and the anticipated schedule. The vehicles used to transport heavy equipment and construction materials would require transportation permits when they exceed the size, weight, width, or length thresholds set forth in Section 35780 of the CVC, Sections 117 and 660-711 of the California State Highway Code, and Sections 1411.1 to 1411.6 of the California Code of Regulations. Affected vehicles would be required to obtain transportation permits from Caltrans, San Joaquin County, and potentially the City of Lodi.

Transport route arrangements would be required with Caltrans and CHP officials for permitting and escort, as applicable. Transportation of hazardous materials to and from KICP should be conducted in accordance with CVC Section 31303.

TABLE 5.12-8
Potential Traffic and Transportation Permits and Permit Schedule

Permit	Administering Agency	Schedule
Single/annual-trip transportation permit for oversized loads and oversized vehicles	Caltrans North Region Transportation Permits Office 1823 14th Street Sacramento, CA 95814	Obtain when necessary, 2-hour processing time (single trip) to 2 weeks (annual trip).
Hazardous materials transportation license	California Highway Patrol HM Licensing Program	Obtain when necessary, approximately 2-week processing time.
Transportation Permit for Oversized Loads in San Joaquin County	San Joaquin County Public Works 1810 East Hazelton Avenue Stockton, CA 95205	Usually two-day processing time for either a single trip permit or an annual (blanket) permit.
Encroachment Permit for San Joaquin County	San Joaquin County Public Works 1810 East Hazelton Avenue Stockton, CA 95205	Obtain when necessary, issuance varies depending on the complexity of the work; usually issued within a week, up to a year.
Encroachment/Entry Permit for US Bureau of Reclamation for hauling on King Island	Reclamation District No. 2042, King Island 311 East Main Street, Suite 400 Stockton, CA 95202	Prior to construction
Transportation permit for the transportation of oversize and overweight loads through the City of Lodi	City of Lodi Public Works 221 West Pine Street Lodi, CA 95240	Obtain when necessary, issuance within 3 to 5 business days.

5.12.5 References

AirNav. 2014a. FAA Information Effective July 24, 2014 Regarding Kingdon Airpark. Available online at: http://www.airnav.com/airport/O20

AirNav. 2014b. FAA Information Effective July 24, 2014 Regarding Lodi Airpark. Available online at: http://www.airnav.com/airport/L53

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5.13 Visual Resources

This section describes the existing visual character of the King Island CAES Project (KICP) site and its vicinity, identifying sensitive views and recommending key observation points (KOP) for use in further project analysis. Visual resources are the natural and cultural features of the environment that can be seen and that contribute to the public's enjoyment of the environment. Visual resource or aesthetic impacts are generally defined in terms of a project's physical characteristics and potential visibility, and the extent that the project's presence would change the visual character and quality of the environment in which it would be located.

Figure 5.13-1 shows the location of the site, primary project features, and the locations of the KOPs selected to analyze the visual resources effects of the project and viewpoints referenced in this section. The existing views toward the project site from the KOPs follow as Figures 5.13-2 through 5.13-5. A preliminary, mass-model simulation of the view from KOP 2 (Figure 5.13-3a) is included among these figures. Additional viewpoints (Figures 5.13-6 through 5-13-8) are included to provide further context in terms of the project area's existing landscape character and distance from the project site and other sensitive views in the area. (Note that all figures are at the end of the section).

5.13.1 Affected Environment

5.13.1.1 Regional Setting

The project would be developed in the vicinity of White Slough, in an area generally bounded by Interstate 5 (I-5) to the east, State Route 12 (SR-12) to the north, and Eight Mile Road (marking the northern boundary of the City of Stockton) to the south. The facility would have two major project operation locations (referred to collectively as the "project area"): the 20-acre Energy Conversion Facility (ECF) would contain the majority of the project equipment and would be located on land under the jurisdiction of the City of Lodi, adjacent and to the west of I-5 and approximately 1.5 miles south of SR-12; the well field, consisting of the compressed air storage reservoir and underground storage injection and withdrawal (I/W) equipment on two well pads, would be located approximately 2 miles southwest of the ECF, on King Island, which is under San Joaquin County jurisdiction. Various pipelines (compressed air and gas) and electrical transmission interconnection lines would extend from and between these two general locations.

The region is agricultural in character, with row/field crops, grazing, orchards, vineyards and sod farms evident throughout the area. However, the dominant landscape feature in the area is the network of waterways associated with White Slough, which provide water for the agricultural uses, as well as for recreation and wildlife conservation. The White Slough Wildlife Area (WA) is approximately 0.5 mile west of the ECF site, and King Island is formed by sloughs.

Row crops occupy the lands within and immediately to the north and west of the ECF site. Adjacent to the south of the ECF site are the City of Lodi's White Slough Water Pollution Control Facility (WPCF) holding ponds. WPCF structures are located to the south of the holding ponds, immediately east of the Northern California Power Agency (NCPA) Lodi Energy Center (LEC) and the NCPA Combustion Turbine Project #2. Approximately 2 miles north of the ECF site, I-5 intersects with SR-12. A commercial cluster including gas stations, a truck stop, hotel, restaurants, and similar services is in the southeast segment of the intersection. A golf course (Reserve at Spanos Park) is located south of the project site and is accessible from Eight Mile Road. Eight Mile Road intersects I-5 approximately 2 miles south of the ECF site and provides access to the golf course, and forms the northern urban edge of Stockton.

The expanded well pad locations on King Island are currently planted with young walnut orchards. King Island is nearly entirely agricultural, with orchards and row crops predominant. Residences and associated agricultural facilities are intermittently present along King Island Road, which extends along the perimeter of the island. Eight Mile Road runs east-west and bisects the island. No more than a half dozen residences or residential clusters were observed on King Island. Marinas along the sloughs surrounding King Island are located at the southeast and southwest corners of the Island.

Population density in the region is low and fewer than ten residences are present within 1 mile of the proposed ECF site. The nearest residences are concentrated in the land to the northeast, with a cluster of three homes associated with the Hilmar Cheese dairy farm within 0.5 mile of the ECF site, just east of I-5 and on the opposite side of I-5 from the ECF. The nearest higher-density residential area is the series of subdivisions along the southern edge of Eight Mile Road, approximately 2 miles from the ECF site and within the Stockton city limits. A small number of homes are west of the ECF site, beyond the White Slough WA along Guard Road.

There are no officially designated or eligible State Scenic Highways in the vicinity of the project site. The segments of I-5 and Eight Mile Road that pass through the project area are identified in the San Joaquin County General Plan as Scenic Routes.

5.13.1.2 Project Sites, Linear Routes, and Staging Areas

Under the proposed project, the 20-acre ECF site, which currently contains corn crops, would be developed as the power island and location of the air compressors, turbo-expanders, and ancillary equipment for the KICP. Two existing well pad sites, would be expanded to occupy a total of approximately 4 and 6 acres, respectively, and consisting of up to 30 air I/W wells and ancillary equipment, would be developed approximately 2 miles southwest of the ECF site on King Island. An air pipeline would extend between the two areas to convey compressed air to and from the well pads. Other linear facilities associated with the project include pipelines to convey water and natural gas supplies, an electrical interconnection with the wider electrical grid (located near the southwest corner of the ECF site) and a 12-kilovolt (kV) service line extension to the well pads. Complete details on the project design are included in Section 2.0, Project Description.

The tallest elements within the ECF site are the two turbo-expander stacks, which would be approximately 100 feet tall. By comparison, the exhaust stack at the nearby LEC is approximately 150 feet tall. The tallest element at the well pads, aside from the 12 kV service line, would be the communication antenna for the control building, which would be approximately 50 feet tall. In addition, to address flood design considerations various equipment and the control buildings will be mounted on elevated platforms approximately 11 feet tall. Young walnut trees in the immediate area surrounding the well pads are currently between 10 and 15 feet tall, but can be expected to grow to 30 to 50 feet tall at maturity.

Staging areas for the project would be located in three separate locations near the ECF site: one to the north of the site, along I-15; one to the south of the site, also along I-5; and one adjacent to the western edge of the ECF site. The proposed well pad sites are of sufficient size that additional staging areas are not needed.

5.13.1.3 Potential Project Visibility

The ECF site is visible from locations throughout the surrounding area, as evidenced by the general visibility of the existing LEC and STIG plants. The southbound lane of I-5 just east of the project site affords the closest, least obstructed, and most sustained views of the area. Trees planted to block views from the

freeway toward the STIG plant and LEC impede views toward the general area from a portion of the northbound lanes of I-5. However, given the lack of any substantial structures on adjacent parcels, the ECF site is clearly visible in views from throughout the area, including from residences and the White Slough WA. The well pad developments are likely to be visible from unpaved farm roads adjacent to each of the sites, and in longer, elevated views from the levee along the perimeter of King Island (a private, yet publicly accessible road for use by adjacent property owners).

5.13.1.4 Sensitive Viewing Areas and Key Observation Points

In anticipation of a future analysis of the proposed project's effects on visual resources undertaken to license the project, sensitive receptors[1] and the view areas that would be the most sensitive to the project's potential visual effects were identified. Recommended representative viewpoints from these sensitive receptor locations are referred to as key observation points (KOPs). The KOPs suggested here either represent or approximate the best viewing conditions from the major areas of viewer sensitivity: the view from the bird watchers' parking lot at the southwest corner of the ECF site (KOP 1); the southbound lane of I-5 (KOP 2), north of the site; the view from a location near a trail within the White Slough WA (KOP 3); and an elevated view from King Island road toward the well field (KOP 4A). Three additional views from viewpoints representing sensitive receptors are included here to demonstrate the degree to which the project is likely to be only slightly visible: a second view from KOP 4 to show the relationship between the slough and the well pad area (KOP 4B); the view from the westbound shoulder of Eight Mile Road, north of a residential subdivision (Viewpoint 1); and the view from the exit of Oak Grove Regional Park, on the south side of Eight Mile Road, east of I-5 (Viewpoint 2). The locations of these KOPs and viewpoints are indicated on Figure 5.13-1.

Based on field work conducted in August 2014, the existing visual conditions of the views from each of the KOPs were documented. Assessments of existing levels of scenic quality were made based on professional judgment that took a broad spectrum of factors into consideration, including:

- Natural features, including topography, water courses, rock outcrops, and natural vegetation
- The positive and negative effects of cultural alterations and built structures on visual quality
- Visual composition, including an assessment of the vividness, intactness, and unity of patterns in the landscape[2]

The final scenic quality ratings assigned to each view fit within the rating scale summarized in Table 5.13-1. Development of this scale builds on a scale developed for use with an artificial intelligence system for evaluation of landscape visual quality (Buhyoff et al., 1994), and incorporates landscape assessment concepts applied by the U.S. Forest Service and the U.S. Department of Transportation.

[1] Typically, residents and recreationists are considered to be sensitive receptors to changes in the landscape. This is because of the potential for effects to their long-term views or their enjoyment of a particular landscape or activity.

[2] Vividness is the memorability of the visual impression received from contrasting landscape elements as they combine to form a striking and distinctive visual pattern. Intactness is the integrity of visual order in the natural and built landscape, and the extent to which the landscape is free from visual encroachment. Unity is the degree to which the visual resources of the landscape join together to form a coherent, harmonious visual pattern. Unity refers to the compositional harmony of intercompatibility between landscape elements. (U.S. DOT Federal Highway Administration, 1988).

TABLE 5.13-1
Landscape Scenic Quality Scale

Rating	Explanation
Outstanding Visual Quality	A rating reserved for landscapes with exceptionally high visual quality. These landscapes are significant nationally or regionally. They usually contain exceptional natural or cultural features that contribute to this rating. They are what we think of as "picture post card" landscapes. People are attracted to these landscapes to view them.
High Visual Quality	Landscapes that have high quality scenic value. This may be due to cultural or natural features contained in the landscape or to the arrangement of spaces contained in the landscape that causes the landscape to be visually interesting or a particularly comfortable place for people. These landscapes have high levels of vividness, unity, and intactness.
Moderately High Visual Quality	Landscapes that have above average scenic value but are not of high scenic value. The scenic value of these landscapes may be due to man-made or natural features contained within the landscape, to the arrangement of spaces, in the landscape or to the two-dimensional attributes of the landscape. Levels of vividness, unity, and intactness are moderate to high.
Moderate Visual Quality	Landscapes, that are common or typical landscapes that have, average scenic value. They usually lack significant cultural or natural features. Their scenic value is primarily a result of the arrangement of spaces contained in the landscape and the two-dimensional visual attributes of the landscape. Levels of vividness, unity, and intactness are average.
Moderately Low Visual Quality	Landscapes that have below average scenic value but not low scenic value. They may contain visually discordant man-made alterations, but these features do not dominate the landscape. They often lack spaces that people will perceive as inviting and provide little interest in terms of two-dimensional visual attributes of the landscape.
Low Visual Quality	Landscapes that have below average scenic value. They may contain visually discordant man-made alterations, and often provide little interest in terms of two-dimensional visual attributes of the landscape. Levels of vividness, unity, and intactness are below average.

Note: Rating scale based on Buhyoff, et al., 1994; U.S. DOT Federal Highway Administration, 1988, and United States Department of Agriculture Forest Service, 1995.

5.13.1.4.1 KOP 1 – View from Bird Watchers' Parking Lot

Figure 5.13-2 depicts the view from KOP 1, a parking lot used by bird watching recreationists that is located at the southeast corner of the ECF site. This viewpoint was selected due to its proximity to the site and the presumed visual sensitivity of the location's primary users, visiting the area for recreational birding. According to the White Slough WPCF, birdwatchers parking in this location are there primarily to observe birds using the WPCF evaporation ponds. An unobstructed view of the ECF site is available from this location, which is located along the access road to the WPCF, STIG, and LEC facilities.

The existing view from this location, despite being generally lacking in prominent structures, demonstrates the infrastructural and agricultural character of the landscape in the area. Row crops (corn) are visible within the proposed project site and the 230-kV and 500-kV transmission lines span the entire view beyond the agricultural uses in the foreground. The northern edge of the WPCF holding ponds are visible along the left edge of the view. The trees visible along the horizon indicate the proximity of the riparian White Slough WA (just over 1 mile away) and contribute an element of natural vegetation to the view, despite the fact that they exist along the edge of constructed ponds.

Applying the scale presented in Table 5.13-1, this view is rated as having a moderately low level of visual quality. The crops in the foreground provide a moderate level of vividness to the view; however, the paved and unpaved roads in the immediate foreground, in concert with the transmission lines across the view,

result in a moderately low level of visual intactness. A moderately low level of visual unity results from the overall degree of contrast evident in the view.

5.13.1.4.2 KOP 2—View from Interstate 5 Southbound

Figure 5.13-3 depicts the view from KOP 2, approximately one-third of a mile north of the ECF site, along a frontage road adjacent to I-5. This viewpoint was selected to approximate the view from I-5, which is a major public roadway, with approximately 80,000 vehicles passing the project site on the freeway daily[3]. I-5 is also designated as a scenic route in the San Joaquin County General Plan[4]. An unobstructed view of the project site is available from KOP 2. This view is seen by drivers and passengers in automobiles traveling south on I-5. These viewers could be making local, regional, or long-distance trips.

The existing view in this location is agricultural and industrial in character and is indicative of a highly managed landscape. The immediate foreground is characterized by the presence of row crops, beyond which a band of industrial-appearing structures extends across the view. The existing LEC and STIG facilities are visible in the left portion of the view, and the 230-kV and 500-kV transmission lines that pass through the project site vicinity extend across the view, north from the project site area. The mountains that form a segment of the Coast Range are visible in the distance, but are partially obscured by existing structures and transmission lines.

Applying the scale presented in Table 5.13-1, this view is rated as having a moderately low level of visual quality. The farmland in the foreground provides a moderate level of vividness to the view, and the industrial-appearing uses and transmission lines appear in a band across the view, providing a moderate level of visual intactness. However, these uses contrast visually, and the inclusion of the road in the immediate foreground results in a moderately low level of visual unity.

5.13.1.4.3 KOP 3—View from White Slough Wildlife Area

Figure 5.13-4 depicts the view from KOP 3, a viewpoint within the White Slough WA, approximately 0.6 mile northwest of the ECF project site. This KOP was selected to represent views from the nearest recreation area. The 880-acre White Slough WA provides opportunities for hunting, fishing, hiking, and wildlife viewing, and typical viewers from this KOP are likely people participating in one or more of those activities. The White Slough WA includes a series of man-made ditches, canals, borrow ponds, freshwater marshes, grassland, riparian habitat, and constructed ponds. From this location, near Pond 11, the LEC and STIG plant are visible, with the exhaust stacks being most prominently visible. Some of the structures associated with the WPCF are also visible to the east of the STIG plant. Views of the project site like this one are available from throughout the eastern edge of the White Slough WA. There are very few locations in which topography or vegetation obstruct views of the STIG plant.

The foreground of this view includes land that has been only minimally developed. However, a short distance beyond the fence, in the middleground of this view, there is land currently under agricultural production that appears to extend almost completely from one side of this view to the other. Toward the background of this view are the already noted LEC, STIG plant, and WPCF structures. The existing

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[3] See Section 5.12, Traffic and Transportation. California Department of Transportation data from 2012 reported an average daily traffic volume of 79,000 vehicles on I-5 near the interchange with State Route 12 and 82,000 vehicles near the interchange with Eight Mile Road.

[4] The San Joaquin County General Plan identifies scenic routes and includes in its Open Spaces Element a policy on Scenic Route Enhancement. This policy states that the County shall: (a) initiate a program to enhance its scenic routes by litter removal programs, route identification signs, and provision of parking at desirable viewpoints; (b) require landscape plans for development along scenic routes; and (c) include in the Design Review Manual guidelines for development in the viewshed of the scenic route.

transmission lines pass through the middleground in the northern edge of this view, and extend into the horizon in the southern edge.

Applying the view rating scale presented in Table 5.13-1, this view is rated as having a moderately low level of visual quality. There is no distinctive pattern evident in the landscape and thus there is a low level of vividness present in the view. The industrial facilities and transmission lines in the middle-ground contrast with the less developed—albeit still disturbed—land closer to the viewer. As such, there is a moderately low level of visual intactness. Further, despite the appearance throughout the fore- and middleground of land that is under production, the dominant uses themselves contrast visually and result in a moderately low level of visual unity.

Because this view represents the view from an area that provides opportunities for recreation, the level of visual sensitivity is moderate.

5.13.1.4.4 KOP 4 – View from King Island Road to the Well Pad

Figure 5.13-5 depicts the view from KOP 4 (KOP 4A) from along King Island Road, looking to the south toward the proposed location of the eastern well pad, from which the western well pad would also be visible. This viewpoint was selected due to its proximity to the well pad site, its elevated viewpoint, and because it is the primary private, yet publicly accessible road in the vicinity of the well field, though likely traveled only infrequently by ranchers and the technicians servicing the existing gas production well.

The existing view from this location indicates the predominance of agricultural uses in the area. The well field would exist entirely within existing orchards. Thus, there is a moderate degree of vividness (when trees have leaves or are in bloom) and an intactness resulting from the presence of orchards that is offset, somewhat, by the presence of existing distribution poles, which extend above the orchard. Overall, the view has a moderate degree of visual unity; its visual character is clearly defined by the preponderance of visible agriculture. Applying the scale presented in Table 5.13-1, this view is rated as having moderate visual quality.

A second view from KOP 4 (KOP 4B) is included here in order to show the view to the east from the same location (see Figure 5.13-6) and the relationship between the proposed well pad location and White Slough, within which recreational fishing activities were observed during the site visit. The LEC is approximately 2 miles from KOP 4. Given the height of the levee road and the relatively depressed elevation of the proposed well pad site, project facilities would not likely be visible from within White Slough.

5.13.1.4.5 Supplemental Views from Eight Mile Road

Figures 5.13-6 and 5.13-7 show supplemental views included here not as recommended KOPs but for indication of the project's likely visibility from two locations where viewer sensitivity is presumed to be moderate to high. These locations were not selected as KOPs for which more formal analysis would be conducted because of distance between these viewpoints and the project location and also due to proposed project's presumed low degree of prominence in the view. They are discussed here to provide an account of the local area's visual resources characteristics from the nearest areas to the KICP having higher density of residential viewers.

Figure 5.13-6 depicts the view from Viewpoint 1, approximately 2.6 miles south of the ECF site, along the westbound shoulder of Eight Mile Road, which is a County-designated scenic route. This view is intended to represent the residential view from the homes on the southern side of Eight Mile Road, part of the Spanos Park development, and west of the shopping center. This neighborhood is densely populated relative to the surrounding area. There are homes along an approximately three-quarter-mile-long segment of the roadway that would have a view toward the project site similar to this one, in which the proposed facility

would be located directly beyond the LEC. To that extent, the majority of the proposed project would be obscured by the existing power plant and nearby facilities, and would likely not occupy a substantial portion of the horizon.

Figure 5.13-7 depicts the view from Viewpoint 2, approximately 2.9 miles south-southeast of the ECF site, located at the entrance to Oak Grove Regional Park. Similar to the view from Viewpoint 1, the proposed project would likely not be prominently visible from this location, appearing from this location to be adjacent to the right of the LEC and STIG facilities along the horizon of the view.

5.13.2 Environmental Analysis

This section summarizes the California Environmental Quality Act (CEQA)-based criteria, upon which the analysis of the proposed project's environmental effects would eventually be made. Project appearance is briefly summarized, followed by a preliminary discussion of likely project impacts. Formal, photo-realistic simulations have not been produced for this analysis. As such, no assessment of visual effects for each of the KOP views is included here. This step can be completed for the formal filing of an Application for Certification for the KICP. However, Figure 5.13-3a shows a preliminary, refined mass-model simulation in the view from KOP 2, which is the most proximate KOP that would allow the ECF site to be completely visible. This rendering allows for preliminary conclusions about the project's scale and potential visibility, which are discussed in Section 5.13.2.3.

5.13.2.1 Impact Evaluation Criteria

The following criteria from the CEQA Guidelines were considered in determining whether a visual impact would be significant.

The CEQA Guidelines define a "significant effect" on the environment to mean a "substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project including…objects of historic or aesthetic significance" (14 California Code of Regulations (CCR) Section 15382).

Appendix G of the CEQA Guidelines, under Aesthetics, lists the following four questions to be addressed regarding whether the potential impacts of a project are significant:

1. Would the project have a substantial adverse effect on a scenic vista?
2. Would the project substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a State Scenic Highway?
3. Would the project substantially degrade the existing visual character or quality of the site and its surroundings?
4. Would the project create a new source of substantial light or glare that would adversely affect day or nighttime views in the area?

5.13.2.2 Project Appearance

Section 2.0, Project Description, provides full detail of the proposed project and its components. In brief, the ECF would include compressors, turbo-expanders, generators, switchyard, transmission interconnection, and cooling equipment. The 100-foot-tall turbo-expander stack is anticipated to be the tallest project structure. This would shorter than the nearby 150-foot-tall LEC exhaust stack. Other ECF components are anticipated to closely resemble the nearby LEC and STIG facilities in terms of form, color, and materials.

The two well pad areas combined would have up to 30 I/W wells. Each well pad area would have a storage warehouse and a control building. The control building, various electrical equipment, and other items meeting flood design criteria will be mounted on a platform elevated approximately 11 feet above the ground. The tallest of the facilities would be the control building, with an anticipated height of 10 feet above the platform height. The rest of the project facilities, including the pipeline networks, pumps and water storage tanks would be located at ground level and therefore do not factor into this discussion.

The project lighting system is intended to provide personnel with illumination for operation under normal conditions and for egress under emergency conditions. Lighting would be designed to minimize light escaping the site into the surrounding areas utilizing techniques such as local task lighting, motion detection, and directional lighting hoods.

Water vapor plumes emanating from the proposed cooling tower at the ECF would only occur during very cool weather with relatively high humidity, at night, or in the early morning hours. These may be times when the air compressors are operating. Cooling tower plumes would not be visible during warm weather. The height of the plume (whether visible or not) would be a function of the buoyant rise of the air. The width of the visible water vapor plume would depend on the length of time it takes for the plume to be diluted with ambient air, such that the moisture content of the air drops below the dew point, and hence the plume becomes visible.

5.13.2.3 Impact Significance

A preliminary discussion regarding whether the visual effects of the project would be likely to be significant pursuant to CEQA is provided below. The assessment of these impacts has been structured by applying the criteria set forth in Appendix G of the CEQA Guidelines, with the assumption that formal analysis of potential visual impacts will be conducted for the project. The CEQA Guidelines define a "significant effect" on the environment to mean a "substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project, including objects of historic or aesthetic significance." (14 CCR Section 15382) The four questions related to aesthetics that are posed for lead agencies and the answers to them are:

Would the project have a substantial adverse effect on a scenic vista?

No. There are no State-designated scenic roads or vista points in the nearby (2-mile radius) project viewshed.

Would the project substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?

No. This question does not apply to the proposed project because none of the project facilities fall within the boundaries of a state scenic highway.

Would the project substantially degrade the existing visual character or quality of the site and its surroundings?

No. The project area, and the ECF site in particular, is adjacent to an existing industrial area that is itself surrounded primarily by land dedicated to mechanized agriculture (large-scale crop production and grazing). The project area's existing visual character reflects several layers of human use. Along with the existing LEC, STIG plant, WPCF, and large-scale agricultural uses, three separate lattice steel tower electric transmission lines of substantial size (230-kV) pass through the site vicinity. In addition, constructed ponds and waterways are the dominant landform in the area west of the ECF site, near the

proposed well pad sites. In short, this is a highly engineered landscape, put into a variety of production-oriented uses.

As indicated, the project would likely be visible in views from KOPs 1, 2, 3, and 4. Figure 5.13-3a includes a preliminary, refined mass-model simulation of the ECF to depict the view from KOP 2 with the project in place. In this view, project facilities would be prominent, expanding the horizontal space currently occupied by power-related structures, including nearby transmission lines. Based on this approximation, project facilities would likely dominate the view from KOP 1, given the proximity of the KOP. In other views, however, the project would likely be visually absorbed into the overall setting, to varying degrees. The ECF would particularly be absorbed into its immediate surroundings, which are predominantly industrial in character at present. The relatively tall structures (the stacks) added to the landscape as a result of the project would be consistent with the tallest structures at the nearby LEC, and it is anticipated that other project components would relate to the LEC and STIG facilities in terms of their similarity in form, shape, and color. The preliminary simulation in Figure 5.13-3a indicates the comparative scale of the proposed structures as seen from KOP 2. The presence of the project would likely not substantially degrade the visual character of the views from I-5 or the White Slough WA. The existing envelope of industrial-appearing development would appear expanded in some views, to degrees that would be less substantial with greater distance from the ECF site. At the well pads, the removal of orchard trees required for installation would be visible in adjacent views but the gap in vegetation would likely decrease in visibility after rather short distances. Some structures may be visible above the trees, though the duration of such visibility depends on the final height of the structures and the ultimate height of the surrounding trees.

Because of the character of the area and the presence of other plumes from other nearby sources, including the existing facility, cooling tower vapor plumes that would occur at the EFC would not be likely to result in a significant impact on the visual character of the area. Plumes emitted from the proposed plant would not significantly detract from views of the area.

Would the project create a new source of substantial light and glare that would adversely affect day or nighttime views in the area?

No. As described in Section 5.13.2.2, project light fixtures would be restricted to areas required for safety, security, and operations, and lighting would be directed onsite. These measures would substantially reduce the offsite visibility of project lighting. Because adjacent uses to the south (namely, LEC and STIG) currently have nighttime lighting, the lighting associated with the ECF is not likely to create a substantial change in nighttime lighting at the site. If materials used in construction of the proposed project are similar to those used at nearby facilities, particularly LEC, major project features should not have highly reflective surfaces and should therefore not be a source of daytime glare.

5.13.3 Laws, Ordinances, Regulations, and Standards

This subsection describes the LORS relevant to the visual resource issues associated with the KICP. The project site includes lands under the jurisdiction of City of Lodi and lands under the jurisdiction of San Joaquin County. As such, he project is subject to all visual resources-related LORS contained within the City of Lodi General Plan and City of Lodi Municipal Code, and San Joaquin County General Plan policies related to scenic routes also apply to the project. No federal or state visual resources LORS apply to the proposed project.

Table 5.13-2 lists the plans and ordinances that are pertinent to the project elements.

TABLE 5.13-2
Laws, Ordinances, Regulations, and Standards for Visual Resources

LORS	Requirements/Applicability	Administering Agency
City of Lodi General Plan (2010)	Comprehensive long-range plan to serve as the guide for the physical development of the City.	City of Lodi Community Development Department, Planning Division
City of Lodi Development Code—Municipal Code Title 17 (2013)	Establishes zoning districts governing land use and the placement of buildings and district improvements.	City of Lodi Community Development Department, Planning Division
San Joaquin County General Plan (2010)	Comprehensive long-range plan to serve as the guide for the physical development of the County.	San Joaquin County

5.13.3.1 City of Lodi General Plan Urban Design and Cultural Resources Section

The LEC site is on land incorporated into the City of Lodi and is therefore subject to the provisions of the City of Lodi General Plan. As described in Section 5.6, Land Use, the project site is designated Public/Quasi Public, which allows some industrial uses. The provisions of the City's General Plan that are therefore applicable to the visual resources-related facets of the project are summarized and evaluated in Table 5.13-3.

TABLE 5.13-3
Conformity with the City of Lodi General Plan Chapter 6: Parks, Recreation, and Open Space

Provision	Conformity?
Guiding Policy P-G2: Protect natural resource areas, native vegetation, scenic areas, open space areas, and parks from encroachment or destruction.	Yes. The proposed project would not encroach upon or destroy native vegetation, scenic areas, open space areas, or parks.

Source: City of Lodi, 2010.

5.13.3.2 City of Lodi Development Code—Municipal Code Title 17

The City of Lodi Development Code—Municipal Code Title 17 ("Municipal Code") implements the policies of the General Plan by classifying and regulating the uses of land and structures within the City of Lodi in a manner consistent with the General Plan. The Public and Community Facilities (PF) Zoning District is consistent with the Public/Quasi Public and the Detention Basins and Parks land use designations of the General Plan. The provisions of the Municipal Code that are applicable to the project are discussed in detail in Section 5.6, Land Use, and those that are related to visual resources are summarized in Table 5.13-4.

TABLE 5.13-4
Conformity with the City of Lodi Municipal Code

Provision	Conformity?
Lodi Municipal Code 17.26.040 Public and Community Facilities District Development Standards: Standards for development within the PF zoning district will be determined by the City through the project review process.	Yes. The CEC would consult the City of Lodi regarding conformance with its development standards during the licensing process.

Source: City of Lodi, 2013.

5.13.3.3 County of San Joaquin General Plan

The County of San Joaquin General Plan includes policies related to visual resources in the Open Space and Community Development Elements, as presented in Table 5.13-5.

TABLE 5.13-5
Conformity with the San Joaquin County General Plan 2010

Provision	Conformity?
Open Space Policy 10: Views of waterways, hilltops, and oak groves from public land and public roadways shall be protected.	Yes. The project would not eliminate views of any waterways or oak groves. In views from I-5, the proposed structures would obstruct views of some segments of the hills that are currently visible in the background. However, existing structures already obstruct substantial portions of the hills from viewpoints along I-5. In addition, these views are from vehicles typically moving at high speeds and are therefore intermittent and limited in duration.
Open Space Policy 13: Development proposals along scenic routes shall not detract from the visual and recreational experience.	There are no vista points or other important scenic viewpoints in the project vicinity. I-5 is a County-designated scenic road. Full analysis of visual effects from this viewpoint have yet to be determined.
Open Space Implementation Policy 7. Scenic Route Enhancement. The County shall: b) require landscape plans for development along scenic routes; and c) include in the Design Review Manual guidelines for development in the viewshed of the scenic route.	Yes. The project would be visible from both I-5 and Eight Mile Road, and it is anticipated that ultimate design of the project would adhere to the City's site review guidelines and, if required through coordination with the City of Lodi and CEC, a landscape plan would be developed for the project. The portions of the project located in unincorporated areas (well pads) would likely not be visible from scenic routes.
Community Development Policy 11: Development should complement and blend in with its setting.	Yes. The majority of the project would be constructed adjacent to existing industrial development (White Slough WPCF, LEC, STIG). The well pad locations are within recently planted orchards where visibility from outside viewpoints would be somewhat limited.
Community Development Policy 12: Aesthetics should be considered when reviewing development proposals.	Yes. It is assumed that aesthetics have been considered by identifying materials and finishes, addressing light and glare to reduce visual impacts.

Source: County of San Joaquin, 2005.

5.13.3.4 Summary of Project's Conformity with Applicable LORS

The project complies with applicable LORS related to visual resources issues.

5.13.4 Agencies and Agency Contacts

The agency responsible for the design review is the City of Lodi (Table 5.13-6).

TABLE 5.13-6
Agency Contacts for Visual Resources

Issue	Agency	Contact
Design review	City of Lodi Community Development Department, Planning Division	Community Development Secretary 221 West Pine Street P.O. Box 3006 Lodi, California 95241-1910

5.13.5 Permits and Permit Schedule

The required permit that is of the most direct relevance to visual resources issues is the Design Review, which includes site plan, architectural, and landscape elements. The City and County design reviews would take place through the CEC's consultation with these agencies during a power plant site certification (licensing) process.

TABLE 5.13-7
Permits and Permit Schedule for Visual Resources

Permit or Approval	Agency Contact	Schedule
Design Review including Site Plan and Landscape Plan review	Community Development Secretary City of Lodi Community Development Department, Planning Division 221 West Pine Street Lodi, California 95241-1910	CEC licensing Discovery Phase
Design Review including Site Plan review	San Joaquin County Community Development Department – Planning Division 1810 East Hazelton Avenue Stockton, CA 95205-6232	CEC licensing Discovery Phase

5.13.6 References

Buhyoff, G.J., P.A. Miller, J.W. Roach, D. Zhou, and L.G. Fuller. 1994. "An AI Methodology for Landscape Visual Assessments." *AI Applications* Vol. 8, No. 1, pp. 1-13.

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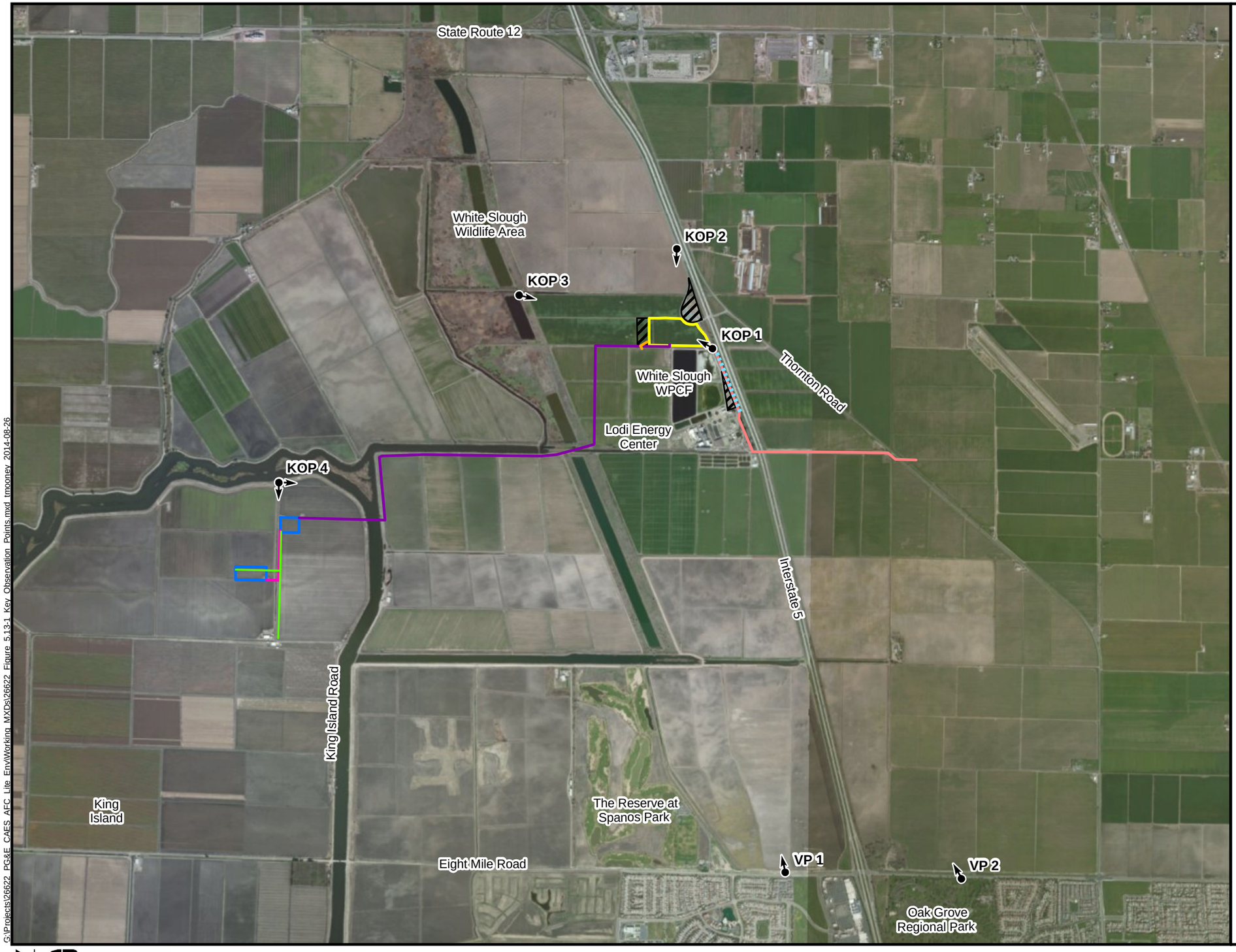
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KOP
Air Pipeline
Air Collection Pipeline
Gas Pipeline
ECF Generator Tie-Line
12kV Service Line
Water Supply Pipeline
Energy Conversion Facility (ECF)
Well Pad
Staging

This map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

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North State Resources, Inc.

PG&E King Island Compressed Air Energy Storage Project

Figure 5.13-1
Key Observation Points



View to the northwest toward the ECF site from the Bird Watchers parking lot. The proposed project site, currently under agricultural production with corn, is just north of the WPCF holding ponds.



View to the south toward the ECF site approximating that from the southbound lane of Interstate 5. The existing LEC and STIG facilities are visible in the left portion of the view, beyond the proposed ECF site.



Preliminary simulation of ECF from KOP 2. The existing LEC and STIG facilities would be mostly obscured by the new structures.

Figure 5.13-3a
Simulated View from Key Observation Point 2



View to the southeast toward the ECF site from within the White Slough Wildlife Area. The existing LEC and STIG facilities are visible in the right portion of the view and would appear to the right of the ECF.

Figure 5.13-4
Key Observation Point 3



View to the south toward the well field from King Island Road, a levee between King Island and White Slough. The intersection of distribution lines visible along the dirt road indicate the northwest corner of one of the proposed well pad locations.



View to the east toward the ECF from King Island Road. The existing LEC, visible near the center of the view, is approximately 2 miles away.



View to the north from Eight Mile Road near the Spanos Park residential subdivision in Stockton. The LEC is approximately 2 miles away from this location; the project site would located beyond the LEC.



View to the northwest from the entrance to Oak Grove Regional Park on Eight Mile Road in Stockton. The LEC is approximately 2 ½ miles away from this location; the project site would be located beyond the LEC.

5.14 Waste Management

This section evaluates the potential effects on human health and the environment from nonhazardous and hazardous waste generated by the construction and operation of the PG&E KICP. It summarizes the results of the Phase I Environmental Site Assessment (ESA) completed by Pacific Gas and Electric (PG&E) for the ECF site, which includes environmental database reports indicating the locations of previously reported environmental conditions, including previous hazardous materials handling locations, storage tanks, or reported spills.

If during construction or operation of KICP, contamination is found to be present at the Energy Conversion Facility (ECF), well pads, or along the project linears, this section provides the regulatory process required to address the issues.

5.14.1 Affected Environment

This section discusses the condition of the KICP site, in terms of the potential need to remove or otherwise treat contaminated soil or groundwater at the project site, and discusses the various nonhazardous and hazardous waste streams for KICP construction and operation.

5.14.1.1 Site Investigations

A Phase I ESA was undertaken at the ECF site to determine whether contamination requiring removal or remediation is present (ERM 2014a). This document concludes that there are no recognized environmental conditions or controlled recognized environmental conditions on the ECF site. A copy of the Final Phase I ESA is included in Appendix 5.14A.

A limited soil investigation was also conducted for the ECF site to determine if historical land use, particularly agricultural use, has resulted in subsurface contamination (ERM 2014b). Among other results, chemicals of concern that may have resulted from extended agricultural use of the property, specifically chlorinated herbicides and organochlorine pesticides, were not detected above the laboratory reporting limits in the samples taken. A copy of the limited soil investigation report is included in Appendix 5.14B.

The KICP site would get its process water supply from the City of Lodi's White Slough WPCF, and wastewater from the KICP site would be disposed of on site in a new Class I underground injection well (UIW) located at the well field. Potable water would be supplied via a new on site well. Further information regarding the UIW can be found in Section 5.15, Water Resources and in Appendix 2A. The facility would produce no reclaimable process wastewater, and there would therefore be no groundwater discharges associated with the proposed project.

5.14.1.2 Project Waste Generation

Wastewater, solid nonhazardous waste, and liquid and solid hazardous waste would be generated at the KICP site during facility construction and operation.

5.14.1.2.1 Construction Phase

During construction, the primary waste generated would be solid nonhazardous waste. However, some nonhazardous liquid waste and hazardous waste (solid and liquid) would also be generated. The types of waste and their estimated quantities are described below. Typical wastes generated during construction are identified in Table 5.14-1.

TABLE 5.14-1
Wastes Generated during Construction

Waste	Origin	Composition	Estimated Quantity	Classification	Disposal
Scrap wood, steel, glass, plastic, paper, calcium silicate insulation, mineral wool insulation	Construction Activities	Normal refuse	280 tons	Nonhazardous	Recycle and/or dispose of in a Class II or III landfill
Scrap Metals	Construction Activities	Parts, containers	<3 tons	Nonhazardous	Recycle and/or dispose of in a Class III landfill
Empty hazardous material containers*	Operations and maintenance of plant	Drums, containers, totes	<2 tons	Hazardous and nonhazardous solids	Containers <5 gallons would be disposed as normal refuse. Containers >5 gallons would be returned to vendors for recycling or reconditioning.
Spent welding materials	Construction Activities	Solid	2,800 lbs	Hazardous	Disposal at a Class I landfill
Waste oil filters	Construction equipment and vehicles	Solids	1,500 lbs	Nonhazardous	Recycle at a permitted TSD facility
Used and waste lube oil	Lube oil flushes	Hydrocarbons	8,000 gallons	Hazardous	Recycle at a permitted TSD facility
Oily rags, oil sorbent excluding lube oil flushes	Cleanup of small spills	Hydro-carbons	300 lbs	Hazardous	Recycle or dispose at a permitted TSD facility
Solvents, paint, adhesives	Maintenance	Solids and Liquids	450 gallons	Hazardous	Recycle at a permitted TSD facility
Spent lead acid batteries	Construction Machinery	Heavy metals	10	Hazardous	Store no more than 10 batteries (up to 1 year), recycle offsite
Spent alkaline batteries	Equipment	Metals	50 lbs	Universal Waste solids	Recycle or dispose offsite at an Universal Waste Destination Facility
Waste oil	Equipment, vehicles	Hydro-carbons	500 gallons	Non-RCRA Hazardous Liquid	Dispose at a permitted TSD facility
Sanitary waste	Portable toilet holding tanks	Solids and Liquids	250,000 gallons	Nonhazardous Liquid	Remove by contracted sanitary service
Fluorescent, mercury vapor lamps	Lighting	Metals and PCBs	20 lbs	Universal Waste solids	Recycle or dispose off site at an Universal Waste Destination Facility

TABLE 5.14-1
Wastes Generated during Construction

Waste	Origin	Composition	Estimated Quantity	Classification	Disposal
Chemical cleaning fluid waste	Pipe cleaning and flushing	Liquids	2500 gallons	Hazardous or nonhazardous liquid	Sample and characterize – if clean, dispose of in sanitary sewer; otherwise, manage appropriately off site

* Containers include <5-gallon containers and 55-gallon drums or totes
PCBs = polychlorinated biphenyls
RCRA = Resource Conservation and Recovery Act
TSD = treatment, storage, and disposal

Nonhazardous Solid Waste

Listed below are nonhazardous waste streams that could potentially be generated from construction of the ECF, well field, and project linears:

Paper, Wood, Glass, and Plastics—Approximately 280 tons of paper, wood, glass, and plastics would be generated from packing materials, waste lumber, insulation, and empty nonhazardous chemical containers during project construction. These wastes would be recycled where practical. Waste that cannot be recycled would be disposed of weekly in a Class III landfill. On site, the waste would be placed in dumpsters.

Metal—Approximately 3 tons of metal, including steel from welding/cutting operations, packing materials, and empty nonhazardous chemical containers, and aluminum waste from packing materials and electrical wiring would be generated during construction. Waste would be recycled where practical and non-recyclable waste would be deposited in a Class III landfill.

Wastewater

Wastewater generated during construction would include sanitary waste, stormwater runoff, equipment washdown water, and water from excavation dewatering during construction (if dewatering is required). Depending on the chemical quality of these wastewaters, they could be classified as hazardous or nonhazardous. As discussed in a later section, wastewater would be sampled and if found hazardous would be disposed of. Methods for disposing of nonhazardous wastewaters are identified in Section 5.14.1.2.2.

Hazardous Waste

Most of the hazardous waste generated during construction would consist of liquid waste, such as water from excavation dewatering (if it contains contaminants), flushing and cleaning fluids, and solvents. Some hazardous solid waste, such as welding materials and dried paint, may also be generated during construction.

Flushing and cleaning waste liquid may be generated as pipes are cleaned and flushed. The volume of flushing and cleaning liquid waste generated is estimated to be one to two times the internal volume of the pipes cleaned. The quantity of welding, solvent, and paint waste is expected to be minimal. Wastewater generated during construction could also be considered hazardous, if demonstrated so by sampling. Methods for recycling and disposal of hazardous wastes during construction are described in a Section 5.14.2.3.

The construction contractor would be considered the generator of hazardous construction waste and would be responsible for proper handling of hazardous waste in compliance with all applicable federal, state, and local laws and regulations. This responsibility would include licensing, personnel training, accumulation limits and times, and reporting and recordkeeping. The hazardous waste would be collected in satellite accumulation containers near the points of generation. It would be moved daily to the contractor's 90-day hazardous waste storage area located at the site construction laydown area. The waste would be removed

from the site by a certified hazardous waste collection company and delivered to an authorized hazardous waste management facility, before expiration of the 90-day storage limit.

5.14.1.2.2 Operation Phase

During KICP facility operation, the primary waste generated would be nonhazardous solid waste. However, varying quantities of both solid and liquid hazardous waste may also be generated periodically. The types of wastes and their estimated quantities are discussed below.

Nonhazardous Solid Waste

The KICP would produce facility wastes, typical of power generation facility operations and maintenance activities. These would include rags, air filters, metal and machine parts, defective or broken electrical materials, empty containers, typical refuse generated by workers and small office operations, and other miscellaneous solid wastes. The quantity of all solid nonhazardous waste generated is estimated to be approximately 2 tons per year. Large metal parts would be recycled.

Nonhazardous Wastewater

The water balance diagrams, provided in Figure 2.1-5, illustrate the expected liquid waste streams and flow rates for the KICP. The wastewater collection system would collect sanitary wastewater from sinks, toilets, and other sanitary facilities to be discharged to an on-site septic system.

General facility drainage would consist of area washdown, sample drains, equipment leakage, and drainage from facility equipment areas. Water from these areas would be collected in a system of floor drains, hub drains, sumps, and piping, and would be routed to the facility's oil/water separator. If needed, water from this sump would be sampled and analyzed at an approved lab. If contamination is present, the water would be trucked off site for disposal at an approved wastewater disposal facility. If sampling results show no contamination, the water would be discharged to WPCF, and the oily sludge would be shipped to an appropriate disposal facility.

Non-hazardous wastewater would also come from the I/W wells as native water entrained in the withdrawal stream and also as condensed vapor resulting from expansion of the compressed air on withdrawal. This water would be captured at the wellhead and re-injected into a non-potable aquifer situated geologically below the air reservoir using one of the injection wells at the well pad sites. For additional information, please see Section 5.15, Water Resources and Appendix 2C.

Hazardous Waste

Hazardous waste generated would include waste lubricating oil, used oil filters, and chemical cleaning wastes. Chemical cleaning wastes, consisting of alkaline and acidic cleaning solutions, may be generated from periodic cleaning of the piping. These wastes may contain high concentrations of heavy metals and would be collected for offsite disposal.

Floor drains would collect spillage, tank overflows, effluent from maintenance operations, and liquid from area washdowns. Water collected would be sampled and, if it is not contaminated, released to the WPCF. The quantity of this effluent is expected to be minimal.

Wastes potentially generated during operations at the facility are summarized in Table 5.14-2.

TABLE 5.14-2
Hazardous Wastes Generated During Operations

Waste	Origin	Composition	Estimated Quantity	Classification	Disposal
Lubricating oil	Small leaks and spills	Hydrocarbons	500 lbs/year	Hazardous	Cleaned up using sorbent and rags – disposed of by certified oil recycler

TABLE 5.14-2
Hazardous Wastes Generated During Operations

Waste	Origin	Composition	Estimated Quantity	Classification	Disposal
Batteries	Equipment	Metals	50 lbs/year	Hazardous	Recycled by certified recycler
Lubricating oil filters	Lubricating oil system	Paper, metal, and hydrocarbons	1,000 lbs/year	Hazardous	Recycled by certified oil recycler
Laboratory analysis waste	Water treatment	Various agents and reagents	400 gal/year	Hazardous	Recycled by certified recycler
Oily rags	Maintenance, wipe down of equipment, etc.	Hydrocarbons, cloth	One 55-gallon container (monthly)	Hazardous	Recycled by certified oil recycler
Oil sorbents	Cleanup of small spills	Hydrocarbons	200 lbs/year	Hazardous	Recycled or disposed of by certified oil recycler
Equipment washwater	Equipment cleaning	Water and biodegradable detergent possibly heavy metals	4,000 gallons/year	Hazardous/ nonhazardous*	TSD facility if hazardous; if nonhazardous to WPCF

* = Generally, nonhazardous would be sampled prior to disposal.

5.14.2 Environmental Analysis

5.14.2.1 Significance Criteria

According to California Environmental Quality Act Guidelines Section 15002(g), Appendix G, the project could have a significant effect on the environment in terms of waste management if it would do the following:

- Be located on a site which is included on a list of hazardous materials sites (Cortese List) compiled pursuant to Government Code Section 65962.5 and, as a result, would create a significant hazard to the public or the environment
- Have solid waste disposal needs beyond the capacity of appropriate landfills to accommodate them

The risks or hazards posed by the transportation of hazardous materials, including hazardous wastes, are described and analyzed in Section 5.5, Hazardous Materials Handling.

5.14.2.2 Cortese List

An examination of the California Department of Toxic Substances Control (DTSC) Hazardous Waste and Substances Site List (Cortese List) shows seven of the 57 sites currently on the list for San Joaquin County compiled pursuant to Government Code Section 65962.5 are located within the city limits of Lodi (DTSC, 2014a). The project site is located west of Interstate 5, approximately 5 miles southwest of the westernmost portion of Lodi and approximately 3 miles north of the northernmost portions of Stockton.

Of the seven sites within Lodi city limits, the site located in Lodi, California at 17 South Church Street is the closest to the KICP project site. The site is known as Guild Cleaners and is located on 0.5 acre. A dry cleaning operation has been located on this site since 1959 and perchloroethylene (PCE) had been used as a solvent for dry cleaning. PCE was detected in the groundwater in Municipal Well #3, located 0.25 miles from Guild Cleaners. The Regional Water Quality Control Board (RWQCB) has performed two soil gas surveys and sampled the sewer. The U.S. Environmental Protection Agency (EPA) completed a preliminary assessment of

the site in July 1991 and recommended closing two wells due to PCE and trichloroethylene (TCE) contamination. RWQCB was no longer actively working on the site as of June 30, 1992.

The KICP site is not located on a Cortese-listed site and is not affected by the Guild Cleaners site, or any of the other listed sites, due to the distances between them.

5.14.2.3 Solid Waste Disposal

Nonhazardous solid waste (often referred to as solid waste, municipal solid waste, or garbage) would be recycled or deposited in a Class III landfill. Hazardous wastes, both solid and liquid, would be delivered to a permitted offsite treatment, storage, and disposal (TSD) facility for treatment or recycling, or would be deposited in a permitted Class I landfill. The following sections describe the waste disposal sites feasible for disposal of KICP wastes.

5.14.2.3.1 Nonhazardous Waste

Approximately 280 tons of nonhazardous solid waste would be generated during construction of the KICP, and solid waste would continue to be generated during operation of the project. Other solid wastes would be recycled to the extent possible, and what cannot be recycled would be disposed of at a permitted landfill.

It is anticipated all excavated soil would be used onsite for grading and leveling purposes. In the event some of the excavated soil would not be reused onsite, classification of the soil for disposal would be made on the basis of sampling completed once the soil is excavated and stockpiled. Soil determined to be nonhazardous on the basis of the sampling conducted could be suitable for reuse at a construction site or disposal at a regional disposal facility, depending on the chemical quality.

Through San Joaquin County, the City of Lodi contracts with Central Valley Waste Services (CVWS) to provide local service for residential, commercial, and industrial solid waste hauling, as well as the collection of recyclable materials. CVWS operates a transfer and processing facility at 1333 East Turner Road in Lodi, approximately 10 miles northeast of the KICP project site. The CVWS Transfer and Processing Facility encompasses 16 acres and is permitted to receive 1,700 tons of waste per day.

The primary disposal facility is the county owned and operated North County Recycling Center and Sanitary Landfill located in Victor, approximately 20 miles from the KICP site. The North County Recycling Center and Sanitary Landfill has adequate capacity to handle and dispose of solid waste generated by the KICP facility, as shown in Table 5.14-3. The other landfills included in this table, Foothill Sanitary Landfill and Lovelace Materials Recovery Facility and Transfer Station, are alternatives to the North County Recycling Center and Sanitary Landfill.

TABLE 5.14-3
Solid Waste Disposal Facilities in the Vicinity of the KICP Project

Landfill/MRF/ Transfer Station	Location	Class	Permitted Capacity* (Cubic Yards)	Remaining Capacity* (Cubic Yards)	Permitted Throughput* (Tons per Day)	Estimated Closure Date*	Violation of Minimum State Standards Noted*
North County Recycling Center and Sanitary Landfill	Victor, CA	III	17,300,000 (prior to new module)	17,600,000	825	1/1/2035	No
Foothill Sanitary Landfill	Linden, CA	III	102,000,000	97,900,000	1,500	1/1/2054	No

TABLE 5.14-3
Solid Waste Disposal Facilities in the Vicinity of the KICP Project

Landfill/MRF/ Transfer Station	Location	Class	Permitted Capacity* (Cubic Yards)	Remaining Capacity* (Cubic Yards)	Permitted Throughput* (Tons per Day)	Estimated Closure Date*	Violation of Minimum State Standards Noted*
Lovelace Materials Recovery Facility and Transfer Station	Manteca, CA	Not Listed	1,959 tons/day	Not Applicable	1,300	Not Listed	No
CVWS Transfer and Processing Facility	Lodi, CA	Not Listed	2,914,286	Not Listed	1,700	Not Listed	No

*Based on CIWMB Solid Waste Information System Database (CIWMB, 2014a).

North County Recycling Center and Sanitary Landfill opened on November 1, 1991. North County is located at 17720 East Harney Lane, 8 miles east of Lodi, and approximately 20 miles east of the KICP project site. Encompassing 320 acres, this site receives an average of 496 tons of waste daily with a permitted quantity of 825 tons. A new 16-acre module constructed during the summer of 2003 is now operational. The closure date for this facility is expected in 2048.

According to the California Integrated Waste Management Board (CIWMB), North County Recycling Center and Sanitary Landfill has a maximum permitted capacity of 41.2 million cubic yards of refuse and the estimated remaining capacity as of December 31, 2009 was 35.4 million cubic yards, with the opening of the new module. According to the CIWMB, there were no violations reported against North County Recycling Center and Sanitary Landfill in the last 12 months (CIWMB, 2014a).

Foothill Sanitary Landfill has been owned by San Joaquin County since 1991, and operated by Foothill, Inc. since 1965. Foothill, Inc. is under an agreement with San Joaquin County. Foothill Sanitary Landfill is at 6484 North Waverly Road, approximately 30 miles east of the KICP site, near Linden. Foothill encompasses 800 acres and receives an average of 791 tons of waste daily with a permitted quantity of 1,500 tons. Annual waste received for 2004 was 284,903 tons. A new 34-acre module constructed during the summer of 2003 is now operational. Closure of the old module, which reached its capacity in 2003, and installation of a landfill gas system was completed in 2005. The closure date for the Foothill Sanitary Landfill is expected in 2082.

Lovelace Materials Recovery Facility (MRF) and Transfer Station is owned and operated by San Joaquin County. The facility was purchased on July 1, 1977 and remodeled during 1994 and 1995. Lovelace MRF is at 2323 East Lovelace Road, in Manteca, approximately 22 miles south of the KICP site. It encompasses 15 acres and is permitted to a maximum throughput of 1,300 tons per day. This site receives an average of 499 tons of waste daily, which is transported to Foothill Sanitary Landfill on county-owned transfer trucks carrying loads of up to 20 tons per truck.

Adequate landfill capacity exists; therefore, disposal of solid nonhazardous waste would not be a constraint on KICP development.

5.14.2.3.2 Hazardous Waste

Hazardous waste generated at the KICP facility would be stored at the facility for less than 90 days. The waste would then be transported to a TSD facility by a permitted hazardous waste transporter. These facilities vary considerably in what they can do with the hazardous waste they receive. Some can only store waste, some can treat the waste to recover usable products, and others can dispose of the waste by incineration, deep-

well injection, or landfilling depending on the waste type. Because incineration and deep-well injection of the materials specific to KICP are not permitted in California, only options for landfilling are discussed further.

According to DTSC, there are over 60 facilities in California that can accept hazardous waste for treatment and recycling (DTSC, 2014b). For ultimate disposal, California has the three hazardous waste (Class I) landfills (described below). The closest commercial hazardous waste disposal facility to the project site is the Waste Management Kettleman Hills Landfill.

Waste Management Kettleman Hills Landfill

This facility accepts Class I and II waste. Currently the landfill is permitted for and would accept all hazardous wastes except radioactive, medical, and unexploded ordnance; this landfill has permitted capacity of 10 million cubic yards. The life expectancy remaining for Landfill B-18 has been reached; however, expansion of the facility has been completed, and the closure date extended to 2036.

Clean Harbors Buttonwillow Landfill

This landfill is permitted at 14.3 million cubic yards (CIWMB, 2014a). At the current deposit rate, the landfill is permitted to accept waste until 2040 (CIWMB, 2014a). Buttonwillow has been permitted to accept all hazardous wastes except flammables, PCBs with a concentration greater than 50 parts per million, medical waste, explosives, and radioactive waste with radioactivity greater than 1,800 picocuries.

Clean Harbors Westmoreland Landfill

This facility is not currently open and accepting waste because the Buttonwillow facility can accommodate the current hazardous waste generation rate. The facility is, however, available in reserve and could be reopened if necessary. The landfill's conditional use permit prohibits the acceptance of some types of waste, including radioactive (except geothermal) waste, flammables, medical waste, PCB, dioxins, air- and water-reactive wastes, and strong oxidizers.

Additional Facilities

In addition to hazardous waste landfills, there are numerous offsite commercial liquid hazardous waste treatment and recycling facilities in California. Some of the closest facilities in the state include Clean Harbors, LLC in San Jose; Evergreen Environmental Services in Davis; Evergreen Oil Company in Newark; Ramos Environmental Services in West Sacramento; and Veoliaes (Onyx) Environmental Services in Richmond (DTSC, 2014b).

5.14.2.4 Waste Disposal Summary

The KICP facility would generate nonhazardous solid waste that would add to the total waste generated in San Joaquin County and in California. However, there is adequate recycling and landfill capacity in California to recycle and dispose of the waste generated by the KICP. It is estimated the KICP would generate approximately 280 tons of solid waste during construction (including approximately 5 tons of solid hazardous waste) and about 3.5 tons per year from operations (including approximately 1.5 tons of solid hazardous waste). Considering 1,160,533 tons of solid waste were landfilled in San Joaquin County in the year 2013, KICP's contribution would likely represent less than one percent of the county's total waste generation (CIWMB, 2014b). Therefore, the impact of the project on solid waste recycling and disposal capacity would not be significant.

Hazardous waste generated would consist of waste oil, filters, and fluids used to clean piping. The waste oil would be recycled. Hazardous waste treatment and disposal capacity in California is more than adequate. Therefore, the effect of the KICP on hazardous waste recycling, treatment, and disposal capability would not be significant.

5.14.3 Cumulative Effects

A cumulative impact refers to a proposed project's incremental effect together with other closely related past, present, and reasonably foreseeable future projects whose impacts may compound or increase the incremental effect of the proposed project.

The quantities of nonhazardous and hazardous wastes that would be generated during construction and operation of the KICP, furthermore, would be relatively low, at an estimated 280 tons of solid waste during construction and approximately 3.5 tons per year during operation. Recycling efforts would be prioritized wherever practical, and capacity is available in a variety of treatment and disposal facilities. There is currently sufficient landfill capacity available in the project area. Therefore, these added waste quantities generated by the KICP would not result in significant cumulative waste management impacts.

5.14.4 Mitigation Measures and Waste Management Methods

The handling and management of waste generated by the KICP would follow the hierarchical approach of source reduction, recycling, treatment, and disposal. The first priority would be to reduce the quantity of waste generated through pollution prevention methods (e.g., high-efficiency cleaning methods). The next level of waste management would involve reusing or recycling wastes (e.g., used oil recycling). For wastes that cannot be recycled, treatment would be used, if possible, to make the waste nonhazardous (e.g., neutralization). Finally, offsite disposal would be used to dispose of residual wastes that cannot be reused, recycled, or treated.

The following sections present methods for managing both nonhazardous and hazardous waste generated by KICP.

5.14.4.1 Construction Phase

Handling requirements and mitigation measures for the handling of wastes during construction are described in the following sections.

5.14.4.1.1 Nonhazardous Wastes

Nonhazardous solid waste generated during construction would be collected in onsite dumpsters and picked up periodically by CVWS. The waste would then be taken to the North County Recycling Center and Sanitary Landfill or another local landfill. Recyclable materials would be segregated and transported by construction contractors or other private haulers to an area recycling facility. CVWS can provide drop boxes or debris boxes for large quantities of recyclables.

Wastewater generated during construction would include sanitary waste and could include excavation dewatering water, equipment washwater, and stormwater runoff. Sanitary waste would be collected in portable, self-contained toilets. Excavation dewatering water would be contained in portable tanks and sampled prior to offsite disposal. Equipment washwater would be contained at designated wash areas and would be disposed of offsite. Stormwater runoff would be managed in accordance with a stormwater management permit, which would be obtained prior to the start of construction. The generation of nonhazardous wastewater would be minimized through water conservation and reuse measures.

5.14.4.1.2 Hazardous Wastes

Most of the hazardous waste generated during construction would consist of liquid waste, such as excavation dewatering water, flushing and cleaning fluids, and solvents. Some solid waste, in the form of welding materials and dried paint, may also be generated. Nonhazardous materials would be used whenever possible to minimize the quantity of hazardous waste generated. The construction contractor would be the generator of hazardous construction waste and would be responsible for proper handling in compliance with all applicable federal, state, and local laws and regulations, including licensing, training of personnel, accumulation

limits and times, and reporting and recordkeeping. The hazardous waste would be collected in satellite accumulation containers near the points of generation. This waste would be moved daily to the contractor's 90-day hazardous waste storage area, located at the construction laydown area. The waste would be delivered to an authorized hazardous waste management facility, before expiration of the 90-day storage limit.

5.14.4.2 Operation Phase

Handling requirements and mitigation measures for the handling of wastes during operation are described in the following sections.

5.14.4.2.1 Nonhazardous Wastes

Wastewater from facility sinks, toilets, and showers would be disposed of through an on-site septic system. Nonhazardous solid waste or refuse would be collected and deposited in a local landfill. Whenever practical, recycling would be implemented throughout the facility to minimize the quantity of nonhazardous waste that must be disposed of in a landfill.

5.14.4.2.2 Hazardous Wastes

To avoid the potential effects on human health and the environment from handling and disposing of hazardous wastes, procedures would be developed to ensure proper labeling, storage, packaging, recordkeeping, and disposal of all hazardous wastes.

Specifically, hazardous waste handling would include the practices of recovery and recycling, such as for waste lubricating oil and spent oil filters. Handling of hazardous wastes in this way would minimize the quantity of waste deposited to landfills.

5.14.4.3 Facility Closure

When the KICP is closed, both nonhazardous and hazardous wastes must be handled properly. Closure can be temporary or permanent. Temporary closure would be for a period of time greater than the time required for normal maintenance, including overhaul. Causes for temporary closure could be a disruption in the supply of natural gas, flooding of the site, or damage to the plant from earthquake, fire, storm, or other natural causes. Permanent closure would consist of a cessation in operations with no intent to restart operations and could result from the age of the project, damage beyond repair, economic conditions, or other unforeseen reasons. Handling of wastes for these two types of closure are discussed below.

5.14.4.3.1 Temporary Closure

For a temporary closure, where there is no release of hazardous materials, facility security would be deployed on a 24-hour basis, and the CEC would be notified. Depending on the length of shutdown necessary, a contingency plan for the temporary cessation of operations would be implemented. The plan would be developed to ensure conformance with all applicable laws and regulations, and for the protection of public health and safety and the environment. All wastes would be disposed of according to applicable laws, regulations, and ordinances.

5.14.4.3.2 Permanent Closure

The planned life of the generation facility is 30 years, although operation could be longer. When the facility is permanently closed, the handling of nonhazardous and hazardous waste and hazardous materials would be part of a general closure plan that would attempt to maximize the recycling of facility components. Unused chemicals would be sold back to the suppliers or other purchasers or users. All equipment containing chemicals would be drained and shut down to protect public health and safety and the environment. All nonhazardous wastes would be collected and disposed of in appropriate landfills or waste-collection facilities. All hazardous wastes would be disposed of according to applicable laws, regulations, and ordinances. The site would be secured 24 hours per day during the KICP decommissioning activities.

5.14.4.3.3 Monitoring

Because the environmental impacts caused by construction and operation of the facility are expected to be minimal, extensive monitoring programs would not be required. Generated waste, both nonhazardous and hazardous, would be monitored during project construction and operation in accordance with the monitoring and reporting requirements mandated by the regulatory permits to be obtained for construction and operation.

5.14.5 Laws, Ordinances, Regulations, and Standards

Nonhazardous and hazardous waste handling at KICP would be governed by federal, state, and local laws. Applicable laws and regulations addressing proper waste handling, storage, and disposal practices protect the environment from contamination and protect facility workers and the surrounding community from exposure to nonhazardous and hazardous waste. During construction and operation of KICP, waste management practices would be in accordance with all applicable federal, state, and local laws, ordinances, regulations, and standards.

The San Joaquin County Environmental Health Department, as the Certified Unified Program Agency (CUPA), is the local entity responsible for inspecting hazardous waste generators and reviewing their procedures for storage, treatment, and disposal of hazardous wastes and for environmental contamination issues and site re-development. The San Joaquin County Office of Emergency Services is a Participating Agency, assisting the CUPA, and administering additional waste management programs.

The San Joaquin County Environmental Health Department is certified by CIWMB as the Local Enforcement Agency (LEA) for solid waste facilities within the unincorporated area of San Joaquin County. The San Joaquin County Environmental Health Department would be responsible for administering and enforcing the CIWMA for solid, nonhazardous waste for the KICP.

5.14.6 Agencies and Agency Contacts

Several agencies, including EPA at the federal level, and DTSC and the California Environmental Protection Agency at the state level, regulate nonhazardous and hazardous waste and would be involved in the regulation of the waste generated by the KICP. The regulations, however, are administered and enforced primarily through the San Joaquin County Environmental Health Department, which is the designated CUPA.

5.14.7 References

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5.15 Water Resources

This section provides a discussion of the existing water resources in the KICP study area and assesses the potential effects of project construction and operations on water resources. Specifically, this chapter discusses the KICP and its potential effects in the following areas:

- Water supply and quality
- Disposal of wastewater
- Compliance with state water policies
- Stormwater discharge
- Flooding

5.15.1 Affected Environment

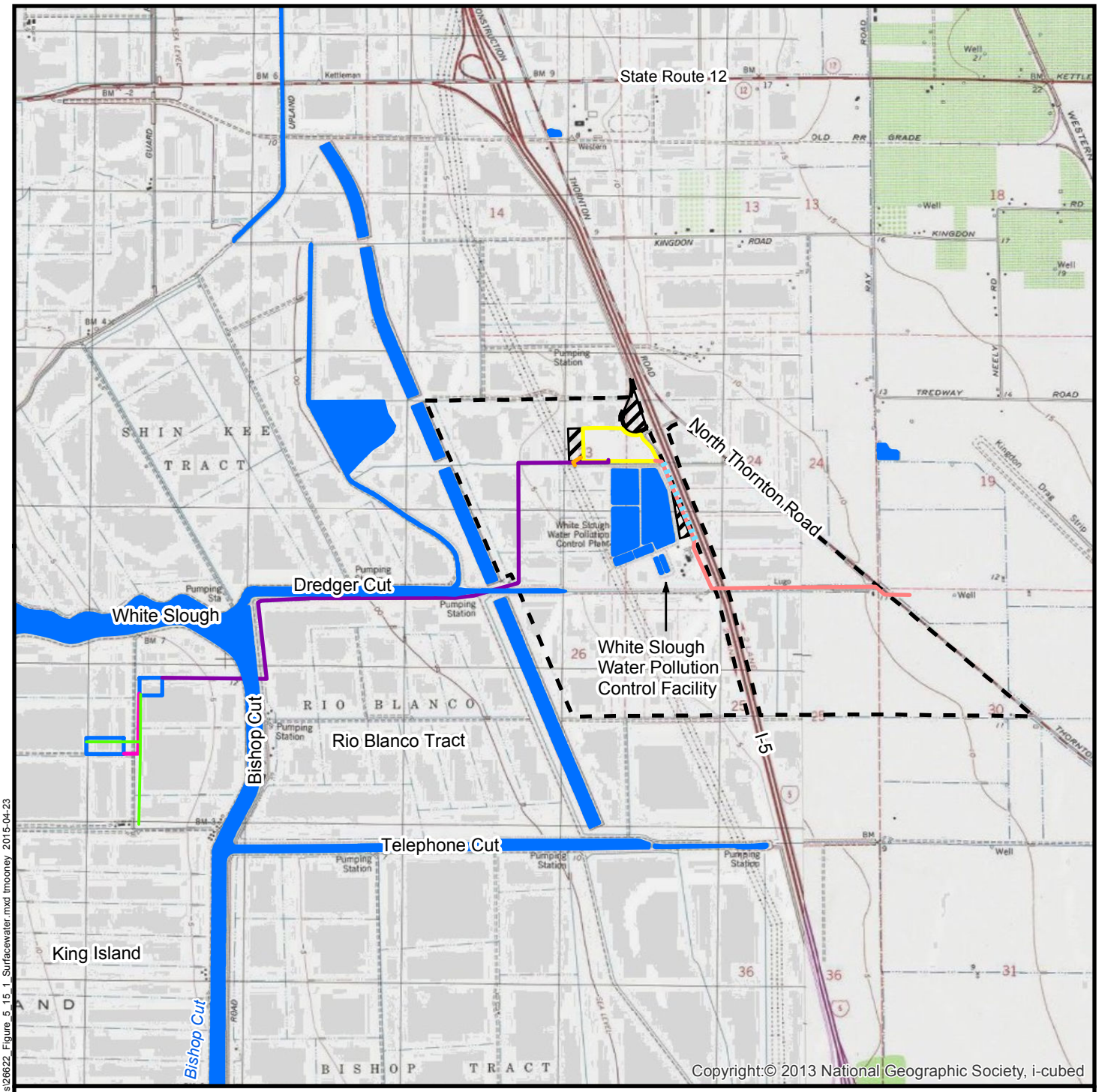
5.15.1.1 Water Features, Rainfall, and Drainage

The KICP components are on the eastern edge of the Delta (Figure 5.15-1). In the Delta region, the Sacramento and San Joaquin rivers converge with tidal action to produce a biologically rich estuarine environment. Over time, the Delta has been modified by channelization and water diversions for municipal, industrial, and agricultural uses, creating a regional patchwork of islands and tracts surrounded by natural and man-made channels and sloughs.

Major rivers in San Joaquin County include the San Joaquin, Mokelumne, Calaveras, and Stanislaus. The San Joaquin River originates in Fresno County, crossing southwestern San Joaquin County before terminating in the Delta. The Mokelumne, Calaveras, and Stanislaus rivers terminate in the San Joaquin River at or near the Delta. All of the major rivers in San Joaquin County have been modified by impoundments or diversion channels. The San Joaquin River also serves as a deep water shipping channel for transportation between the San Francisco Bay and the Port of Stockton.

The KICP ECF and well sites are located on irrigated agricultural lands. Crops near the ECF site are irrigated with recycled water from the White Slough WPCF that is pumped to lined ditches where siphon pipes are used to convey water to the fields. Field irrigation drainage is conveyed ultimately to the southwest corner of the City property where it is collected and re-processed by the WPCF. Portions of the gas pipeline are also within this recycled water drainage area. On King Island and Rio Blanco Tract, the orchards and vineyards are irrigated either with drip systems or by flood irrigation. The water is drawn from Bishop Cut or White Slough by siphons. Field drainage is collected by ditches and, as necessary, pumped back into either Bishop Cut or White Slough. White Slough flows to the west of the project site and continues to the San Joaquin River.

The KICP ECF, well sites, and air and gas pipeline ROWs are located within the jurisdiction of the Central Valley Regional Water Quality Control Board (RWQCB). The Central Valley RWQCB makes critical water quality decisions for its region, including setting standards, issuing waste discharge requirements, determining compliance with those requirements, and taking appropriate enforcement actions. The Central Valley RWQCB adopts water quality control plans, or Basin Plans, which establish water quality objectives to ensure the reasonable protection of beneficial water uses. For those waters not attaining water quality standards, the Central Valley RWQCB establishes total maximum daily loads (TMDLs) and a program of implementation to meet the TMDL. Table 5.15-1 lists the pollutants for which the Delta does not meet water quality objectives and proposed TMDL completion dates.



Rivers, Streams, and Canals
City of Lodi
Energy Conversion Facility (ECF)
Well Pad
Staging

Air Pipeline
Air Collection Pipeline
Gas Pipeline
ECF Generator Tie-Line
12 kV Service Line
Water Supply Pipeline

N

3,000 1,500 0 3,000
Feet

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North State Resources, Inc.

PG&E King Island Compressed Air Energy Storage Project

Figure 5.15-1
Surface Water Resources

Due to the Delta's complexity and size, the San Francisco Bay RWQCB also has consulting jurisdiction. The San Francisco Bay RWQCB also designates beneficial uses for the Delta, determines compliance with discharge regulations and takes appropriate enforcement actions. Water quality objectives for the Delta are contained in the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary prepared by the State Water Resources Control Board (SWRCB) (SWRCB, 1995).

TABLE 5.15-1
CWA Section 303 (d) List of Water Quality Impairments in the Delta

Pollutant/Stressor	Potential Sources	TMDL Completion
Chlordane	Nonpoint	2013
DDT	Nonpoint	2013
Dieldrin	Nonpoint	2013
Dioxin compounds	Atmospheric deposition	2019
Furan compounds	Atmospheric deposition	2019
Invasive species	Ballast water	2019
Mercury	Multiple	2008
PCBs (polychlorinated biphenyls)	Unknown nonpoint	2008
PCBs (dioxin-like)	Unknown nonpoint	2008
Selenium	Multiple	2010

Source: Central Valley RWQCB, 2008-2010 Approved 303(d) List

The southern portion of the ECF area is bordered by a drainage ditch that drains into White Slough. White Slough is to the west of the project site and ultimately drains to the Delta. There are no beneficial uses identified for White Slough in the Basin Plan (San Francisco Bay RWQCB, 2007a). Table 5.15-2 describes the water quality characteristics of the surface waters in the vicinity of the KICP site.

TABLE 5.15-2
Water Quality Characteristics of Surface Waters in the Vicinity of the KICP Site

Constituent	Dredger Cut (mg/L)	White Slough (mg/L)
Bicarbonate alkalinity ($CaCO_3$)	80	71
Total alkalinity ($CaCO_3$)	80	71
Hardness ($CaCO_3$)	86	74
Total dissolved solids (TDS)	200	150
Chloride	23	18
Sulfate	19	14
Calcium	18	16
Magnesium	10	8.9
Sodium	25	16

Notes:
mg/L = milligram per liter
$CaCO_3$ = calcium carbonate
Source: Beeler, 1990

Average rainfall in the region ranges from 8 inches per year south of the City of Tracy to 17 inches per year in the City of Lodi. Most of the precipitation occurs between December and April, while the summer

months are virtually rainless (San Joaquin County, 1992). Table 5.15-3 provides average historical rainfall from the meteorological station in Lodi.

TABLE 5.15-3
Average Rainfall near the Proposed Project Site (Lodi, California) (1893-2013)

Precipitation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average	3.43	2.94	2.71	1.31	0.61	0.15	0.03	0.04	0.27	0.93	1.93	2.92	17.24

Source: Western Regional Climate Center, 2014

5.15.1.2 Groundwater

The KICP project elements are within the Eastern San Joaquin Sub-basin of the San Joaquin Valley Groundwater Basin (Figure 5.15-2). The Eastern San Joaquin Sub-basin is defined by the areal extent of unconsolidated to semi-consolidated sedimentary deposits that are bounded by the Mokelumne River on the north and northwest, San Joaquin River on the west, Stanislaus River on the south, and consolidated bedrock on the east.

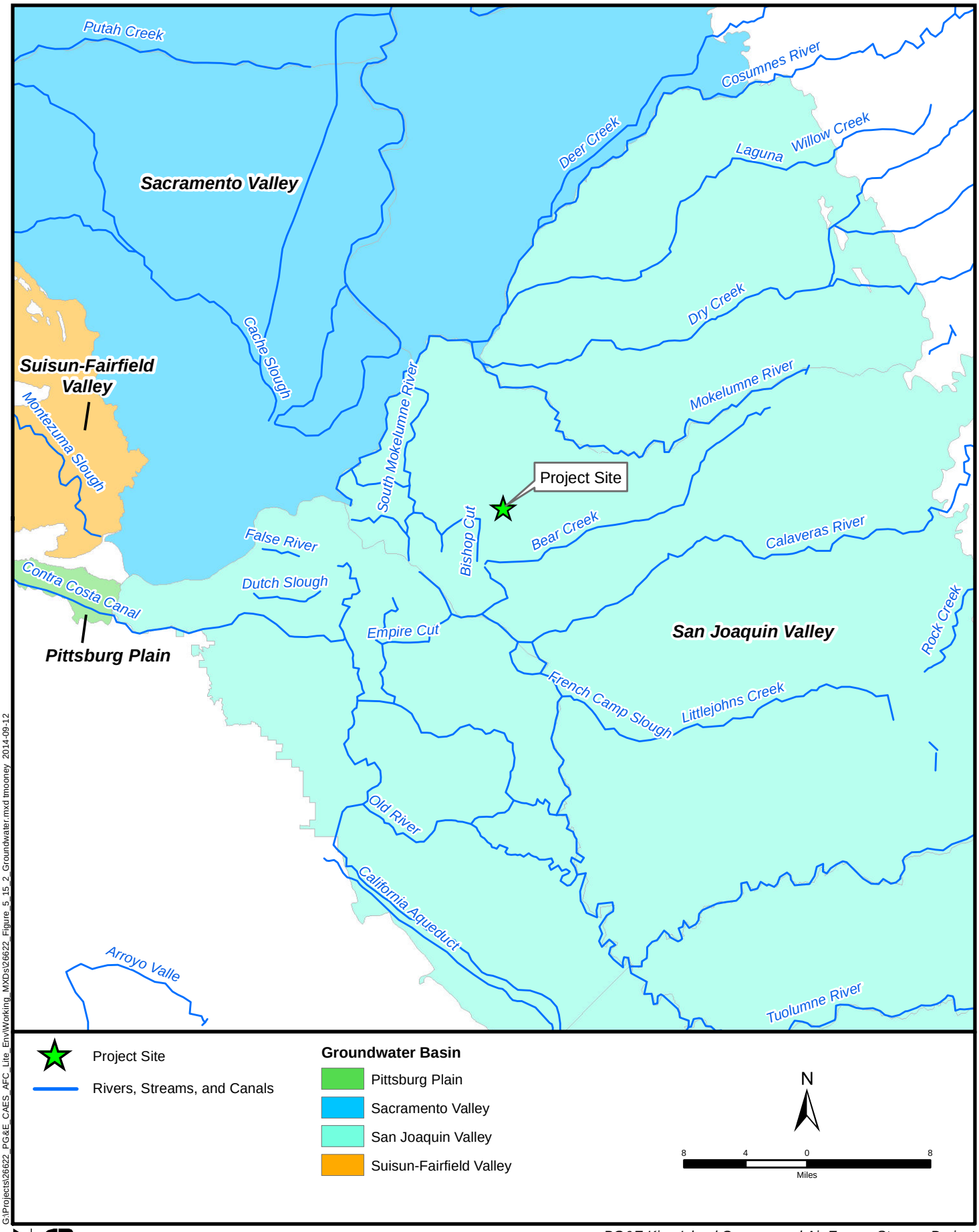
Unless otherwise designated by the Central Valley RWQCB or excluded based on the minimum beneficial use exception criteria described in Table 5.15-4, all groundwaters are considered suitable, or potentially suitable, at a minimum, for municipal and domestic water supply, in addition to agricultural, industrial service, and industrial process supplies.

TABLE 5.15-4
Minimal Beneficial Use Exception Criteria

Minimum Beneficial Use	Exception Criteria
Municipal and domestic water supply	TDS exceeds 3,000 mg/L (5,000 mhos/cm, electrical conductivity) and is not reasonably expected to supply a public water system
Municipal and domestic water supply, agricultural supply, industrial service supply, and industrial process supply	Contamination, either by natural processes or by human activity (unrelated to a specific pollution incident) cannot reasonably be treated for domestic use using either best management practices (BMPs) or best economically achievable treatment practices
Municipal and domestic water supply, agricultural supply, industrial service supply, and industrial process supply	Does not provide sufficient water to supply a single well capable of producing an average, sustained yield of 200 gallons per day (gpd)
Municipal and domestic water supply, agricultural supply	The aquifer is regulated as a geothermal energy producing source or has been exempted administratively pursuant to 40 CFR Section 146.4 for the purpose of underground injection of fluids associated with the production of hydrocarbon or geothermal energy, provided that these fluids do not constitute a hazardous waste under 40 CFR Section 261.3

Source: Central Valley RWQCB, 1998

Domestic wells in the Eastern San Joaquin Sub-basin range from approximately 25 to 993 feet in depth, averaging approximately 242 feet (DWR, 2006). Irrigation wells in the sub-basin range from approximately 75 to 780 feet in depth, averaging approximately 349 feet (DWR, 2006).



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Figure 5.15-2
Groundwater Resources

Groundwater elevations in the vicinity of the KICP fluctuate seasonally and in response to variations in precipitation from year to year (City of Lodi, 2006). Groundwater fluctuations are lowest near and to the west of the well pads because the Delta is subject to less pumping and more uniform recharge throughout the year. Groundwater elevations at production wells in the vicinity of the ECF site typically fluctuate by up to approximately 10 feet annually (City of Lodi, 2006). Groundwater elevation in the vicinity of the KICP site is also affected by local groundwater pumping. The primary use of groundwater in the area is agricultural.

Substantial groundwater recharge occurs in the vicinity of the KICP. Sources of groundwater recharge in the area include irrigation of Delta lands and seepage from related Delta waterways to the west, surface-water-irrigated lands to the north and east, percolation from WPCF storage ponds, and recharge from WPCF land application areas (City of Lodi, 2006).

Groundwater levels in the Eastern San Joaquin Sub-basin have shown a continuous decline over the past 40 years. Declining at a rate of 1.7 feet per year, groundwater levels in some areas of the sub-basin have dropped as much as 100 feet (DWR, 2006). These declining levels of groundwater have contributed to saltwater intrusion, impacting groundwater quality. Regionally, the hydrologic gradient and groundwater movement are controlled by a pumping cone of depression around the City of Stockton (located southeast of the project site) that persists throughout the year. This depression causes the groundwater to move in an east-southeasterly direction.

Due to saltwater intrusion, the majority of groundwater in the Eastern San Joaquin Sub-basin is characterized by calcium-magnesium bicarbonate or calcium-sodium bicarbonate types. Bicarbonate is predominant in the eastern part of the sub-basin. Large areas of chloride-type water occur along the western margin of the sub-basin along the San Joaquin River. Based on the analyses of 174 water supply wells in the sub-basin, TDS concentration ranges from 30 to 1,632 milligrams per liter (mg/L), with an average TDS of approximately 310 mg/L (DWR, 2006). Table 15.5-5 presents groundwater quality from a well near the ECF site.

TABLE 5.15-5
Groundwater Quality in the Vicinity of the ECF Site

Constituent	Quantity
TDS	600-700 mg/L
Calcium, magnesium	40 mg/L
Chlorine	10-20 mg/L
Sulfate	5 mg/L
Sodium, potassium	60-70 mg/L
Bicarbonate, carbonate	60-70 mg/L

Source: Lowney-Kaldveer Associates, 1975

During construction of the proposed injection wells, additional groundwater information would be obtained and submitted to the EPA. This information would include a TDS analysis to demonstrate either the presence or absence of any underground sources of drinking water and their quality. Within this submittal, well logs and representative water sample analyses would be submitted as evidence.

Groundwater at the ECF has been detected at depths ranging from approximately 7 to 9 feet below ground surface (Ninyo and Moore, 2014). Groundwater at the well pad sites is maintained at a level of approximately 6 to 8 feet below surface by a system of agricultural drains. Other surficial geologic deposits within 1 mile of the project features are described below.

5.15.1.3 Flooding Potential

Both the ECF and well pads are within Zone AE, as mapped by Federal Emergency Management Agency (FEMA). Zone AE is defined as a special flood hazard area where base flood elevations are provided, and is commonly referred to as the 100-year floodplain (1 in 100 chance of flooding in a given year).

ECF Site—Per FEMA Floodplain Insurance Rate Map (FIRM) Map Number 06077C0285F, dated October 16, 2009, the proposed ECF site is located in its entirety within Flood Zone AE with a base flood elevation of 10.0 feet (referenced to the North American Vertical Datum of 1988 [NAVD 88]) (Figure 5.15-3). Top of concrete foundation elevation for the site equipment is required to be at least 1.0 foot (per San Joaquin County code and standard engineering practices) above the 100-year, 24-hour storm drain event or flood elevation. Note that grade elevation at this location is 8 feet on average.

Well Pads—In addition to a site elevation of approximately 0.0 feet (average) for the east well pad and approximately 5 feet (average) below msl for the west well pad, the well pad sites are also within the 100-year floodplain and King Island is hydrologically isolated and surrounded by levees that protect it from flows and floodwaters from Bishop and Honker Cuts and White and Disappointment Sloughs. The well pads could be inundated, however, in the event of a levee breach. For this reason, critical equipment at the well pads would either be located on platforms elevated above the flood level and/or designed to cease operation safely in the event of a flood, per San Joaquin County guidelines and good engineering safety practices.

5.15.1.4 Water Supply

This section describes the quantity of water required, sources of the water supply, and water treatment requirements.

Process Water

ECF process water would be recycled water from the adjacent White Slough WPCF. An average of 1,101 acre-feet per year of recycled water would be used for cooling, as well as for NOx control and other industrial purposes. Due to the high level of reliability of water from the WPCF, no backup water supply is planned for the project at this time. After it is used, most process water would be discharged into new, onsite (either at the ECF and/or well pads) water injection wells at a rate of 282 gpm (annual average). However, during peak process water demand periods assuming the worst case process and temperature scenarios, the wastewater injection rate could increase to 1,354 gpm. A Class I UIC well permit application or applications would be submitted to the EPA Region IX Ground Water Office. Appendix 2A provides a sample UIC permit application template and analysis.

In addition to the above wastewater injection approach, a small amount of process water (e.g., wash water) would be collected for offsite disposal.

Table 5.15-6 is a summary of expected water quality of water from the WPCF.

TABLE 5.15-6
WPCF Water Quality Data

Parameter	Units	Value
Alkalinity – bicarbonate	mg/L	170.73
Alkalinity – carbonate	mg/L	0.00
Alkalinity – P-$BaCl_2$	mg/L	0.00
Barium	mg/L	0.00

TABLE 5.15-6
WPCF Water Quality Data

Parameter	Units	Value
Chloride	mg/L	66.00
Fluoride	mg/L	0.00
Calcium	mg/L	32.00
Magnesium	mg/L	12.00
Iron	mg/L	0.09
Nitrate	mg/L	40.00
pH	Standard units	8.30
Phosphate	mg/L	0.40
Potassium	mg/L	15.00
Silica	mg/L	69.00
Sodium	mg/L	72.00
Sulfate	mg/L	31.00
TDS	mg/L	508.22
Specific conductance	µS/cm	667.05
Free CO_2	mg/L	1.42
Total cations	mg/L $CaCO_3$	305.84
Total anions	mg/L $CaCO_3$	355.60
Total hardness	mg/L $CaCO_3$	129.44

Notes:
mg/L $CaCO_3$ =
µS/cm = microsiemens per centimeter
Source: NALCO, 2008

Domestic and Sanitary Water Use

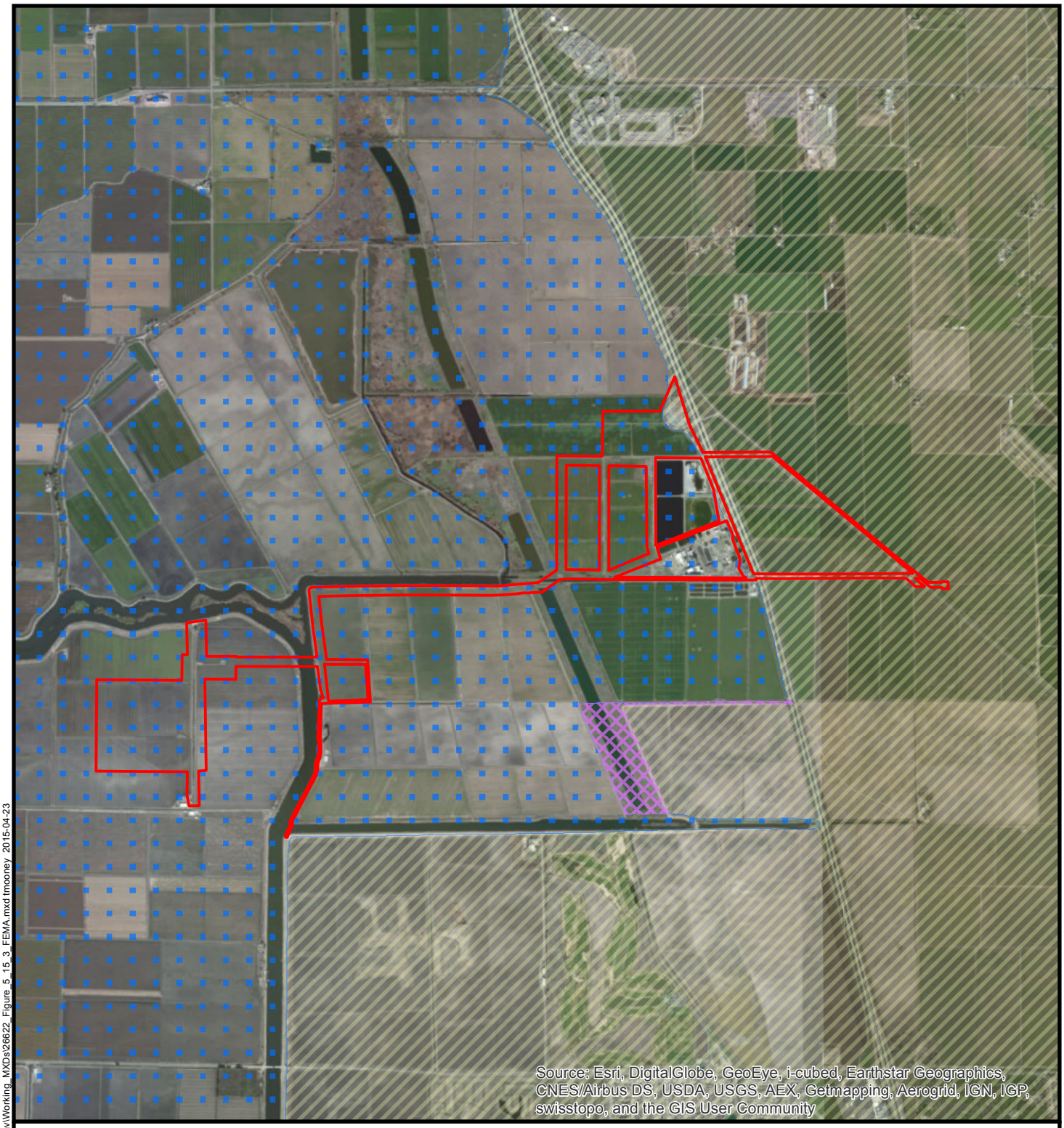
Potable water would be used for domestic uses, such as: drinking, washing, eye-wash stations, and sanitary facilities. The KICP would obtain potable water from a new onsite groundwater well, using an estimated 0.8 acre-feet of water per year (720 gpd). Disposal of water for domestic uses would be to a new onsite septic system.

Water Supply during Construction

Construction of the KICP is scheduled to last approximately 24 months. The entire 20.3-acre ECF site, 6-acre western well pad, and 4-acre eastern well pad would be graded during construction. In addition, excavation would take place for the recycled water supply, natural gas, and air pipelines. During construction, water would be required primarily for dust suppression (12 hours per day). Construction activities would require a relatively limited amount of water (an average of approximately 50 gpm and approximately 200 gpm for 1 hour for dust control and soil compaction, at peak use). The construction water supply for the ECF would come from the WPCF and municipal water sources for the well pads.

5 .15.1.5 ECF Wastewater Collection, Treatment, Discharge and Disposal

Wastewater from the ECF would be discharged directly to a Class I underground injection well that would be constructed on the ECF site and/or piped to the injection well(s) located at the well pads. For the base-case scenario, on an annual average basis, the ECF would discharge 282 gpm of process wastewater that would be injected into the well(s). The highest volume anticipated from the ECF (see below for additional



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Figure 5.15-3
FEMA Map

flow of well pad produced water) would be 1,354 gpm during high ambient temperature conditions, 100 percent dispatch, and worst-case equipment scenarios. A Class I underground injection well permit package would be submitted to the EPA Region IX Ground Water Office. Appendix 2A contains a sample/draft UIC permit application package and Chapter 2.0 includes selected water balance diagrams (excluding produced water from the well pads).

The plant washwater from the equipment drains would pass through an oil-water separator and wastewater sump before it is discharged to the atmosphere through evaporation in the cooling tower. The oil and sludge removed from the washwater would be disposed of offsite. Sanitary wastewater would be minimal and would be discharged to a new onsite septic system.

5.15.1.6 Produced Water/Condensate

It will also be necessary to dispose of water produced during normal operations at the well pads. Reservoir modeling has indicated that after the first few months and reservoir conditions have been stabilized, an estimated 5,000 barrels per day (bbl/day) of water could be produced and separated from the air flow stream during withdrawal operations. Note that this equates to approximately 146 gpm, based on modeling yet to be field verified and also on flows that are highly dependent on well field operating practices. During the early stages of withdrawal operations after the bubble building is complete, the water production is estimated at up to 12,000 bbl/day, reducing to the 5,000 bbl/day rate over the first 6 months. This produced water will need to be disposed of in one (or both) of the injection wells. On average, the produced water will amount to approximately 23 million gallons per year after the first 6 months of operation. Water would also be produced at the wells during the bubble build period, and would also be discharged to the injection wells.

5.15.1.7 Stormwater Runoff and Drainage

ECF—For the ECF, the site would be graded such that all runoff would be collected in the storm water retention pond where evaporation and infiltration is anticipated. When the storm water inflow exceeds the 50-year, 24-hour storm event design capacity of the retention pond, the excess storm water would be discharged through a series of small pipes and or a weir to the existing irrigation drainage channel on the south side of the ECF site. From here it would eventually flow in existing drainage channels to the southwest corner of the City property where it would be collected and re-processed by the WPCF. Table 5.15-7 presents the pre-development and post-development runoff volumes for the site.

TABLE 5.15-7
Maximum Pre- and Post-development Runoff for the 20-acre ECF Site and Well Pads

Area (acres)	Runoff Peak (cfs) – ECF Site	Runoff Peak (cfs) – Well Pads
Pre-development	14	10
Post-development	20	15

Note:
cfs = cubic feet per second

Runoff will increase for the post-development condition due to an increase in impermeable surfaces. However, paving would improve both the air and water quality due to the minimization of dust during the dry season and sedimentation of runoff during rain events.

Well Pads—The well pads would be elevated approximately 1 foot above the surrounding grade, sloped slightly to drain toward the perimeter, and surfaced with gravel resulting in minimal storm water runoff.

5.15.2 Environmental Analysis

Project effects on water resources can be evaluated relative to significance criteria derived from the CEQA Appendix G checklist. Under CEQA, the project is considered to have a potentially significant effect on water resources if it would:

- Substantially alter the existing drainage pattern of the site or area, including the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or offsite, or in flooding on- or offsite.
- Create or contribute runoff water which would exceed the capacity of existing or planned storm water drainage systems, or provide substantial additional sources of polluted runoff.
- Violate any water quality standards or waste discharge requirements, or otherwise substantially degrade water quality.
- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted).
- Place within a 100-year flood hazard area structures that would impede or redirect flood flows.
- Cause inundation by seiche, tsunami, or mudflow.

5.15.2.1 Construction Impacts

Drainage

At both the ECF and well pad sites, grading would establish a working surface for the construction and plant operating areas. In addition, grading would provide positive drainage away from all buildings, structures, and well pads while ensuring adequate ground coverage for all subsurface utilities. The ECF site (including temporary construction work areas), air and gas pipeline routes, and well pads are hydrologically isolated and do not have significant potential to drain into receiving waters of the state. Since the ECF site and surrounding agricultural fields are irrigated with recycled water, all runoff – storm water or agricultural – is captured and recycled by the WPCF. Since King Island and Rio Blanco Tract are flat and below sea level, minimal storm-water runoff is collected in drainage ditches which require pumping to return the water to the adjacent sloughs. As such, minimal surface-water impacts are anticipated to occur related to short-term construction activity. These impacts would be minor, and mostly consist of erosion of newly excavated or placed soils. These short-term impacts would be mitigated by compliance with engineering and construction plans and specifications, including approved grading and drainage plans. Furthermore, as required under the General Permit for Stormwater Discharges Associated with Construction Activity (SWRCB Water Quality Order No. 2009-0009-DWQ), a Storm Water Pollution Prevention Plan (SWPPP) would be prepared for all construction areas, and would include BMPs for erosion and sediment control. The SWPPP would be prepared prior to construction of the project to prevent the migration of sediments and other pollutants and to reduce the effects of runoff from the construction areas. With successful implementation of the SWPPP, construction impacts would be mitigated appropriately.

Water Quality

Due to general construction and soil excavation for the ECF, well pads, and linear appurtenances, there are potential water-quality impacts to surface water. In addition, construction materials could contaminate runoff or groundwater if they are not properly stored and used. Such impacts would be less than significant, however, because the project areas are hydrologically isolated and do not have significant potential to drain into receiving waters of the state. Runoff from the ECF that does not infiltrate into the retention pond or evaporation will be returned to the WPCF system for re-processing. Runoff in Rio Blanco Tract King Island collects in drainage ditches and is pumped into adjacent sloughs. In addition, the project will involve implementation of a SWPPP and the associated BMPs, including practicing proper housekeeping at all construction areas. As stated in the previous paragraph, a SWPPP is required under the General Permit for Stormwater Discharges Associated with Construction Activity for projects resulting in 1 or more acres of soil disturbance. SWPPP procedures include submitting a Notice of Intent (NOI) to the Central Valley RWQCB and developing the SWPPP prior to the start of construction activities. Thus, the SWPPP creation and implementation would prevent the offsite migration of sediment and other pollutants, and would reduce the effects of runoff from the constructions areas to offsite locations. This would also reduce construction impacts to water quality.

Furthermore, water used for dust control and soil compaction during construction would not result in discharge because only a minimal amount of water would be used. Therefore, no impact to water quality would occur as a result of runoff from dust control and soil compaction. In addition, during the construction period, sanitary waste would be collected in portable toilets supplied by a licensed contractor for collection and disposal at an appropriate receiving facility. Equipment washwater would also be collected and disposed of offsite as outlined in the SWPPP.

5.15.2.2 Operational Impacts

Drainage

The KICP ECF and well pad sites consist of undeveloped agricultural fields that would be converted to developed uses, including the construction of an energy production site and well pads. Due to the increase of impervious surfaces and compacted soils, there would be greater potential for runoff in the project area. To address this increase, grading and drainage plans would be developed consistent with applicable local regulations, and would address how runoff is to be managed. In addition, these plans would ensure that the site is protected from flooding (e.g., by raising equipment pad elevations), and that the project does not adversely affect the carrying capacity of the floodplain. Final ECF plans would include a storm water retention pond, which would be appropriately sized consistent with applicable local standards. No offsite runoff is anticipated for the ECF site and, if storm water volumes were to exceed the retention basin's capacity, the additional runoff would collect through the WPCF's recycling system and return to the WPCF. Runoff from the well pads not infiltrating through gravel surfacing will be directed into the adjacent agricultural area or through a runoff collection facility at the downgradient corner.

Water Quality

ECF—Operation of the KICP would result in the disposal of ECF process wastewater into a suitable subsurface formation. Disposal of wastewater using underground injection wells could result in the degradation of groundwater quality such that beneficial uses may be impaired. However, use of underground injection wells is regulated by the EPA. In its underground injection control permit application, the KICP would demonstrate that beneficial uses are protected.

Well Pads—In addition to the ECF process wastewater, produced water from the I/W wells would be captured at the well pads and returned belowground via the onsite water injection wells. This water would be disposed of in a geological formation below the underground sources of drinking water and so would not contaminate the sources of drinking water.

Waste Discharge Requirements

Wastewater from the KICP would be discharged to new onsite Class I underground injection wells to be constructed as part of this project. The wells would be permitted through the EPA UIC program, which strictly regulates the conditions on which a permit for Class I injection wells can be issued. Class I permits allow the injection of hazardous and nonhazardous fluids (industrial and municipal wastes) into isolated formations beneath the lowermost underground source of drinking water (EPA, 2004). The base case KICP operation would discharge up to 430 gpm of process and produced wastewater from the ECF and well pads, combined, to the underground injection well(s) on an average annual basis and, under worst-case maximum discharge conditions (ambient temperature and equipment operation), approximately 1,500 gpm.

Because wastewater discharge to the injection well would be permitted under the EPA UIC program, impacts to groundwater quality would be less than significant. A sample UIC permit application and permitting analysis is provided in Appendix 2A.

Groundwater

Onsite Well

The KICP would use potable water from a new onsite well for eye-wash stations and sanitary facilities, as needed. This well would be permitted through the San Joaquin Department of Environmental Health, as required by the City of Lodi Municipal Code, Chapter 8.08.

The onsite well would draw from the Eastern San Joaquin Sub-basin within the highly productive San Joaquin Valley Groundwater Basin. Well yields in the freshwater-bearing formation underlying the sub-basin range from approximately 650 to 1,500 gpm (DWR, 2006). The onsite well would have sufficient capacity to supply 720 gpd of potable water necessary for the KICP. The overall volume of potable water to be used by the KICP is less than 0.8 acre-foot per year on average with a maximum pumping rate of less than 1 gpm to a pressure tank. All pumped water would be consumptively used and no groundwater return flows are expected.

There are two aquifers in the KICP area. The upper aquifer is perched on top of an impervious zone and is found at depths of 2 to 14 feet (Lowney-Kaldveer Associates, 1975). The lower aquifer begins at a depth of about 50 feet and is of a higher water quality than the upper aquifer. For the KICP, the onsite well would be screened several hundred feet below the known area of low-quality shallow groundwater. The target aquifer is the Laguna Formation, which has average irrigation well yields of 900 gpm in the Eastern San Joaquin Sub-basin (DWR, 2006). The well would be screened at a sufficient depth to be unaffected by the existing shallow low-quality groundwater. Additional measures to protect the water quality of the well include:

- Cemented surface casing would be installed for 75 feet
- Vertical hydraulic gradients would be estimated annually using the existing shallow groundwater monitoring wells
- A sampling port would be installed at the well and the well would be sampled for general chemistry parameters, nitrates, and coliform at least annually

Given the low production rate of the onsite well relative to what the aquifer is capable of producing, the effect on local groundwater levels is expected to be negligible. An extensive monitoring well network exists for several miles surrounding the WPCF, which allows actual water level and water quality effects to be observed, if they are measurable. Operation of this well is not expected to have any measurable effect on production wells or surface water bodies within 0.5 mile of the KICP potable well or contribute to the migration of groundwater contaminants.

Groundwater is available within the Eastern San Joaquin Sub-basin to supply the KICP. In the vicinity of the KICP site, groundwater recharge and water-use returns exceed the current and expected future pumping, which occurs primarily for agricultural use. Sources of recharge in the vicinity of the KICP include irrigation of Delta lands and seepage from related waterways to the west, surface-water-irrigated lands to the north and east, percolation from WPCF storage ponds, and recharge from WPCF land application areas (City of Lodi, 2006). Because the KICP would not substantially deplete groundwater supplies such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level, impacts to groundwater are less than significant.

As described above, groundwater recharge in the vicinity of the KICP occurs from several sources. Once developed, the project would result in less than 20 acres of impervious surfaces, which would not interfere substantially with groundwater recharge and impacts are less than significant. Because the project would use only a small amount of water, the project is unlikely to affect groundwater quality. No changes in the existing physical or chemical conditions of groundwater resources are expected as a result of the KICP and no impacts to groundwater quality would occur.

Flooding Potential

ECF—The ECF site is in the 100-year flood plain (Zone AE) as defined by FEMA. The potential for a 100-year flood event to impact the site is medium to high. The KICP site is on the eastern edge of the Delta and is protected from the Delta by a system of levees. Weakness and instability within the Delta levee system has led to the creation of numerous programs targeted at repairing and maintaining the Delta levees. The City of Lodi Municipal Code Title 15 (Buildings and Construction) addresses flood damage prevention (Chapter 15.60) and sets guidelines for development in flood hazard areas. A development permit shall be obtained before construction or development begins within any area of special flood hazards (Lodi Municipal Code Section 15.60.070). Furthermore, all construction and development in flood hazard areas must adhere to the Standards of Construction in Section 16.60.140, Article III, Provisions for Flood Hazard Reduction. While the project could potentially expose people or structures to significant risk of loss, injury, or death resulting from levee failure, compliance with the Lodi Municipal Code would sufficiently mitigate any flood risk to a less-than-significant level. Furthermore, the KICP is not near the Pacific Ocean or on steep slopes, and any potential inundation from seiche, tsunami, or mudflow is remote.

Well Pads—The well pads are located on King Island in unincorporated San Joaquin County also within the 100-year floodplain and at a site elevation slightly below sea level, as described above. King Island is hydrologically isolated and surrounded by levees, but the well pads could be inundated in the event of a levee breach. For this reason, critical equipment at the well pads would either be located on platforms elevated above the flood level and/or designed to cease operation safely in the event of a flood, per San Joaquin County guidelines and good engineering safety practices.

5.15.3 Cumulative Effects

A cumulative impact refers to a proposed project's incremental effect together with other closely related past, present, and reasonably foreseeable future projects whose impacts may compound or increase the

incremental effect of the proposed project [Public Resources Code § 21083; CCR Title 14, § 15064(h), 15065(c), 15130, and 15355]. The identification of other projects and the potential for cumulative effects to reach a level of significance would be determined at the time a license application is prepared for the KICP.

5.15.4 Mitigation Measures

Mitigation measures beyond adherence to applicable LORS (see Section 5.15.5) are not needed to ensure that potential impacts to water quality are not significant.

5.15.5 Laws, Ordinances, Regulations, and Standards

Federal, state, and local LORS applicable to water resources and anticipated compliance are discussed in this section and summarized in Table 5.15-8.

TABLE 5.15-8
LORS for Water Resources

LORS	Requirements/ Applicability	Administering Agency
Federal		
CWA /Water Pollution Control Act. P.L. 92-500, 1972; amended by Water Quality Act of 1987, P.L. 100-4 (33 USC 466 et seq.); National Pollutant Discharge Elimination System (NPDES) (CWA, Section 402)	Prohibits discharge of pollutants to receiving waters unless the discharge is in compliance with an NPDES permit. Applies to all point-source discharges, including storm-water runoff from construction (including demolition).	See below under State and Local
Safe Drinking Water Act	Requires EPA to develop minimum federal requirements for UIC programs and other safeguards to protect public health by preventing injection wells from contaminating underground sources of drinking water.	EPA Region IX Ground Water Office 475 Hawthorne Street (WTR-9) San Francisco, CA 94105-3901
State		
Federal CWA (implemented by State of California)	Implements and enforces the federal NPDES permit program.	Central Valley RWQCB 11020 Sun Center Drive #200 Rancho Cordova, CA 95670-6114
Porter-Cologne Water Quality Control Act	Controls discharge of wastewater to the surface and groundwaters of California.	Central Valley RWQCB 11020 Sun Center Drive #200 Rancho Cordova, CA 95670-6114
Delta Protection Commission	An entity that plans for and guides the conservation and enhancement of the natural resources of the Delta. The KICP ECF site is located within the secondary zone which is not within the planning area of the Delta Protection Commission. The KICP well pads are within the primary zone and come under the Commission's planning area.	Delta Protection Commission 14215 River Road P.O. Box 530 Walnut Grove, CA 95690

TABLE 5.15-8
LORS for Water Resources

LORS	Requirements/ Applicability	Administering Agency
SWRCB Resolution No. 75-58; California Water Code Sections 13550, 13551, 461, and 13751; CEC Policy	Identifies statewide water-quality principles for adoption of discharge requirements and implementation actions for power plants. Provides guidance in the planning of new power plants to encourage the use of wastewater for cooling, thus minimizing the use of potable water. Encourages the conservation of potable water resources and the maximum reuse of wastewater to conserve potable water, particularly in areas where recycled water of adequate quality is available at a reasonable cost.	Central Valley RWQCB 11020 Sun Center Drive #200 Rancho Cordova, CA 95670-6114 California Energy Commission 1516 Ninth Street, MS-29 Sacramento, CA 95814-5512 Department of Water Resources 1416 9th Street Sacramento, CA 95814
Local		
San Joaquin County General Plan 2010, Section IV – Community Development, Section V – Public Health and Safety, Section VI – Resources	Addresses infrastructure services, flood hazards, and water resources and quality.	San Joaquin County, Community Development Department 1810 E. Hazelton Avenue Stockton, CA 95205
Title 9 – Development Title of San Joaquin County	Provides requirements for alteration of land within the County.	San Joaquin County, Community Development Department 1810 E. Hazelton Avenue Stockton, CA 95205
Improvement Standards for San Joaquin County	Provides design standards for improvements within the County.	San Joaquin County, Department of Public Works 1810 East Hazelton Avenue Stockton, CA 95205
San Joaquin County Standard Specifications and Special Provisions	Provides the County's minimum requirements for excavation safety, dust control, watering, earthwork, erosion, and pollution control.	San Joaquin County, Department of Public Works 1810 East Hazelton Avenue Stockton, CA 95205
Lodi Municipal Code	Provides requirements for development of land within the City limits, including land within flood hazard designations, and requirements for obtaining permits for water wells.	City of Lodi, Community Development Department 221 W. Pine Street Lodi, CA 95240

5.15.5.1 Federal Laws, Ordinances, Regulations, and Standards

In California, various discharges of wastewater and storm water into surrounding surface waters are regulated by the SWRCB and RWQCBs under the federal CWA and the state Porter-Cologne Water Quality Control Act. The KICP would discharge process water and wastewater to underground injection wells, domestic water to a septic tank, and storm-water runoff to surface drainages and to land. Relevant NPDES permits for storm-water quality management are discussed below under state and local LORS.

5.15.5.1.1 Safe Drinking Water Act

The Safe Drinking Water Act (SDWA) was originally passed by Congress in 1974 to protect public health by regulating the nation's public drinking water supply. The law was amended in 1986 and 1996, and requires many actions to protect drinking water and its sources. The EPA sets national standards for drinking water to protect against health risks, considering available technology and costs. These National Primary Drinking Water Regulations set enforceable maximum contaminant levels for particular contaminants in drinking

water or required ways to treat water to remove contaminants. The SDWA requires EPA to develop minimum federal requirements for UIC programs and other safeguards to protect public health by preventing injection wells from contaminating underground sources of drinking water. As a result, a permit from EPA is required to discharge to an underground injection well. The federal regulations for the UIC program are found in CFR Title 40.

5.15.5.2 State Laws, Ordinances, Regulations, and Standards

5.15.5.2.1 SWRCB Resolution No. 75-58; California Water Code Sections 13550, 13551, 461, and 13751; and CEC Policy

SWCRB Resolution No. 75-58 provides statewide water-quality principles for adoption of discharge requirements and implementation actions for power plants that depend on inland waters for cooling. This policy also provides guidance in the planning of new power plants to encourage the use of wastewater for cooling, thus minimizing the use of potable water. In addition, California Water Code Sections 13550, 13551, and 461 encourage the conservation of potable water resources and the maximum reuse of wastewater to conserve potable water, particularly in areas where recycled water of adequate quality is available at a reasonable cost. California Water Code Section 13751 requires a well completion report be filed with DWR within 60 days from the date of construction, alternation, abandonment, or destruction of a well is completed.

In the 2005 Integrated Energy Policy Report, the CEC adopted a policy requiring new power plants to use degraded or recycled water or air-cooled systems to reduce the amount of freshwater used for power plant cooling systems. Freshwater can only be used if alternative cooling methods would cause a significant adverse environmental impact or be economically or otherwise infeasible. Consistent with state law and the Integrated Energy Policy Report, the KICP would use recycled water from the City of Lodi for cooling and other industrial uses.

5.15.5.2.2 Industrial Storm Water NPDES Permit

The SWRCB implements regulations under the federal CWA requiring that point source discharges of storm water (which is a flow of rainfall runoff in some kind of discrete conveyance such as a pipe, ditch, channel, or swale) associated with industrial activity that discharges either directly to surface waters or indirectly through municipal separate storm sewers must be regulated by an NPDES permit. The ECF site is internally drained and storm-water runoff that exceeds the capacity of the retention basin will re-enter the WCPF processing system. The SWRCB has issued Waste Discharge Requirements (WDRs) for discharges of storm water associated with industrial activities (SWRCB Order 97-03-DWQ), excluding construction activities.

5.15.5.2.3 Construction Storm Water NPDES Permit

The federal CWA effectively prohibits discharges of storm water from construction sites unless the discharge is in compliance with an NPDES permit. The SWRCB is the permitting authority in California and has adopted a statewide General Permit for Stormwater Discharges Associated with Construction Activity (SWRCB Water Quality Order No. 2009-0009-DWQ) that applies to projects resulting in 1 or more acres of soil disturbance. The proposed project would result in disturbance of more than 1 acre of soil. Therefore, the project would require the preparation of a construction SWPPP that would specify site management activities to be implemented during site development. These management activities would include construction storm water BMPs, dewatering runoff controls, and construction equipment decontamination. The Central Valley RWQCB requires an NOI to be filed prior to prior to any storm-water discharge from construction activities, and that the SWPPP be implemented and maintained onsite. A Construction

Drainage Erosion and Sediment Control Plan/SWPPP would be completed prior to the beginning of construction activities.

5.15.5.3 Local Laws, Ordinances, Regulations, and Standards

5.15.5.3.1 San Joaquin County

Applicable San Joaquin County regulations include the General Plan 2010 (San Joaquin County, 1992), Development Title (LexisNexis Municipal Codes, 1995), Improvement Standards (San Joaquin County Department of Public Works, 1997), as well as the Standard Specifications and Special Provisions document (San Joaquin County Department of Public Works, 2008).

Sections of the General Plan that may be relevant to this project include Section IV (Community Development), Section V (Public Health and Safety), and Section VI (Resources). Infrastructure services are addressed in the Community Development section, flood hazards are addressed in the Public Health and Safety section, and water resources and quality are addressed in the Resources section of the plan.

The Development Title describes the requirements for land alteration within the County. Several of the Development Title divisions that may apply to this project include Division 11 (Infrastructure Standards and Requirements), Division 14 (Grading and Excavation Regulations), Division 15 (Natural Resources Regulations), and Division 16 (Safety Regulations). Specifically, Chapter 9-1400 of the San Joaquin County Ordinance provides a permitting process for construction excavation, grading, and earthwork within the County. The ordinance requires the preparation and submittal of a drainage, erosion, and sedimentation control plan to minimize impacts to waters of the State as a condition of securing a building permit.

The Improvement Standards document describes design standards for roads, storm drains, water systems, sewer systems, and fire access that would apply to onsite construction. The San Joaquin County Standard Specifications and Special Provisions document provides the County's minimum requirements for excavation safety, dust control, earthwork, watering, erosion control, and pollution control.

5.15.5.3.2 City of Lodi

Lodi Municipal Code Title 8 (Health and Safety), Chapter 8.08 (Water Wells) requires a (well) Boring Permit application be submitted to the San Joaquin Department of Environmental Health prior to placement of a well. A well or pump may be installed by property owners as long as work is accomplished in accordance with Chapter 8.08 of the Lodi Municipal Code.

Also, Lodi Municipal Code Title 15 (Buildings and Construction) addresses flood damage prevention and sets guidelines for development in flood hazard areas. A development permit shall be obtained before construction or development begins within any area of special flood hazards that exist within the City of Lodi limits. Application for a development permit shall be made on forms furnished by the floodplain administrator. In addition, prior to construction of the proposed site, a site preparation grading permit is required in accordance with Lodi Municipal Code Title 17 (Zoning). Furthermore, all construction and development in flood hazard areas must adhere to the Standards of Construction in Section 16.60.140, Article III, Provisions for Flood Hazard Reduction. While the project could potentially expose people or structures to significant risk of loss, injury, or death resulting from levee failure, compliance with the Lodi Municipal Code would sufficiently mitigate any flood risk to a less-than-significant level.

BMPs are required to be implemented to prevent, control, and reduce storm-water pollution for all construction within the City limits. At this time, there are no formal permits associated with BMPs because they are built into the City's construction and land development permit review. The KICP would conform to these requirements by preparing and submitting an application for the site preparation grading permit.

5.15.6 Agency Contacts, Permits Required, and Permit Schedule

Agency contacts for required permits are listed in Table 5.15-9.

TABLE 5.15-9
Permits and Permitting Agencies for Water Resources

Permit	Schedule	Agency
Application of Service for Recycled Water	Will-serve letter to be obtained prior to Application for Certification (AFC) filing	City of Lodi, Public Works Department P.O. Box 3006 Lodi, CA 95241-1910
Industrial Wastewater Discharge Permit	Apply for exemption prior to operation of the KICP	City of Lodi, Public Works Department P.O. Box 3006 Lodi, CA 95241-1910
NPDES General Permit for Construction	Submit NOI to use the permit at least 30 days in advance of use, prepare SWPPP for construction	Central Valley RWQCB 11020 Sun Center Drive #200 Rancho Cordova, CA 95670-6114
Site Preparation Grading Permit, Development permit for areas of special flood hazards	Prior to construction of the KICP	City of Lodi, Public Works Department P.O. Box 3006 Lodi, CA 95241-1910
Class I Underground Injection Well Permit	Prior to operation of the KICP	EPA Region IX Ground Water Office 475 Hawthorne Street (WTR-9) San Francisco, CA 94105-3901
(Well) Boring Permit Application	Submit permit application at least 48 hours prior to proposed commencement of work on water well	San Joaquin Department of Environmental Health Director of Environmental Health Donna Heran, REHS 600 E. Main Street Stockton CA 95202
Report of Completion	Submit within 60 days from the completion date of construction of the water well	Department of Water Resources 1416 9th Street Sacramento, CA 95814

5.15.7 References

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5.16 Worker Health and Safety

This section summarizes the worker health and safety issues that may be encountered during the construction and operation of the King Island CAES Project (KICP). Because of the subject matter, this section follows a slightly different format than other sections in Section 5.0. Instead of a following the affected environment/impact assessment/mitigation measure format of the California Environmental Quality Act (CEQA) disciplines, this section contains worker safety information, including the laws, ordinances, regulations and standards (LORS) that apply to this project and of health and safety plans that will ensure worker safety and public fire protection.

5.16.1 Setting

The KICP Energy Conversion Facility (ECF) site is in San Joaquin County south of the intersection of North Thornton Road and Interstate 5, adjacent to and north of the City of Lodi's White Slough Water Pollution Control Facility (WPCF). The ECF site is on land owned and incorporated by the City of Lodi, and is approximately 5 miles west of the westernmost portion of Lodi. The northernmost portion of Stockton is approximately 3 miles to the south. The ECF project site is currently in agricultural production. The KICP well pad sites and related facilities are located on King Island, approximately 2 miles southwest of the ECF site.

5.16.2 Health and Safety Programs

5.16.2.1 Environmental Checklist

Impacts would generally be evaluated with respect to the CEQA checklist. As stated above, this section focuses on applicable LORS and on having the appropriate plans in place to ensure regulatory compliance and worker health and safety.

Questions related to the release of hazardous materials, such as aqueous ammonia or native natural gas entrained in the compressed air flow, are addressed in Section 5.5, Hazardous Materials Management; occupational exposure to noise is addressed in Section 5.7, Noise; exposure of the public to air toxics and other public health hazards are addressed in the Section 5.9, Public Health; contaminated soil and water risks during construction are addressed in Section 5.14, Waste Management; and safety issues associated with flooding are addressed in Section 5.15, Water Resources.

5.16.2.2 Hazard Analysis

Workers will be exposed to construction and plant operation safety hazards. A hazard analysis is included to evaluate these hazards and assess control measures. The analysis identifies the hazards anticipated during construction and operation, and indicates which safety programs should be developed and implemented to mitigate and appropriately manage those hazards. The hazard analysis for construction activities is presented in Table 5.16-1; the hazard analysis prepared for plant operation is presented in Table 5.16-2. Because the types of hazards anticipated during plant construction and operation are similar, there is duplication between the tables.

Programs are overall plans that set forth the method or methods that will be followed to achieve particular health and safety objectives. For example, the Fire Protection and Prevention Program will describe what has to be done to protect against and prevent fires. This will include equipment required, such as alarm systems and firefighting equipment, and procedures to follow to protect against fires. The Emergency Action Program/Plan will describe escape procedures, rescue and medical procedures, alarm and

communication systems, and response procedures for every hazardous material that can migrate, such as ammonia. The programs or plans are set forth in written documents that are usually kept at specific locations within the facility.

Each program or plan will contain training requirements that are translated into detailed training courses. These courses are taught to plant construction and operating personnel, as needed. For example, all plant operating personnel will receive training in escape procedures under the Emergency Action Program/Plan, but only those working with flammables will receive training under the Fire Protection and Prevention Program.

Tables 5.16-1 and 5.16-2, which list construction and operation activities and associated hazards, also show (under the "Control" column) the program designed to reduce the occurrence of each hazard.

TABLE 5.16-1
Construction Hazard Analysis for the KICP

Activity	Hazard[a]	Control
Motor vehicle and heavy equipment use	Employee injury and property damage from collisions between people and equipment	Motor Vehicle and Heavy Equipment Safety Program
Forklift operation	Same as heavy equipment	Forklift Operation Program
Trenching and excavation	Employee injury and property damage from the collapse of trenches and excavations or exposure to fumes or vapors which have collected in the trench/excavation	Excavation/Trenching Program
Working at elevated locations	Falls from the same level and elevated areas	Fall Prevention Program Scaffolding/Ladder Safety Program Articulating Boom Platforms Program
Use of cranes and derricks	Property damage from falling loads; employee injuries from falling loads; and injuries and property damage from contact with crane or derrick	Crane and Material Handling Program Crane Operator certification
Working with flammable and combustible liquids	Fire/spills	Fire Protection and Prevention Program; Housekeeping and Material Handling and Storage Program
Hot work (including cutting and welding)	Employee injury and property damage from fire; exposure to fumes during cutting and welding; ocular exposure to ultraviolet and infrared radiation during cutting and welding	Hot Work Safety Program; Respiratory Protection Program; Employee Exposure Monitoring Program; Personal Protective Equipment (PPE) Program
Inspection and maintenance of temporary systems used during construction activities	Employee injury and property damage from contact with hazardous energy sources (electrical, thermal, mechanical, etc.)	Electrical Safety Program
Working on electrical equipment and systems	Employee contact with live electricity and energized equipment	Electrical Safety Program; PPE Program
Exposure to Hazardous Waste	Personnel who are working with or have the potential to be exposed to contaminated soil, groundwater, or debris during construction[b]	Hazardous Waste Program
Confined space entry	Employee injury from physical and chemical hazards	Permit-Required; Confined-Space Entry Program

TABLE 5.16-1
Construction Hazard Analysis for the KICP

Activity	Hazard[a]	Control
General construction activity	Employee injury from hand and portable power tools	Hand and Portable Power Tool Safety Program; PPE Program
General construction activity	Employee injury/property damage from inadequate walking and work surfaces	Housekeeping and Material Handling and Storage Program
General construction activity	Employee exposure to occupational noise	Hearing Conservation Program PPE Program
General construction activity	Employee injury from improper lifting and carrying of materials and equipment	Back Injury Prevention Program
General construction activity	Employee injury to head, eye/face, hand, body, foot, and skin	PPE Program
General construction activity	Employee exposure to hazardous gases, vapors, dusts, and fumes	Hazard Communication Program; Respiratory Protection Program; PPE Program; Air Monitoring Program
General construction activity	Employee exposure to various hazards; reporting of hazardous conditions during construction	Injury and Illness Prevention Program
General construction activity	Heat and cold stress	Heat and Cold Stress Monitoring and Control Program
Construction and testing of high-pressure steam and air systems	Employee injury and property damage due to failure of pressurized system components or unexpected release of pressure	Pressure Vessel and Pipeline Safety Program; Electrical Safety Program

[a]The hazards and hazard controls provided are generic to construction activities. During various phases of construction, a hazard analysis will be performed to more specifically evaluate the relevant hazards and to develop appropriate controls.

[b]Because neither construction nor operation of the KICP will involve contact with groundwater, there will be no contact with contaminated groundwater.

TABLE 5.16-2
Operation Hazard Analysis for the KICP

Activity	Hazard*	Control
Motor vehicle and heavy equipment use	Employee injury and property damage from collisions between people and equipment	Motor Vehicle and Heavy Equipment Safety Program
Forklift operations	Same as heavy equipment	Forklift Operation Program
Working at elevated locations	Falls from the same level and elevated areas	Fall Protection Program; Scaffolding/Ladder Safety Program
Use of cranes or derricks	Property damage from falling loads, employee injuries from falling loads, injuries and property damage from contact with crane or derrick	Crane and Material Handling Program
Working with flammable and combustible liquids	Fire/spills	Fire Protection and Prevention Program

TABLE 5.16-2
Operation Hazard Analysis for the KICP

Activity	Hazard*	Control
Working with hazardous materials	Employee injury due to ingestion, inhalation, dermal contact	Hazard Communication Program
Hot work (including cutting and welding)	Employee injury and property damage from fire; exposure to fumes during cutting and welding; ocular exposure to ultraviolet and infrared radiation during cutting and welding	Hot Work Safety Program; Respiratory Protection Program; Employee Exposure Monitoring Program; PPE Program; Fire Protection and Prevention Program
Troubleshooting and maintenance of plant systems and general operational activities	Employee injury and property damage from contact with hazardous energy sources (electrical, thermal, mechanical, etc.)	Electrical Safety Program
Working on electrical equipment and systems	Employee contact with live electricity	Electrical Safety Program; PPE Program
Confined space entry	Employee injury from physical and chemical hazards	Permit-Required; Confined-Space Entry Program
General plant operation activities	Employee injuries from hand and portable power tools	Hand and Portable Power Tool Safety Program; PPE Program
General plant operation activities	Employee injury and property damage from inadequate walking and work surfaces	Housekeeping and Material Handling and Storage Program
General plant operation activities	Employee overexposure to occupational noise	Hearing Conservation Program; PPE Program
General plant operation activities	Employee injury from improper lifting and carrying of materials and equipment	Back Injury Prevention Program
General plant operation activities	Employee injury and property damage from unsafe driving	Safe Driving Program
General plant operation activities	Employee overexposure to hazardous gases, vapors, dusts, and fumes	Hazard Communication Program; Respiratory Protection Program; PPE Program; Employee Exposure Monitoring Program
General plant operation activities	Reporting and repair of hazardous conditions	Injury and Illness Prevention Program
General plant operation activities	Heat and cold stress	Heat and Cold Stress Monitoring and Control Program
General plant operation activities	Ergonomic injuries	Ergonomic Awareness Program
Maintenance and repair of high-pressure steam and air systems	Employee injury and property damage due to failure of pressurized system components or unexpected release of pressure	Pressure Vessel and Pipeline Safety Program; Electrical Safety Program
Ammonia storage	Ammonia release	Emergency Action Program/Plan; Risk Management Plan (RMP) (see Section 5.5)

*The hazard and hazard controls provided are generic to operational activities. This hazard analysis may have to be updated if plant operations change or new equipment is added that was not considered during this evaluation.

5.16.2.3 Training and Safety Programs

To protect the safety and health of workers during the construction and operation of the KICP, health and safety programs designed to mitigate hazards and comply with applicable regulations will be implemented. Periodic audits will be performed by qualified individuals to determine whether proper work practices are being used to mitigate hazardous conditions and to evaluate regulatory compliance.

The following sections contain information on the anticipated content of the health and safety programs.

5.16.2.3.1 Construction Health and Safety Program

The following construction safety programs will be developed and implemented during construction of the KICP as outlined in the following lists.

Injury and Illness Prevention Program

- Philosophy and safety commitment
- Safety leadership and responsibilities
- Accountability
- Specific core safety processes (see Construction Safety Programs later in this section)
- Employee communication
- Planning “job hazard analysis and pre-task”
- Compliance with work rules and safe work practices
- Measurement of compliance and effectiveness of prevention methods, inspections/audits
- Communication of performance and implementation of necessary improvements
- Training and other communication requirements

Fire Protection and Prevention Program

- General requirements
- Housekeeping and proper material storage
- Employee alarm/communication system
- Portable fire extinguishers
- Fixed firefighting equipment
- Fire control and containment
- Flammable and combustible liquid storage
- Dispensing and disposal of flammable liquids
- Service and refueling areas
- Training

Personal Protective Equipment Program

- Personal protective devices
- Head protection
- Eye/face protection
- Body protection
- Hand protection
- Foot protection
- Skin protection
- Fall protection
- High-voltage protection
- Respiratory protection

- Hearing protection
- Hazard analysis
- Training

Emergency Action Program/Plan

Emergency procedures for the protection of personnel, equipment, the environment, and materials:

- Fire and emergency reporting procedures
- Response actions for accidents involving personnel and/or property
- Bomb threat response procedures
- Site assembly and emergency evacuation route procedures
- Natural disasters response

Reporting and notification procedures for emergencies and contacts, including offsite and local authorities:

- Alarm and communication systems
- Spill response, prevention, and control action plan
- Emergency response equipment
- Emergency personnel (response team) responsibilities and notification roster
- Training requirements

Construction Safety Programs

Pressure Vessel and Pipeline Safety Program

- Line-breaking program
- Equipment inspection and maintenance
- Blocking, bleeding, and blanking
- Training

Heavy Equipment Safety Program

- Operation and maintenance of vehicles
- Inspection
- PPE
- Training

Forklift Operation Program

- Trained and certified operators
- Fueling operations
- Safe operating parameters
- Training

Excavation/Trenching Program

- Shoring, sloping, and benching requirements
- California Occupational Safety and Health Administration (Cal-OSHA) permit requirements
- Inspection
- Air monitoring
- Access and egress

Fall Protection Program

- Evaluation of fall hazards
- Protection devices
- Training

Scaffolding/Ladder Safety Program

- Construction and inspection of equipment
- Proper use
- Training

Articulating Boom Platforms Program

- Inspection of equipment
- Load ratings
- Safe operating parameters
- Operator training

Crane and Material Handling Program

- Certified and licensed operators
- Inspection of equipment
- Load ratings
- Safe operating parameters
- Training

Hazardous Waste Program

- Evaluation of hazard
- Training
- Air monitoring
- Medical surveillance
- Health and Safety Plan (HSP) preparation

Hot Work Safety Program

- Welding and cutting procedures
- Fire watch
- Hot work permit
- PPE
- Training

Employee Exposure Monitoring Program

- Exposure evaluation
- Monitoring requirements
- Reporting of results
- Medical surveillance
- Training

Electrical Safety Program

- Grounding procedure
- Lock-out/tag-out (LO/TO) procedures
- Overhead and underground utilities
- Utility clearance
- Assured Grounding Program/GFCIs
- Training

Permit-Required Confined Space Entry Program

- Air monitoring and ventilation requirements
- Rescue procedures
- LO/TO and blocking, blinding, and blanking requirements
- Permit completion
- Training

Hand and Portable Power Tool Safety Program

- Guarding and proper operation
- Training

Housekeeping and Material Handling and Storage Program

- Storage requirements
- Walkways and work surfaces
- Equipment handling requirements
- Training

Hearing Conservation Program

- Identifying high-noise environments
- Exposure monitoring
- Medical surveillance requirements
- Hearing-protective devices
- Training

Back Injury Prevention Program

- Proper lifting and material handling procedures
- Training

Hazard Communication Program

- Labeling requirements
- Storage and handling
- Material Safety Data Sheets (MSDS)
- Chemical inventory
- Training

Respiratory Protection Program

- Selection and use
- Storage
- Fit testing
- Medical requirements
- Inspection and repair
- Training

Heat and Cold Stress Monitoring and Control Program

- Monitoring requirements
- Prevention and control

5.16.2.3.2 Operation Health and Safety Program

Upon completion of construction and commencement of operations at KICP, the construction HSP will transition into an operations-oriented program reflecting the hazards and controls necessary during operation. The following outline sets forth the topics that will be included in the Operations Health and Safety Program.

Injury and Illness Prevention Program

- Personnel with the responsibility and authority for implementing the plan
- Safety and health policy
- Work rules and safe work practices
- System for ensuring that employees comply with safe work practices
- Employee communications
- Identification and evaluation of workplace hazards
- Methods and/or procedures for correcting unsafe or unhealthy conditions, work practices, and work procedures in a timely manner based on the severity of the hazards
- Specific safety procedures (see Plant Operation Safety Program)
- Training and instruction

First Aid, CPR, and Automated External Defibrillator

- General requirements
- Written program
- Training
- Maintenance

Fire Protection and Prevention Program

- General requirements
- Fire hazard inventory, including ignition sources and mitigation
- Housekeeping and proper materials storage
- Employee alarm/communication system
- Portable fire extinguishers
- Fixed firefighting equipment
- Fire control
- Flammable and combustible liquid storage
- Use of flammable and combustible liquids
- Dispensing and disposal of liquids
- Training
- Personnel to contact for information on plan contents

Emergency Action Program/Plan (Part of the Risk Management Plan)

- Emergency escape procedures and emergency escape route assignments
- Procedures for employees who remain to operate critical plant operations before they evacuate
- Procedures to account for all employees after emergency evacuation has been completed
- Rescue and medical duties for those employees performing rescue and medical duties
- Fire and emergency reporting procedures

- Alarm and communication system
- Personnel to contact for information on plan contents
- Response procedure for ammonia release
- Training requirements

Personal Protective Equipment Program

- Hazard analysis and prescription of PPE
- Personal protective devices
- Head protection
- Eye and face protection
- Body protection
- Hand protection
- Foot protection
- Skin protection
- Sanitation
- Safety belts and life lines for fall protection
- Ladder climbing devices
- Protection for electric shock
- Medical services and first aid/bloodborne pathogens
- Respiratory protective equipment
- Hearing protection
- Training

Plant Operation Safety Program

Pressure Vessel and Pipeline Safety Program

- Line-breaking policy
- Equipment inspection and maintenance
- Blocking, bleeding, and blanking
- Communication
- Training

Compressed Gas Handling

- Storage
- Safe handling and use

Motor Vehicle and Heavy Equipment Safety Program

- Operation and maintenance of vehicles
- Inspection
- PPE
- Training

Forklift Operation Program

- Trained and certified operators
- Fueling operations
- Safe operating parameters
- Training

Excavation/Trenching Program

- Shoring, sloping, and benching requirements
- Cal-OSHA permit requirements
- Inspection
- Air monitoring
- Access and egress

Fall Protection Program

- Evaluation of fall hazards
- Protection devices
- Training

Scaffolding/Ladder Safety Program

- Construction and inspection of equipment
- Proper use of scaffolds and ladder climbing devices
- Training

Articulating Boom Platforms Program

- Inspection of equipment
- Load ratings
- Safe operating parameters
- Operator training

Crane and Material Handling Program

- Certified and licensed operators
- Inspection of equipment
- Load ratings
- Safe operating parameters
- Training

Hot Work Safety Program

- Welding and cutting procedures
- Fire watch
- Hot work permit
- PPE
- Training

Workplace Ergonomics Program

- Identification of personnel at risk
- Evaluation of personnel
- Workplace and job activity modifications
- Training

Employee Exposure Monitoring Program

- Exposure evaluation
- Monitoring requirements
- Reporting of results
- Medical surveillance
- Training

Electrical Safety Program

- Grounding procedure
- LO/TO procedures
- Overhead and underground utilities
- Utility clearance
- Arc Flash
- Training

Permit-required Confined Space Entry Program

- Air monitoring and ventilation requirements
- Rescue procedures
- LO/TO and blocking, blinding, and blanking requirements
- Permit completion
- Training

Hand and Portable Power Tool Safety Program

- Guarding and proper operation
- Training

Housekeeping and Material Handling and Storage Program

- Storage requirements
- Walkways and work surfaces
- Equipment handling requirements
- Slips and tripping hazards
- Training

Hearing Conservation Program

- Identifying high-noise environments
- Exposure monitoring
- Medical surveillance requirements
- Hearing-protective devices
- Training

Back Injury Prevention Program

- Proper lifting and material-handling procedures
- Training

Hazard Communication Program

- Labeling requirements
- Storage and handling
- MSDS
- Chemical inventory
- Training

Respiratory Protection Program

- Selection and use
- Storage
- Fit testing
- Medical requirements
- Inspection and repair
- Training

Heat and Cold Stress Monitoring and Control Program

- Monitoring requirements
- Prevention and control

Safe Driving Program

- Operation and maintenance of vehicles
- PPE
- Inspection and maintenance
- Training

5.16.2.3.3 Safety Training

To ensure that employees recognize and understand how to protect themselves from potential hazards during this project, comprehensive training programs for construction and operation will be implemented as indicated in Tables 5.16-3 and 5.16-4. Each of the safety procedures developed to control and mitigate potential site hazards will require some form of training. Training will be delivered in various ways, depending on the requirements of Cal-OSHA standards, the complexity of the topic, the characteristics of the workforce, and the degree of risk associated with each of the identified hazards.

Tables 5.16-3 and 5.16-4 summarize the safety training programs that will be provided to construction and operations personnel, respectively.

TABLE 5.16-3
Construction Training Program for the KICP

Training Course	Target Employees
Injury and Illness Prevention Training	All
Emergency Action Program/Plan	All
PPE Training	All
Motor Vehicle and Heavy Equipment Safety Training	Employees working on, near, or with heavy equipment or vehicles
Forklift Operation Training	Employees operating forklifts

TABLE 5.16-3
Construction Training Program for the KICP

Training Course	Target Employees
Excavation/Trenching Safety Training	Employees involved with trenching or excavation
Fall Protection Training	Employees working at heights greater than 6 feet or required to use fall protection
Scaffolding/Ladder Safety Training	Employees required to erect or use scaffolding and employees who use ladders
Crane Safety Training	Employees supervising or performing crane operations
Fire Protection and Prevention Training	Employees responsible for the handling and storage of flammable or combustible liquids or gases
Hazard Communication Training	Employees handling or working with hazardous materials
Hazardous Waste	Employees handling or excavating hazardous waste
Hot Work Safety Training	Employees performing hot work
Electrical Safety Training	Employees performing LO/TO or working on systems that require LO/TO activities
Electrical Safety Training	Employees required to work on electrical systems and equipment, or use electrical equipment and cords
Permit-Required Confined-Space Entry Training	Employees required to supervise or perform confined-space entry activities
Hand and Portable Power Tool Safety Training	Employees that will be operating hand and portable power tools
Heat Stress and Cold Stress Safety Training	Employees that are exposed to temperature extremes
Hearing Conservation Training	All
Back Injury Prevention Training	All
Safe Driving Training	Employees supervising or driving motor vehicles
Pressure Vessel and Pipeline Safety Training	Employees supervising or working on pressurized systems or equipment
Respiratory Protection Training	All employees required to wear respiratory protection
Fire Protection and Prevention Training	All

TABLE 5.16-4
Operations Training Program for the KICP

Training Course	Target Employees
Injury and Illness Prevention Training	All
Emergency Action Plan	All
PPE Training	All
Pressure Vessel and Pipeline Safety Training	Employees supervising or working on pressurized systems or equipment

TABLE 5.16-4
Operations Training Program for the KICP

Training Course	Target Employees
Excavation/Trenching Safety Training	Employees involved with trenching or excavation
Scaffolding/Ladder Safety Training	Employees required to erect or use scaffolding
Fall Protection Training	Employees required to use fall protection
Forklift Operator Training	Employees operating forklifts
Crane Safety Training	Employees supervising or performing crane operations
Workplace Ergonomics	Employees performing repetitive activities
Fire Protection and Prevention Training	Employees responsible for the handling and storage of flammable or combustible liquids or gasses
Hot Work Safety Training	Employees performing hot work
Electrical Safety Training	Employees performing LO/TO
Electrical Safety	Employees required to work on electrical systems and equipment
Permit-Required Confined-Space Entry	Employees required to supervise or perform confined-space entry
Hand and Portable Power Tool Safety Training	Employees that will be operating hand and portable power tools
Heat Stress and Cold Stress Safety Training	Employees exposed to temperature extremes
Hearing Conservation Training	All
Back Injury Prevention Training	All
Safe Driving Training	Employees supervising or driving motor vehicles
Hazard Communication Training	Employees handling or working around hazardous materials
Respiratory Protection Program	All employees required to wear respiratory protection
Fire Protection and Prevention Training	All
First Aid, CPR, and Automated External Defibrillator	All

5.16.2.4 Fire Protection

There are four fire stations in the Woodbridge Fire Protection District system. Fire Station #4, at 6365 W. Capitol St. Lodi, California 95242, is the closest fire station to the ECF; approximately 1.25 miles to the north of the ECF (5 miles by road). Approximate response time from Fire Station #4 to the ECF would be 7 to 10 minutes. Mutual aid response would come from the other three Woodbridge stations, as well as the City of Lodi and City of Stockton fire stations, depending on situation and need.

5.16.3 Laws, Ordinances, Regulations, and Standards

KICP construction and operation will be conducted in accordance with all applicable LORS. Table 5.16-5 summarizes the federal, state, and local (San Joaquin County) LORS relating to worker health and safety. Table 5.16-5 also provides a summary of the applicable national consensus standards.

TABLE 5.16.5
Laws, Ordinances, Regulations, and Standards for Worker Health and Safety

LORS	Requirements/Applicability	Administering Agency
Federal		
Title 29 Code of Federal Regulations (CFR) Part 1910	Contains the minimum occupational safety and health standards for general industry in the United States	OSHA
Title 29 CFR Part 1926	Contains the minimum occupational safety and health standards for the construction industry in the United States	OSHA
State		
California Occupational Safety and Health Act, 1970	Establishes minimum safety and health standards for construction and general industry operations in California	Cal-OSHA
8 California Code of Regulations (CCR) 339	Requires list of hazardous chemicals relating to the Hazardous Substance Information and Training Act	Cal-OSHA
8 CCR 450	Addresses hazards associated with pressurized vessels	Cal-OSHA
8 CCR 1509	Addresses requirements for construction, accident, and prevention plans	Cal-OSHA
8 CCR 1509, et seq., and 1684, et seq.	Addresses construction hazards, including head, hand, and foot injuries and noise and electrical shock	Cal-OSHA
8 CCR 1528, et seq., and 3380, et seq.	Requirements for PPE	Cal-OSHA
8 CCR 1597, et seq., and 1590, et seq.	Requirements addressing the hazards associated with traffic accidents and earth-moving	Cal-OSHA
8 CCR 1604, et seq.	Requirements for construction hoist equipment	Cal-OSHA
8 CCR 1620, et seq., and 1723, et seq.	Addresses miscellaneous hazards	Cal-OSHA
8 CCR 1709, et seq.	Requirements for steel reinforcing, concrete pouring, and structural steel erection operations	Cal-OSHA
8 CCR 1920, et seq.	Requirements for fire protection systems	Cal-OSHA
8 CCR 2300, et seq., and 2320, et seq.	Requirements for addressing low-voltage electrical hazards	Cal-OSHA
8 CCR 2395, et seq.	Addresses electrical installation requirements	Cal-OSHA
8 CCR 2700, et seq.	Addresses high-voltage electrical hazards	Cal-OSHA
8 CCR 3200, et seq., and 5139, et seq.	Requirements for control of hazardous substances	Cal-OSHA
8 CCR 3203, et seq.	Requirements for operational accident prevention programs	Cal-OSHA
8 CCR 3270, et seq., and 3209, et seq.	Requirements for evacuation plans and procedures	Cal-OSHA
8 CCR 3301, et seq.	Requirements for addressing miscellaneous hazards, including hot pipes, hot surfaces, compressed air systems, relief valves, enclosed areas containing flammable or hazardous materials, rotation equipment, pipelines, and vehicle-loading dock operations	Cal-OSHA

TABLE 5.16.5
Laws, Ordinances, Regulations, and Standards for Worker Health and Safety

LORS	Requirements/Applicability	Administering Agency
8 CCR 3360, et seq.	Addresses requirements for sanitary conditions	Cal-OSHA
8 CCR 3511, et seq., and 3555, et seq.	Requirements for addressing hazards associated with stationary engines, compressors, and portable, pneumatic, and electrically powered tools	Cal-OSHA
8 CCR 3649, et seq., and 3700, et seq.	Requirements for addressing hazards associated with field vehicles	Cal-OSHA
8 CCR 3940, et seq.	Requirements for addressing hazards associated with power transmission, compressed air, and gas equipment	Cal-OSHA
8 CCR 5109, et seq.	Requirements for addressing construction accident and prevention programs	Cal-OSHA
8 CCR 5110, et seq.	Requirements for the implementation of an ergonomics program	Cal-OSHA
8 CCR 5139, et seq.	Requirements for addressing hazards associated with welding, sandblasting, grinding, and spray-coating	Cal-OSHA
8 CCR 5150, et seq.	Requirements for confined space entry	Cal-OSHA
8 CCR 5155, et seq.	Requirements for use of respirators and for controlling employee exposure to airborne contaminants	Cal-OSHA
8 CCR 5160, et seq.	Requirements for addressing hot, flammable, poisonous, corrosive, and irritant substances	Cal-OSHA
8 CCR 5192, et seq.	Requirements for conducting emergency response operations	Cal-OSHA
8 CCR 5193, et seq.	Requirements for controlling employee exposure to blood borne pathogens associated with exposure to raw sewage water and body fluids associated with first aid/CPR duties	Cal-OSHA
8 CCR 5194, et seq.	Requirements for employee exposure to dusts, fumes, mists, vapors, and gases	Cal-OSHA
8 CCR 5405, et seq.; 5426, et seq.; 5465, et seq.; 5500, et seq.; 5521, et seq.; 5545, et seq.; 5554, et seq.; 5565, et seq.; 5583, et seq.; and 5606, et seq.	Requirements for flammable liquids, gases, and vapors	Cal-OSHA
8 CCR 5583, et seq.	Requirements for design, construction, and installation of venting, diking, valving, and supports	Cal-OSHA
8 CCR 6150, et seq.; 6151, et seq.; 6165, et seq.; 6170, et seq.; and 6175, et seq.	Fire protection requirements	Cal-OSHA
Title 24, Part 3, California Electrical Code	The Cal/OSHA electrical safety regulations incorporate the requirements of the Uniform Electrical Code located in Title 24, Part 3	Cal-OSHA
8 CCR, Part 6	Provides health and safety requirements for working with tanks and boilers	Cal-OSHA

TABLE 5.16.5
Laws, Ordinances, Regulations, and Standards for Worker Health and Safety

LORS	Requirements/Applicability	Administering Agency
Health and Safety Code Section 25531, et seq.	Requires that every new or modified facility that handles, treats, stores, or disposes of more than the threshold quantity of any of the listed regulated materials prepare and maintain an RMP	Cal-OSHA
Health and Safety Code Sections 25500 through 25541	Requires the preparation of a Hazardous Material Business Plan that details emergency response plans for a hazardous materials emergency at the facility	Cal-OSHA
Local		
Specific hazardous material handling requirements	Provides response agencies with necessary information to address emergencies	San Joaquin County Office of Emergency Services San Joaquin County Environmental Health Department
Emergency Response Plan	Allows response agency to integrate KICP emergency response activities into any response actions	San Joaquin County Office of Emergency Services
Business Plan	Provides response agency with overview of KICP purpose and operations	San Joaquin County Office of Emergency Services
RMP (Certified Unified Program Agency [CUPA], administered by the County)	Provides response agency with detailed review of risks and hazards located at KICP and mitigation implemented to control risks or hazards	San Joaquin County Environmental Health Department
National Standards		
Uniform Fire Code, Article 80	Addresses the prevention, control, and mitigation of dangerous conditions related to storage, dispensing, use, and handling of hazardous materials and information needed by emergency response personnel	Woodbridge Fire Protection District
National Fire Protection Association (NFPA) 10, Standard for Portable Fire Extinguishers	Requirements for selection, placement, inspection, maintenance, and employee training for portable fire extinguishers	Woodbridge Fire Protection District
NFPA 11, Standard for Low-Expansion Foam and Combined Agent Systems	Requirements for installation and use of low-expansion foam and combined-agent systems	Woodbridge Fire Protection District
NFPA 11A, Standard for Medium- and High- Expansion Foam Systems	Requirements for installation and use of medium- and high-expansion foam systems	Woodbridge Fire Protection District
NFPA 12, Standard on Carbon Dioxide Extinguishing Systems	Requirements for installation and use of carbon dioxide extinguishing systems	Woodbridge Fire Protection District
NFPA 13, Standard for Installation of Sprinkler Systems	Guidelines for selection and installation of fire sprinkler systems	Woodbridge Fire Protection District
NFPA 13A, Recommended Practice for the Inspection, Testing, and Maintenance of Sprinkler Systems	Guidance for inspection, testing, and maintenance of sprinkler systems	Woodbridge Fire Protection District

TABLE 5.16.5
Laws, Ordinances, Regulations, and Standards for Worker Health and Safety

LORS	Requirements/Applicability	Administering Agency
NFPA 14, Standard for the Installation of Standpipe and Hose Systems	Guidelines for selection and installation of standpipe and hose systems	Woodbridge Fire Protection District
NFPA 15, Standard for Water Spray Fixed Systems	Guidelines for selection and installation of water spray fixed systems	Woodbridge Fire Protection District
NFPA 17, Standard for Dry Chemical Extinguishing Systems	Guidance for selection and use of dry chemical extinguishing systems	Woodbridge Fire Protection District
NFPA 20, Standard for the Installation of Centrifugal Fire Pumps	Guidance for selection and installation of centrifugal fire pumps	Woodbridge Fire Protection District
NFPA 22, Standard for Water Tanks for Private Fire Protection	Requirements for water tanks for private fire protection	Woodbridge Fire Protection District
NFPA 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances	Requirements for private fire service mains and their appurtenances	Woodbridge Fire Protection District
NFPA 26, Recommended Practice for the Supervision of Valves Controlling Water Supplies	Supervision guidance for valves controlling water supplies	Woodbridge Fire Protection District
NFPA 30, Flammable and Combustible Liquid Code	Requirements for storage and use of flammable and combustible liquids	Woodbridge Fire Protection District
NFPA 37, Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines	Fire protection requirements for installation and use of combustion engines and gas turbines	Woodbridge Fire Protection District
NFPA 50A, Standard for Gaseous Hydrogen Systems at Consumer Sites	Fire protection requirements for hydrogen systems	Woodbridge Fire Protection District
NFPA 54, National Fuel Gas Code	Fire protection requirements for use of fuel gases	Woodbridge Fire Protection District
NFPA 59A, Standard for the Storage and Handling of Liquefied Petroleum Gases	Requirements for storage and handling of liquefied petroleum gases	Woodbridge Fire Protection District
NFPA 68, Guide for Explosion Venting	Guidance in design of facilities for explosion venting	Woodbridge Fire Protection District
NFPA 70, National Electrical Code	Guidance on safe selection and design, installation, maintenance, and construction of electrical systems	Woodbridge Fire Protection District
NFPA 70B, Recommended Practice for Electrical Equipment Maintenance	Guidance on electrical equipment maintenance	Woodbridge Fire Protection District
NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces	Employee safety requirements for working with electrical equipment	Woodbridge Fire Protection District
NFPA 71, Standard for the Installation, Maintenance, and Use of Central Station Signaling Systems	Requirements for installation, maintenance, and use of central station signaling systems	Woodbridge Fire Protection District

TABLE 5.16.5
Laws, Ordinances, Regulations, and Standards for Worker Health and Safety

LORS	Requirements/Applicability	Administering Agency
NFPA 72A, Standard for the Installation, Maintenance and Use of Local Protective Signaling Systems for Guard's Tour, Fire Alarm and Supervisory Service	Requirements for installation, maintenance, and use of local protective signaling systems	Woodbridge Fire Protection District
NFPA 72E, Standard on Automatic Fire Detection	Requirements for automatic fire detection	Woodbridge Fire Protection District
NFPA 72F, Standard for the Installation, Maintenance and Use of Emergency Voice/Alarm of Communication Systems	Requirements for installation, maintenance, and use of emergency and alarm communications systems	Woodbridge Fire Protection District
NFPA 72H, Guide for Testing Procedures for Local, Auxiliary, Remote Station and Proprietary Protective Signaling Systems	Testing procedures for types of signaling systems anticipated for facility	Woodbridge Fire Protection District
NFPA 75, Standard for the Protection of Electronic Computer/Data Processing Equipment	Requirements for fire protection systems used to protect computer systems	Woodbridge Fire Protection District
NFPA 78, Lightning Protection Code	Lightning protection requirements	Woodbridge Fire Protection District
NFPA 80, Standard for Fire Doors and Windows	Requirements for fire doors and windows	Woodbridge Fire Protection District
NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems	Requirements for installation of air conditioning and ventilating systems	Woodbridge Fire Protection District
NFPA 101, Code for Safety to Life from Fire in Buildings and Structures	Requirements for design of means of exiting the facility	Woodbridge Fire Protection District
NFPA 291, Recommended Practice for Fire Flow Testing and Marking of Hydrants	Guidelines for testing and marking of fire hydrants	Woodbridge Fire Protection District
NFPA 850, Recommended Practice for Fire Protection for Fossil Fuel Steam Electric Generating Plants	Requirements for fire protection in fossil-fuel steam electric generating plants	Woodbridge Fire Protection District
NFPA 1961, Standard for Fire Hose	Specifications for fire hoses	Woodbridge Fire Protection District
NFPA 1962, Standard for the Care, Maintenance, and Use of Fire Hose Including Connections and Nozzles	Requirements for care, maintenance, and use of fire hoses	Woodbridge Fire Protection District
NFPA 1963, Standard for Screw Threads and Gaskets for Fire Hose Connections	Specifications for fire hose connections	Woodbridge Fire Protection District
American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME), Boiler and Pressure Vessel Code	Specifications and requirements for pressure vessels	N/A
ANSI, B31.2, Fuel Gas Piping	Specifications and requirements for fuel gas piping	N/A

5.16.4 Agencies and Agency Contacts

Several agencies are involved to ensure protection of worker health and safety. Agency contacts relative to worker health and safety and fire are shown in Table 5.16-6.

TABLE 5.16-6
Agency Contacts for Worker Health and Safety

Issue	Agency	Contact
Hazardous Waste Land and Water Quality	San Joaquin County Environmental Health Department (CUPA)	600 E. Main Street Stockton, CA 95202
Community Health	San Joaquin County Office of Emergency Services (Participating Agency)	2101 E. Earhart Avenue, Suite 300 Stockton, CA 95206
Fire Response	Woodbridge Fire Protection District	405 E. Augusta St. Woodbridge, CA 95258
Worker Health and Safety	Cal-OSHA, Modesto	1209 Woodrow, Suite C-4 Modesto, CA 95350

5.16.5 Permits and Permit Schedule

Table 5.16-7 lists applicable permits related to the protection of worker health and safety for KICP certification. The activities covered and application requirements to obtain each permit are provided.

All permits noted in Table 5.16-7 may be obtained from any Cal-OSHA district or field office, as needed. Notification requirements are listed as 24 hours because the permits may be required at several points in the construction of the plant or during operations; no specific permitting schedule is provided.

TABLE 5.16-7
Permits and Permit Schedule for Worker Health and Safety

Permit	Agency Contact	Schedule
Trenching and excavation permit	Any Cal-OSHA district or field office	Submit completed permit application to any Cal-OSHA district or field office prior to commencing construction
Permit to erect a fixed tower crane	Any Cal-OSHA district or field office	Submit completed permit application to any Cal-OSHA district or field office at least 24 hours prior to initiation of activity
Pressure vessel permit	Any Cal-OSHA district or field office	Submit completed permit application to any Cal-OSHA district or field office prior to commencing construction

SECTION 6.0

Alternatives

This section discusses alternatives to the King Island Compressed Air Energy Storage (CAES) project (KICP), including the "no project" alternative, ECF site alternatives, linear facility route alternatives, technology alternatives, water supply alternatives, and wastewater disposal alternatives. These alternatives are discussed in relation to the environmental, public policy, and business considerations involved in developing the KICP. The main objective of the KICP is to design, construct, and operate a 300-megawatt (MW) (nominal) utility-scale CAES project using a depleted natural gas field as an air storage reservoir.

6.1 Project Objectives

The key objective of the PG&E CAES feasibility study was to prove the technical and economic viability of providing approximately 300 MW of energy storage capacity and grid support ancillary services capability to the California Independent System Operator (CAISO) controlled grid for up to 10 hours before recharging the reservoir. An important part of this objective is to demonstrate understanding and experience with the CAES technology, particularly with CAES using a depleted natural gas field as an air storage reservoir. As more renewable resources are brought online to meet California's Renewable Portfolio Standard (RPS), energy storage projects such as KICP that are specifically designed to adjust to the load profile rapidly (either to inject air into the reservoir in order to store excess energy or to withdraw the stored air to generate electricity) and operate at part load, will be critical in supporting grid electrical reliability and stability.

In addition to technology alternatives described in this section, project objectives for site selection were driven first and foremost by selection of a depleted gas reservoir suitable to support a nominal 3,000 megawatt hours (MWh) Energy Conversion Facility (ECF). Related objectives included minimizing the length of project linears, including air, gas, and water supply lines; discharge lines; and transmission interconnections. ECF site and linear route selection were also based on site control/owner-related issues. These objectives minimize potential on- and offsite environmental impacts, emphasize the ability to acquire property at reasonable cost, minimize the likelihood of obtaining required permits, and minimize the cost of construction.

In responding to and addressing the need for environmentally responsible, cost-effective, operationally flexible, and efficient power generation capacity in northern California, the KICP site selection included and was based upon the following project objectives:

- Power block/ECF site near an underground reservoir which can support 300 MW for 10 hours
- ECF adjacent to or near 230-kilovolt (kV) high-voltage electrical transmission lines
- ECF adjacent to or near high-pressure natural gas transmission lines
- ECF adjacent to or near a Title 22 (tertiary treatment) water pollution control facility (WPCF) (preferable) for a reclaimed cooling water supply
- ECF and well pad areas large enough to accommodate the site equipment, including construction laydown

The proposed King Island site met all of the project siting objectives.

6.2 The "No Project" Alternative

The "no project" alternative would forego all of the benefits associated with the KICP. The CAISO would not experience the benefits of CAES and the ancillary grid operation services that the project can provide. The utility industry and U.S. Department of Energy (DOE) would not realize the considerable value of additional demonstrated experience with an operating, utility-scale CAES facility using a depleted natural gas field as a CAES reservoir.

In summary, the "no project" alternative would not serve the growing needs of the Central Valley and California's businesses and residents for economical, reliable, flexible, and environmentally sound energy storage and generation resources. Moreover, the "no project" alternative would not satisfactorily meet the project objectives specified above and, thus, was rejected in favor of the proposed project.

6.3 Alternative Air Reservoir Sites

As stated in Section 1.0, 148 depleted gas fields were initially considered for the air storage reservoir. Based on public information and records, the following criteria were used to develop a priority list of reservoirs for further evaluation and study:

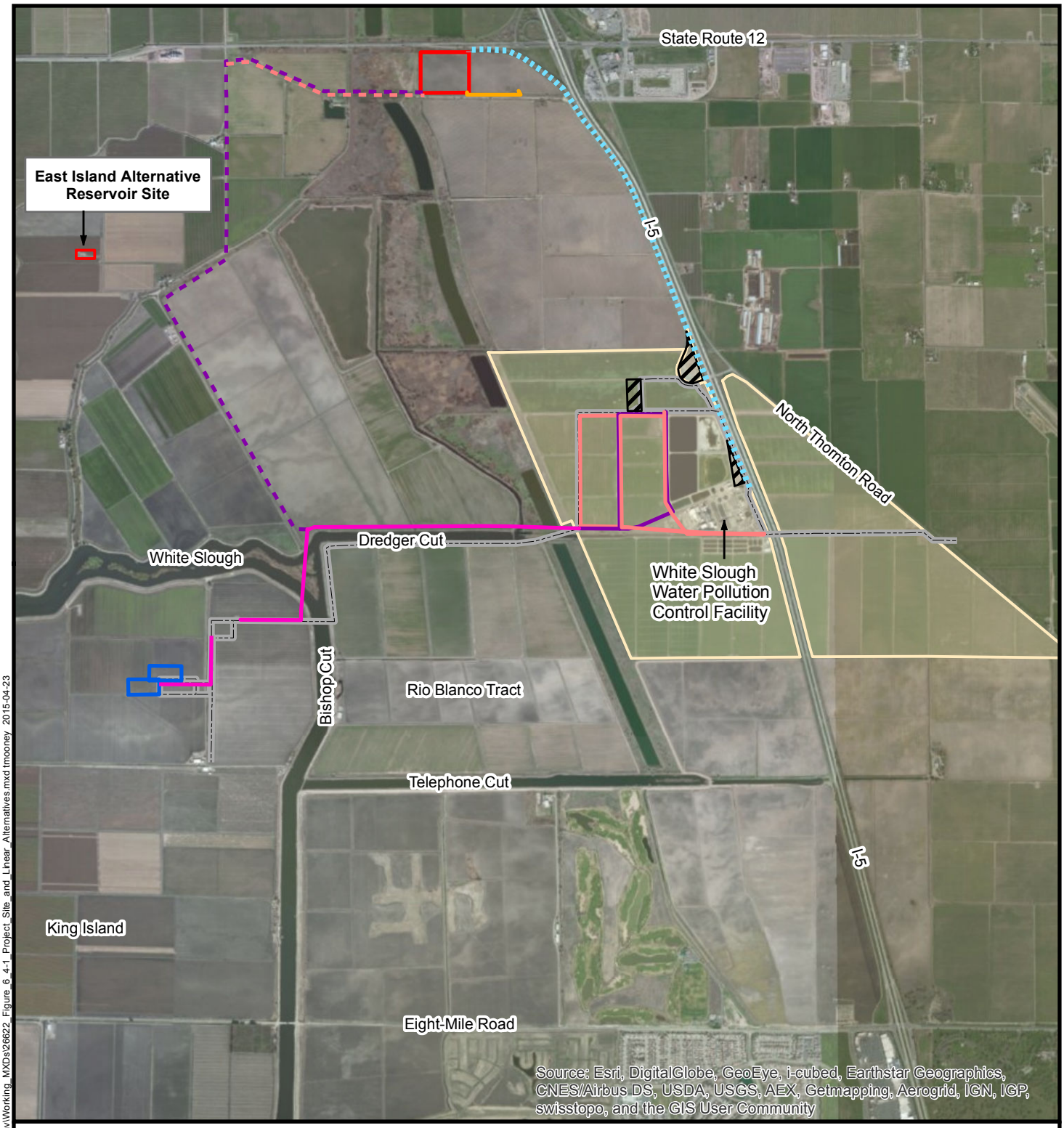
- Reservoir cumulative gas production sufficiently large to support a 300 MW, 10 hours of storage, project objective
- Minor/moderate water drive mechanism in the reservoir
- Porosity greater than 15 percent
- Permeability greater than 400 millidarcys (mD)
- Reservoir with a net sand thickness of 20 feet or more

Using these criteria, a priority list of 20 reservoirs was selected for further technical and environmental evaluation to determine whether specific sites had fatal flaws that would eliminate them from consideration. As a result, the list was reduced to 12 priority sites for further cost and environmental study. Additional evaluation identified seven high-priority sites for site control discussions. Based on the progress of the site control discussions and further refinement of the geological, environmental and costs information, three sites were chosen as finalists for site-control efforts. Site control was achieved at two locations and these sites were selected for core drilling and additional analysis.

Initial geological testing, modeling, engineering analysis, and other evaluation factors for these sites led to the choice of the King Island reservoir as the preferred site. Both sites have geological properties that exceed the minimum permeability and porosity thresholds initially developed for the KICP; however, the King Island reservoir is larger and able to support the project objective of 300 MW for 10 hours and thus the King Island site was chosen for the air injection testing phase.

6.4 ECF Site Alternatives

In addition to the proposed King Island reservoir site, two ECF site alternative locations were identified that could meet the project's basic objectives. The alternative ECF site is shown in Figure 6.4-1. The key siting criteria in considering these alternatives and the proposed site are provided in Section 6.1.



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North State Resources, Inc.

PG&E King Island Compressed Air Energy Storage Project

Figure 6.4-1
Project Site and Linear Alternatives

6.4.1 Proposed ECF Site

The proposed ECF site meets all of the project's objectives and would, based on preliminary analysis, have no significant, unmitigated environmental impacts. The proposed King Island CAES ECF site:

- Provides a location near electrical transmission and natural gas supply that is also near the King Island reservoir, which is considered a suitable depleted natural gas reservoir for CAES
- Requires an approximate 270-foot connection to PG&E's existing Gold Hill-Eight Mile Road 230-kV transmission line for a source of power to operate the compressors as well as for grid interconnection
- Is located near a PG&E natural gas pipeline of sufficient capacity to supply the KICP
- Is located adjacent to the City of Lodi White Slough WPCF, a source of tertiary treated reclaimed water for cooling
- Has an adjacent parcel for construction laydown areas
- Is located in an area with compatible industrial use

6.4.2 Alternative ECF Site: State Route 12

The alternative ECF site is approximately 1.3 miles north of the proposed ECF site, adjacent to State Route 12 (SR-12), and adjacent to and west of Interstate 5 (I-5) and is part of Assessor's Parcel 055-15-018. This is a 64-acre parcel, of which the project would use approximately 20 acres in the western half of the parcel (see Figure 6.4-1). SR-12 would border the parcel on the north. The site is surrounded on three sides by agricultural uses and on the west by the California Department of Fish and Wildlife's (CDFW) White Slough Wildlife Area Safety (no firearms) Zone. The PG&E Gold Hill-Eight Mile Road 230-kV transmission line bisects the parcel and the ECF would be positioned just west of this line.

This site has a General Plan Land Use Designation of General Agriculture (A/G) and is zoned AG-40, indicating a minimum parcel size of 40 acres. This site is situated next to electrical transmission facilities as is the proposed site, but would require longer pipelines than the proposed ECF site to convey compressed air to and from the well pads, natural gas, cooling water from the White Slough WPCF, and wastewater to the well pad.

6.5 Comparative Evaluation of Alternative Sites

In the discussion that follows, the reservoir/ECF sites are compared in terms of each of the 16 topic areas required in a California Energy Commission (CEC) Application for Certification (AFC), as well as in terms of project development constraints. The most useful topics for comparison are as follows:

- **Project Development Constraints**—Are there site characteristics that would prohibit or seriously constrain development, such as significant contamination problems, or lack of fuel, transmission capacity, flood zone mitigation, or water supply?
- **Land Use Compatibility**—Is the parcel zoned appropriately for industrial use and compatible with local land use plans and policies?
- **Routing and Length of Linear Facilities**—Can linear facilities be routed to the site along existing corridors, such as transmission lines, pipelines, and roads? Will linear facilities be significantly shorter for a given site?

- **Transmission System**—Are required electric system improvements prohibitive in cost, regardless of the generator tie-line distance?
- **Visual Resources**—Are there significant differences between the sites in their potential for impact on valuable or protected viewsheds?
- **Biological Resources**—Would there be significant impacts on wetlands or threatened or endangered species such that mitigation of these effects would be unduly expensive or constrain the supply of available mitigation resources?
- **Contamination**—Is there significant onsite contamination, such that cleanup expense would be high or cleanup would cause significant schedule delay?
- **Noise**—Is the site sufficiently near a sensitive receptor area such that it would be difficult to mitigate potential noise impacts to below the level of significance?
- **Use of Previously Disturbed Areas**—Has the site been previously disturbed? Does the site minimize the need for clearing vegetation and otherwise present low potential for impact on biological and cultural resources?
- **Other Environmental Categories**—Are there significant differences between the sites in their potential for impact in other environmental categories?

There is no precise mathematical weighting system established for considering potential impacts in alternatives analyses. Some of the criteria used to compare the alternatives are more or less important to consider than others. For example, an impact that could affect public health and safety or could result in significant environmental impacts is obviously of greater concern than a purely aesthetic issue associated with an advisory design guideline. It is important in comparing alternatives to focus on the key siting advantages and the potential adverse environmental effects of a particular site. Comparing each of the environmental disciplines and giving each discipline equal weight would provide a misleading analysis because effects in one area are not necessarily equivalent in importance to effects in another area.

6.5.1 Project Development Constraints

As described in Section 6.1, Project Objectives, the basic needs of power plant siting for land, access to electrical transmission, gas supply, and water are met at the proposed (base case) ECF site. The SR-12 alternative ECF site is similarly situated in terms of proximity to electrical transmission to the proposed site and is nearer to a natural gas supply than the proposed site. The alternative site would require a 1.7-mile-long water supply pipeline (compared 0.30 mile for the proposed site) to use city water as a make-up source. The alternative site would also require a longer air pipeline (3.7 miles, compared with 2.6 miles for the proposed site).

6.5.2 Air Quality

The quantity of emissions from project operation would be the same at either site. A facility located at either site would have roughly the same contribution to airshed emissions and, therefore, would be subject to similar review, emission reduction crediting, and permitting requirements. Neither site is less than 1,000 feet from a school. Each site is on relatively flat terrain that would help to promote dispersion of emissions. The differences between the sites in terms of their distances from the nearest residences should not make a significant difference in air quality impacts at these residences. Mitigation would bring any potential impacts to a level below significance for any of the alternatives.

6.5.3 Biological Resources

Both sites are located on agricultural land and both were surveyed for biological resources for this study. The SR-12 alternative site is immediately adjacent to a CDFW wildlife management area, and the proposed site is approximately 0.5 mile from the wildlife management area. There could be greater sensitivities regarding facility noise at the alternative site in terms of its effects on nesting birds and other species in the wildlife area than at the proposed site. Both sites require construction of the air pipeline through giant garter snake habitat and raptor nesting areas and would be roughly equivalent in their potential for biological resources effects along the pipeline, except that the pipeline for the alternative site is approximately 1 mile longer than the pipeline for the proposed site.

6.5.4 Cultural Resources

Based on literature search and intensive pedestrian survey of both sites, neither site is known to have significant cultural resources present. Both sites have approximately the same general cultural resource sensitivity, which is low to medium.

6.5.5 Geological Resources and Hazards

There would be no significant difference between the sites in terms of geological resources and hazards. The air pipeline would cross areas prone to subsidence to reach either site. There are no geological resources located on or near any of the sites.

6.5.6 Hazardous Materials Handling

There would be no significant difference between the site locations in terms of hazardous materials handling. The uses of hazardous materials would be the same for either of the sites. While there might be differences in the distances that trucks carrying hazardous materials would travel to deliver the materials, these differences would be minor and would not be consequential, given the effective mitigation measures available and the excellent safety record for transport of these materials.

6.5.7 Land Use and Agriculture

The City of Lodi-owned property on which the proposed ECF site is located is an island of City jurisdiction approximately 3 miles west of the City limits. The Lodi General Plan designation for the proposed site is Public/Quasi Public and the zoning designation is Public and Community Facilities. Utility facility is a permitted use within this zoning designation. The proposed site is located in an area that was acquired by the City of Lodi in 1968 as the site of a wastewater treatment plant (White Slough WPCF). The City and the CEC have subsequently permitted compatible uses such as the Northern California Power Agency's Lodi Energy Center (255-MW, combined-cycle, natural-gas-fired power plant) and the existing 49-MW Combustion Turbine Project #2, also known as the steam-injected gas turbine (STIG) plant.

The SR-12 alternative site is located in unincorporated San Joaquin County. The General Plan designation is General Agriculture (AG) and the zoning designation is General Agriculture (AG-40), with a minimum lot size of 40 acres. Per the San Joaquin County Zoning Code (San Joaquin County Development Title, Title 9, Division 6), "the AG zone is established to preserve agricultural lands for the continuation of commercial agricultural enterprises." In the zoning code (9-605.6 [d]) "Major utility services" are permitted subject to site approval and also to the following findings: (a) the source of power requires the use of an agricultural area, (b) there would be "no detrimental effect to agricultural activities in the vicinity," and (c) the site can be returned to agricultural use "if the power source is temporary." In this particular case, it may be easier

to argue that the source of power requires the use of an agricultural area since the ECF would only be feasible within 5 miles of the storage reservoir and virtually all of this area is in agricultural use.

The proposed ECF site is designated by the California Department of Conservation as Unique Farmland; however, it is within a City boundary and in an area zoned for Public Facilities, as stated above. The SR-12 site is located on Prime Farmland.

The proposed site is not enrolled in the Williamson Act agricultural preserve program. The SR-12 alternative site is in non-renewal status. This means that non-renewal of the Williamson Act contract has been filed per Government Code Section 51245. The contract will remain in effect during a 9-year-long non-renewal period.

6.5.8 Noise

Developments at each site would likely be able to meet the appropriate City and County noise standards. The proposed ECF site is approximately 1,900 feet from the nearest residence. The SR-12 alternative site appears to be approximately 3,000 feet east of the nearest receptors at a hotel adjacent to North Thornton Road.

6.5.9 Paleontology

There would be no significant difference between the sites in terms of potential effects on paleontological resources. The probability of encountering significant fossils is low at each site.

6.5.10 Public Health

The project would not be likely to cause significant adverse long-term health impacts (either cancer or non-cancer) from exposure to toxic emissions, regardless of the site chosen. The sites would not differ in their public health effects.

6.5.11 Socioeconomics

Both sites are located in San Joaquin County. The number of workers, construction costs, payroll, and property tax revenues would be nearly the same for the project at each of the sites. Most of the workers would come from the local area. Most workers would commute daily or weekly to the plant site. Some may move temporarily to the local area during construction, causing site-specific impacts on schools, utilities, and emergency services. These impacts would be temporary. Disproportionate impacts on minority and low-income populations would be unlikely because minority populations are not concentrated in an area or areas that are also high potential impact areas. The project is not likely to cause significant adverse public health impacts on areas that are disproportionately minority or low income.

6.5.12 Soils

Differences in soil erosion would be inconsequential with the use of best management practices during construction and operation. The SR-12 site is located in an area that has expansive soils that may make construction more difficult and expensive, compared with the proposed site.

6.5.13 Traffic and Transportation

The number of employees working at a given time during project operation (approximately 25) would not significantly impact local traffic conditions at either site. The peak number of employees during construction (450) would have a greater impact. This impact would be temporary, however, and could be mitigated by transportation management planning. For this reason, the effect of construction-phase traffic

should not figure as a major consideration in evaluating or comparing the sites. Both sites are situated along or near I-5, a major transportation artery. The SR-12 alternative site is also located on SR-12, a two-lane east-west highway that is heavily traveled by commuters and others. Both sites are accessed from the frontage road crossing under I-5 off North Thornton Road.

6.5.14 Visual Resources

Neither site is located in an area with protected viewshed or in a designated viewshed corridor. From either site, the project would be visible to travelers on I-5. The ECF at the proposed site would be visually consistent with the adjacent White Slough WPCF, Lodi Energy Center, and STIG plant. There are few sensitive viewers near the proposed site. The nearest residences are on the opposite side of the I-5 freeway.

The SR-12 alternative site is adjacent to the CDFW White Slough Wildlife Area, which may attract sensitive viewers in the form of hikers and bird-watchers. There are no residential viewers near (within 0.75 mile) the SR-12 site.

6.5.15 Water Resources

Each of the alternative sites could use tertiary treated reclaimed water from the White Slough WPCF that would be piped to the ECF site. PG&E's current agreement with the City of Lodi, however, includes only the proposed ECF site and not the alternative site. If it were not feasible to reach agreement with the City to supply water for the alternative site, then it would be necessary to use an alternative cooling method, probably air-cooled condenser, at the alternative site, at a higher cost and likely with a larger surface foot print. Process water (cooling tower blowdown) would be disposed of in injection wells located at the well pads and potentially at the ECF.

Both sites are located within the Federal Emergency Management Agency AE flood zone. This zone designates "Areas subject to inundation by the 1-percent-annual-chance flood event… Mandatory flood insurance purchase requirements and floodplain management standards apply." Power block buildings, structures, and equipment would be constructed on elevated pads and foundations at elevations above the flood elevation to meet flood zone design standards.

6.5.16 Waste Management

The management of wastes would not differ between the proposed project site and alternative site. Demolition is not necessary at either site to make way for the ECF.

6.5.17 Summary and Comparison

Based on the site selection criteria as described in Section 6.3, it is clear that ECF siting is feasible at either site (Table 6.5-1). Following is a summary of site selection factors:

- **Site Control Feasible**—Site control has been achieved at the proposed ECF site. PG&E also negotiated a purchase option agreement with the owner of the SR-12 site but may elect to terminate the agreement.
- **Location near Electrical Transmission Facilities**—Both sites are adjacent to the PG&E Gold Hill-Eight Mile Road 230-kV transmission line.
- **Location near Ample Natural Gas Supply**—Both sites are near a sufficient source of fuel gas.
- **Location near ECF Site**—Air pipe and wastewater interconnection for both of the sites and the King Island well pads are feasible, although the proposed site is approximately 1 mile closer.

- **Location near Cooling Water Source**—The proposed site is located directly adjacent to the proposed tertiary water source while the alternative ECF site is significantly further away and would require additional agreements with the City of Lodi and construction of a pipeline to convey reclaimed water.
- **Land Zoned for Industrial Use**—The proposed site is located in a zoning district for which utility uses are permitted uses and is appropriately zoned. The SR-12 alternative site is prime agricultural land that is zoned A/G so power generation uses would require additional agency review and approval, compared with the proposed site.
- **Parcel or Adjoining Parcels of Sufficient Size for the Site and Construction Laydown**—Both sites have adjacent land to use for construction laydown.

When taking into account the comparative analysis provided above, the proposed site best meets the project objectives as compared with the SR-12 site. The SR-12 alternative site is adjacent to a wildlife preserve, which could pose land use and biological resources concerns. The alternative site would also require somewhat longer linear routing for the air pipeline and a possible water pipeline and, therefore, greater disturbance and cost.

When taking into account the comparative analysis provided above, the proposed site best meets the project objectives as compared. The SR-12 alternative site would likely be more difficult to permit because it is prime agricultural land that is zoned A/G. In addition, the alternative site is adjacent to a wildlife preserve, which could pose land use and biological resources concerns.

TABLE 6.5-1
Environmental and Project Development Constraints of the King Island CAES and Alternative Site

Site or Alternative	King Island CAES Site	SR-12 Site
Site control	Yes	Yes
Brownfield site	No	No
Land use and zoning	Zoned as Public and Community Use, power plants are an allowable use, and there are two power plants adjacent	Zoned as AG-40, general agricultural, minimum parcel 40 acres; power plants are not a permitted use, and a zoning and General Plan amendment would be needed
California Department of Conservation designation	Unique Farmland	Prime Farmland
Williamson Act contract	Not enrolled	Enrolled and filed for nonrenewal
Sensitive noise receptors nearby	Nearest residence ~1,900 feet east	Nearest residence 3,000 feet west
Visual resources	No nearby sensitive resources; adjacent to power plant and wastewater treatment facility	Adjacent to CDFW wildlife area and viewing area
Biological resources	Land is actively farmed	Land is actively farmed; CDFW wildlife area adjacent to the west
Cultural resources	No surface resources identified during surveys	No surface resources identified during surveys
Significant unmitigated impacts or costly mitigation likely	No	Site would need to be rezoned and General Plan amended; may need biological resources mitigation for noise

6.6 Alternative Project Design Features

This section addresses alternatives to the locations of the natural gas supply pipeline, electrical transmission line, and water supply pipeline.

6.6.1 Alternative Natural Gas Supply Pipeline Routes

The proposed facility would connect to PG&E's existing high-pressure natural gas distribution pipeline near Thornton Road. Although this interconnection is direct and relatively short distance, routing and design constraints prompted analysis of multiple routing alternatives as outlined in a Gas Supply Feasibility Study (PG&E, 2014) and in Section 4.0, Natural Gas Supply. While not addressed in the Feasibility Study, an extension of approximately 1.7 miles from the proposed ECF site to the SR-12 alternative site along the public road was considered feasible. Additionally, a potential gas pipeline connection from the alternative site to an existing gas gathering pipeline approximately 0.8 mile west on Guard Road was identified but not evaluated.

6.6.2 Electrical Transmission System Alternatives

The assumed transmission interconnection is with the PG&E Gold Hill-Eight Mile 230-kV transmission line, which is located only 270 feet from the proposed ECF site and approximately 1,200 feet from the alternative ECF site. The other 230-kV lines in the vicinity are located either 20 miles to the west or 18 miles to the east. Because of the close proximity of the Gold Hill-Eight Mile Road line, no other alternatives were considered (refer to Section 3.0, Electric Transmission).

6.6.3 Water Supply Alternatives

The proposed ECF site is adjacent a wastewater treatment plant that can provide reclaimed water for cooling tower make-up and other uses. Reclaimed water is not currently available for the alternative site and, thus, would require the use of an air-cooled system unless agreement could be reached with the City of Lodi. This alternative would also require construction of a reclaimed water pipeline approximately 1.4 miles longer than the water pipeline for the proposed site. The air-cooled (dry) system, while feasible, would significantly increase the project cost as well as increasing the surface footprint for the ECF. Potable water was not considered for cooling, due to CEC statewide policies discouraging the use of potable water for power plant cooling. Dry cooling was considered as discussed below.

6.7 Technology Alternatives

The CAES technology selected for the KICP (compressors and turbo-expanders using a porous rock geological structure as a compressed air reservoir) is, broadly speaking, the only technology that would meet the project's most important objective of testing and developing CAES technology using a depleted natural gas field. Use of a salt dome as an energy storage reservoir was not contemplated as an objective of the Feasibility Study and would not be feasible for KICP, because these geological structures are generally not found in California. The Dresser-Rand Smart CAES technology was selected over potential, yet unproven, competing CAES designs due its operational history, commercial warrantee availability, superior turn-down ratio, and ability to provide utility-scale, dispatchable power and ancillary services meeting project power delivery objectives. Because the investigation of CAES technology was pre-determined when the feasibility study was developed in conjunction with the DOE, California Public Utilities Commission and CEC, this section briefly discusses specific alternatives investigated within the design of the CAES technology. For comparison, Table 6.7-1 lists some of the specifications for the KICP-proposed technology.

TABLE 6.7-1
Performance Specifications, KICP

I. Operations	
P_{max} net (@ ISO)	158 MW
P_{max} (@ July peak conditions)	157 MW
P_{max} (@ July peak conditions, % of ISO)	99%
Start time to P_{min}	5 min
Cold start	40 min
Hot start	10 min
II. Efficiency	**50.9**
Heat rate @ ISO conditions (LHV)[a]	3,916 Btu/kWh
P_{min} heat rate @ ISO conditions (LHV)	4,415 Btu/kWh
Energy ratio (MW in/MW out)	81.6%
Roundtrip efficiency MWe out/(MWe + MWt) in	51%
III. Emissions (controlled, out of stack, ISO conditions)	
NO_x emissions, lb/MWh	0.031
CO emissions, lb/MWh	0.018
PM emissions, lb/MWh	0.013
VOC emissions, lb/MWh	0.015
CO2 emissions, lb/MWh	448

Notes:
Btu/kWh = British thermal units per kilowatt hour
CO = carbon monoxide
CO_2 = carbon dioxide
ISO = International Organization for Standardization
LHV = Lower heating value
min = minute(s)
MWe = Megawatt, electric
MWt = Megawatt, thermal
NO_x = nitrogen oxide
PM = particulate matter
P_{max} = Maximum load
P_{min} = Minimum load
VOC = volatile organic compound
[a]Power generation cycle includes both heat rate and efficiency in % (~85% for CAES)

6.7.1 ECF Cooling Alternatives

Dry-cooling technology was evaluated as an alternative to the use of the mechanical draft cooling tower. With the wet-cooled plant as proposed, reclaimed water (Title 22 processed wastewater) would be pumped to the cooling tower and used as make-up for water evaporated in the cooling process and lost to blowdown. Water losses would include the following approximate contributions: evaporation at 1,692 gpm, blowdown at 1,302 gpm, and make-up at 2,864 gpm on a peak summer day. The heat load would be generated primarily from the compressor inter- and after-coolers, pumped through finned tubes in the cooling tower for cooling, and then returned in a closed loop to the compressors.

Wet cooling using recycled/reclaimed water is encouraged under CEC and state policy (as opposed to use of potable water for cooling) and a supply of tertiary treated (Title 22) recycled water is readily available at the White Slough WPCF adjacent to the plant site and, therefore, this technology was chosen for the KICP.

Dry cooling using an air-cooled condenser was considered as an alternative to the cooling tower in the engineering analysis (Worley Parsons, 2015). Disadvantages of this technology are: (1) a larger portion of the energy generated is needed to drive the cooling fans (parasitic load) than for the cooling tower and the result is less efficient operation; (2) it requires a very large and bulky structure, raising the possibility of adverse visual resources impacts; (3) it requires a larger amount of space at the ECF site than the cooling tower, imposing significant design constraints; and (4) it would make it difficult to satisfy cooling requirements during the hottest operating season which would not satisfy key project objectives regarding operating flexibility. No other technologies are currently available that are capable of adequately cooling the facility.

6.7.2 Fuel Technology Alternatives

Technologies based on fuels other than natural gas were eliminated from consideration because they do not meet the project objective of developing and demonstrating a CAES project using natural gas. Other fuel systems are not feasible or have not been developed for CAES technology.

6.7.3 Waste Discharge Alternatives

The proposed King Island CAES facility would discharge the process wastewaters, including cooling tower blowdown and well pad produced water and condensate to new injection wells that would be permitted and developed for this purpose. Two total injection wells are envisioned with various combinations of well locations possible between the well pads and the ECF. The injection wells would be drilled into a nonpotable aquifer that is below the level of the King Island CAES air storage reservoir (and would not interfere with the reservoir or water table) and would require an Underground Injection Control (UIC) permit issued by the EPA (see Appendix 2B for a detailed description). Storm water would be processed through an oil/water separator as necessary and then discharged into a drainage system that meets the San Joaquin County design requirements for drainage design and that discharges down-gradient of the ECF site (see Section 5.15, Water Resources).

The alternative discharge method for process wastewater would be to construct a zero liquid discharge (ZLD) system at the ECF in which concentrators and crystallizers are used to evaporate process wastewater and to remove the residual salts and other contaminants such that little or no water is discharged, and residual salt is trucked as a “salt cake” byproduct to a landfill. The blowdown would be pumped to a brine concentrator, which would concentrate the entrained silica and other minerals, and send approximately 95 percent of the recovered water/distillate back into the plant to be used as cooling tower make-up or for other water system needs. The remaining waste/concentrate from the brine concentrator would form a slurry that would be sent to a crystallizer, where a small amount of the remaining water is recovered as it reduces the brine concentrate to a nearly dry solid. The solid is pressed into cake for disposal in an approved landfill (Worley Parsons, 2015). This is a labor-intensive system having a history of operating challenges, including foaming, that can make the system less reliable than the reclaimed water system selected.

Wet cooling using recycled water is the option selected for the KICP for the following reasons:

- Reclaimed water is readily available in quantities sufficient to support site operations
- ZLD systems are technologically complex and expensive to construct as well as challenging to operate and maintain
- ZLD system reliability poses a concern related to plant outages that affect operating ability, availability of power, and grid reliability.

To summarize, using ZLD for a plant of this nature would not support the project objectives of providing easily dispatchable, reliable, and economically viable power to the northern California grid. The cost of a ZLD in terms of initial construction costs, operations and maintenance costs, and lost production costs would be out of proportion to any environmental benefits of the eliminated volume of wastewater. The use of a ZLD would be economically unfeasible and would offer little or no environmental benefit, relative to the use of reclaimed water.

6.8 References

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Worley Parsons, A. 2015. Final Engineering Report, King Island Compressed Air Energy Storage Project. Prepared for Pacific Gas and Electric Company. Prepared by Worley Parsons, Sacramento, CA.

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PG&E King Island
Compressed Air Energy Storage Project

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Appendix 1A
Persons Who Prepared this Environmental Siting, Licensing, and Permitting Analysis

APPENDIX 1A

Persons Who Prepared the Environmental Siting, Licensing, and Permitting Analysis

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Appendix 2A
Underground Injection Well Permitting Analysis

Underground Injection Control Permitting Analysis

King Island Compressed Air Energy Storage Project

King Island, San Joaquin County, California

Prepared for:
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Executive Summary

Introduction

The United States Department of Energy (DOE), the California Public Utilities Commission (CPUC), and the California Energy Commission (CEC) have provided funding for Pacific Gas and Electric Company (PG&E) to investigate the viability of using a depleted natural gas field to store energy by injecting compressed air into a subsurface reservoir during periods of low electric grid demand or excess energy generation, and recovering it by generating electricity using turbo-generation equipment during high demand periods and to support other grid reliability operations. The King Island reservoir was selected for CAES development by the PG&E project team following detailed evaluation of its surface and subsurface attributes, significant performance testing of the reservoir and various other considerations. The results of the compression testing completed in during the 1st and 2nd Quarter of 2015 indicate that, with an established air bubble of approximately 8.0 Bscf (billion standard cubic feet), the reservoir can support a 300 MW power generation facility in a variety of operating scenarios. The reservoir will be used to store compressed air that is piped from the energy conversion facility (ECF) until it is needed, at which time it will be released and returned to the ECF for conversion to electric power.

In addition to various other federal, state and local permitting processes, the reservoir testing completed by PG&E was subject to Underground Injection Control (UIC) regulation by the Environmental Protection Agency (EPA) and a permit was issued in August of 2014 for an injection and withdrawal well, subsequently completed in November 2014, EPA Class V Experimental Well, Permit No. R9UIC-CAS5-FY 13-1]. Similarly, the development of King Island injection and withdrawal wells for an underground storage reservoir to support the operation of a permanent 300 MW CAES facility would be subject to the same regulation, thus requiring a new UIC permit. In addition, any injection of water produced by the I/W wells and/or ECF processes would require a UIC permit. In addition to the UIC permits, several other permits will be required for the King Island Compressed Air Project (KICP), all of which will be considered in the CEC Application for Certification (AFC) process as detailed in the Environmental Siting, Licensing and Permitting Analysis (ESLPA) (CH2M HILL 2014).

The development of a depleted natural gas reservoir for CAES operations is very similar to that of a natural gas underground storage reservoir. The key subsurface elements are high capacity injection/withdrawal (I/W) wells, observation wells to monitor conditions within and around the reservoir, and water injection wells for the disposal of produced process waters. Water production during withdrawal operations is likely to occur. Facilities would need to be installed to dispose of the expected volume of this produced water and any wastewater supplied from the ECF.

EPA Regulation

The Safe Drinking Water Act was passed by the U.S. Congress in 1974 to ensure security of various sources of drinking water. Specific requirements are found in Title 40 of the Code of Federal Regulations. EPA has been charged with enforcing these regulations and the Underground Injection Control program is a key part of their regulatory oversight. The Ground Water Office of EPA Region IX, located in San Francisco, would be responsible for processing all UIC permits for this CAES project.

Purpose of Report

The purpose of the information gathered in this report is to provide a potential developer of the permanent KICP with a high level analysis of the EPA UIC permitting process and a template of a UIC permit application populated with information gathered during the earlier testing phase and an assumed base case development scenario. This base case is consistent with assumptions and design criteria provided in other key project reports developed for the commercial scale project and referenced throughout the environmental siting, licensing, and permitting analysis (ESLPA) prepared for the KICP (CH2M HILL 2014). Reservoir modeling of the base case bubble building and full operations provide reasonable estimates for the operating characteristics pertinent to a UIC permit. Variations from that base case would require changes to the permit application information provided in this document. In certain cases where development scenarios other than the base case have been evaluated, information has been included indicating what changes might likely be required in the permit application. This document is intended as a guide only. Data and analysis specific to the intended development will need to be incorporated into the UIC and other permit applications necessary for the final design and operating plans of the CAES facility. Some of the documentation prepared for the compression testing program permit application is directly applicable to the full development project as well, but much of the new application will need to be redrafted with specific information relevant to the final development and operating plans.

Structure of the UIC Permit Application Template

Based on preliminary discussions with EPA, at least two UIC permits will be required for two very different operations: 1) The injection of air into the King Island reservoir, and 2) The injection of waste water from CAES operations (well field and ECF) into an approved disposal zone. Certain sections of the permit application(s) will require different analysis and discussion of both the air and water injection activities. Because these are occurring in different underground formations, the analysis of the impact on each can yield significantly different results. Attempts have been made in this report to indicate where these separate analyses are required. Due to the unique nature of the project, it is suggested that the project developer meet with EPA early in the planning stages to come to a better understanding of the regulatory requirements and EPA's expectations regarding the permitting process.

It is assumed that the Starkey formation will be the likely disposal zone for water from the facility. Other than the Mokelumne River formation, which is the target for CAES air injection, the Starkey formation is the shallowest formation below the underground source of drinking water (USDW) based on data derived during the PG&E coring operations. The developer will need to include specific data describing the characteristics of the Starkey formation, its capability as a water disposal formation, and other technical details related to the intended injection.

Base Case Description

The King Island reservoir characteristics were evaluated based on data from previous exploration and production activity, reservoir rock data obtained from a core well drilled by PG&E in 2013, and simulation work utilizing a reservoir model constructed from all available data. Simulation runs of various air injection and withdrawal well development and operating scenarios were completed assuming the following base case objectives and boundary conditions:

1. Provide injection capacity to build an 8 Bscf air bubble in approximately one year
2. Provide a sufficient number of withdrawal wells to support a 300 MW generating facility for 10 hours requiring an air flow rate of 1,100 MMscfd

3. Develop the air bubble and operate the facility to limit the native gas production in the withdrawal air flow to within safe limits

4. Provide for an air injection rate of 550 MMscfd

To achieve these objectives, several bubble building scenarios were evaluated. Based on an assumed design pressure limitation on the reservoir of 3,000 psi, it was discovered that the bubble build rate was very slow due to limited water efflux from the underlying aquifer at this pressure, requiring several years to achieve an 8 Bscf air bubble. In order to speed up the bubble build rate, the model was adjusted to simulate water extraction from the underlying aquifer, effectively creating space within the reservoir for the injected air to occupy. By installing 4 water withdrawal wells at the perimeter of the reservoir and pumping water from them at rates of 3,200 Bbl/day each and injecting air at 3,000 psi, the model predicts that a 7.7 Bscf bubble could be created in 14 months (Burzlaff et al. 2014). This development scenario achieves the stated objectives, but would require the re-injection of approximately 12,800 Bbl/day of produced water into an approved disposal formation which would be subject to the UIC regulations. This scenario was adopted as the base case. However, it should be noted that subject to the final design of the facility and its operational characteristics, the developer's preferences, future permitting conditions and various other criteria, a large range of alternative development scenarios is possible. Some of the more plausible scenarios are discussed herein.

For purposes of UIC permitting, the base case project would have three distinct sources of water that require disposal by injection into an approved formation:

1. Water withdrawn during the bubble build period (described above)
2. Water produced from the reservoir during air withdrawal operations
3. Process wastewater produced at the CAES ECF and piped over to the well pads (or injected at a well located at the ECF)

Numerous bubble building scenarios are possible depending on the developer's objectives. Several alternatives to the base case were evaluated with reservoir simulations, but none were found that could achieve all of the objectives stated above. Those additional cases included:

- No water withdrawal & injection limited by 3,000 psi maximum reservoir pressure – this case was deemed unacceptable due to the very long bubble build time (10 years, 4 months)
- Use of horizontal vs. vertical I/W wells – deemed too difficult to control the injected air bubble during development resulting in high natural gas concentrations during withdrawal
- Slower water withdrawal rate – extended the bubble development time proportional to the rate of water withdrawal
- Inside-out bubble development with natural gas production – the injected air displaces the produced native natural gas, and shortens the bubble building period to approximately 41 months for half rate operation capability (150 MW) and 59 months for a full 300 MW operation.

Note that this represents only a very discrete number of possible development scenarios, and there are numerous hybrids of these cases which could be attractive to a developer, depending on their specific design and operating objectives. Each case will perform differently in bubble building effectiveness, air bubble maintenance, native gas production, and water production rates. These cases are examples of a variety of approaches and the results are based on reservoir simulations. The actual results will likely vary from the simulation predictions. Each of these cases represent trade-offs of various operating parameters,

with advantages and disadvantages for each. Potential developers will need to formulate their own plans based on their assumptions, operational objectives, and simulated results. The development of any underground storage project includes elements of risk during the permitting, project development, as well as once the facility is operational.

Regardless of the scenario selected by a developer for building the bubble and operating the facility, the UIC permit will need to contain the specific information related to that scenario. The decision by the developer to pump water or not during the bubble build period has implications, not only for the time required to build an appropriately sized bubble to start operations, but also from a permitting standpoint. Creating space in the reservoir rock for injected air by removing water will require the handling and proper disposal of the water.

Availability of Additional Data

A significant amount of data has been compiled for a potential developer to utilize in developing plans for the full field development and preparing a UIC application. In addition to information compiled for the compression testing operations, PG&E has performed numerous reservoir modeling simulations and has compiled the actual testing results. Additional reservoir data has been identified by PG&E that may potentially be available to a developer. These include the following:

- 3D Seismic Data – The King Island Gas Field is located within a 250 mile 3D seismic survey that was shot in early 1999 by Eagle Geophysical in western San Joaquin County. This data is likely available for purchase.
- Citizen Green 1 Well Data – In 2011 an exploratory well was drilled in the King Island Field by WestCarb to evaluate the potential of various formations for carbon sequestration. Much of the logging and testing data from that well is available in the PG&E RFO data room; additional data may be available from the participants in the WestCarb effort that may be of value to a CAES developer.

Summary

The development of a CAES project in a depleted natural gas reservoir will be the first operation of its kind. As such, developers, regulatory agencies and other stakeholders will be dealing with numerous issues for the first time. EPA has jurisdiction over the injection of fluids underground and will be one of the key regulatory agencies involved in the project. The documentation included with this report should provide a developer with valuable information directly related to UIC processes and considerations for KICP. Due to the unique nature of the project, it is suggested that the successful developer meet with EPA early in the planning stages to come to a better understanding of the regulatory requirements and EPA's expectations regarding the permitting process. In conclusion, based on successful permitting of the I/W test well, extensive industry experience permitting similar deep injection wells for gas storage, extensive project-specific modeling and, related engineering analysis, the EPA UIC permitting process is expected to be manageable and to follow a process similar to that outlined herein.

KICP UIC Permitting Analysis

1.0 Introduction

Compressed Air Energy Storage (CAES) is a technology that stores, in the form of air, excess energy generated during periods of low electric grid demand or excess energy generation, and then utilizes the pressurized air to generate electricity during periods of high demand and/or to support other grid reliability operations. In the case of renewable energy resources, such as wind and solar power, the energy generated by these resources is intermittent and highly dependent on the availability of the resource (i.e. wind and sun); the energy generated by those resources, does not always match the time periods when customers need it most. Therefore, CAES technology is being investigated as one potential opportunity for storing this intermittent energy for use during higher demand periods. Under California's existing Renewable Portfolio Standard, utilities must supply 33 percent of all electricity retail sales from eligible renewable resources by the year 2020. Much of this renewable generation is expected to be derived from the addition of new solar and wind power generation. As such, energy storage is a potential strategy to mitigate the intermittent effects and enable greater penetration of wind and solar power on to the electric transmission system. CAES has the potential to be a key technology for expanding reliance on wind and solar renewable resources for electricity production.

The United States Department of Energy (DOE), the California Public Utilities Commission (CPUC), and the California Energy Commission (CEC) funded Pacific Gas and Electric Company (PG&E) to investigate the viability of using a depleted natural gas field to store energy by injecting compressed air into a subsurface reservoir, during periods of excess and/or low-cost generation, and recovering it by generating electricity using turbo-generation equipment during high demand periods. The application of CAES using a depleted gas reservoir for storage provides several distinct advantages. First, depleted gas reservoirs are proven geologic traps that formerly held natural gas reserves under high pressure for millions of years and therefore should be capable of containing compressed air to power a CAES facility. Second, the subsurface data, including well logs, production, and seismic imaging data, that are needed for characterization of the reservoir and predicting its performance in a CAES application are typically available for previously developed natural gas fields. Finally, the Sacramento Valley Basin contains many natural gas fields that are situated along California's power transmission backbone, and thus ideally located to provide utility-scale power storage to facilitate integration and distribution of renewable energy throughout the state.

Based on the results of detailed evaluation of its surface and subsurface attributes, including significant performance testing of the reservoir, the King Island reservoir has been selected by the PG&E project team as capable of supporting commercial-scale CAES development. Extensive reservoir modeling was completed by MHA Petroleum Consultants (Burzlaff, et al. 2014). This report provides an analysis and prediction of reservoir performance during the compression test as well as for a full-field base case development scenario. The results of the compression testing completed in 2015 will be compared to the predictions in the base case reservoir simulations and are expected to indicate that with an established air bubble of approximately 8.0 Bscf the reservoir can support a 300 MW power generation facility in a variety of operating scenarios. The air flow requirements from the reservoir are 1.1 Bscfd to support an electric generation period of up to 10 hours, followed by an injection period of 6 hours at roughly the same rate, along with weekend injection (injection periods of longer than 6 hours/day during the week and then on the weekend, would allow the facility to operate 7 days/week).

2.0 Project Description

The King Island CAES project would store energy in the form of compressed air for later release to generate electricity. The Project would use electric-powered compressors to compress air and move the air through a pipeline to an underground air storage reservoir in the King Island natural gas field. When additional power and or ancillary services is needed to meet the California Independent System Operator (CAISO) system needs, the air would be released from the reservoir, heated via natural gas-fired combustors and used to drive turbo expander units that would generate electricity for grid use. The facility would have a nominal generating capacity of 300 megawatts (MW).[1]

Principal design elements of the project include the following base case design features:

- ECF (Energy Conversion Facility)/power island site for the turbo-machinery including compressors, turbo expanders, generators, switchyard, and cooling equipment; 20 acres
- Underground storage injection and withdrawal (I/W) equipment at 2 well pads, with up to 30 I/W wells, hydrocarbon monitoring/control equipment, control building, and water storage tanks; 10 acres total footprint for both pads
- Underground compressed air pipeline, ECF to Well Pad #1 (also known as East Pad); 2.6 miles
- Air collection pipeline from Well Pad #1 to Well Pad #2 (also known as West Pad), 0.3 mile
- Natural gas pipeline to convey fuel to the ECF from a PG&E Distribution Feeder Main (DFM), 1.4 miles
- Generator tie-line connecting the ECF to the existing Gold Hill - Eight Mile 230 kV transmission line circuit, 270 feet
- Reclaimed cooling water supply pipeline from the City of Lodi's White Slough Water Pollution Control Facility (WPCF), 0.3 miles
- Two (total) Wastewater injection wells: one (1) located at Well Pad #1 and one (1) either located at Pad #2 or at the ECF

A detailed description of the full project and associated siting and permitting issues has been prepared (CH2M HILL 2014). This UIC permitting analysis is focused on the King Island reservoir and associated well field facilities.

2.1 Reservoir Design Considerations

The development of a CAES reservoir is very similar to that of a natural gas underground storage reservoir. The key elements are high capacity injection/withdrawal (I/W) wells, observation wells to monitor conditions within and around the reservoir, and water injection wells for the disposal of produced and non-hazardous process waters. The I/W wells' locations within the reservoir need to be based on a plan to avoid pressure interference between the wells during periods of high flow rates and also to fully utilize the reservoir's volumetric capacity which provides for longer sustained operations.

The anticipated design of the I/W wells is based on the results of the compression testing and the simulation results of various well completion designs. It was determined that straight, directional or highly deviated wells are preferred to horizontal well designs. This was dictated primarily because the

[1] Approximate targeted facility output with both turbo expander trains operating at 100% load at International Standards Organization (ISO) conditions (15° C, 65% relative humidity, and ambient pressure at sea level).

directional and highly deviated wells were found to provide better control over the native gas concentrations in the withdrawal flow stream than horizontal wells.

The EPA has indicated that they will require two separate runs of casing to be cemented from below the USDW to surface. The casing program design permitted by the EPA for the compression testing I/W well calls for 600 feet of 20" surface casing, 13 3/8" intermediate casing to approximately 3,500' TVD, and then 9 5/8" casing set to the top of the reservoir. The reservoir is completed with a well screen and gravel pack and 5 ½" tubing set on a packer to within 50' of the top of the reservoir. Casing and tubing lengths will be longer for more highly deviated wells. Each I/W well is designed for a flowrate of up to 50 MMcfd, and it was determined that 5 ½" tubing was adequate for this purpose without significant pressure loss.

Well spacing is an even more important design consideration for a CAES reservoir than for natural gas storage due to the limitations on natural gas concentrations[2] in the withdrawn air. Tighter spacing may provide for a better sweep of the natural gas during the bubble build period, but could lead to interference and flowrate constraints later during operations. A broader well spacing tends to leave trapped native gas between wells which later can become an issue during withdrawal operations. The optimal well spacing will take into account the following factors:

- The bubble build plan which includes injection rates, total volume, schedule and injection pressure limitations
- The maximum tolerable native gas concentration in the withdrawal stream
- The overall bubble size
- The anticipated operating plan, including capacity ramp-up considerations over the first few months of operation
- The total number of I/W wells for the planned full field development

2.2 Water Withdrawal & Disposal

One of the key findings from the modeling work completed to date is that reservoir pressure is affected by a partial water drive. In other words, as gas was produced from the reservoir initially, the pressure decline was dampened by water influx into the reservoir from the underlying aquifer. Over time the reservoir pressure has continued to rise due to the continued water influx. This response was relatively slow, and the modeling revealed that the effort to push the water from the reservoir back into the aquifer during the bubble build will likely be slow as well. With a given maximum injection pressure constraint, a developer could either inject at a rate that the water will naturally efflux from the reservoir (push the water back with pressure), or physically remove a volume of the water from the invaded zone in the reservoir. Time constraints to develop an adequately sized air bubble in a timeframe meeting a developer's overall project schedule objectives will likely require the physical removal of some water from the reservoir.

The initial modeling runs that assumed the water removal strategy during the bubble build period were based on four water withdrawal wells located on the perimeter of the storage reservoir, operating at rates of approximately 3,200 Bbl per day each. Using this water removal rate and a maximum injection

[2] The estimate of original gas-in-place from the King Island reservoir model is 13.8 Bscf. Of this total, 10.6 Bscf has been produced. Of the remaining 3.2 Bscf, it is estimated that 1.0 Bscf is in the form of free gas, and 2.2 Bscf is residual gas which is trapped in the water swept portions of the reservoir. Development of the air bubble and subsequent injection and withdrawal operations should be optimized to limit the concentration of this native natural gas in the withdrawn air to safe levels.

pressure of 3,000 psi, the model indicates an 8 Bscf bubble could be built in the Mokelumne River formation (MRF) in approximately one year. This produced water would be re-injected into EPA approved injection wells completed in zones deeper than the USDW. In the vicinity of King Island, the Starkey formation is deeper than the USDW and would not interfere with the air storage operations in the MRF. Disposal of produced waters would require one or more disposal wells, tankage for temporary storage, properly sized pumps for this purpose, and the interconnecting piping between the equipment location and the disposal well site. Preliminary indications from the EPA are that these water injection wells will be subject to a permitting process that is separate from that for the air I/W wells.

In addition to the need to dispose of water withdrawn from the storage reservoir during the bubble build period, it will be necessary to dispose of water produced during normal operations. Reservoir modeling has indicated that after the first few months and reservoir conditions have been stabilized, an estimated 5,000 Bbl/day of water could be produced and separated from the air flow stream during withdrawal operations. During the early stages of withdrawal operations after the bubble building is complete, the water production is estimated at up to 12,000 Bbl/day, reducing to the 5,000 Bbl/day rate over the first 6 months. This produced water, along with non-hazardous water from the ECF, will need to be disposed of. Maximum ECF wastewater production for the base case is approximately 1350 gpm, although the average annual rate will be significantly less as outlined in detail in the project engineering report (Worley Parsons 2015) and in the Water Resources chapter of the ESLPA. Thus, base case operation would discharge up to 430 gpm of process and produced wastewater from the ECF and well pads, combined, to the underground injection well(s) on an average annual basis and, under worst-case maximum discharge conditions (ambient temperature and equipment operation), approximately 1,500 gpm.

For the base case analysis it has been assumed that wastewater disposal will be performed utilizing the same equipment that was used during the bubble build period (potentially supplemented by an additional injection well located at the ECF) and will be in the Starkey formation.

2.3 Reservoir Operations

Unlike other gas storage operations, the air stored in a CAES reservoir provides the motive force that will be used to drive electric generation equipment. It is the potential energy of the air in the reservoir stored at a high pressure that provides the motive force necessary for the operation to be successful. The CAES facility has its greatest value in its operational flexibility, including the ability to respond on very short notice to changes in electric market conditions.

Some basic rules of operation will help maintain the maximum capability and greatest operational flexibility for the reservoir:

1. During reservoir development, the bubble should be built slowly and large enough to ensure high pressure throughout the withdrawal cycle.

2. The reservoir pressure should generally be maintained as high as possible up to the permitted limit. This not only improves delivery of high pressure air to the surface equipment to maximize power generation capability, it also helps keep water from encroaching into the reservoir.

3. The concentration of native natural gas coming to the surface should be minimized by actively monitoring and intervening in the withdrawal of individual wells. All the wells will perform differently, so identifying those with high gas concentrations and employing operating strategies to limit their impact on the total flow stream will be critical.

4. Injection/withdrawal well performance should be investigated at the first sign of impaired performance. If necessary, plans should be developed to rework any under-performing wells to

restore capability. Each underperforming well puts a proportionately larger burden on the remaining wells and can have a negative impact on the total performance of the reservoir and thus on the performance of the ECF.

5. Production limits should be established for every injection/withdrawal well to ensure they are not overproduced, especially the high performing wells. This could lead to a significant reduction in capability if any of these wells fails.

The anticipated operations of the CAES facility should be described in the UIC application in a manner that provides for as much flexibility as possible within defined reservoir constraints while at the same time ensuring protection of the USDW. EPA will typically want limits on the injected air volume and maximum reservoir pressure and have specific design requirements for wells (new injection/withdrawal, new water injection, observation wells and existing gas production wells) that penetrate the USDW.

3.0 UIC Permit Requirements

The table below presents a summary of the required UIC permit attachments that are discussed in this report, the approach necessary to meet the UIC requirements, and any proposed deviations from typical requirements for a Class I injection well. Note that certain attachments will require data to support both the air storage reservoir as well as the water disposal zone. Both the injection of air and the disposal of water will be subject to review and approval by EPA and will likely require separate permits.

TABLE 3-1: DESCRIPTION OF PERMIT ATTACHMENTS AND DEVIATIONS FROM CLASS I REQUIREMENTS

Permit Attachment	Approach	Deviation from Class I Requirements
A: Area of Review	Separate analyses need to be conducted for the Areas of Review (AOR) to be designated for both air injection and water disposal (separate formations). These are based on a review of reservoir and USDW geology, and pressure modeling to establish the Zone of Endangering Influence plus application of a default ¼-mile radius where the ZEI is less than ¼ mile from the well. For air injection, the analyses performed need to support an AOR that encompasses the lateral limits of the gas reservoir plus a default minimum ¼ -mile radius from the proposed injection/withdrawal wells. For the water disposal well(s), the same ¼ mile buffer applies.	None
B: Maps of Well/Area and Area of Review	Maps need to be prepared showing surface features, existing and proposed well surface and bottomhole locations, and the established AOR.	None

TABLE 3-1: DESCRIPTION OF PERMIT ATTACHMENTS AND DEVIATIONS FROM CLASS I REQUIREMENTS

Permit Attachment	Approach	Deviation from Class I Requirements
C: Corrective Action Plan and Well Data	Existing artificial penetrations (wells) within each AOR (one for the air reservoir and one for the water disposal wells) need to be reviewed in terms of their completion and cementing details (for active and shut in wells) or their plugging and abandonment details (for plugged and abandoned wells). In addition predicted pressures in the target injection formation at the well locations will be evaluated to determine whether the maximum anticipated pressure increase could mobilize fluid flow through the well bores. The program, once developed, needs to comply with EPA requirements to prevent the potential for communication between the target injection zone and overlying USDWs.	Several wells within the potential AOR have not been plugged or completed with cement at the base of USDW in accordance with EPA standards. Some of these wells are completed with annular cement above the injection zone which is expected to provide adequate protection against upward flow of gas, air or formation fluids into USDW and other formations. Given that the existing condition of those wells would be protective of USDW no corrective action need be proposed. Other wells within the AOR may require some form of correction.
D: Maps and Cross Sections of USDW	This section includes maps and cross sections showing the extent and depth of USDW in the vicinity of the air storage reservoir and also near the water disposal wells	None
E: Name and Depth of USDWs	The depth of USDWs should be determined based on geophysical log analysis or laboratory analysis of water samples previously collected. This attachment will describe the methodology used.	Not normally required for Class I wells, however EPA Region 9 requests that this information be included.
F: Maps and Cross Sections of Geologic Structure of Area	Maps and cross sections have been developed for the air storage reservoir based on regional geologic data, well log data obtained from DOGGR, seismic survey data interpretation, and information derived from the core well drilled at the site. Separate maps for the air storage reservoir and water disposal zones will be required.	None
G:Geological Data on Injection and Confining Zones	A narrative description of the site geologic setting, injection and confining zones for both the air storage reservoir and water disposal zone is required.	Not normally required for Class I wells, however EPA Region 9 requests that this information be included
H: Operating Data	Details need to be provided regarding the proposed use of the reservoir for the injection and withdrawal of air from wells completed into the reservoir. This needs to include injection rates, pressures, volumes, flow rates, temperatures and nature of the injected air. Similar data needs to be provided for the water disposal operations.	None
I: Formation Testing Program	Information from the compression testing program regarding reservoir performance analysis and the establishment of the maximum tolerable injection pressure. The water disposal formation will require the definition of similar limits.	None
J: Stimulation Program	A stimulation program was prepared for the testing program application and should be very similar.	None
K: Injection Procedures	A description of air injection procedures is required, including a process flow diagram. Similar information is required for the water disposal operations.	None
L: Construction Procedures	Construction procedures are consistent with Class I well requirements.	None
M: Construction Details	A diagram showing construction details is required.	None

TABLE 3-1: DESCRIPTION OF PERMIT ATTACHMENTS AND DEVIATIONS FROM CLASS I REQUIREMENTS		
Permit Attachment	**Approach**	**Deviation from Class I Requirements**
N: Changes in Injected Fluid	A description of the anticipated movement and changes of air and water in the subsurface as a result of the proposed air injection and water disposal (separate formations) is required. An evaluation of potential chemical changes in the air storage reservoir as a result of air injection should be included.	None
O: Plans for Well Failures	Contingency plans for failure of any air injection or water disposal well is required.	None
P: Monitoring Program	An outline of the proposed monitoring program for both the air reservoir and the water disposal zone (separate reservoirs). For the air reservoir this may include the use of existing gas production wells as pressure observation wells within the reservoir. For the water disposal zone, this may be simply equipping the injection well with appropriate instrumentation.	None
Q: Plugging and Abandonment Plan	A plugging and abandonment program for the typical air Injection/Withdrawal well and the water disposal well is required.	None
R: Necessary Resources	Evidence is provided to demonstrate financial capability to fulfill commitments related to future well plugging and abandonment.	None
S: Aquifer Exemptions	Not applicable (applicant not applying for an aquifer exemption).	None

Reference Cited

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ATTACHMENT A
AREA OF REVIEW

Area of Review

A.1 Requirements

UIC regulations require that an Area of Review (AOR) be established around a new injection well for the investigation of possible pathways for out-of-zone migration of injection fluids into Underground Sources of Drinking Water (USDW). The AOR should encompass the area where pressure buildup as a result of injection could result in upward flow of fluid from the injection zone into a USDW through artificial penetrations or natural conduits in the area, if these exist. Separate AOR's will need to be established for both the air injection operations as well as for the water disposal wells. This section gives the methods and the calculations used to determine the size of the area of review based on the intended operation. Regulations require that a minimum AOR for a Class I non-hazardous injection well is a fixed radius of ¼ mile (1,320 feet) around the injection well; however, the radius may be larger as defined by site-specific conditions.

The background and general approach to establishing the AOR is discussed in Section A.2. Additional information regarding the bubble formation process is described in Section A.3. An evaluation of potential pressure buildup as a result of the proposed compression test to establish the Zone of Endangering Influence (ZEI) is discussed in Section A.4. The designation of the AOR is discussed in Section A.5.

A.2 Background and General Approach

Air Storage Reservoir

For the CAES development project, air will be injected into originally gas-bearing permeable sands of the Upper Cretaceous Mokelumne River Formation. Injection/Withdrawal Wells will be completed in the depleted King Island gas reservoir, near the top of an elliptical-shaped erosional remnant of upper Mokelumne River Formation that is eroded on all sides by the Paleocene Meganos Channel Fill (Figure A-1 and A-2). The reservoir is sealed on the sides by shale deposited along the flanks of the Meganos Channel, and is capped by the Eocene Capay Shale. Approximately 80% of the original natural gas has been produced from this reservoir; however, a small amount of gas remains as attic gas or free gas in the top of the reservoir structure, while the rest of the reservoir has been invaded by water inflow from an underlying aquifer leaving trapped gas and water in this invaded zone. The geology of the Mokelumne River Formation and the King Island gas reservoir is discussed in detail in Attachment F and G, and summarized below.

Overall, the Mokelumne River Formation is a coarsening upwards sequence of sediment packages deposited in a prograding delta. The uppermost sequence at King Island consists of sandstones with a net composite thickness ranging from about 65 to 175 feet. This includes the gas reservoir sands above the original gas-water contact as well as similar underlying sands that are underlain by shale and siltstone, which in turn are underlain by three additional sediment packages that consist of sand grading downward into siltstone and shale. The lowermost sediment package is the finest grained and grades downwards into the H&T Shale. The net composite thickness of Mokelumne River Formation in the erosional remnant is up to approximately 1,600 feet (Figure A-1).

In terms of hydrogeology, the sediments in the King Island erosional remnant consist of packages of permeable aquifer sands separated by lower permeability siltstone, mudstone and shale that act as aquitards. Overall, the sand packages decrease in permeability with depth. The gas reservoir at the top of

this sequence has been mostly invaded by water and together with the sands immediately below the original gas-water contact comprises the uppermost aquifer in this sequence. Collectively, this uppermost aquifer is referred to as the "gas reservoir" or "gas reservoir sand" in this Attachment. The average horizontal permeability of sands in the King Island gas reservoir is approximately 807 millidarcies (mD), based on the average of permeability measurements (converted to reservoir confined stress permeability) from laboratory analysis of core samples retrieved from the Piacentine 2-27 core well (Table G-1). The permeability of the sands in the next deeper package (designated herein as MR2) is somewhat lower than the gas reservoir sands (Table G-4). The permeability of sands in the MR3 and upper portion of the MR4 is approximately 10 to 19 mD (Table G-4). The lower 300 feet of the MR4 generally consists of siltstones, mudstones and shale that effectively form a basal aquitard layer that grades downwards into the H&T Shale. In summary, the MR2, MR3 and upper MR4 sand packages comprise a series of saline aquifers with an attenuated hydraulic connection to each other and to the water-invaded gas reservoir at the top of the structure.

The permeable sands of the Mokelumne River Formation, including the gas reservoir and the underlying saline aquifers, comprise the injection zone that will experience increased pressures as a result of the proposed air injection. As air is injected into the King Island gas reservoir, the displacement of natural gas and water will cause pressures within the water-invaded gas reservoir sands in the uppermost portion of the King Island erosional remnant to increase. Based on the relatively high permeability of these sands, this pressure increase will propagate throughout the reservoir sands relatively rapidly. The increase in pressure will cause water to flow slowly out of the reservoir through the underlying shale and siltstone and into the underlying aquifer sequence. The displacement and outflow of water from the reservoir sands will propagate downwards through the sequence of sandstone aquifers and intervening siltstone and shale aquitards, until it reaches the thick aquitard sequence in the lowermost portion of the Mokelumne River Formation, through which it will propagate laterally. In addition, water flow and pressure will take place laterally in each aquifer until it reaches the relatively impermeable shales deposited at the edge of the Meganos Channel (assuming, as is likely, that these act as barriers to water flow and pressure propagation). Based on this conceptual understanding, the lateral propagation of pressure associated with the proposed Injection/Withdrawal Well would be limited by the lateral extent of the reservoir and aquifer sands of the King Island erosional remnant as shown on Figure A-3.

Notwithstanding the above, the possibility that the Mokelumne River Formation aquifers beneath the gas reservoir have sand-on-sand contacts with the adjacent Meganos Channel fill cannot be conclusively ruled out. As such, there are two possible paths of communication for pressure propagation to occur beyond the lateral boundaries of the King Island gas reservoir.

Case A - Downward pressure propagation through the MR2, MR3 and MR4 sands, and then laterally outwards through the lower MR4. The attenuating effect of the lower permeability layers separating the MR-2, MR-3 and MR-4 sand packages and the aquitard at the base of the MR4 will tend to significantly limit this route of pressure propagation.

- The lateral and vertical upward boundaries of the King Island gas reservoir are considered effectively impermeable seals through which pressure propagation cannot occur since they acted as effective seals for gas accumulation. The nature and adequacy of the gas reservoir seals is further discussed in Attachment G.
- The lateral boundaries of the underlying Mokelumne Formation sandstones, where they are truncated by the Meganos Channel, are also likely to be aquifer boundaries since abundant shale has generally been found to be present along the flanks of the channel fill (Attachment G).

- The propagation of pressure downwards vertically through the aquifer sequence that underlies the gas reservoir was evaluated by computer modeling as described in Section A.4.1. The approach taken was to assess the potential pressure buildup in the reservoir, the uppermost MR2 sands, lower MR2 sands, and the combined MR3/MR4 sand packages to establish the Zone of Endangering Influence (ZEI) vertically within the Mokelumne River Formation.

Case B - Sand-on-sand contacts between sands deposited in the Meganos Channel fill and the King Island erosional remnant. As indicated above, it is possible, though unlikely, that sand-on-sand contacts could allow the lateral propagation of water flow and pressure laterally beyond the boundaries of the Mokelumne River Formation beneath the gas reservoir. Core testing of Meganos Channel Fill sandstone at the East Islands gas field indicates that the lithology and permeability of these sandstones is generally similar to those of the Mokelumne River Formation (Attachment G-2). This is expected, since these deposits essentially consist of reworked Mokelumne River Formation sands derived from more proximal portions of the channel.

- The propagation of pressure laterally through potential sand-on-sand contacts between the Mokelumne River Formation and the Meganos Channel was evaluated by computer modeling as described in Section A.4.2. The approach taken was to assess the areal pressure build-up distribution based on the assumption that an aquifer sand unit in the Mokelumne River Formation is hydraulically connected to a similar sand unit in the Meganos Channel fill, and that together they act as a laterally continuous aquifer through which flow and pressure propagation can occur without significant impedance. The effect of a potentially impermeable fault boundary south of the King Island gas reservoir to increase pressure build-up was also considered.

- Computer modeling based on this assumption should predict the maximum lateral distance of pressure build-up beyond the boundaries of the King Island erosional remnant if a sand-on-sand contact exists, and establish the lateral limits of the ZEI.

Water Disposal Zone

A description and approach similar to the one described above for the air reservoir will be necessary for the intended water disposal zone. Well data from the Citizen Green #1 and Moresco et al. Unit A #1 indicates that both of those wells penetrated the potential water disposal zone (the Starkey formation) and will therefore provide valuable information in the determination of the AOR for water disposal.

A.3 Air Bubble Formation and Volumetric Material Balance

A.4 Modeling to Establish the Zone of Endangering Influence

A.5 Area of Review

As discussed above, separate AOR's will be required for the air storage reservoir and the water disposal zone. In order to establish the appropriate areas of review, the predicted potential pressure buildup in the injection zone as a result of CAES bubble building and operation must be compared to pressures in the overlying USDW formations. The area of review is then defined as the areal extent of predicted pressure buildup that could drive out-of-injection-zone flow through artificial penetrations or natural conduits, if they exist and are capable of transmitting flow. As a conservative measure, it is assumed that the AOR encompasses the area where pressure differences between the injection zone and the AOR as a result of the injection well could drive flow through an unobstructed conduit or penetration, although such a conduit in reality is not expected to exist.

Existing Pressures in the Injection Zone

Information regarding pressures in the injection zone can be derived from historical production data and bottom-hole pressures (calculated from reported tubing head pressures) for the production wells in the King Island gas field, as well as from pressure measurements taken during injection testing operations. Graphs presenting gas production data, water production and calculated bottom-hole pressures for the Moresco, Piacentine 1-27 and Citizen Green wells are included in Attachment A-4. Details regarding the RDT™ testing program for the Piacentine 2-27 well drilled in 2013 are presented in Attachment G-1 and summarized in Table G-5.

Moresco et al. Unit A 1. The Moresco well was the discovery well for the King Island gas field, and had an initial bottom hole pressure of 2,080 psig prior to production in 1985. At that time, the Moresco well was perforated from 4,733 to 4,749 feet below ground surface, indicating a pressure gradient of 0.439 psi/foot (Table A-3). This value is believed to represent the normal hydrostatic gradient at the King Island gas field.[1] Pressures dropped steadily during early production but recovered when production was stopped for several months in late 1989/early 1990 due to water invasion. The well was re-perforated higher in the reservoir in January 1990, and pressures again dropped steadily until water invasion killed the well in 1995. Pressure measurements after production ceased are not available, and the well was plugged and abandoned in 1997.

Piacentine 1-27. This well was installed in 1986 and initial pressures were slightly below hydrostatic (2,020 psi at 4750-4764 feet; 0.425 psi/foot); however, the equilibration period prior to measurement was shorter than for the Moresco well and production from the field had already begun, so this measurement is not considered reliable (Attachment C-1). Pressures fell steadily during initial production, and then recovered and eventually became more erratic due to measurement errors resulting from water production. The well was re-perforated progressively higher in the reservoir several times, and produced much of the time between late 1989 and mid-2003 with intermittent water production. Production ceased between mid-2003 and mid-2006. Production was intermittent between mid-2006 and December 2013, when the well was last shut-in. Since early 2005 pressure has steadily increased, and on June 2012 was 1,906 psi, approximately 114 psi below the initial pressure of 2,020 psi. On February 12, 2014, a bottom hole pressure of 1,883 psi was measured with a downhole pressure gauge, which is slightly less than the calculated bottom hole pressure of 1,906 psi in June 2012 and approximately 137 psi below the initial pressure of 2,020 psi. The pressure data is included in Attachment A-5, and is summarized in Table A-3. When not being produced or when production is very small, pressures have recovered at a rate of approximately 50 psi per year. (As noted below, production from the Citizen Green well since early 2013 should be causing current pressures to remain stable at a minimum.) This suggests that the King Island gas reservoir has a moderate water drive with an attenuated but consistent hydraulic connection with the underlying MR2 aquifer. The current slow but continuing recovery is consistent with a reservoir that has largely re-equilibrated with the underlying aquifer.

Citizen Green 1. This well was completed in December 2011 as a sidetrack well from the King Island 1-28 well, and has been producing attic gas from the western lobe of the King Island gas field. Initial pressures in this well were similar to the Piacentine 1-27, or approximately 1925 psi. On February 12, 2014, a bottom hole pressure of 1,898 psi was measured with a downhole pressure gauge. The pressure data is included in Attachment A-5, and summarized in Table A-3. Due to active production, the data from this well does not currently provide useful data regarding stabilized pressures in the gas field. Earlier production from the King Island 1-28 well occurred from an isolated gas pool in sands of the Meganos Channel fill that is

[1] The normal hydrostatic gradient at depth is typically higher than the fresh water gradient of 0.433 psi/foot due to salinity, temperature and formation pressure effects (Guerard, 1984).

not connected to the King Island gas field (Attachment G, Section G.5). Gas has been produced from this well at a rate of approximately 100 to 250 Mscfd since early 2013, which should be decreasing reservoir pressures slightly, or at a minimum keeping them stable.

Based on the above data, the normal hydrostatic gradient for the King Island gas field is estimated to be 0.439 psi/foot. As such, current pressures in the reservoir sands are estimated to be at approximately 150 psi below hydrostatic. This equates to the following normal hydrostatic pressures at the existing wells that penetrate the gas reservoir sands:

Table A-6: Calculated Hydrostatic Pressures in the Uppermost Mokelumne River Formation at Existing King Island Gas Field Wells

Well	Depth to Top of Mokelumne River Formation (feet) [1]	Current Pressure (psi) [2]	Normal Hydrostatic Pressure (psi) [3]
Piacentine 1-27	4,657	1,895	2,044
Piacentine 2-27	4,674	1,902	2,052
Citizen Green 1	4,688	1,908	2,058
Moresco et al. Unit A 1	4,684	1,906	2,056

1. Depths are feet below ground level calculated based on data presented in Tables C-1 and C-3.
2. Calculated by multiplying the depth to the top of the Mokelumne River Formation by the current pressure gradient of 0.407 psi/foot.
3. Calculated by multiplying the depth to the top of the Mokelumne River Formation by the normal hydrostatic gradient of 0.439 psi/foot.

Existing Pressures in USDW

As discussed in Attachment E, the lowermost USDW near the site occurs in the overlying Domengine Formation, about 700 feet above the Mokelumne River Formation. As shown in Table G-5, the pressure measured in the Domengine Formation during RDT™ logging of the Piacentine 2-27 well indicates pressures near hydrostatic in this formation with a gradient of 0.437 psi/foot. Water levels in the freshwater aquifers near the site are known to be within approximately 10 feet of the ground surface as discussed in Attachment E and shown on Figures E-2 and E-3. Because both underlying and overlying aquifers have pressures that are consistent with a hydrostatic gradient, it is reasonable to assume that the USDW formations in the area are also at hydrostatic pressures.

Determination of the Area of Review

Separate analysis will need to be completed to determine the AOR for both the air storage reservoir as well as the water disposal zone.

A.6 References

Engineering Enterprises, 1985. Guidance Document for the Area of Review (AOR) Requirement.

Guerard, Bill, 1984. CDOGGR Publication M13, Evaluation and Surveillance of Water Injection Projects.

Harbaugh, Banta, Hill and McDonald, 2000. MODFLOW-2000, The U.S. Geological Survey Modular Ground-Water Model User Guide to Modularization Concepts and the Ground-Water Flow Process: USGS Open File Report 00-92.

Van der Heijde, PKM, 1996. THWELLS: Flow in a Confined, Leaky, Confined or Unconfined Aquifer with Regional Uniform Flow and Multiple Wells: International Ground Water Modeling Centre, Colorado School of Mines.

ATTACHMENT B
MAP OF WELL / AREA OF REVIEW

N

0 1,200

SCALE IN FEET

UPLAND CANAL

PROPOSED I/W WELL BOTTOM

AREA OF REVIEW
(LATERAL EXTENT OF KING ISLAND RESERVOIR PLUS 1/4-MILE RADIUS FROM I/W WELL BOTTOM)

RANCH DRAINAGE CANAL (TYPICAL)

RANCH YARD

RESIDENCE

RESIDENCE

RESIDENCE

King Island 1-28

Klein 1-28

Piacentine 1-27

Piacentine 2-27

Citizen Green 1 (Bottom Hole)

Moresco et al Unit A 1

King Island 33-1

Piacentine 1

Rio Blanco 1

City of Lodi 1

NCPA Stig 1

LEC 1

Federal Imeson 1

White Slough Water Pollution Control Plant

TRACT

SLOUGH

ROAD

HITE

RIO BLANCO TRACT

KING ISLAND

BISHOP TRACT

CUT

TELEPHONE CUT

Pumping Station

Pumping Sta

BM 3

BM 7

BM 3

23

24

25

26

36

2 LANE

2 LANE

Legend

- PROPOSED I/W WELL SURFACE LOCATION
- PROPOSED I/W WELL BOTTOM HOLE LOCATION
- INJECTION WELL LOCATION
- COMPLETE GAS WELL
- ABANDONED GAS WELL
- DRY HOLE
- ALIGNMENT OF DEVIATED WELL
- DOMESTIC WELL
- LATERAL EXTENT OF KING ISLAND GAS FIELD RESERVOIR SAND
- FARM IRRIGATION/DRAINAGE CANAL
- SECTION LINES

Note

FIGURE PREPARED BY:
JACOBSON, JAMES & ASSOCIATES, INC.

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Prepared for
PACIFIC GAS AND ELECTRIC COMPANY

PG&E CAES PROJECT
COMPRESSION TESTING I/W WELL UIC APPLICATION
SAN JOAQUIN COUNTY, CALIFORNIA

PROJECT No.	DATE	DRAWN BY	APPR. BY
03.WP.004	12/30/13	PEM	RF

FIGURE B-1

WELL LOCATIONS AND AREA OF REVIEW

ATTACHMENT C
CORRECTIVE ACTION PLAN AND WELL DATA

Corrective Action Plan and Well Data

C.1 Requirements

This section requires evaluation of well completion, plugging and abandonment data for all wells that have the potential to be affected by injection into the air storage reservoir or the water disposal zone within their respective Areas of Review (AOR).

If any of these wells is not properly completed, or not plugged and abandoned so as to prevent the migration of injectate through the wellbores into the overlying Underground Sources of Drinking Water (USDW), a corrective action plan must be proposed under 40 CFR 144.55. As provided in 40 CFR 146.7, the following criteria must be considered in determining the need for and adequacy of any corrective action plan:

- Nature and volume of injected fluid (see Attachment H);
- Nature of native fluids or by-products of injection (see Attachment H);
- Potentially affected population (see Attachment D);
- Geology (see Attachments F and G);
- Hydrology (see Attachments D, E and N);
- History of the injection operation (not applicable);
- Completion and plugging records (this attachment);
- Abandonment procedures in effect at the time the well was abandoned (this attachment); and
- Hydraulic connections with USDW (this attachment).

C.2 Approach

General Approach – Air Storage

The proposed underground air storage operations will be used to support the surface power generation facilities for this Compressed Air Energy Storage development in the depleted King island gas field. As such, the injection/withdrawal wells will be classified as Class V Injection Wells under the UIC regulations. A UIC Program Guidance memorandum issued by EPA regarding the application of the UIC permitting process to Class V wells for carbon sequestration pilot projects states the following:[1]

> *"Class V experimental technology wells are intended to demonstrate unproven but promising technologies. EPA's rationale for allowing the use of Class V experimental technology wells is to encourage innovation. In other words, under EPA's regulations an injection well that is being*

[1] United States Environmental Protection Agency, 2007. Memorandum from Cynthia C. Dougherty, Director, Office of Groundwater and Drinking Water, to Water Management Division Directors, Regions I through X. Subject: Using the Class V Experimental Well Classification for Pilot Geological Sequestration Projects – UIC Program Guidance (UICPG #83). March 1.

used to demonstrate a developing technology may be subject to more flexible, yet fully protective, technical standards than those designed for commercially operating facilities."

Until specific regulations related to the injection of air into depleted gas reservoirs are adopted, it is assumed that CAES developments will be permitted under Class V regulations.

General Approach – Water Disposal

Wells designated for the disposal of produced and process waters are permitted by EPA as Class I injection wells.

Approach to Heavy Mud Plugs

Oil and gas wells in California are generally completed with annular cement plugs across the producing formations and are plugged and abandoned in similar fashion in order to protect USDW. In addition, drilling mud has historically been used as a reservoir plug when there are no oil or gas shows. In both cases cement plugs are placed at the base of state-defined freshwater resources. Current well abandonment standards applied by the California Department of Oil, Gas and Geothermal Resources (DOGGR) allow the use of mud plugs at the USDW interface. A letter dated May 20, 2010, from the California State Oil and Gas Supervisor to all of the DOGGR district offices, provided standards for its Class II UIC program. Highlighted in these standards is the following excerpt:

"Historically, the Division has protected water quality of ~3,000 mg/L TDS or less. This is supported by both the State Water Resources Control Board Resolution No. 88-63 and the Federal aquifer exemption regulations (3,000 mg/L TDS or less is considered a major aquifer exemption). A minor aquifer exemption is required for water quality between 3,000 and 10,000 mg/L TDS. The Divisions construction standards, consisting of the use of casing, mud, and cement, are adequate to prevent fluid migration and the comingling of lesser quality fluids. The hole and casing annulus space, between the top of cement isolating the oil and gas zones and the base of cement covering the BFW interface should have heavy mud to prevent the movement of fluids. Therefore, it is reasonable to conclude that the water quality of 10,000 TDS or less will be protected by the standards that are in place."

"Failure to meet any one of these conditions without an appropriate variance indicates non-confinement, which is not allowed."

In 2011, EPA requisitioned a review of the DOGGR's Class II Underground Injection Control (UIC) program. Horsley Witten Group (2011) issued a Final Report on the review of the UIC program in June 2011, and made specific recommendations regarding the protection of USDW. Below is an excerpt from this report:

"In addition, USDWs containing more than 3,000 mg/L TDS are not protected to the extent that fresh water aquifers are protected from inflow of lesser quality waters. Placement of cement plugs is required at the BFW, but not at the base of other USDWs unless those depths happen to be coincident in a well. Protection from fluid movement into and between USDWs below the BFW depends partially on the presence of heavy mud in the casing/wellbore annulus and between cement plugs in the open-hole or inside casing strings. However, USDWs must be isolated from fluid movement exiting the injection zone and hydrocarbon bearing zones, by placement of sufficient cement volumes in the annular space and cement plugs above those zones. The presence of drilling mud may not prevent fluid movement between zones in the uncemented annulus, especially in the older wells within the AOR since the mud will degrade

over time and not retain the density and other properties necessary to suppress fluid movement. In our view, cement should be placed at the base of USDWS as it is for the BFW to ensure long term protection from fluid movement into or between USDWs."

These recommendations highlight EPA's desire to implement uniform well completion and abandonment standards that are protective of USDW.

In order to determine the degree of protection afforded by mud completions or mud plugs above the injection zone, we reviewed available literature regarding the potential degradation in effectiveness or performance of mud plugs over time. The available literature supports the consideration of mud weight and gel strength when evaluating the potential for fluid movement. As indicated below, we were unable to find any specific references regarding the diminishment of mud densities or degradation of other properties necessary to suppress fluid movement in inorganic muds over time.

- Annis (1967) and Barker (1981) indicate that water based muds commonly used in well plugging develop high gel strengths after prolonged periods of quiescence, which may increase indefinitely with time. Additionally, they indicate that mud gel strengths observed in laboratory tests would probably increase under reservoir conditions due to the greater time involved and fluid loss to the formation.
- Davis (1985) and Gray and Darly (1981) identified an increase in mud gel strength with an increase in temperature.
- Johnson (1985) reported that mud in reentered boreholes was found to have thickened to a gel strength greater than that of the original mud conditions. However, no evidence was found that such thickened muds ever solidified completely.

The evidence presented in the literature review supports that heavy drilling mud can provide protection against the inter-formation migration of fluids in boreholes and wells. The use of drilling mud for well plugging relies on the characteristics of mud weight and gel strength to prevent upward flow of reservoir fluids. For upward flow of fluids to occur, the formation fluids must overcome the downward pressure exerted by the weight of the mud column in the wellbore and the resistance offered by the mud's gel strength. The gel strength of mud is the resistance to shear that develops when the mud is not moving.

Static mud columns exert pressure on the formation. In order for a well to provide a pathway for fluid movement, the induced hydrostatic pressure acting on the mud column must first overcome the static mud column pressure. In addition, the gel strength of the drilling mud must also be considered. This relationship is explained by Davis (1986) as:

$$P_f + P_i > P_s + P_g$$

Where:

P_f = original formation pressure (pounds per square inch [psi])

P_i = formation pressure increase due to injection (psi)

P_s = static mud column pressure (psi)

P_g = gel strength pressure (psi)

Therefore, pressure increase due to injection must be greater than static fluid column pressure minus original formation pressure:

$$P_i > P_s + P_g - P_f$$

Static mud column pressure is calculated using the equation:

$$P_S = 0.052 \times h \times M$$

Where:

P_S = pressure of static mud column (psi)

h = depth to the injection reservoir (feet)

M = fluid mud weight (pounds per gallon) and

0.052 is the conversion factor so that Ps is in psi.

In an artificial penetration filled with a column of drilling mud, the gel strength of the mud must also be considered, as it provides additional resistance to flow. In this case, for upward fluid movement to begin, original formation pressure (P_f) plus the pressure due to injection (P_i) must be greater than the static fluid column pressure plus the gel strength of the mud:

$$P_g = 0.00333 \times G \times h \times d$$

Where:

P_g = pressure due to gel strength (psi)

G = gel strength (pounds/100 feet^2)

h = depth to the injection reservoir (feet)

d = borehole diameter (inches)

Where 0.00333 is the conversion factor, such that P_g is in psi.

To evaluate the potential need for corrective action at any wells identified within the AOR, the pressure increase to which these wells could be subjected as a result of the proposed Injection/Withdrawal Well must be evaluated. The construction information and (where applicable) plugging and abandonment data for these wells needs to be evaluated to determine if the pressure increase could cause mobilization of fluids into overlying USDW. Cementing across the zone of potential pressure increase is considered to provide sufficient protection against the upward movement of fluids in the annular space of completed wells, or in plugged wells or boreholes. The presence of drilling mud is also accounted for in this evaluation as additional potential prevention against potential fluid migration. A factor of safety of 100 psi or more is considered to provide sufficient protection. Finally, the completion of wells perforated in the zone of pressure increase is evaluated to assess the potential that fluids could migrate up the well and out into the overlying USDW.

C.3 Identification of Artificial Penetrations in the Area of Review

A review of public records maintained by the DOGGR was conducted to assess the location and condition of deep wells in the vicinity of the King Island depleted gas reservoir. As shown on Figure C-1,

nine wells have been identified within approximately 1-mile from the proposed Injection/Withdrawal Well location. These wells were drilled for gas exploration or production either in the King Island gas reservoir or on the flanks of the erosional remnant of Mokelumne River Formation in which the King Island gas field is located (Attachment G). Completion details for these wells are summarized in Table C-1, and complete well logs, completion details, and histories are included in Attachment C-1.

Of the wells listed, four have been determined to be located within the minimum AOR (1/4 mile radius from the reservoir) and are evaluated in Section C.4 to determine whether corrective actions are required. These include the Piacentine 1-27, Piacentine 2-27, Citizen Green 1 and Moresco et al. Unit A 1 (Moresco) wells. The remaining wells are outside the AOR and eliminated from further evaluation based on the following findings:

- Rio Blanco 1. This well was drilled as a dry hole and has been plugged and abandoned. It reached total depth in the Meganos Channel fill. It does not penetrate the Mokelumne River Formation and is outside the area where pressures could build up sufficiently to induce vertical flow to a USDW if a sand-on-sand contact existed between the Mokelumne River Formation and sands in the Meganos Channel fill (Attachment A-3).

- Klein 1-28. This well was drilled as a dry hole and has been plugged and abandoned. It penetrates the Mokelumne River Formation in the lower MR2, stratigraphically below the water-invaded gas reservoir sands (Attachment G). Predicted pressure buildup in the Mokelumne River Formation sands penetrated by this well will be below hydrostatic pressures and will not be sufficient to drive flow upward into a USDW (Contour Plot A-2a in Attachment A-2). In addition, the well is outside the area where pressures could build up sufficiently to induce vertical flow to a USDW if a sand-on-sand contact existed between the Mokelumne River Formation and sands in the Meganos Channel fill (Attachment A-3).

- King Island 1-28. This well was completed as a producing well in a small gas pool within sands of the Meganos Channel fill and has since been plugged and abandoned. Review of production records indicates that the well is completed in a different pressure regime than the main King Island gas field (Attachment G). The well reached total depth in the Meganos Channel fill and does not penetrate the Mokelumne River Formation. The well is outside the area where pressures could build up sufficiently to induce vertical flow to a USDW if a sand-on-sand contact existed between the Mokelumne River Formation and sands in the Meganos Channel fill (Attachment A-3).

- King Island 33-1. This well was drilled as a dry hole and has been plugged and abandoned. It penetrates the Mokelumne River Formation in the shale overlying the upper MR2, stratigraphically below the water-invaded gas reservoir sands (Attachment G). Log interpretation indicates that a wedge of shale associated with the Meganos Channel fill separates this well from the King Island gas reservoir. Predicted pressure buildup in the Mokelumne River Formation sands penetrated by this well will be below hydrostatic pressures and will not be sufficient to drive flow upward into a USDW (Contour Plot A-2a in Attachment A-2). In addition, the well is outside the area where pressures could build up sufficiently to induce vertical flow to a USDW if a sand-on-sand contact existed between the Mokelumne River Formation and sands in the Meganos Channel fill (Attachment A-3).

- Piacentine 1. This well was drilled as a dry hole and has been plugged and abandoned. It penetrates the Mokelumne River Formation in the upper MR2, stratigraphically below the water-invaded gas reservoir sands (Attachment G). In addition, it is separated from the King Island gas field by the fault mapped between the King Island 33-1 and Piacentine 1. Predicted pressure buildup in the Mokelumne River Formation sands penetrated by this well will be below hydrostatic pressures and

will not be sufficient to drive flow upward into a USDW (Contour Plot A-2a in Attachment A-2). In addition, the well is outside the area where pressures could build up sufficiently to induce vertical flow to a USDW if a sand-on-sand contact existed between the Mokelumne River Formation and sands in the Meganos Channel fill (Attachment A-3).

Two additional wells have been drilled as part of the CAES testing program and information regarding these wells should be included as part of the UIC application. These wells are the Piacentine #2-27 observation well and the PG&E Test Injection/Withdrawal Well #1. Detailed information for both of these wells including well logs and well completion reports is available from the PG&E project data room.

C.4 Corrective Action Evaluation

Nature and Volume of Injected Fluid

As described in Attachment H, based on initial projections approximately 8-10 billion standard cubic feet of air will be injected into the water-invaded King Island gas reservoir sands to build a subsurface air bubble and continue injection and withdrawal operations to support the CAES power generation operations. The bubble volume will be updated by the project developer based on the final project design.

Air is relatively inert chemically, consisting mostly of nitrogen. Ambient air has the potential to oxidize iron-bearing minerals in subsurface sediments and cause chemical changes that could mobilize trace metals. Given the mineralogy of the Mokelumne River Formation sands and clays, this is not expected to be a significant process in the injection zone or in fluvial, deltaic or marine sediments in the area in general.

Nature of Native Fluids or By-Products of Injection

The chemistry of the saline groundwater present in the water-invaded King Island gas reservoir is summarized in Attachment H. Dissolved solids were detected in a sample of formation water collected from the Piacentine 2-27 core well at a concentration of 14,000 milligrams per liter (mg/L) and consisted primarily of sodium chloride (Attachment H-2). No water quality analysis has ever been performed on produced water from either of the production wells (Piacentine 1-27 and Citizen Green 1), and there is no opportunity to obtain a water sample from either of these wells at this time, since the Piacentine 1-27 well is currently shut-in and the Citizen Green 1 well is not producing any water.

The water-invaded sands of the King Island gas reservoir contain trapped native gas and a relatively thin native gas cap is present at the top of the reservoir. A small amount of gas is expected to be entrained in withdrawn air during operations. The chemistry of the King Island gas is presented in Attachment H-1.

Potentially Affected Population

The proposed air storage reservoir is located in a designated gas field in a sparsely populated rural agricultural area. The area surrounding the test site is zoned AG-40, which is an agricultural designation. The White Slough Water Pollution Control Facility (WSWPCF), a wastewater treatment plant operated by the City of Lodi, is located approximately 2 miles east of the test site, adjacent to the Northern California Power Authority (NCPA) Lodi Power Plant. The incorporated City Limits of Stockton are located approximately 3 miles southeast of the site, near the intersection of 8-Mile Road and Interstate Highway 5.

Geology

Air will be injected into permeable sands of the Upper Cretaceous Mokelumne River Formation (described in Attachments F and G) that occur at elevations between approximately -4,675 feet and -4,800 feet subsea. These sands comprise the depleted (water invaded) King Island gas reservoir, which occurs at the top of an elliptical-shaped erosional remnant of upper Mokelumne River Formation, approximately 230 acres in plain view, that is enclosed on all sides by shale of the Paleocene Meganos Channel fill, and capped by the Eocene Capay Shale (Figure 2, Attachment F). The competence of the seal provided by these formations is demonstrated by the accumulation of gas in the reservoir over millions of years and is discussed in Attachment G. The reservoir sands consist of sandstones with a net composite thickness ranging from about 80 to 220 feet in the uppermost Mokelumne River Formation. These deposits are underlain by sands, shales and siltstones and dip slightly to the west. Beneath the shale and siltstone that defines the base of the gas reservoir sands, interbedded sand, mudstone and shale of the Mokelumne River Formation extend for an additional depth of over 1,000 feet and grade vertically downward into the H&T Shale. The sands of the Mokelumne River Formation within the erosional remnant, including those within as well as those underlying the water-invaded gas reservoir, may experience increased pressures as a result of the proposed air injection.

Hydrology

In terms of subsurface hydrology, the sediments in the King Island erosional remnant consist of packages of permeable aquifer sands separated by lower permeability siltstone, mudstone and shale that act as aquitards. Overall, the sand packages decrease in permeability with depth. The gas reservoir at the top of this sequence has been mostly invaded by water, and together with the sands immediately below the original gas-water contact, comprises the uppermost aquifer in this sequence. The average horizontal permeability of sands in the King Island gas reservoir is approximately 807 millidarcies (mD), based on the average of permeability measurements (converted to reservoir confined stress permeability) from laboratory analysis of core samples retrieved from the Piacentine 2-27 core well (Table G-1). The permeability of the sands in the next deeper package (designated herein as MR2) is somewhat lower than the gas reservoir sands (Table G-4). The permeability of sands in the MR3 and upper portion of the MR4 is approximately 10 to 19 mD (Table G-4). The lower 300 feet of the MR4 generally consists of siltstones, mudstones and shale that effectively form a basal aquitard layer that grades downwards into the H&T Shale. In summary, the MR2, MR3 and upper MR4 sand packages comprise a series of saline aquifers with an attenuated hydraulic connection to each other and to the water-invaded gas reservoir at the top of the structure.

The permeable sands of the Mokelumne River Formation, including the gas reservoir and the underlying saline aquifers, comprise the injection zone that will experience increased pressures as a result of the proposed air injection. As air is injected into the King Island gas reservoir, the displacement of natural gas and water will cause pressures within the water-invaded gas reservoir sands in the uppermost portion of the King Island erosional remnant to increase. Based on the relatively high permeability of these sands, this pressure increase will propagate throughout the reservoir sands relatively rapidly. The increase in pressure will cause water to flow slowly out of the reservoir through the underlying shale and siltstone and into the underlying aquifer sequence. The displacement and outflow of water from the reservoir sands will propagate downwards through the sequence of sandstone aquifers and intervening siltstone and shale aquitards, until it reaches the thick aquitard sequence in the lowermost portion of the Mokelumne River Formation, through which it will propagate laterally. In addition, water flow and pressure will take place laterally in each aquifer until it reaches the relatively impermeable shales deposited at the edge of the Meganos Channel (assuming, as is likely, that these act as barriers to water flow and pressure propagation). Based on this conceptual model, the lateral propagation of pressure

associated with the proposed Injection/Withdrawal Well would be limited by the lateral extent of the reservoir and aquifer sands of the King Island erosional remnant, as shown on Figure A-3.

History of the Injection Operation

As of the writing of this document, no prior injection wells have been used at this site. In the 2nd Quarter of 2015 PG&E completed its air injection testing of the reservoir; the results of this test are part of the project archive.

Completion and Plugging Records

Completion and plugging records for the wells in the minimum Area of Review (1/4 mile radius) are included in Attachment C-1 and summarized in Table C-1. Specific details are discussed in subsequent sections.

Abandonment Procedures in Effect at the Time the Well was Abandoned

The wells completed in the King Island gas field were drilled between the mid-1980s and 2013 using modern techniques and equipment and completed in accordance with DOGGR standards. Each of the wells was completed with annular cement plugs above the gas reservoir to prevent the migration of fluids and gas out of this zone, and at the base of fresh water as defined by the state of California. The Piacentine 2-27 and Citizen Green 1 wells were also completed with annular cement across the base of USDW; whereas the Moresco and Piacentine 1-27 wells lack cement seals at this depth. The Moresco well was plugged and abandoned in accordance with DOGGR standards, with a cement plug above the top of the well perforations and the base of fresh water.

Structural Integrity of Cement Plugs Below USDW

The structural integrity of an annular cement plug is dependent primarily on its ability to retain a bond with the well casing in a pressurized reservoir. During the 1960's and 1970's, there was considerable investigation into cementing techniques and procedures to prevent leakage due to improper cementing of production casing. This included laboratory testing on the pressure sealing capability of annular cement. As an example, there is an SPE Journal Paper, 903-PA, "Control and Prevention of Inter-Zonal Flow" published in 1965 which performed laboratory testing of annular cement (5 ½" casing in an 8 5/8" chamber that is 48" in length). The results indicated bond failure pressures of 800 to 4,500 psi, depending on the pressure maintained on the cement annulus during the curing process. One of the conclusions of that report was that "[a] pressure of 800 psi was sufficient to cause communication. This test confirms the previous observations that pressures of the order of 1,000 psi are adequate to cause casing-cement bond failure."

In checking the Well Summary Reports for both the Moresco and Piacentine 1-27 wells, the cementing procedures were implemented according to plan. The top of cement for the Moresco well was 4,120 feet, approximately 575 feet above the top of the Mokolumne River Formation (MRF), and the Piacentine 1-27 well top of cement was 4,175 feet, approximately 495 feet above the top of the MRF. Full hydrostatic pressure was maintained on the cement column during the curing process. Records indicate that Casing Bond Logs were run on both wells; however, copies of those logs are not available from the DOGGR database or the field operator. Because these well casings were subsequently perforated and produced for many years, it can be assumed that the operator at the time reviewed the bond logs and assured themselves that the bond was sufficient to prevent leakage from the formation.

Based on the well history, the cementing procedures appear to have been properly executed. Though the well history indicates that a cement bond log was run on this well, a record of the log is not available. Because the well was perforated and used for production for several decades, we conclude

that the cement bond log must have indicated a satisfactory bond. Based on this completion history and the indicated research which shows that even a few feet of cement properly placed in the annulus can provide pressure isolation of at least 800 psi, we have concluded that the predicted pressure increases at the Moresco et.al. Unit "A" #1 and Piacentine #1-27 wells will not cause casing annulus leakage from the MRF due to bond separation during testing.

The resistance of a cement plug to vertical displacement is also a consideration, but only when the plug is of limited vertical extent. Resistance to vertical displacement is a function of the upward force exerted by pressure in the reservoir against the weight of the cement plug, the confining pressure, and the skin friction between the cement plug and the formation. For annular plugs that extend several hundred feet above the reservoir, the upward force exerted by the reservoir pressure (which acts over a very small cross sectional area) is insignificant when compared to the skin friction between the plug and the overlying formations (which acts over a much larger area).

Hydraulic Connections with USDW

A well may be considered to have a hydraulic connection with USDW if pressure in the injection zone builds up sufficiently to overcome the resistance of well completion (or plugging and abandonment) materials and cause vertical flow to occur through the well and into a USDW. In order to evaluate this, the pressure buildup at each of the four wells was evaluated and compared to ability of the well completion and/or plugging and abandonment materials to resist the pressure increase and prevent vertical flow. Pressure buildup was evaluated in a computer simulation model study using the United States Geological Survey (USGS) MODFLOW 2000 modeling code, as discussed in Attachment A, Section A.4.1, and as presented in Attachment A-2. Maximum pressure buildups at the four AOR wells for the six MODFLOW simulation scenarios described in Attachment A (Section A.4, pages A-9 to A-13) are shown graphically on Figure C-1.

The most realistic conservative case among the six simulation scenarios is believed to be the ShKl scenario, because it honors what is known about the effect of trapped gas in the invaded aquifer zone above the original gas-water contact, while at the same time using the more conservative of the two aquitard permeability values. Under this scenario, the short-term pressure increase (above the ambient pressure) at the existing wells that penetrate the gas reservoir sands ranges from 175 psi (14 psi above the normal hydrostatic gradient) at the Moresco A-1, to 250 psi (89 psi above the normal hydrostatic gradient) at Piacentine 1-27 (Attachment A, Table A-4).[2] The ShKl case can be considered a reasonable conservative case to be relied upon for prediction of the maximum anticipated pressure increase in the reservoir.

The worst-case simulation results are from the SlKl scenario. This scenario is not believed to be realistic because the low specific storage scenarios (Sl) neglect the known increase in compressibility of the system resulting from the presence of trapped gas in the reservoir, and the increased compressibility of gas-saturated water; both factors, which if considered, would significantly raise the specific storage. When this is combined with the low permeability scenario (Kl), the combined effect of the two assumptions characterizes the SlKl scenario as a bounding case that represents a potential ceiling for pressure buildup in the reservoir during the compression test, but is not a reliable predictor of actual pressure buildup. The SlKl scenario is included for perspective on the upper bound of possible results. Under this scenario, the model predicts a short-term pressure increase ranging from 389 to 449 psi above ambient pressures at the Moresco A-1 and Piacentine 1-27 wells, respectively (228 to 288 psi

[2] See Attachment A, Section A.5 for calculation of hydrostatic pressures at wells that penetrate the King Island reservoir sands.

above the normal hydrostatic gradient), as shown in Figure C-1. The pressure build-up profiles for the SIKI cases for the AOR wells are provided in Attachment A, Attachment A-2, Graph A-2b.

The duration of these pressure increases is predicted to be relatively limited as pressure equilibrates with the underlying aquifers in the Mokelumne River Formation. The length of time over which pressures diminish to below the normal hydrostatic gradient will be influenced by existing pressure gradients beneath the reservoir sands that were beyond the scope of the modeling study to evaluate; however, the model illustrates that the re-equilibration could occur over a relatively short time period.

An evaluation of the well completion and plugging and abandonment materials for each of the four AOR wells compared to the pressure buildup in excess of hydrostatic pressures is presented below in Table C-2.

C.5 Corrective Action Plan

A description of wells identified within the proposed AOR's (both for air injection and water disposal) that will require Corrective Action under 40 CFR 144.55.

C.6 References

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Johnston, O. C. and Knape, B., 1986, Pressure effects of the static mud column in abandoned wells: Texas Water Commission LP86-06, 106 p

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TABLE C-2: SUMMARY OF CORRECTIVE ACTION EVALUATION FOR NEARBY WELLS					
Well Name	**Distance and Direction from I/W Well**	**Predicted Pressure Increase above Hydrostatic**	**Depth to Base of USDW (feet)1**	**Status**	**Corrective Action Analysis**
Piacentine 1-27	180 feet SW	Realistic Conservative Case = 89 psi Worst Case = 288 psi	4,006	Piacentine No. 1-27 was drilled in 1986 to a total depth of 4,900 feet. A 8-5/8" surface casing was cemented to surface at 627 feet. This well penetrated the MRF starting at 4,670 feet. The MRF contained about 112 feet of gross reservoir sand with a gas/water contact at 4,782 feet. A 5-1/2", 15.5#, K-55 casing was run and cemented at 4,900 feet. The top of cement in the annulus is around 4,175 feet. The well was completed as a gas producer in the MRF. The well is still occasionally producing small amounts of gas and will be used as a monitoring well during the proposed compression test. The conversion program for the well is included in Attachment L-3 and a schematic is included in Attachment M-3. Testing and monitoring of the well is described in Attachment P. The well casing will be pressure tested, a packer and tubing assembly will be inserted into the well, and annular pressure monitoring will be conducted to assure that the well casing remains intact during and after the compression test.	The MRF sands penetrated by this well are predicted to experience pressure buildup as a result of the proposed Injection/Withdrawal Well. The perforations of the well are isolated inside the 5-1/2" casing of the well and there are approximately 495 feet of cement outside of the casing above the perforations and above the top of the MRF. In addition, cement is present below the perforations. Prior to use of the proposed Injection/Withdrawal Well, the casing of the Piacentine 1-27 will be pressure tested. During and after use of the Injection/Withdrawal Well, the Piacentine 1-27 casing above the perforated zone will be isolated with a tubing and packer system, and the annular pressure will be monitored. There is no potential for cross flow from this well to a USDW. No corrective action is required.
Piacentine 2-27	370 feet SW	Realistic Conservative Case = 67 psi Worst Case = 273 psi	3,998	Well drilled in 2013 to a total depth of 4,970'. A 9-5/8" surface casing was cemented to surface at 614 feet. This well penetrated the MRF starting at 4,686 feet and the uppermost reservoir sands were shaled-out at this location. The MRF sand contained no commercial gas in this well. A 5-1/2", 15.5#, J-55 casing was run and cemented at 4,969 feet. Top of cement in the annulus is at the surface. This well has not been perforated in the Mokelumne River Formation or any other formations at this time, and is cemented to surface. It will be used as a monitoring well without modification to run wireline logs during the compression test.	The MRF sands penetrated by this well are predicted to experience pressure buildup as a result of the proposed Injection/Withdrawal Well. Since there are no perforations in the 5-1/2" casing and the cement outside of the 5-1/2" casing extents to the surface, there is no potential for cross flow from this well to a USDW. No corrective action is required.

TABLE C-2: SUMMARY OF CORRECTIVE ACTION EVALUATION FOR NEARBY WELLS

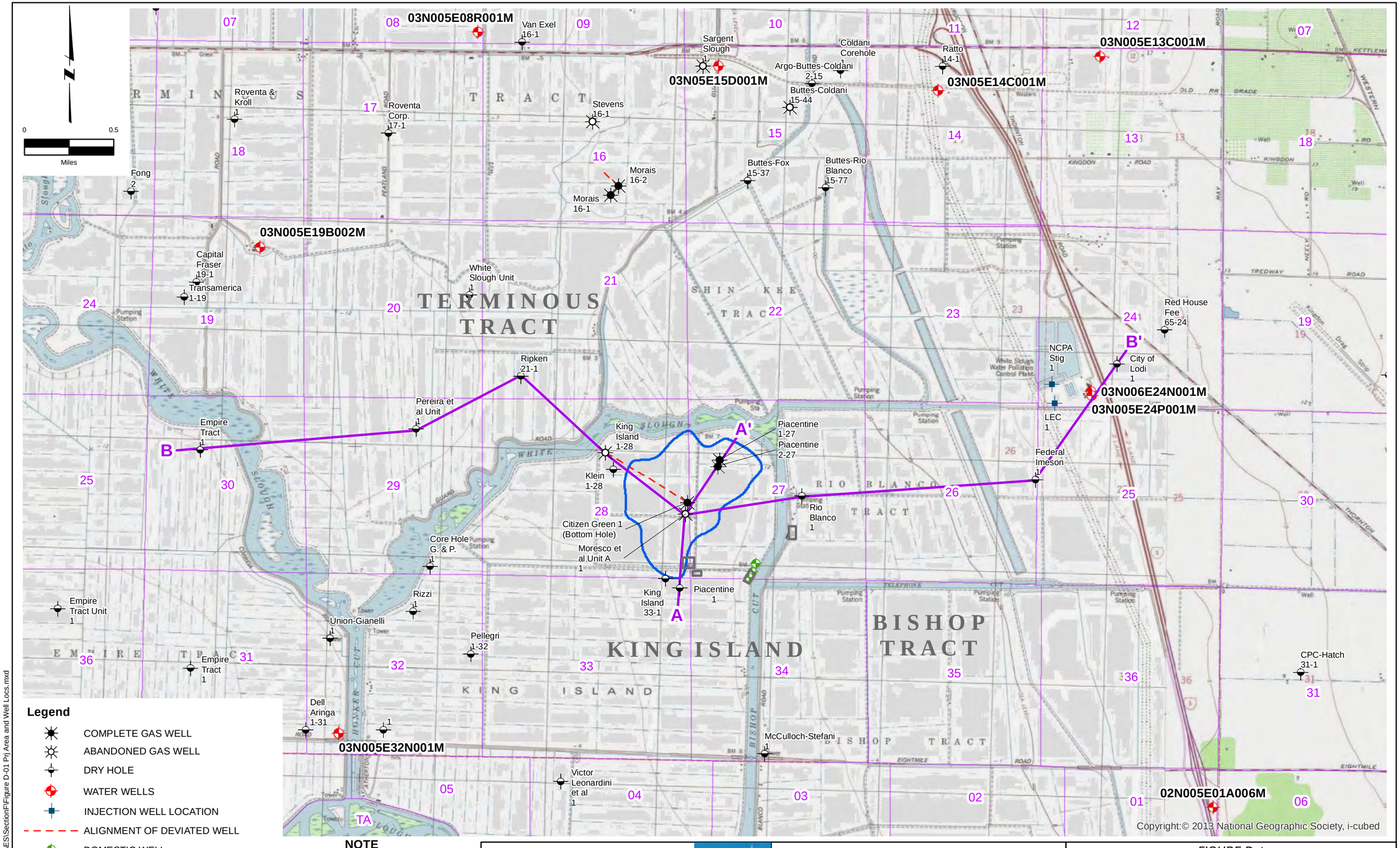
Well Name	Distance and Direction from I/W Well	Predicted Pressure Increase above Hydrostatic	Depth to Base of USDW (feet)1	Status	Corrective Action Analysis
Citizen Green No. 1	Bottomhole 1,750 feet SW	Realistic Conservative Case = 17 psi Worst Case = 232 psi	4,008	Well directionally drilled in 2011/2012 to a total measured depth (MD) of 7,570 feet. 8-5/8" surface casing was cemented from 511 feet to surface. MRF sands were encountered at 5,220 feet MD (4,700 feet VD). The MRF contained about 20 vertical feet of gross reservoir sand with a gas/water contact at 5,244 feet MD (4,720 feet VD). 4-1/2", 11.6#, N-80 casing was run and cemented at 5,513 feet MD. The top of cement in the annulus is approximately 3,700 feet. The well was completed as a gas producer. The well is currently producing small amounts of gas.	The MRF sands penetrated by this well are predicted to experience pressure buildup as a result of the proposed Injection/Withdrawal Well. The perforations of the Citizen Green No. 1 are isolated inside the 4-1/2" casing and there is a cement plug outside the casing above and below the perforations. The upper cement plug extends from the MRF past the base of USDW. There is no potential for cross flow from this well to a USDW. No corrective action is required.
Moresco Et Al Unit A No. 1	2,060 feet SW	Realistic Conservative Case = 14 psi Worst Case = 228 psi	3,881	Well drilled in 1985 to a total depth of 6,500 feet and completed to 4,999 feet. A 8-5/8" surface casing was cemented to surface at 723 feet. This well encountered MRF sands starting at depth of 4,695 feet. The MRF contained 84 feet of gross reservoir sand, with a gas/water contact at 4,779 feet. A 5-1/2", 15.5#, K-55 casing was run and cemented at 4,999 feet. The top of cement in the annulus is approximately 4,120 feet. Completed as a gas producer and produced until 1995, when excessive water production killed the well. The well was plugged and abandoned in 1997. Open perforations in the MRF were abandoned with 156 lineal feet of cement placed inside the 5-1/2" casing. The 5-1/2" casing was perforated at 450 feet (below estimated BFW) and the annulus between the 8-5/8" casing and 5-1/2" casing was squeezed with 43 cubic feet of cement. Approximately 260 lineal feet of cement plug was placed above the perforations inside the well at 450 feet. A 30 foot surface plug was put in place, and the abandonment was approved by the DOGGR.	The MRF sands penetrated by this well are predicted to experience pressure buildup as a result of the proposed Injection/Withdrawal Well. The Moresco et al. Unit A No. 1 was completed with 575 feet of cement above the MRF outside of the 5-1/2" casing, and plugged with 156 feet of cement inside the 5-1/2" casing across the perforations. Above the perforations, the well is filled with heavy drilling mud topped by a cement plug from 450 to 190 feet. Below the perforations, the well is mud plugged, but the lower mud is blocked by the cement plug placed opposite the perforations. There is no potential for cross flow from this well to a USDW. No corrective action is required.

Notes:

1. Methods used to calculate the depth to the base of USDW are described in Attachment E.
2. MRF= Mokelumne River Formation
3. All depths in this table are below Kelly Bushing.

ATTACHMENT D

Maps and Cross Sections of USDW



Legend

- COMPLETE GAS WELL
- ABANDONED GAS WELL
- DRY HOLE
- WATER WELLS
- INJECTION WELL LOCATION
- ALIGNMENT OF DEVIATED WELL
- DOMESTIC WELL
- LATERAL EXTENT OF KING ISLAND GAS FIELD RESERVOIR SAND
- FARM IRRIGATION/DRAINAGE CANAL
- SECTION LINES

NOTE

FIGURE PREPARED BY:
JACOBSON, JAMES
& ASSOCIATES, INC.

Prepared for
PACIFIC GAS AND ELECTRIC COMPANY

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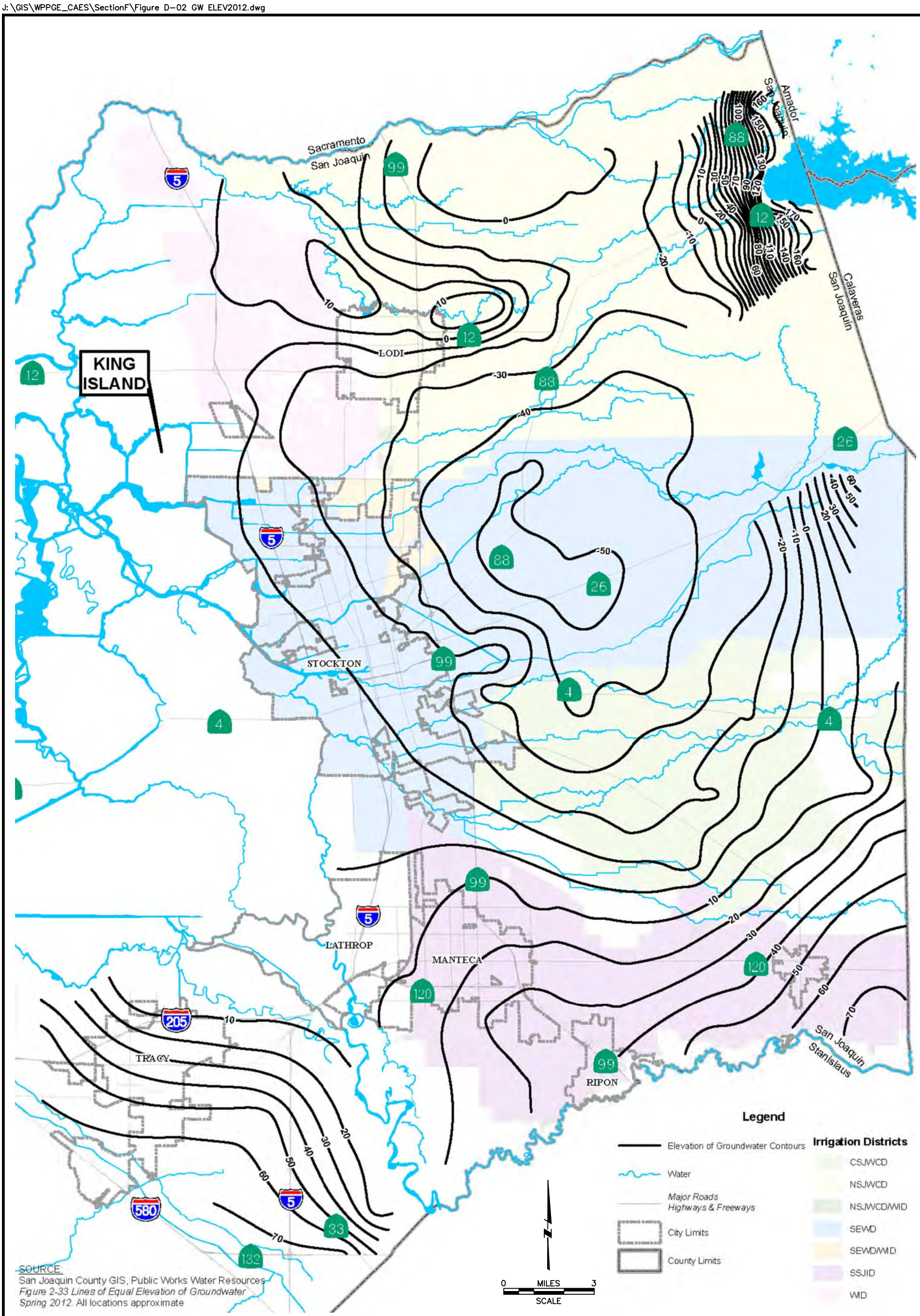
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FIGURE D-1

PROJECT AREA AND WELL LOCATIONS

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SOURCE:
San Joaquin County GIS, Public Works Water Resources
Figure 2-33 Lines of Equal Elevation of Groundwater Spring 2012. All locations approximate

NOTES:
ORIGNAL FIGURE BY: WORLEYPARSONS GROUP, 04-29-2013
FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCAITES, INC.

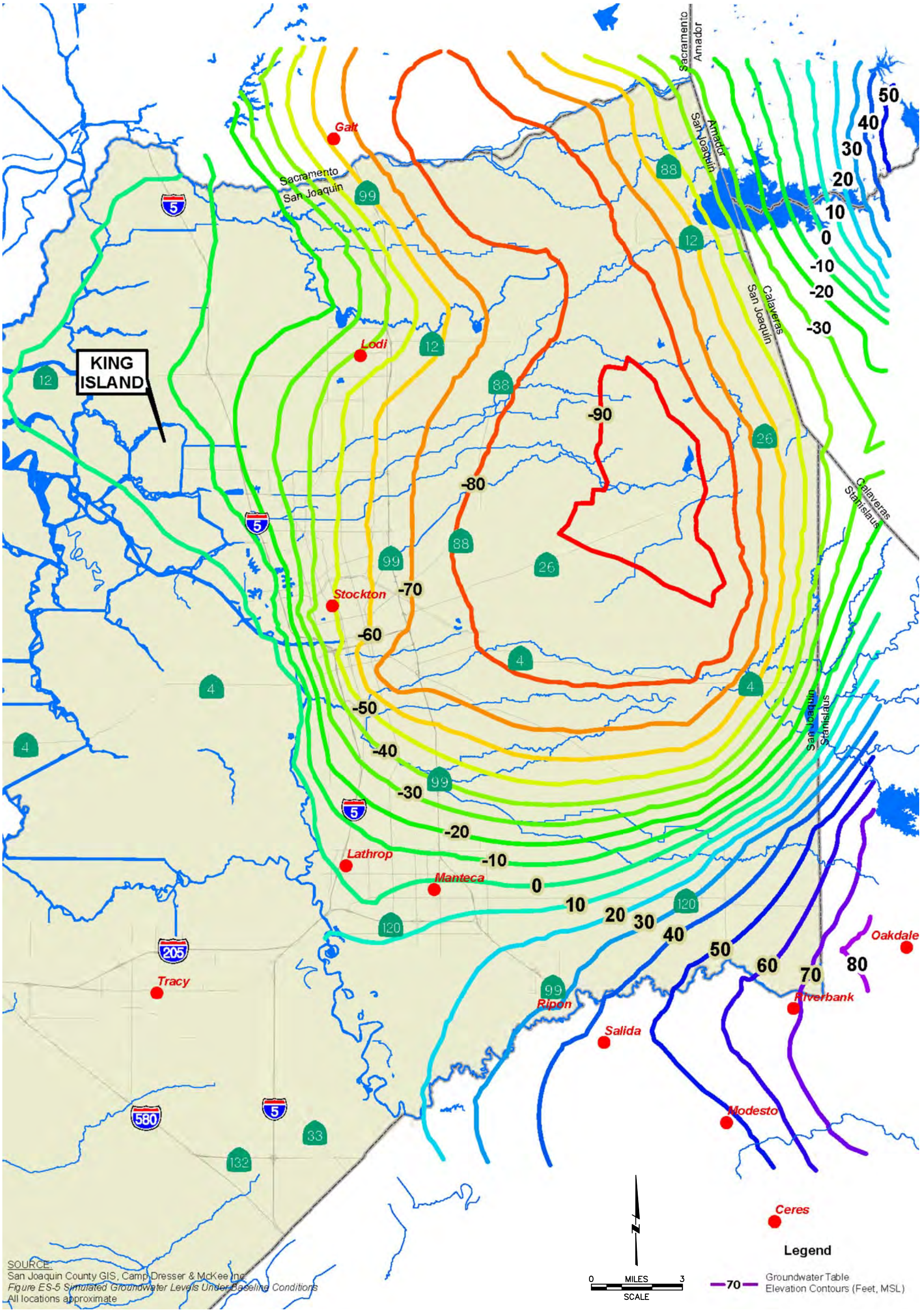
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FIGURE D-2
SAN JOAQUIN COUNTY GROUNDWATER ELEVATION CONTOUR MAP SPRING 2012

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NOTES:

ORIGNAL FIGURE BY: WORLEYPARSONS GROUP, 04-29-2013

FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCAITES, INC.

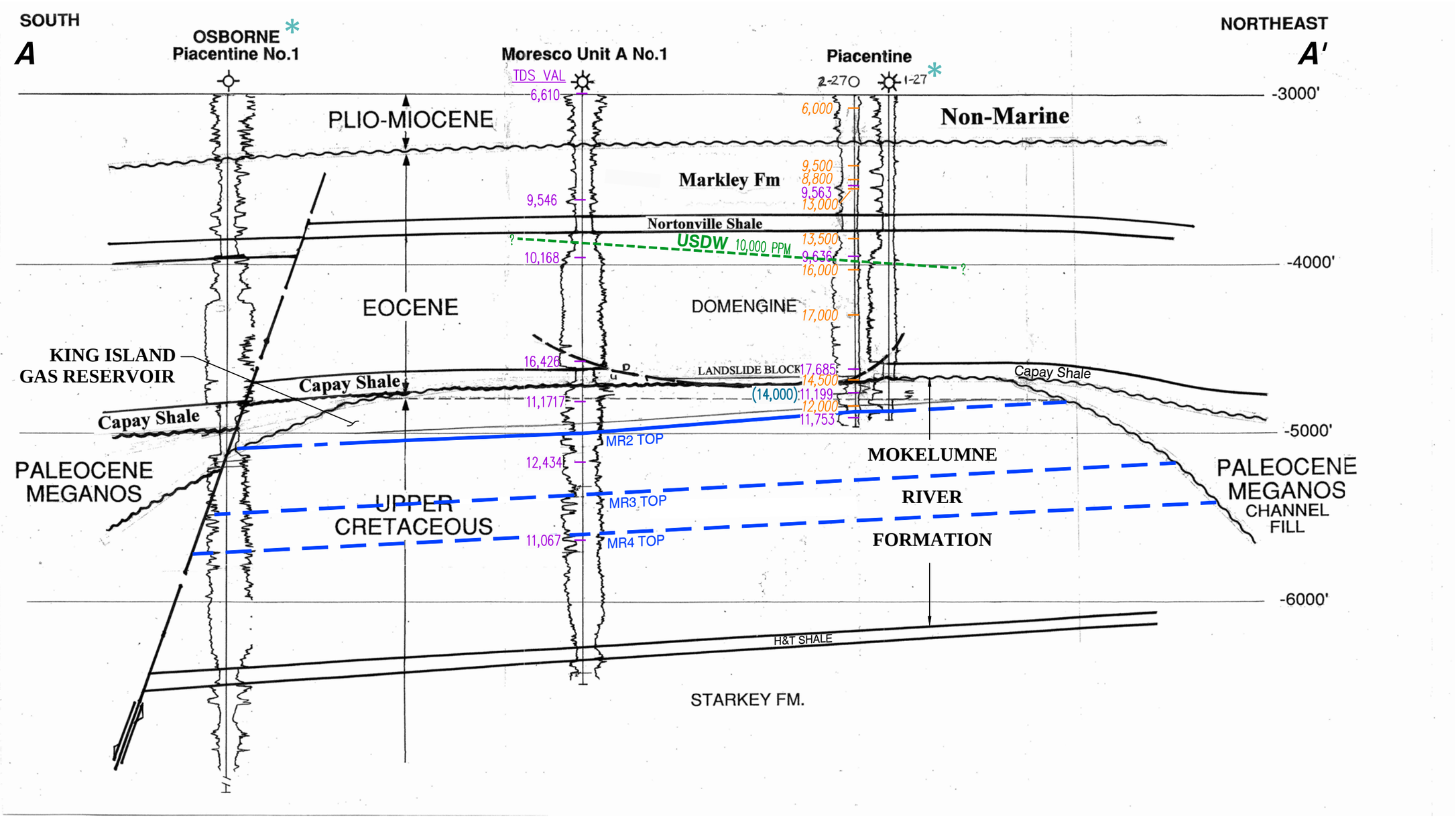
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FIGURE D-3

SAN JOAQUIN COUNTY SIMULATED GROUNDWATER ELEVATION CONTOURS FROM REGIONAL MODEL



LEGEND

12,500	CALCULATED TDS VALUE USING SP METHOD
9,500	CALCULATED TDS VALUE USING ARCHIE METHOD
- - - - - -	10,000 PPM TDS CONTOUR
(14000)	LABORATORY MEASURED TDS CONCENTRATION
*	NOT USED TO CREATE TDS CONTOUR LINE

NOTE:

CROSS SECTION DATA BY F. CRESSEY, WORLEYPARSONS GROUP
TDS DATA BY J. RESOWALLI, JR & ASSOCIATES

FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCAITES, INC.

ABBREVIATIONS:

TDS	TOTAL DISSOLVED SOLIDS
PPM	PARTS PER MILLION

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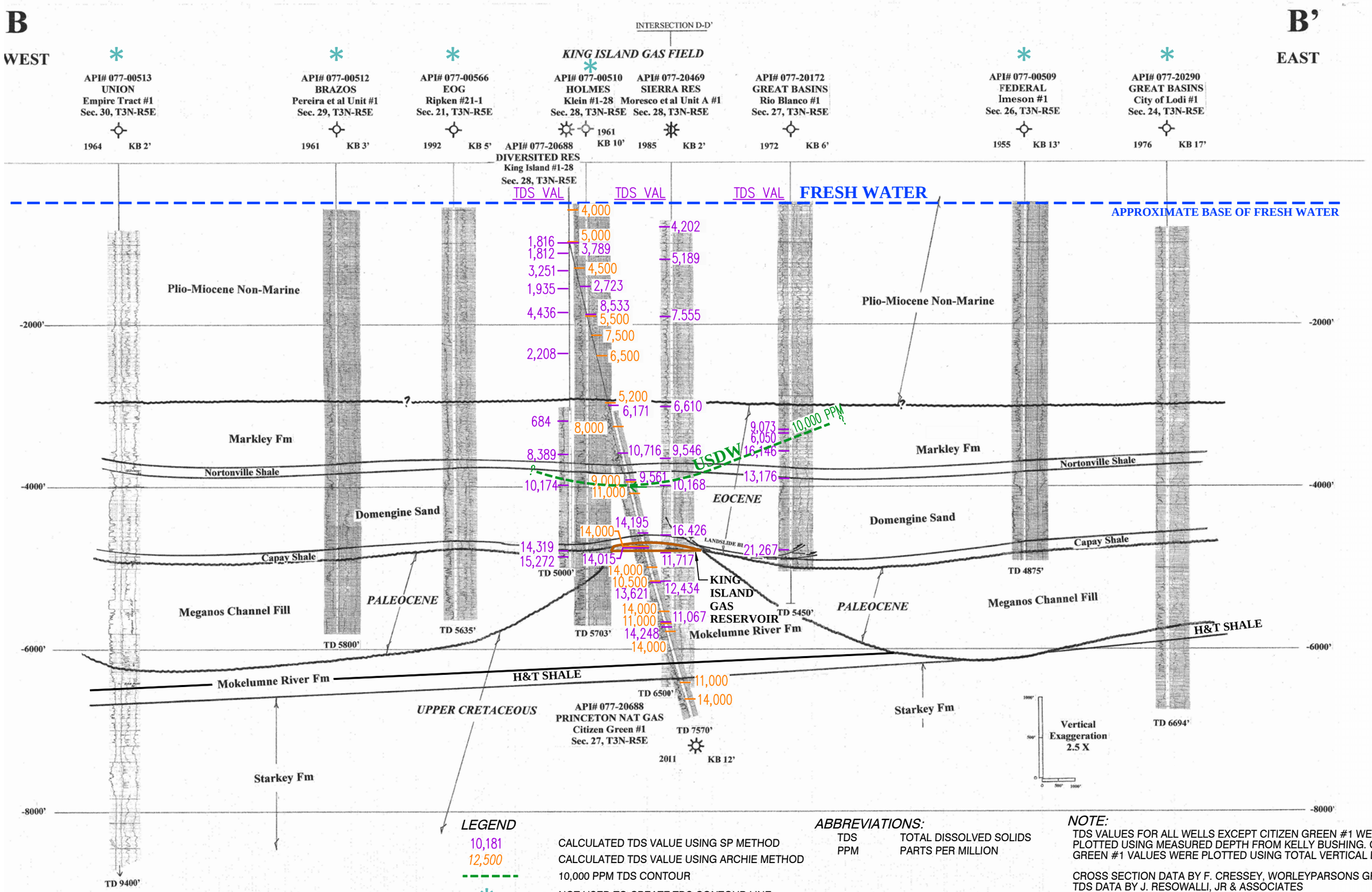
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FIGURE D-4

SECTION A-A' AND BASE OF USDW

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LEGEND

10,181	CALCULATED TDS VALUE USING SP METHOD
12,500	CALCULATED TDS VALUE USING ARCHIE METHOD
- - - - -	10,000 PPM TDS CONTOUR
*	NOT USED TO CREATE TDS CONTOUR LINE

ABBREVIATIONS:

TDS	TOTAL DISSOLVED SOLIDS
PPM	PARTS PER MILLION

NOTE:

TDS VALUES FOR ALL WELLS EXCEPT CITIZEN GREEN #1 WERE PLOTTED USING MEASURED DEPTH FROM KELLY BUSHING. CITIZEN GREEN #1 VALUES WERE PLOTTED USING TOTAL VERTICAL DEPTH.

CROSS SECTION DATA BY F. CRESSEY, WORLEYPARSONS GROUP
TDS DATA BY J. RESOWALLI, JR & ASSOCIATES

FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCIATES, INC.

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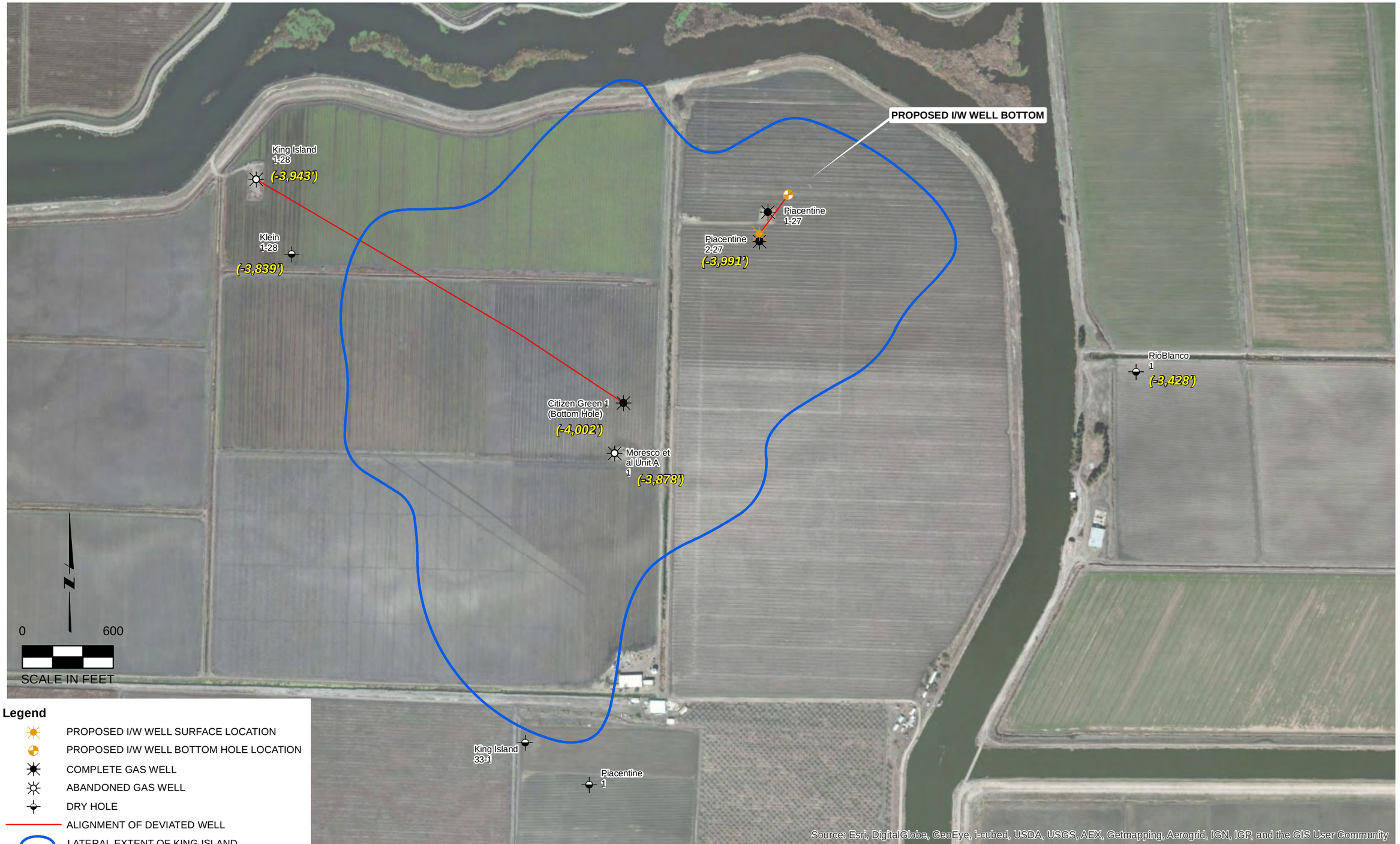
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FIGURE D-5

SECTION B-B' AND BASE OF USDW

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Legend

- PROPOSED I/W WELL SURFACE LOCATION
- PROPOSED I/W WELL BOTTOM HOLE LOCATION
- COMPLETE GAS WELL
- ABANDONED GAS WELL
- DRY HOLE
- ALIGNMENT OF DEVIATED WELL
- LATERAL EXTENT OF KING ISLAND GAS FIELD RESERVOIR SAND
- (3510') DEPTH TO BASE OF USDW (CALCULATED OR INTERPOLATED, SEE ATTACHMENT E)

Notes

ALL ELEVATIONS ARE SUBSEA

FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCIATES, INC.

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FIGURE D-6

KING ISLAND RESERVOIR DEPTH TO USDW, AND WELL LOCATIONS

ATTACHMENT E
NAME AND DEPTHS OF USDWS

NAME AND DEPTHS OF USDWS

E.1 Hydrogeology and Depth of Freshwater Aquifers

California State Water Resources Control Board (SWRCB) Resolution 88-63 assigns groundwater resources containing up to 3,000 milligrams per liter (mg/L) of total dissolved solids (TDS) a potential beneficial use as drinking water. Similarly, the California Department of the Interior, Division of Oil Gas and Geothermal Resources (DOGGR) classifies freshwater as containing less than 3,000 mg/L TDS. These Freshwater Aquifers are a subset of Underground Sources of Drinking Water (USDW, defined in the UIC regulations as containing TDS below 10,000 mg/L). Nevertheless, freshwater aquifers warrant separate discussion because water supply wells in the area are completed in these deposits and they are regulated more stringently by the state.

The King Island gas field comprises approximately 3-acres of irrigated walnut tree orchard located just inside the eastern boundary of the Sacramento-San Joaquin Delta. The proposed CAES development site is bounded by surface water bodies to the north (White Slough approximately 1,000 feet north) and to the east (Bishop Cut approximately 1,500 feet east). The area surrounding the development site is generally level and ranges in elevation from approximately 5 to 10 feet below sea level. Water levels in White Slough and Bishop Cut are slightly above sea level and are separated from King Island by a series of levees. The walnut tree orchard is irrigated by water from White Slough and Bishop Cut using a drip irrigation system, and groundwater levels beneath the orchard are maintained a depth of approximately 6 to 8 feet below ground level by a system of drains. Three shallow domestic water wells are located at a cluster of ranch residences approximately 3,000 feet southeast of the site (Figure D-1). Construction information is not available for these wells; however, most of the domestic and agricultural wells in the region are believed to be between 100 and 200 feet deep based on data from the National Water Information System (NWIS; USGS, 2013) and the reported depth of fresh water at the King Island gas field.

The King Island gas field is located in the northwestern portion of the Eastern San Joaquin groundwater sub-basin (ESJSB), which occupies the central portion of the Northern San Joaquin hydrogeologic basin (NSJHB). The NSJHB lies within the Central Valley hydrogeologic province (DWR, 2006). Marine clastic sediments (sands, silts and clays) were deposited in the Central Valley from middle Cretaceous through middle Tertiary time. These high salinity water bearing marine sedimentary deposits are unconformably overlain by lower salinity to fresh water bearing continental sediments that were deposited from Miocene through Recent time.

The approximately upper 3,000 feet of sediments beneath King Island are Miocene and younger continental deposits that occur in the Mehrten Formation and overlying alluvial, lacustrine and Flood Basin Deposits. The alluvial, lacustrine and Flood Basin Deposits represent basinward finer-grained facies stratigraphically equivalent to the Laguna, Riverbank, and Modesto Formations, and overlying Recent sediments. The lithologies and approximate age and thickness of these are provided in Table E-1, below (DWR, 2006).

TABLE E-1: AGES AND THICKNESS OF FRESHWATER DEPOSITS IN NORTHERN SAN JOAQUIN COUNTY				
Formation	**Age**	**Thickness (feet)**	**Lithologies**	**Hydrogeological Characteristics**
Flood Plain Deposits	Pliocene to Recent	1,400+	Unconsolidated fine-grained sand, silt and clay.	Generally lower permeability. Unconfined to confined aquifers.
Mehrten Formation	Late Miocene to Pliocene	1,300+	Moderately to well indurated andesitic ("black") sandstone interbedded with conglomerate, tuffaceous siltstone and claystone.	Moderate to high permeability in "black sands" units. Wells typically yield 1,000 gallons per minute. Confined to semi-confined aquifers.

There is no detailed information on shallow aquifers in the site area, including depth, lithology, water levels and water quality, including for the three shallow domestic wells mentioned above. The information presented below was derived from available public sources of information.

In northern San Joaquin County, groundwater is not extensively used in the area west of Interstate Highway 5 (San Joaquin County Department of Public Works, 2004). Nine water wells are reported in the NWIS as being located between 2 and 3 miles from the site and are reported to be between 33 and 142 feet in depth (USGS, 2013). The locations of these wells are shown on Figure D-1 and available well completion and analytical data are summarized in Table E-2. TDS analyses results were available for seven of the wells, with concentrations ranging from 63 to 3,140 milligrams per liter (mg/L), though the second highest concentration was only 1,640 mg/L. No analytical data were available for the other two wells.

All of the gas exploration and production wells in and near the field have surface casing set to a minimum depth of 496 feet (in the Klein #1-28, Table C-1), and the interval behind the surface casings has not been logged. DOGGR well histories for wells in and near the field are included as Attachment C-1. The well histories report that base of fresh water (BFW) for most of these wells occurs at 400 feet. The exceptions are the Klein #1-28 and the Rio Blanco #1, for which BFW is reported to occur above 500 feet, and the Piacentine 1-27 and the Piacentine 2-27, for which BFW is reported to occur at 150 feet. The DOGGR Field Rules for the King Island Gas Field report an assumed depth to the base of fresh water of less than 500 feet (DOGGR, 2007). The above data support a depth of fresh water, as defined by the State of California, of less than 500 feet, and possibly as shallow as 150 feet. Based on regional hydrogeologic studies, fresh water would occur in fine-grained unconsolidated sands in the "Flood Plain Deposits" hydrostratigraphic unit described by DWR (2006).

Overdraft pumping in the ESJSB has created groundwater depressions in the central portion of the sub-basin, including east of Stockton and east of Lodi, where groundwater pumping is concentrated. This has caused poorer quality groundwater from the Sacramento-San Joaquin Delta to flow towards the east (San Joaquin County Department of Public Works, 2004). Shallow extensions of these depressions extend westward approximately to Interstate Highway 5. Accordingly, groundwater beneath King Island is expected to flow towards the east (Figures D-2 and D-3). Groundwater withdrawals for irrigation also create a strong component of downward flow in the areas east of Stockton and Lodi.

E.2 Geology and Depth of Underground Sources of Drinking Water

USDW are defined in the Underground Injection Control (UIC) regulations as being groundwater resources with TDS concentrations less than 10,000 mg/L (40 CFR 144.3). As such, they include water

that is more saline than California-defined fresh water resources and they typically underlie these fresh water resources to a greater depth. The base of the Mehrten Formation represents a major unconformity separating late Miocene continental deposits from a thick sequence of Eocene to Upper Cretaceous marine deposits (Figures D-4 and D-5). By virtue of their provenance, groundwater in these marine deposits typically is more saline than in the overlying fresh water deposits.

An evaluation of the lateral and vertical extent of USDW within and near the King Island Gas Field and the East Islands Gas Field was conducted by collecting and evaluating a formation water sample from the King Island gas reservoir during drilling of the Piacentine 2-27 core well in March and April 2013 and reviewing electrical logs from nine gas exploration and production wells located in and near the gas field. The purpose of the evaluation was to determine at what depths formation water meets the UIC criteria for USDW (< 10,000 mg/L of TDS). The well information reviewed included spontaneous potential (SP) and resistivity logs from study area wells. Well histories, including electric logs, of these King Island Gas Field wells are included as Attachment C-1.

TDS can be determined through laboratory analysis of water samples collected from formations of interest. This method is the most accurate and is the preferred method of the USEPA when data are available. A report prepared on the behalf of the USEPA states: *"Sampling and chemical analyses is the benchmark method to determine TDS concentrations"; and "TDS concentration developed from chemical analyses is the preferred method of determining formation water quality"* (Ken E. Davis Associates, 1988). An *in-situ* depth-discrete water sample was collected in the Mokelumne River Formation (MRF) target injection zone (at 4,774 feet MD) in the Piacentine 2-27 core well using Halliburton's Reservoir Description Tool (RDT™). The sample was analyzed in a laboratory for a comprehensive suite of cations and anions, as well as TDS by the gravimetric method. Detailed analytical results for this sample are reported in Attachment H-2. The laboratory-derived TDS is more accurate than a TDS value based on electric log interpretation, and is considered representative for the MRF target injection zone. The MRF formation water sample had a TDS concentration of 14,000 mg/L, which is significantly above the UIC criteria for USDW of 10,000 mg/L of TDS.

There are no known water sample laboratory analytical results available for TDS in the formations overlying the MRF from any of the King Island or nearby wells. For these shallower formations, it is necessary to rely on electric log analysis for the estimation of TDS in formation water. TDS estimates obtained through electric log analysis are typically within $^{+}$/- 15% of laboratory derived TDS values (Ken E. Davis Associates, 1988).

TDS was calculated using two electric log analysis methods; the SP method and the Archie method. The SP method involves calculation of pore water resistivity (R_w) using SP log readings in sand zones, followed by determination of TDS using Schlumberger Chart Gen-6 (Schlumberger, 2009). The chart relates R_w (in Ohm-m^2/m) to salinity (TDS) as sodium chloride (NaCl) in parts per million over a range of temperatures. The Archie method calculates R_w using resistivity and porosity log readings in sand zones and Archie's Equation, followed by TDS determination using Schlumberger Chart Gen-6.

SP Method

The R_w in a water-saturated sand zone can be calculated using the amplitude of the SP curve (E, in millivolts), the formation temperature (FT in degrees Celsius or Fahrenheit) and the resistivity of the mud filtrate (R_{mf}, in ohm-m^2/m) at the formation temperature.

Well log SP curve measurements (representing static SP measurements, or SSP) were made from the shale baseline in thick water saturated sands. The well log header provided the remaining inputs

required for the calculations, including bottom hole temperature (BHT), R_{mf} and the temperature of the R_{mf} measurement. R_{mf} is measured at the well site with a handheld instrument, at least once before the well is logged.

An Excel spreadsheet was developed to perform the series of calculations required to derive estimates of TDS in formation water at the depths for which SSP measurements were taken (Table E-3). The spreadsheet includes the formulas or calculation methodology and a list of abbreviations, as shown below:

TABLE E-4: FORMULAS FOR SP METHOD OF TDS ESTIMATION

Table E-3 Column	Formulas
Column F:	FT (deg C) = (((BHT - MST) / well total depth)) * FD) + MST
Column G:	FT (deg F) = (deg C * 9/5) + 32
Column H:	R_{mf} at FT = R_{mf} at measurement T * [(measurement T + 6.77) / FT + 6.77)] *(Source: Schlumberger chart Gen-6)*
Column I:	R_{weq} = 0.85 * R_{mf} * 10^(SSP / (60.5 + 0.133 * FT)); incorporating the following equations:
	R_{mfeq} = 0.85 * R_{mf}@FT (when R_{mf}@75 > 0.1) *(Source: Schlumberger chart SP-1)*
	SSP = -Kc * log(R_{mfeq} / R_{weq}) *(Source: Schlumberger chart SP-1)*
	K_c = 60.5 * 0.133 * FT *(Source: Ransom, Robert C., 1995)*
Column J:	Empirical solution to Schlumberger chart SP-2, providing R_W from R_{weq} at FT.
Column K:	R_w at 400 deg F = R_w at FT * [FT + 6.77) / 400 + 6.77)] *(Source: Schlumberger chart Gen-6)*
Column L:	Empirical solution to Schlumberger chart Gen-6, providing TDS in ppm from R_w at 400 deg F.

BHT = Bottom hole temperature	ppm = parts per million
deg C = Degrees Celsius	R_{mf} = Resistivity of mud filtrate (Ohm-m^2/m)
deg F = Degrees Fahrenheit	R_{mfeq} = Equivalent mud filtrate resistivity (Ohm-m^2/m)
FD = Formation depth of interest	R_{mc} = Resistivity of mud cake (Ohm-m^2/m)
FT = Formation temperature at depth of interest	R_W = formation water resistivity
K_c = Electrochemical sponteneous potential coefficient	R_{weq} = Equivalent water resistivity
MD = Measured depth from drill rig kelly bushing	SSP = Static spontaneous Potential (millivolts)
MST = Mean surface temperature	T = Temperature
Ohm-m^2/m = Ohm-meters squared per meter	TDS = total dissolved solids in ppm

The general methodology for the SP method is summarized below:

- SSP measurement is read from SP log curve (Table E-3, Column E)
- Temperature at the depth of each sand is interpolated, based on a temperature gradient for each well derived from the average mean surface temperature of 60.8 °F (16 °C) and the BHT (Table E-3, Column F)
- Using the measured R_{mf} value (Table E-3, Column C) and the temperature from the log header (Table E-3, Column B), an R_{mf} at formation temperature is calculated using the formula presented in Schlumberger chart Gen-6 (Table E-1, Column H).
- Using a formula that combines equations provided with Schlumberger chart SP-1, a corresponding R_{weq} is calculated (Table E-3, Column I).
- Using an empirical solution to Schlumberger chart SP-2, R_{weq} is converted to R_w at the formation temperature (Table E-3, Column J).
- Convert R_w at formation temperature to R_w at 400 deg F using the formula presented in Schlumberger chart Gen-6 (Table E-3, Column K).
- Using an empirical solution to Schlumberger chart Gen-6, determine TDS in ppm at 400 deg F (Table E-3, Column L).

Archie Method

R_w can also be derived using the Archie Equation (Archie, G.E., 1942) in the following form:

$$R_w = \phi^m * R_t / a$$

Where:

ϕ = porosity

m = cementation factor

R_t = formation resistivity

a = tortuosity factor

Archie's method depends on reliable porosity data, which are available for only two wells in the King Island area, the Piacentine 2-27 and the Citizen Green 1, both of which were logged using neutron and density tools. The well logs with porosity curves derived from the neutron and density curves are provided in Attachment C-1. For this reason, the Archie method was only performed for these two wells.

The cementation factor (m) and R_w were derived using a Pickett Plot (Pickett, G.R., 1966), which is the logarithm of the Archie equation expressed as a logarithmic plot of formation resistivity (R_t) versus porosity (ϕ). Points of constant water saturation (S_w) plot on a straight line with negative slope of value "m". A Pickett plot was developed for each sand package of interest and used to derive a value of R_w, assuming constant values of 1.7 for m and 1.0 for "a". The Pickett Plots are provided in Attachment E-1.

Schlumberger chart Gen-6 was then used to determine the formation water salinity (TDS) for each sand package based on the Pickett Plot derived R_w value and the temperature of the formation at that depth (based on the temperature gradient established for the SP method). The R_w and TDS values thus derived are annotated on the Pickett Plot sheets in Attachment E-1 and presented in Table E-5.

Discussion and Comparison of SP and Archie Method Calculation Results

Graphs presenting TDS versus depth were prepared for the four wells inside the Area of Review (AOR): Piacentine 1-27, Piacentine 2-27, Citizen Green 1 and Moresco A-1 (Graphs E-1, E-2, E-3 and E-4, respectively). The graphs show the stratigraphic intervals in which the deepest USDWs (sand packages with <10,000 ppm TDS) occur.

At the two wells for which both Archie and SP method TDS values were derived (Piacentine 2-27 and Citizen Green 1), there is reasonably good agreement in the TDS values, especially for the Citizen Green 1 (Graphs E-2 and E-3). One or both of the methods in all four graphs demonstrate that the TDS values >10,000 ppm first occur in the upper portion of the Domengine Formation (Figures D-4 and D-5). Three of the four graphs show TDS concentrations >10,000 ppm in the Mokelumne Formation (Graphs E-2, E-3 and E-4). Only the Piacentine 1-27 has a TDS value <10,000 ppm in the Mokelumne River Formation; specifically, a calculated value of 8,778 ppm at a depth of 4,800 feet within the lower lobe of the King Island gas field reservoir, just below the original gas/water contact. This TDS value is not considered accurate or representative of Mokelumne River Formation salinity, based on the following evidence:

1. Nearly all the TDS values in the Piacentine 1-27 are significantly lower than in the other three wells in the AOR (Graph E-5). The Piacentine 1-27 should have similar TDS values, as all four wells penetrated and logged the same formations and are located near one another in the same unfaulted reservoir. Proximity is especially noteworthy in the case of the Piacentine 1-27 and Piacentine 2-27, which are located only about 200 feet from one another (Figure F-13). This suggests the Piacentine 1-27 results may be biased low.
2. The SP method derived TDS values for the Piacentine 2-27 and the Citizen Green 1 are comparable to the Archie method derived TDS values (Graphs E-2 and E-3), with both methods showing the base of USDW just above or below the Nortonville Shale and TDS values consistently >10,000 ppm in the Mokelumne River Formation. This correlation provides further support for the reliability of the SP method derived TDS values in the Piacentine 2-27 and the Citizen Green 1, and casts further doubt on the SP-derived TDS values for the Piacentine 1-27.
3. As discussed above, the water sample collected from a depth of 4,774 feet in the Mokelumne River Formation reservoir in the Piacentine #2-27 was analyzed in the laboratory and found to have a TDS concentration of 14,000 ppm. This concentration is nearly identical to the Archie method derived TDS value of 14,500 ppm, and comparable to the SP method derived TDS value of 11,199, taken from the same reservoir sand sampled in the Piacentine 2-27 (Tables E-3 and E-4). On the other hand, it is doubtful that the SP method derived TDS value of 8,778 ppm in the Piacentine 1-27, from the same depth and reservoir sand sampled in the Piacentine 2-27, is correct, as the difference is too great for wells located only approximately 200 feet from one another with no apparent intervening geologic discontinuities (i.e., fault).

Based on the evidence presented above, it is concluded that the SP method derived TDS values in the Piacentine 1-27 are not correct, and therefore, have not been used in the determination of USDW in the AOR and have not been plotted on the geologic cross-sections referenced in the discussion below. There are two other wells in the vicinity but outside the reservoir and AOR with SP method derived TDS values that are also believed to be incorrect (too high): the King Island 33-1 and the Piacentine 1 (Table E-3; Figure D-6). A faulty R_{mf} measurement is considered the most likely reason for the too low TDS in the Piacentine 1-27 and the too high TDS in the King Island 33-1 and the Piacentine 1. R_{mf} readings may be incorrect for a variety of reasons, including crew error while taking or recording the reading, instrument error or mis-calibration, or mud properties that changed during drilling and/or as logging tools were run

in and out of the borehole[1]. In the case of the Piacentine 1-27, the R_{mf} is probably too high and in the case of the King Island 33-1 and the Piacentine 1, the R_{mf} is probably too low.

USDW Occurrence and Protection

The approximate depth of the base of USDW at each well was determined by interpolation (Table E-3). The TDS concentrations from Tables E-3 and E-5 (with the exception of the incorrect TDS values for the three wells discussed above) were plotted on geological cross-sections (Figures D-4 and D-5), and the approximate depth of the base of USDW, represented by the TDS 10,000 ppm concentration contour, is depicted. The depth to the base of USDW in the area surrounding the proposed Injection/Withdrawal (IW) Well is also shown on Figure D-6. For the purpose of defining the base of USDW, in the two wells with TDS values derived from both the SP and Archie methods (Piacentine 2-27 and Citizen Green 1), the higher TDS values were used. As can be seen in the cross sections, within and in the vicinity of the AOR and the King Island gas field, the base of USDW generally occurs just below the Nortonville Shale in the Domengine Formation between approximately 3,800 and 4,000 feet in depth. The only exception is the Rio Blanco 1, in which the USDW occurs above the Nortonville Shale in the Markley Formation at an approximate depth of 3,400 feet. Based on the above, the base of USDW is separated from the target injection zone by approximately 700 feet of sedimentary section, which includes most of the Domengine Formation and the Capay Shale.

Correlation of well logs in the region demonstrates that the Capay Shale is regionally extensive (Attachment F: Figures F-5, F-6 and F-7). Several lines of evidence demonstrate that the Capay Shale, which directly overlies the injection zone, is a competent lower permeability unit with proven sealing capability (refer to Attachment G, Section G.5 for a detailed discussion):

- The Capay Shale forms the caprock for several gas fields in the area, including the King Island and East Islands Field. The Capay Shale held these gas accumulations intact for several million years;
- Pressure data collected in the King Island Piacentine 2-27 demonstrate that the Mokelumne River Formation reservoir sands below the Capay shale are in a different pressure regime than the Domengine Formation sands overlying the Capay shale (Table G-5); and
- The Capay Shale comprises low permeability sediments, with a harmonic mean vertical permeability of about 0.05 mD (Table G-6).

The Capay Shale ranges in thickness from 90 to 120 feet in the vicinity of King Island, though it is only 35 feet thick in the northeastern portion of the King Island gas field due to faulting at the head of a paleo-landslide that soles out in the Capay and does not cut the underlying Mokelumne River Formation reservoir (refer to discussion in Attachment G, Section G.3 and Figures F-6 and F-10). This feature cuts out 60 feet of Capay Shale in the Piacentine 2-27 and a similar amount of section in the overlying lower part of the Domengine Sand in the Piacentine 1-27. The competency of the Capay Shale, even at the thin area at the head of the paleo-landslide, is demonstrated by the evidence discussed above and presented in Attachment G, Section G.5.

Though the Capay Shale on its own is considered an excellent seal for the Mokelumne River Formation reservoir, the Nortonville Shale, which is approximately 100 feet thick in the vicinity of King Island provides a competent shallower secondary seal, representing an additional layer of protection to USDWs in the overlying Markley Formation. The Nortonville Shale can be identified on all well logs in the region based on a SP and gamma ray signature characteristic of a marine shale unit, as demonstrated on

1 See http://water.epa.gov/learn/training/dwatraining/upload/dwaUIC-uicpermit.pdf

Figures F-5, F-6 and F-7. The Nortonville Shale thins towards the north and thickens to more than 200 feet approximately 1-mile to the south, but is laterally continuous for at least a 2-mile radius around King Island (Figures F-6 and F-7). The Nortonville Shale is interpreted to be cut by the fault located just south of the King Island Gas (Figure D-4; see discussion in Attachment G, Section G.3), but otherwise appears to be uncomplicated by significant structural deformation in the project area. The Nortonville Shale will act to prevent movement of fluid from USDWs in the top of the Domengine to USDWs in the Markley Formation.

The above data compares favorably to an analysis of USDW made for an injection well recently installed approximately 2 ½ miles east of the site at the Northern California Power Authority (NCPA) Lodi Power Plant, where it was found that the Domengine Formation contained TDS at concentrations exceeding USDW levels.

E.3 References

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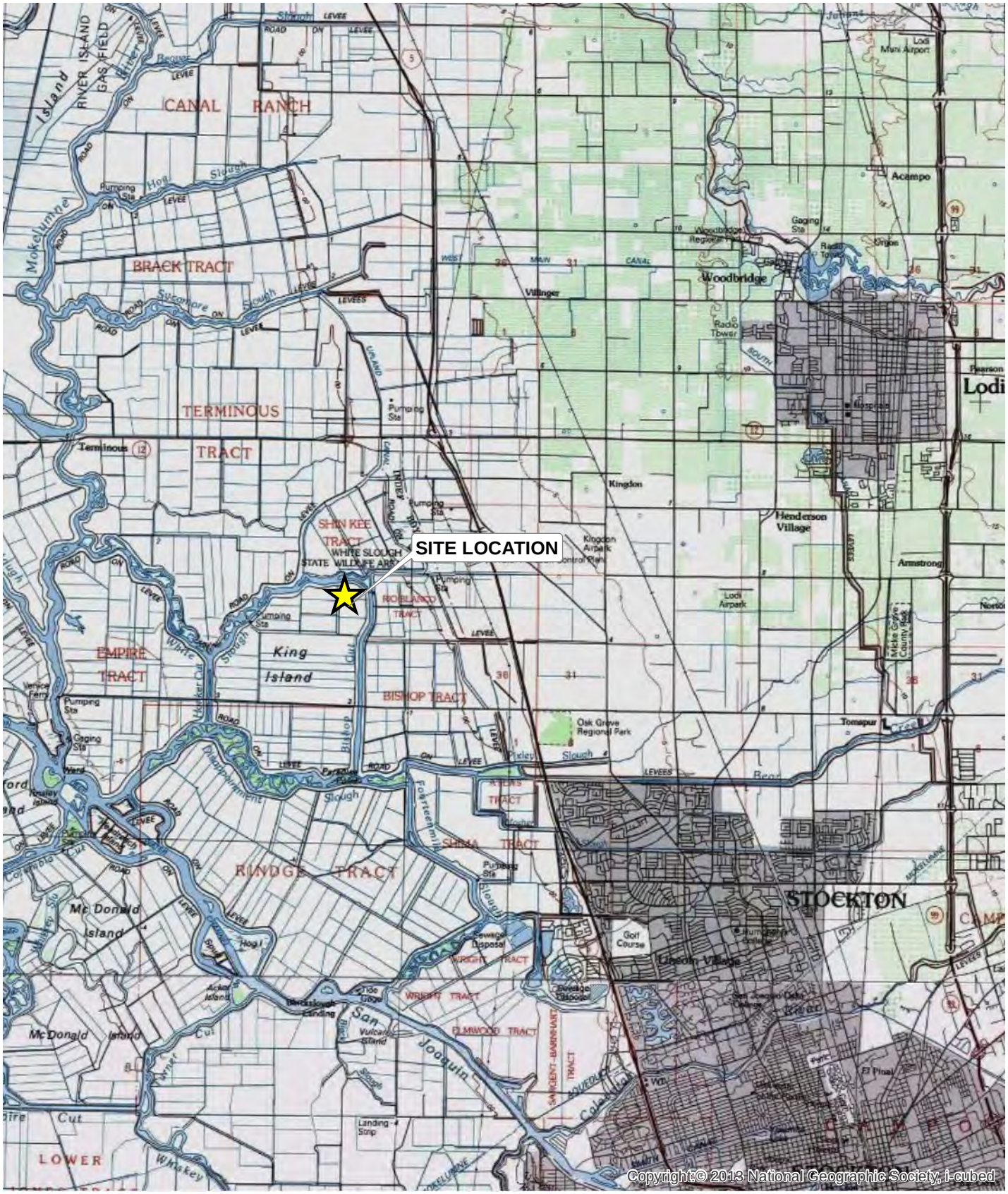
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ATTACHMENT F

Maps and Cross Sections of Geologic Structure of Area

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Figure F-12 South King Island – Section 33 Fault Study
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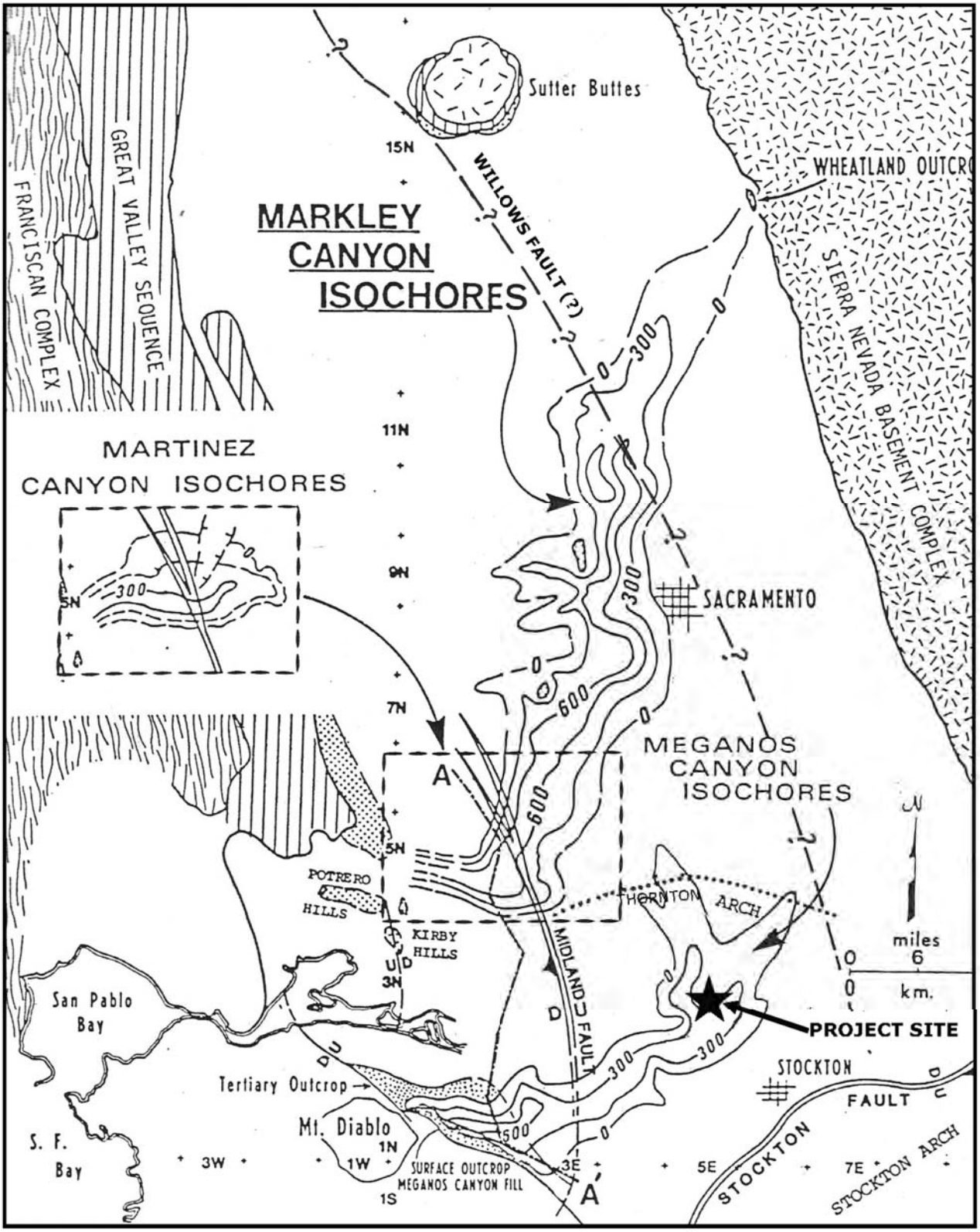


NOTE

FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCIATES, INC.

Prepared for **PACIFIC GAS AND ELECTRIC COMPANY**	LOCATION: *PG&E CAES PROJECT COMPRESSION TESTING I/W WELL UIC APPLICATION SAN JOAQUIN COUNTY, CALIFORNIA*	DATE: 12/17/13
	TITLE: ***SITE LOCTION MAP***	FIGURE: **1**

Path: J:\GIS\WPPGE_CAES\Section\Figure 01 Site Loc Map.mxd

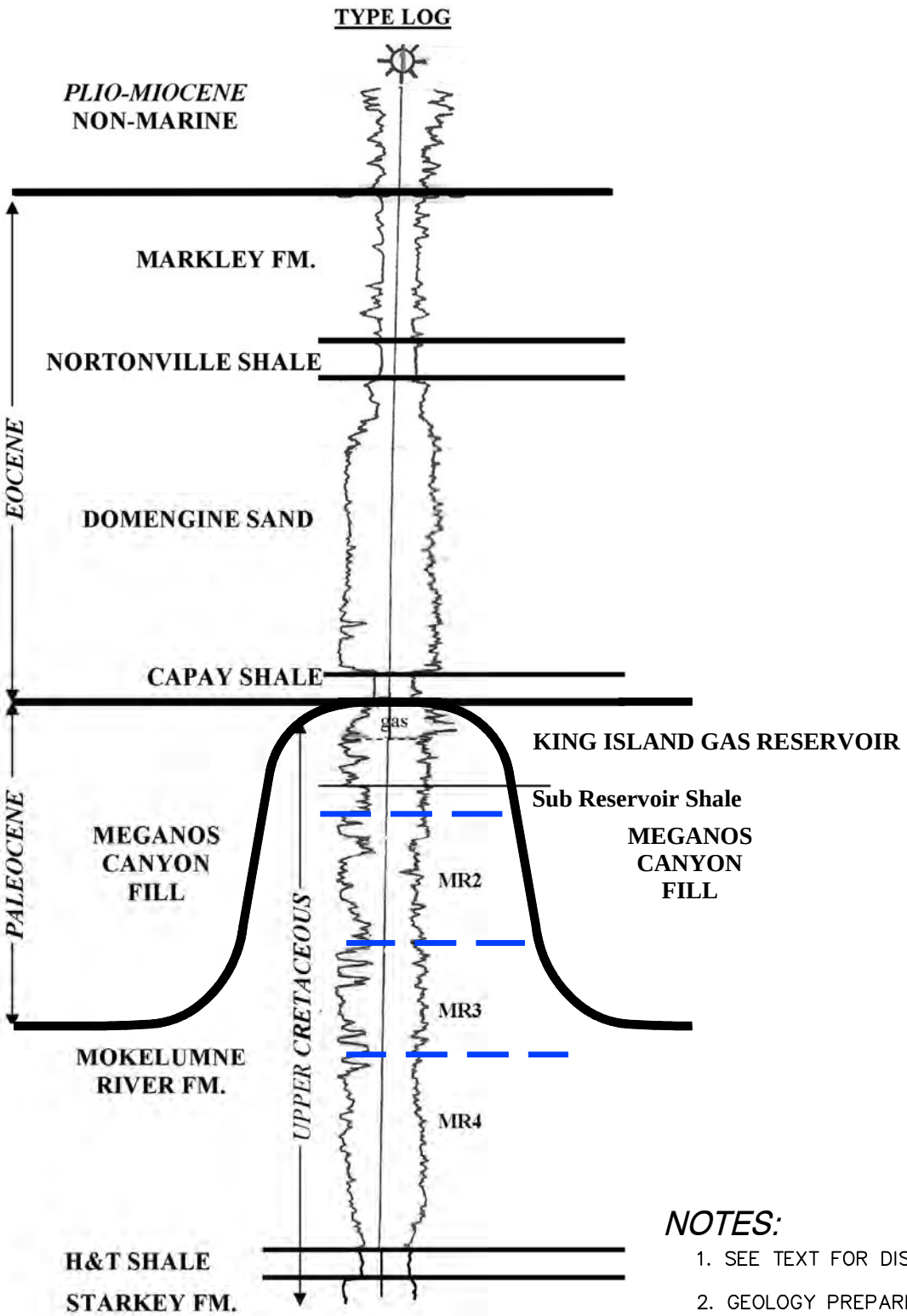


NOTES:

1. MAJOR GEOLOGICAL FEATURES, SOUTHERN SACRAMENTO VALLEY. MAP SHOWS ISOCHORES (IN METERS) OF THE MARTINEZ, MEGANOS, AND MARKLEY SUBMARINE CANYONS. PROJECT LOCATION AT KING ISLAND LIES WITHIN THE EASTERN MEGANOS CANYON AND IS SHOWN BY STAR. MAP MODIFIED FROM BEYER, 1988.
2. GEOLOGY PREPARED BY: F. CRESSEY, WORLEYPARSONS GROUP
3. FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCIATES, INC.

Prepared for **Pacific Gas and Electric Company**	PG&E	TITLE: *MAJOR GEOLOGIC FEATURES - SOUTHERN SACRAMENTO VALLEY*	DATE *12/13/13*
		LOCATION: *PG&E CAES PROJECT COMPRESSION TESTING I/W WELL UIC APPLICATION SAN JOAQUIN COUNTY, CALIFORNIA*	FIGURE: *F-2*

J:\GIS\WPPGE_CAES\SectionF\Figure F-02 Markley Canyon Isochores.dwg



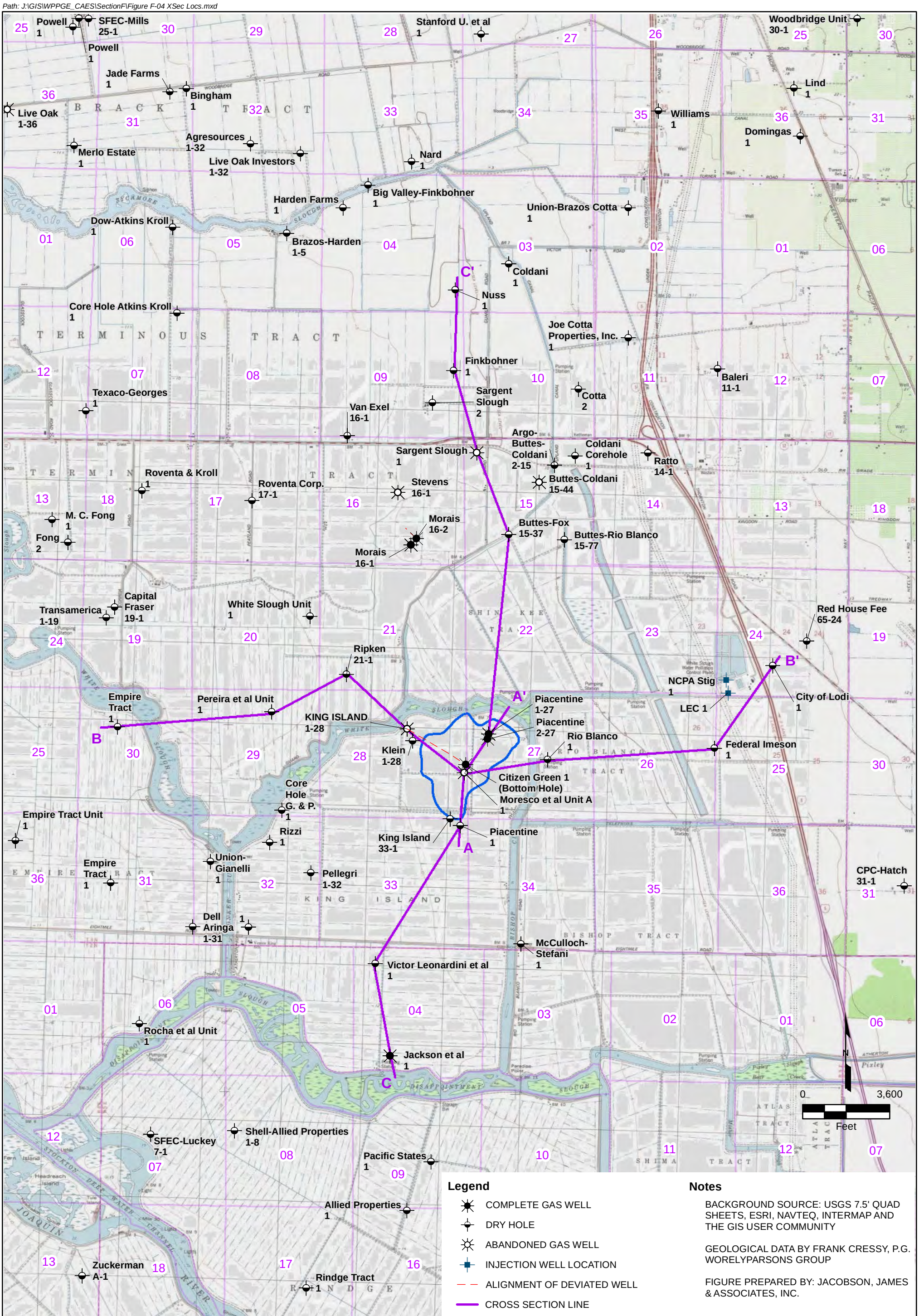
NOTES:

1. SEE TEXT FOR DISCUSSION
2. GEOLOGY PREPARED BY:
   F. CRESSEY, WORLEYPARSONS GROUP
3. FIGURE PREPARED BY:
   JACOBSON, JAMES & ASSOCIATES, INC.

Prepared for **Pacific Gas and Electric Company**	TITLE: *STRATIGRAPHIC COLUMN KING ISLAND GAS FIELD*	DATE *12/30/13*
	LOCATION: *PG&E CAES PROJECT COMPRESSION TESTING I/W WELL UIC APPLICATION SAN JOAQUIN COUNTY, CALIFORNIA*	FIGURE: F-3

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Path: J:\GIS\WPPGE_CAES\SectionF\Figure F-04 XSec Locs.mxd



Legend

- COMPLETE GAS WELL
- DRY HOLE
- ABANDONED GAS WELL
- INJECTION WELL LOCATION
- ALIGNMENT OF DEVIATED WELL
- CROSS SECTION LINE

Notes

BACKGROUND SOURCE: USGS 7.5' QUAD SHEETS, ESRI, NAVTEQ, INTERMAP AND THE GIS USER COMMUNITY

GEOLOGICAL DATA BY FRANK CRESSY, P.G. WORELYPARSONS GROUP

FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCIATES, INC.

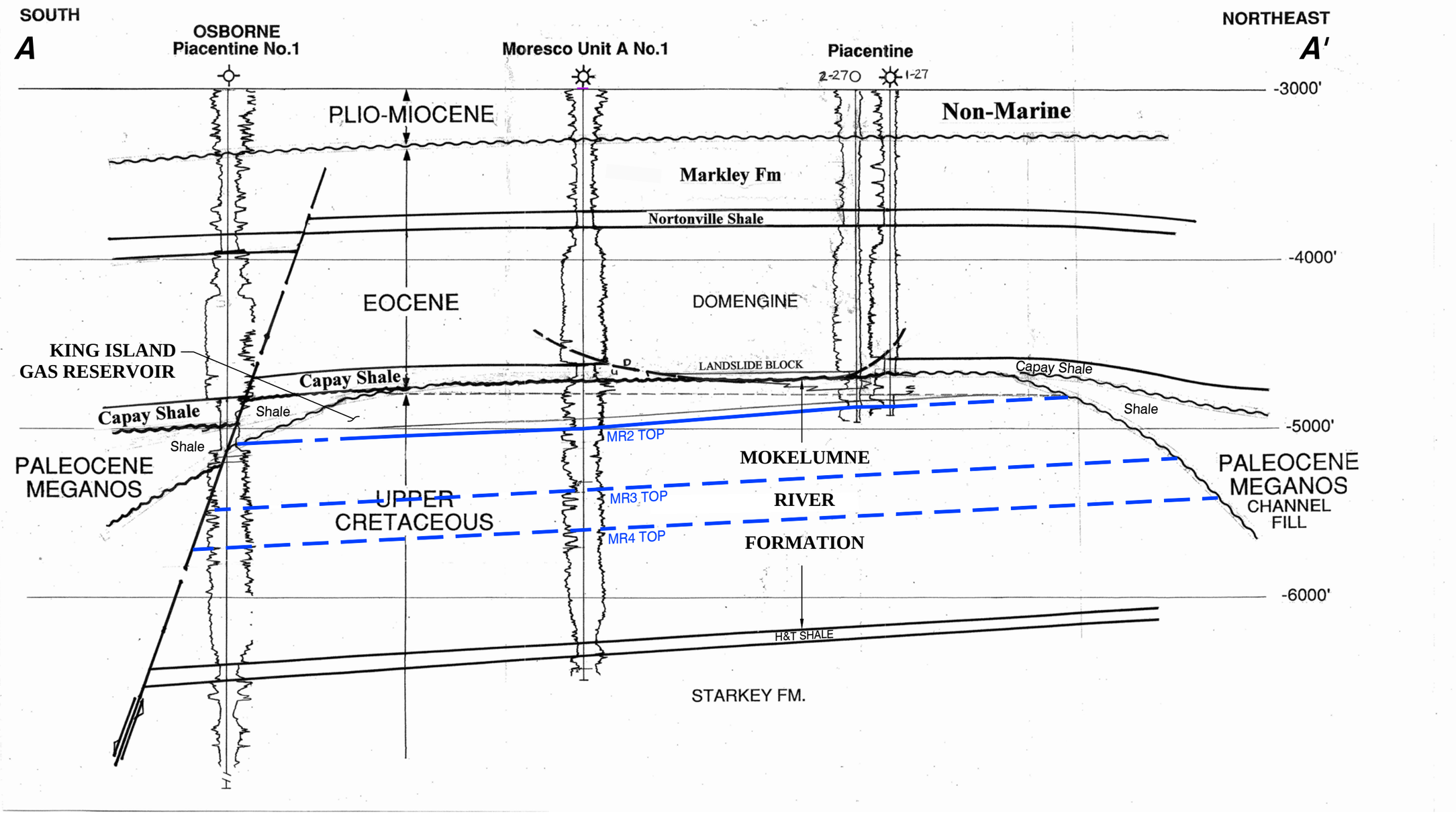
Prepared for
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FIGURE F-4

CROSS-SECTION LOCATIONS



NOTES:

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TDS DATA BY J. RESOWALLI, JR & ASSOCIATES

FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCAITES, INC.

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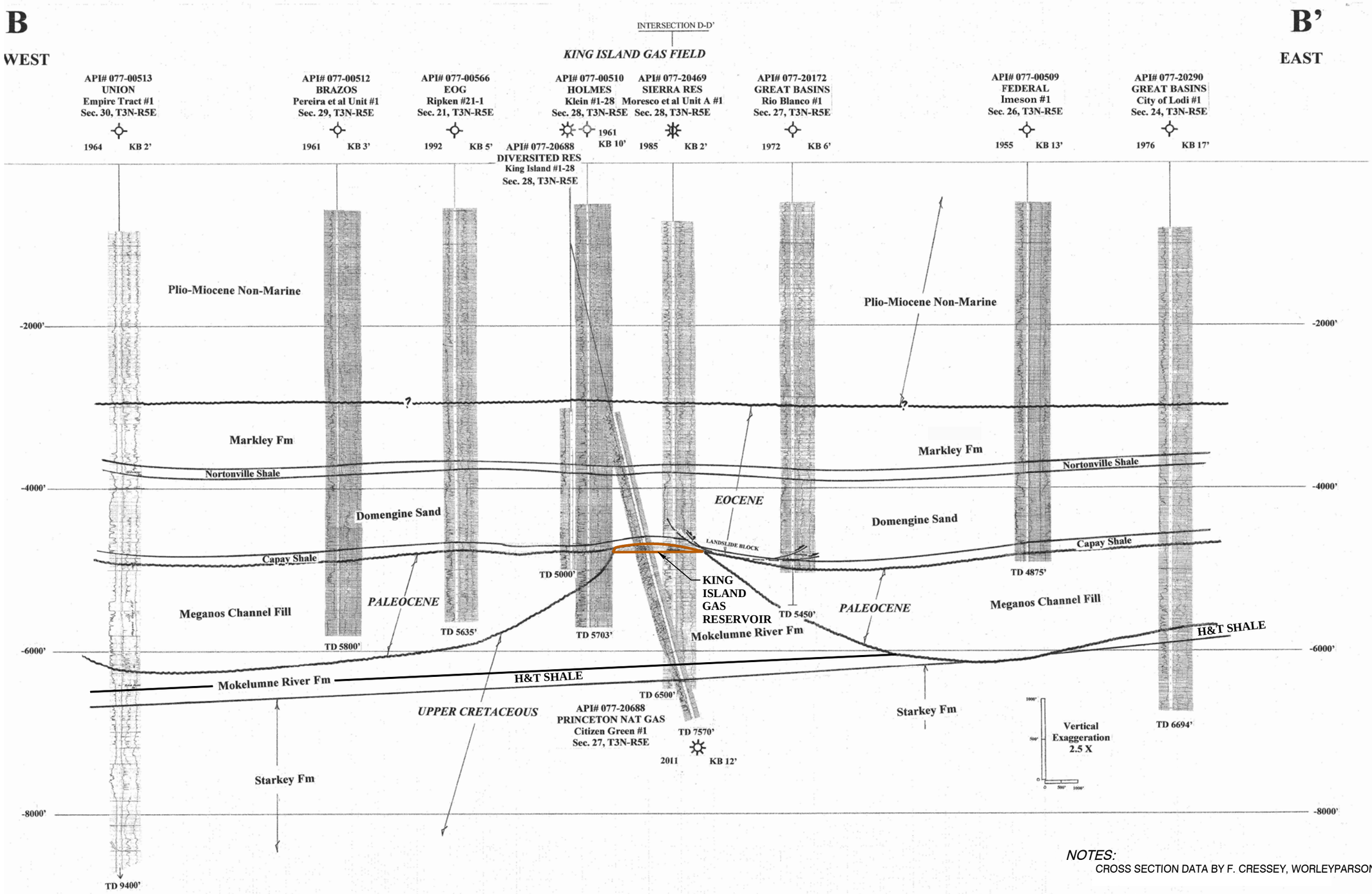
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FIGURE F-5

STRUCTURE SECTION A-A'

J:\GIS\WPPGE_CAES\SectionF\Figure F-05 StrucSection A-A.dwg



NOTES:

CROSS SECTION DATA BY F. CRESSEY, WORLEYPARSONS GROUP

FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCIATES, INC.

J:\GIS\WPPGE_CAES\SectionF\Figure F-06 Section B-B.dwg

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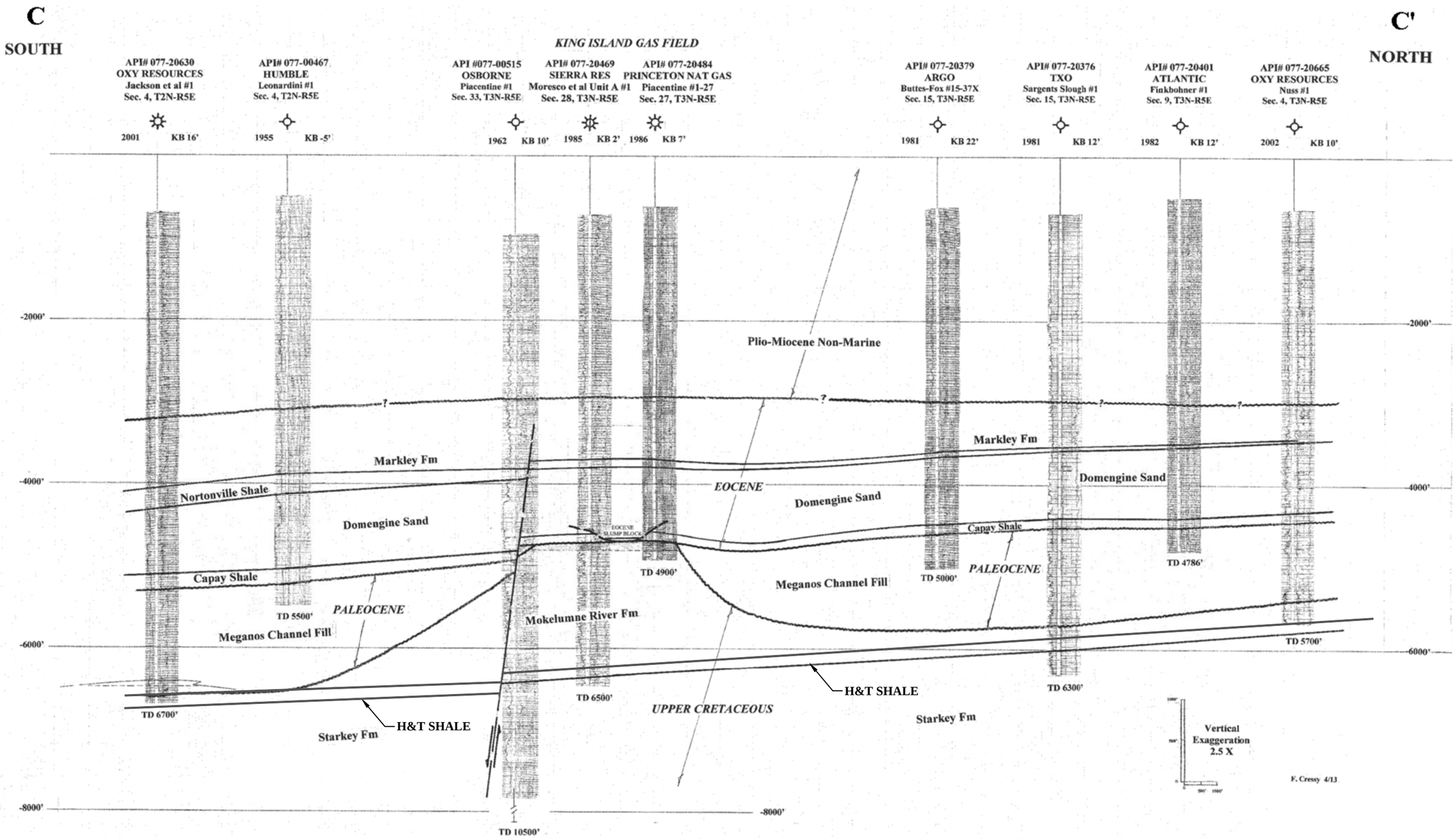
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FIGURE F-6

STRUCTURE SECTION B-B'



NOTES:

1. CROSS SECTION BY F. CRESSY, WORLEYPARSONS GROUP.
2. FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCIATES, INC.

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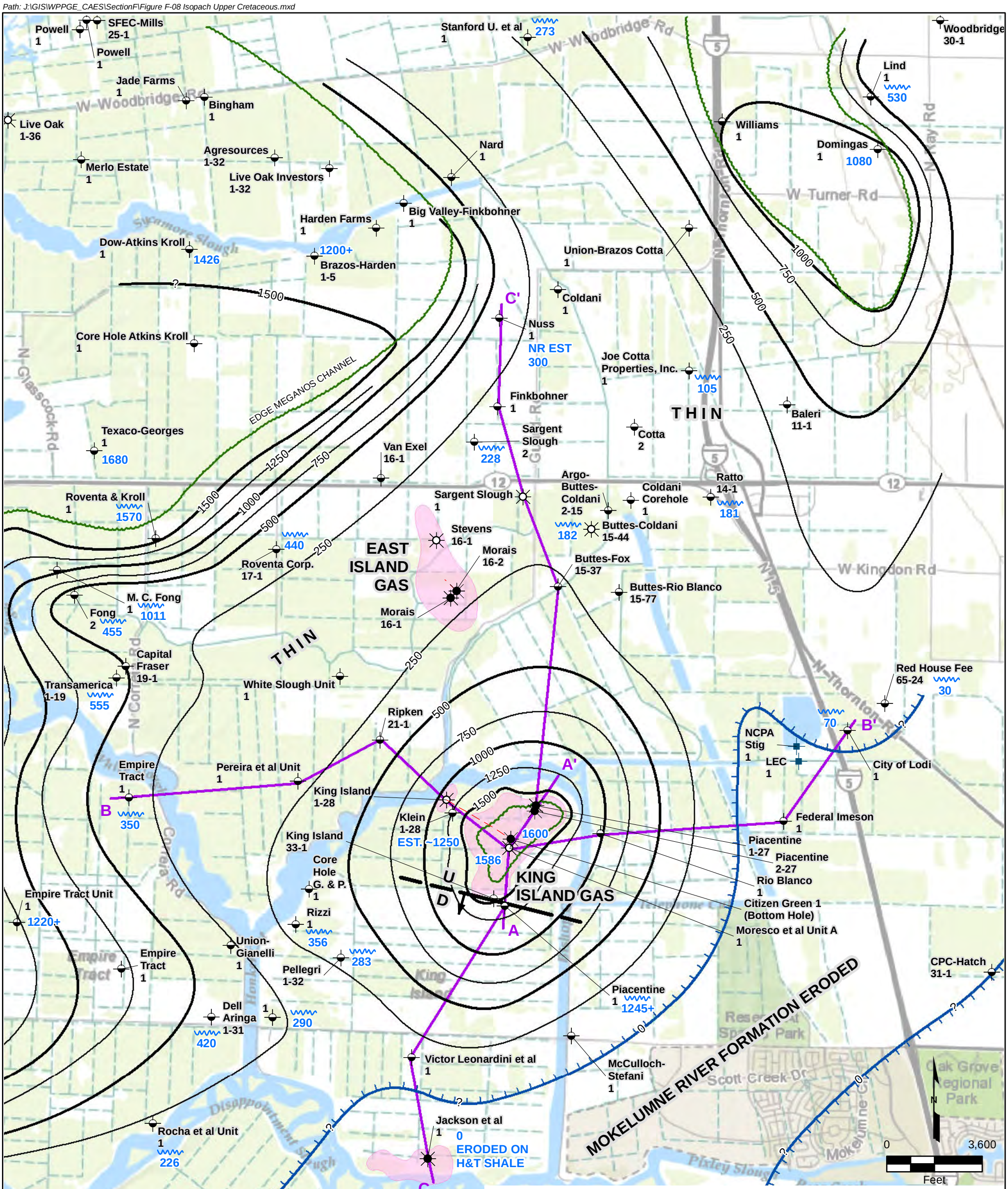
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FIGURE F-7

STRUCTURE SECTION C-C'

J:\GIS\WPPGE_CAES\SectionF\Figure F-07 StrucSection C-C.dwg

Path: J:\GIS\WPPGE_CAES\SectionF\Figure F-08 Isopach Upper Cretaceous.mxd



Legend

- COMPLETE GAS WELL
- DRY HOLE
- ABANDONED GAS WELL
- INJECTION WELL LOCATION
- ALIGNMENT OF DEVIATED WELL
- EROSIONAL UPPER CONTACT
- 1000 MOKELUMNE RIVER FORMATION THICKNESS
- MOKELUMNE RIVER FORMATION THICKNESS CONTOUR (FEET)
- EDGE OF MEGANOS CHANNEL
- CROSS SECTION LINE
- MOKELUMNE RIVER FORMATION TRUNCATION
- FAULT
- APPROXIMATE BOUNDARIES OF GAS POOL (FROM DOGGR RECORDS AND/OR SEISMIC DATA INTERPRETATION)

Notes

BACKGROUND SOURCE: USGS 7.5' QUAD SHEETS, ESRI, NAVTEQ, INTERMAP AND THE GIS USER COMMUNITY

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FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCIATES, INC.

NR EST = NOT REPORTED, ESTIMATE

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FIGURE F-8

ISOPACH MAP: UPPER CRETACEOUS MOKELUMNE RIVER FORMATION

Path: J:\GIS\WPPGE_CAES\SectionF\Figure F-09 Isopach Paleocene Channel Fill.mxd

Powell 1
Powell 1
SFEC-Mills 25-1
Jade Farms 1
Bingham 1
Live Oak 1-36
W Woodbridge Rd
Merlo 1
Merlo Estate 1
Agresources 1-32
Live Oak Investors 1-32
Nard 1
Big Valley-Finkbohner 1
Harden Farms 1
Brazos-Harden 1-5
Dow-Atkins Kroll 1
Sycamore Slough
Core Hole Atkins Kroll 1
N Glasscock Rd
EDGE MEGANOS CHANNEL
Texaco-Georges 1
Roventa & Kroll 1
Roventa Corp. 17-1
M. C. Fong 1
Fong 2
Van Exel 16-1
Sargent Slough 2
Finkbohner 1
Nuss 1
C'
Coldani 1
Stanford U. et al 1
1050
W Woodbridge Rd
500
250
750
1000
Williams 1
Lind 1
368
Domingas 1
N Ray Rd
Union-Brazos Cotta 1
W Turner Rd
Joe Cotta Properties, Inc. 1
1130
Baleri 11-1
Cotta 2
1188
Guard Rd
Sargent Slough 1
1192
Coldani Corehole 1
Ratto 14-1
Buttes-Coldani 15-44
Argo-Buttes-Coldani 2-15
1238
Stevens 16-1
Morais 16-2
Morais 16-1
Buttes-Fox 15-37
Buttes-Rio Blanco 15-77
W Kingdon Rd
1250
1000
N-Thornton-Rd
Red House Fee 65-24
B'
NCPA Stig 1
1030
City of Lodi 1
LEC 1
Federal Imeson 1
Rio Blanco 1
Capital Fraser 19-1
Transamerica 1-19
975
White Slough Unit 1
N Correia Rd
Ripken 21-1
Pereira et al Unit 1
Empire Tract 1
1302
B
A'
King Island 1-28
Klein 1-28
375
Piacentine 1-27
Piacentine 2-27
Moresco et al Unit A 1
Citizen Green 1 (Bottom Hole)
Core Hole G. & P. 1
King Island 33-1
Piacentine 1
148
158
U
D
A
Correia Rd
Telephone Cut
Empire Tract Unit 1
Rizzi 1
Union-Gianelli 1
1335
Pellegri 1-32
1330
Empire Tract 1
Empire Tract
Bisbee Cut
King Island
Dell Aringa 1-31
1140
1250
Victor Leonardini et al 1
McCulloch-Stefani 1
Reserve At Spanos Park
Scott Creek Dr
Oak Grov Regi
Rocha et al Unit 1
1104
Disappointment Slough
Jackson et al 1
1302
C
SFEC-Luckey 7-1
1119
Shell-Allied Properties 1-8
1068
Pacific States 1
Allied Properties 1
Fern Island
Tule Island
Zuckerman A-1
Rindge Tract 1
Rindge
0
3,600
Feet
N

Legend

- COMPLETED GAS WELL
- DRY HOLE
- ABANDONED GAS WELL
- INJECTION WELL LOCATION
- INTERSECTION OF DEVIATED WELLBORE WITH TOP OF MOKELUMNE RIVER FORMATION RESERVOIR
- ALIGNMENT OF DEVIATED WELL
- 1000 MEGANOS CHANNEL FILL THICKNESS
- MEGANOS CHANNEL FILL CONTOUR
- EDGE OF MEGANOS CHANNEL
- FAULT
- CROSS SECTION LINE
- APPROXIMATE BOUNDARIES OF GAS POOL (FROM DOGGR RECORDS AND/OR SEISMIC DATA INTERPRETATION)

Notes

BACKGROUND SOURCE: USGS 7.5' QUAD SHEETS, ESRI, NAVTEQ, INTERMAP AND THE GIS USER COMMUNITY

GEOLOGICAL DATA BY FRANK CRESSY, P.G. WORELYPARSONS GROUP

FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCIATES, INC.

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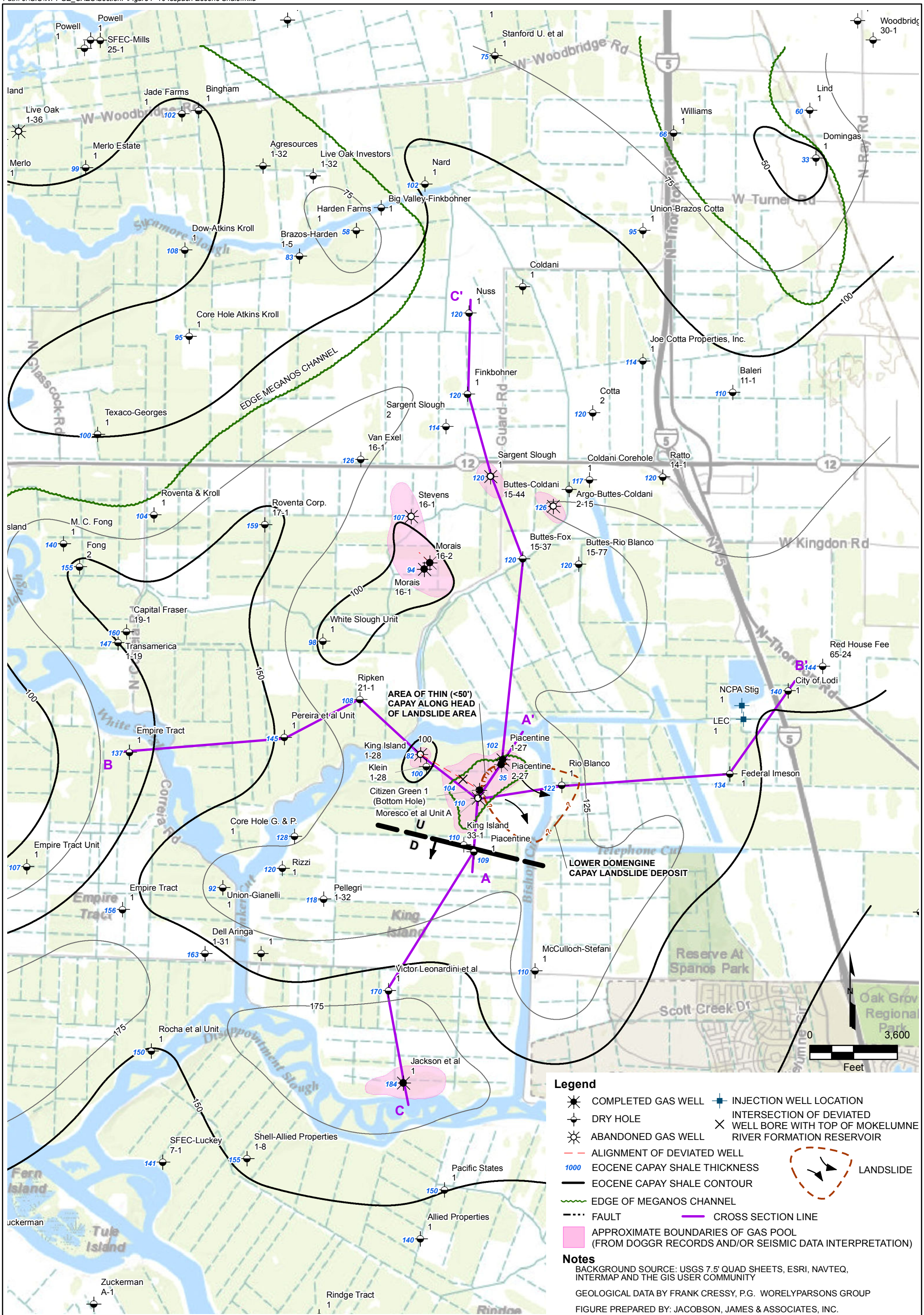
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FIGURE F-9

ISOPACH MAP PALEOCENE MEGANOS CHANNEL FILL THICKNESS

Path: J:\GIS\WPPGE_CAES\SectionF\Figure F-10 Isopach Eocene Shale.mxd



Notes

BACKGROUND SOURCE: USGS 7.5' QUAD SHEETS, ESRI, NAVTEQ, INTERMAP AND THE GIS USER COMMUNITY

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FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCIATES, INC.

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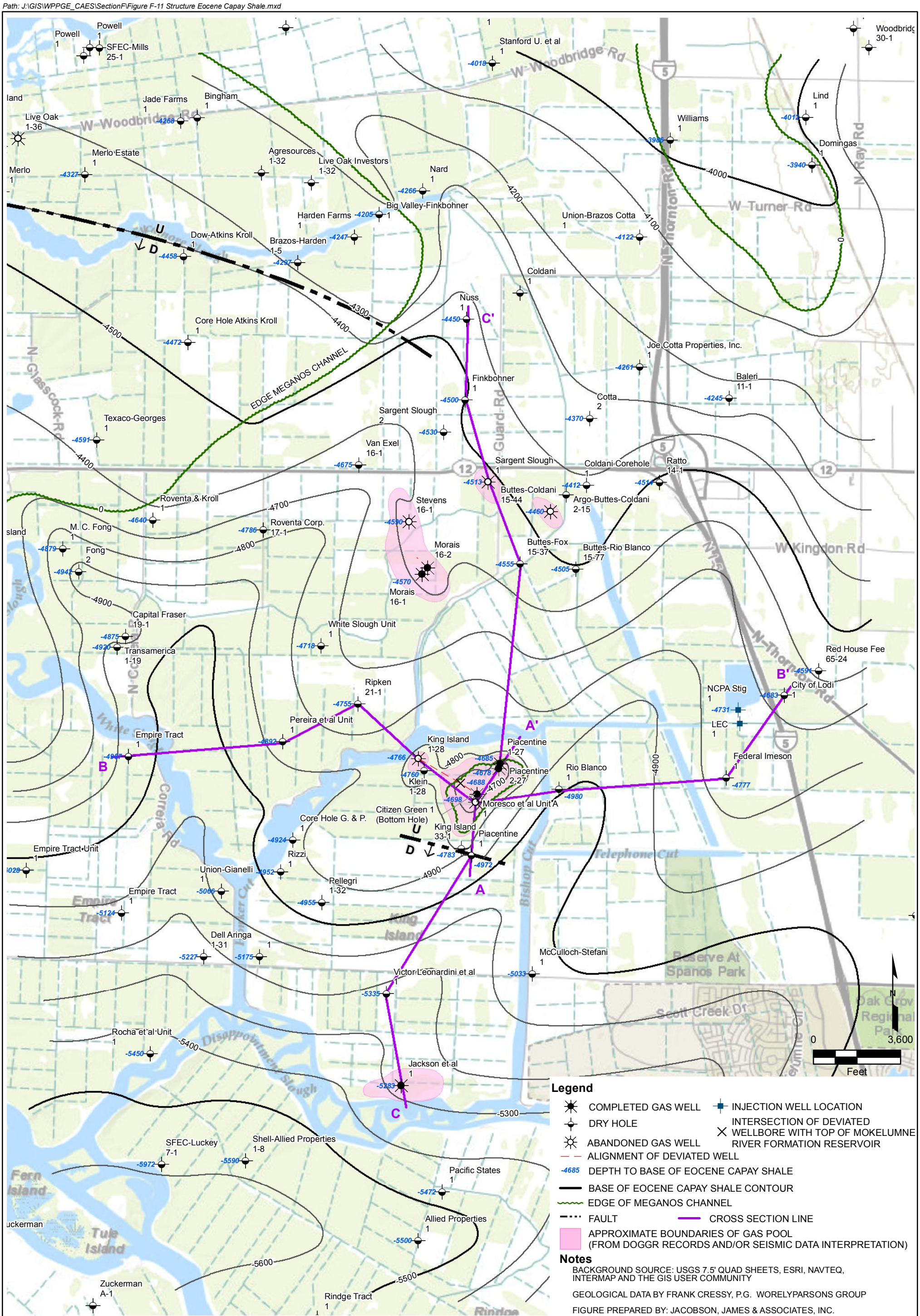
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FIGURE F-10

ISOPACH MAP EOCENE CAPAY SHALE THICKNESS

Path: J:\GIS\WPPGE_CAES\SectionF\Figure F-11 Structure Eocene Capay Shale.mxd



Legend

- COMPLETED GAS WELL
- DRY HOLE
- ABANDONED GAS WELL
- INJECTION WELL LOCATION
- INTERSECTION OF DEVIATED WELLBORE WITH TOP OF MOKELUMNE RIVER FORMATION RESERVOIR
- ALIGNMENT OF DEVIATED WELL
- -4685 DEPTH TO BASE OF EOCENE CAPAY SHALE
- BASE OF EOCENE CAPAY SHALE CONTOUR
- EDGE OF MEGANOS CHANNEL
- FAULT
- CROSS SECTION LINE
- APPROXIMATE BOUNDARIES OF GAS POOL (FROM DOGGR RECORDS AND/OR SEISMIC DATA INTERPRETATION)

Notes

BACKGROUND SOURCE: USGS 7.5' QUAD SHEETS, ESRI, NAVTEQ, INTERMAP AND THE GIS USER COMMUNITY

GEOLOGICAL DATA BY FRANK CRESSY, P.G. WORELYPARSONS GROUP

FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCIATES, INC.

Prepared for
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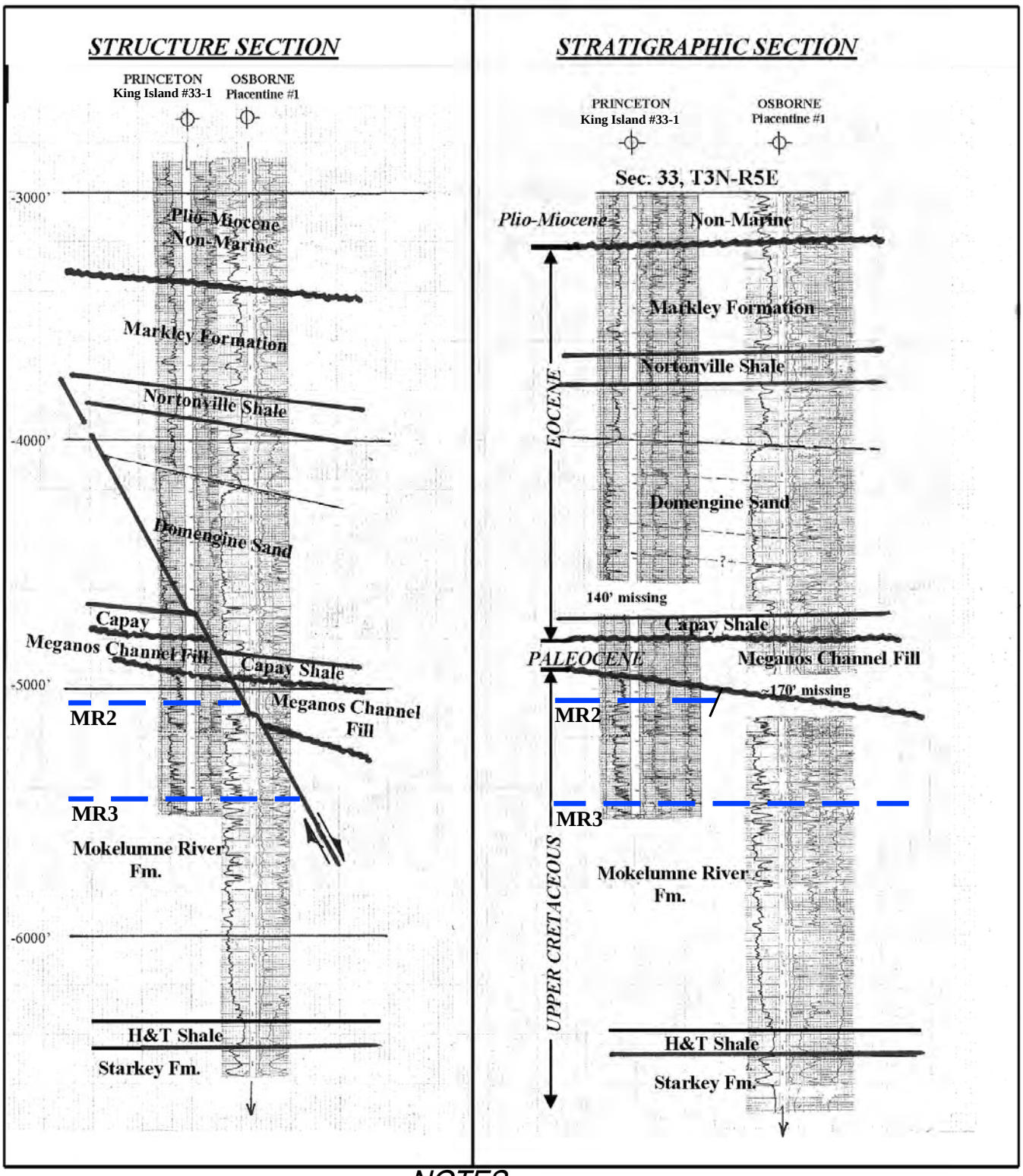
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FIGURE F-11

STRUCTURE MAP SHOWING BASE OF EOCENE CAPAY SHALE

SOUTH KING ISLAND
Section 33 Fault Study



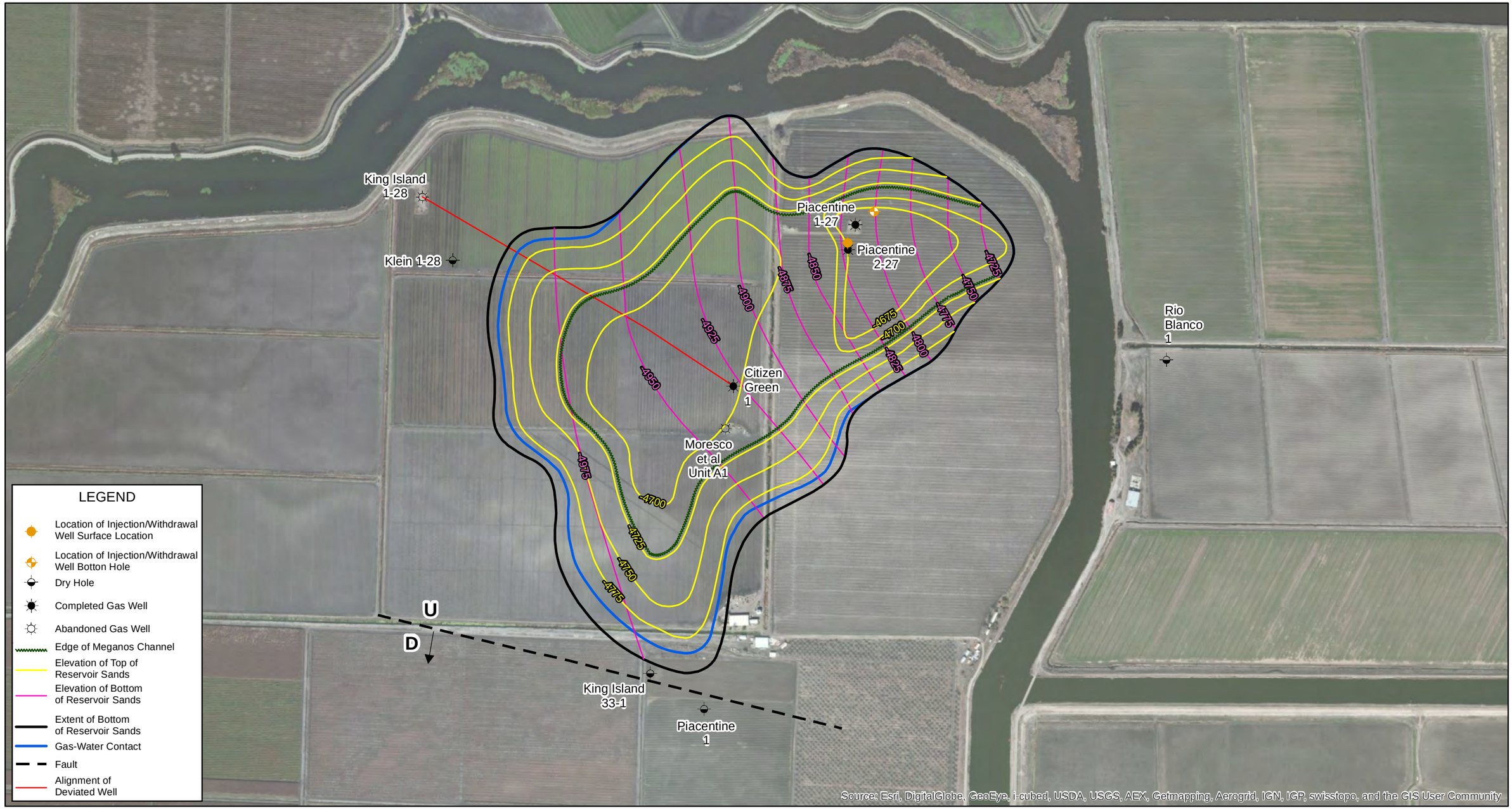
NOTES:

1. GEOLOGY PREPARED BY: F. CRESSEY, WORLEYPARSONS GROUP
2. FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCIATES, INC.

Prepared for
Pacific Gas and Electric Company

TITLE: *SOUTH KING ISLAND SECTION 33 FAULT STUDY*		DATE *12/30/13*
LOCATION: *PG&E CAES PROJECT COMPRESSION TESTING I/W WELL UIC APPLICATION SAN JOAQUIN COUNTY, CALIFORNIA*		FIGURE: F-12

J:\GIS\WPPGE_CAES\SectionF\Figure F-12 South King Island Sec 33 Fault Study.dwg



SOURCE:
California Department of Conservation Division of Oil, Gas and
Klein 1-28 relocated to match Well Summary Report, June 26, 1961
Structural data provided by Douglas Imperato, Ph.D, 12/09/13.
Water Wells from CA DWR. All locations approximate.

N
W E
S
0 750
Feet

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RESERVOIR STRUCTURE MAP
TOP AND BASE OF RESERVOIR SANDS

SWL	RF	12/31/2013
108010-00365		**F-13**

ATTACHMENT G
GEOLOGICAL DATA ON INJECTION AND CONFINING ZONES

Geological Data on Injection and Confining Zones

G.1 Regional Geologic Setting

The King Island gas reservoir is located in northern San Joaquin County between the cities of Stockton and Sacramento, and lies within the northern third of the Great Valley geomorphic province of California (Figure F-1). The Great Valley is an asymmetrical structural trough with a steep west flank and a more gently dipping east flank. It is situated between the Coast Ranges to the west and the Sierra Nevada Range to the east and includes the San Joaquin Valley to the south and the Sacramento Valley to the north. The eastern flank of the southern Sacramento Valley, where the King Island Gas Field is located, is underlain at depth by a basement complex of relatively impermeable metamorphic and crystalline plutonic rocks. These are overlain by marine sedimentary rocks, followed by non-marine volcanic and alluvial deposits derived from the coast range to the west and the Sierra Nevada to the east (Edmondson, W.F. and others, 1967).

During much of the Cretaceous and early Tertiary Period, an ancient sea covered what is now the San Joaquin Valley. A fore-arc basin was located west of the volcanic arc that developed into the Sierra Nevada and east of a deep sea trench complex where the oceanic crust was pulled (subducted) beneath the continental margin of the North American Plate. These rocks were subsequently uplifted to form the Coast Range. Sediment transported in rivers that flowed down from the ancestral Sierra Nevada was deposited as gravels, sand, and clay on the sea floor. Over time, more than 15,000 feet of sediments accumulated. Eventually, these sediments were compacted and formed the marine sandstones, siltstones, and shales found deep beneath the valley. Depositional sequences were typically laid down during times when sea levels rose or the basin subsided (transgressions), and then eroded during times of relative sea level falls or basin uplift (regressions). Four distinct Tertiary age submarine canyons developed during uplift cycles in the valley and were filled in with transgressional marine sequences during times of subsidence and relative sea level rise (Harwood, D.S. and Helley, E.J., 1987). The King Island Gas Field is an erosional remnant within the Meganos submarine canyon complex (also called Meganos Channel) that was eroded and filled during Paleocene time (Figure F-2).

Marine sedimentary sequences in the Sacramento and northern San Joaquin Valley include organic shales that serve both as source rocks for natural gas and, by virtue of their low permeability, as seals or cap rocks for gas accumulations in permeable sandstones reservoirs. Petroleum is generally not found in the Sacramento and northern San Joaquin Valley, but natural gas fields have been extensively developed, including the subject field. Groundwater contained within these marine formations is generally too saline to serve as a potable water supply, except in some shallow locations along the basin edges where salts have been flushed from the rocks by fresh water recharge over geologic time.

The Upper Cretaceous and Eocene marine sedimentary sequences in the Sacramento and northern San Joaquin Basin are overlain by Miocene to Recent alluvial and lacustrine sediments and local volcanic deposits. The alluvial and lacustrine deposits consist of complexly interbedded sands, silts, and clays, and contain the freshwater aquifers of the area.

G.2 Stratigraphy

The stratigraphy underling the vicinity of the King Island Gas Field is described below and shown on the accompanying stratigraphic column (Figure F-3) and graphically on several cross sections. The locations of regional cross sections A-A', B-B' and C-C' are shown on Figure F-4 and the cross sections are presented as Figures F-5 through F-7, respectively. The log correlations and regional formation markers upon which the cross sections are based are in accordance with the regional stratigraphic framework presented in Edmondson, W.F. and others (1967).

The deepest well in the immediate vicinity of the King Island Gas Field is the Osborne "Piacentine" #1 (Sec. 28, T3N-R5E), which was drilled to a total depth of 10,500 feet into Upper Cretaceous E-zone Winters Formation shale, which is interpreted as a marine slope facies deposit. Deep-water sandstones of equivalent age, and also belonging to the Winters Formation, lie westward of the Osborne well. Based on regional studies (Edmondson, W.F. and others, 1967; California Division of Oil and Gas, 1982), there is an estimated 5,000 feet of older Upper Cretaceous sediments that lie below the maximum depth of the Osborne well and above the Sierran crystalline plutonic and metamorphic basement rocks.

Overlying the Winters Formation shale is a 1,650-feet thick sequence of sandstones and shale belonging to the shallow marine Starkey Formation sands that are, in part, age equivalent to the deep-water, basinal Winters Formation sandstones. A 100+ foot thick mudstone and claystone unit, referred to as the H&T Shale regionally overlies the Starkey Formation. Overlying the H&T Shale are Upper Cretaceous fluvial-deltaic sediments of the Mokelumne River Formation. The Mokelumne River Formation reaches nearly 1,600 feet in thickness and is composed predominately of thick interbedded, fluvial-deltaic sandstones with thin interbeds of siltstones, mudstones and shale (Figure F-8). Minor lignite is also present. Several successions of thin marine flooding events within the formation are represented by widespread shale beds that allow good intra-formational correlations. Complete sections of the Mokelumne River Formation are present in the Moresco # A-1 well (Sec. 28, T3N-R5E), the discovery well of the King Island Gas Field, and the Citizen Green # 1 well (Sec. 28, T3N-R5E) (Figure F-3). Sands in the uppermost 240 feet of the Mokelumne River Formation provided the reservoir for the gas accumulation at King Island.

During the Paleocene, sea level fell and the Mokelumne River Formation was deeply eroded by the Paleocene Meganos Channel. As much as 1,300 feet of the Mokelumne River Formation was eroded on all sides of King Island, and in the deepest portions of the channel to the southeast of King Island, the entire Mokelumne River section was eroded (Figure F-8). A rising sea level caused the erosional valley to be subsequently filled by late Paleocene Meganos Formation marine sandstones, siltstones and shales. The channel-fill sediments were complexly deposited, but in general, thick sandstones are more common to the north of King Island and lie near the axis of the channel arms. Based on review of available well logs, shaley sediments nearly completely fill the channel to the south of King Island and generally occur along the channel margins in the sandier areas. Porosity and permeability analyses performed on core plugs from a conventional core collected in April 2013 in the Meganos Channel Formation gas reservoir sand in the Morais #16-2 core well at East Islands (located approximately 1.4 miles to the north of the King Island gas field), yielded average porosity and permeability values at confining stress of 2700 psi of 30% and 1,771 mD, respectively (Attachment G-2). These porosity and permeability values are considered generally representative for the Meganos Channel fill sands in the vicinity of King Island.

The Mokelumne River Formation at King Island remained as a large erosional remnant or island between two erosional arms of the Meganos Channel system. Meganos Channel fill sediments were not encountered in the four wells (Piacentine 1-27, Piacentine 2-27, Moresco et al Unit #1, and the Citizen

Green #1) in the King Island Gas Field. Five wells that lie immediately off the flanks of the field (Rio Blanco #1, Klein #1-28, King Island #1-28, King Island #1-33, and Piacentine #1) encountered varying thicknesses of primarily shaley Meganos Channel fill sediments, with a maximum of 450 feet penetrated in the Rio Blanco #1 (Figure F-6). The Piacentine #1, King Island #1-33 and the Klein #1-28 penetrate a thin sequence of Meganos Channel fill near the edges of the channel before entering Mokelumne River Formation sands that are stratigraphically below the Mokelumne River Formation sands in which the King Island gas pool occurred. The King Island #1-28 and the Rio Blanco #1 reached total depth in the Meganos Channel fill. The interpretation of the contact between the Meganos Channel and the Mokelumne River Formation in the vicinity of the King Island gas field is based on well log correlations and 3D seismic data interpretation. In particular, the laterally continuous Mokelumne River Formation sand packages are readily recognized on electric logs and correlated between wells in the area of the King Island gas field. In contrast, sands within the Meganos Channel fill are more lenticular and discontinuous.

Mokelumne River Formation sediments and the younger Meganos Channel fill sediments are unconformably overlain by the Eocene-age Capay Shale, a regional marine mudstone that is present under much of the central and southern Sacramento basin north of the Stockton fault (Figure F-2). The unit ranges in thickness between 90 and 120 feet in the vicinity of King Island as evidenced by the logs of nine wells located in and immediately adjacent to the King Island Gas Field (logs for these wells are included in Attachment C). The unit is thicker where it overlies thick intervals of Meganos Channel fill sediments (Figure F-10). This unit forms the seal or cap rock for gas trapped in the uppermost Mokelumne River Formation sands at King Island, as well as numerous other gas fields in the southern Sacramento Valley. The Capay is composed of thick gray-green silty mudstones and forms an excellent impermeable seal over the gas reservoir. The basal Capay contains abundant glauconite over a thin basal conglomeratic zone.

The Eocene-age Domengine Formation sandstone conformably overlies the Capay Shale. These sands were deposited in a shallow-water, marine environment. The Domengine Formation is nearly 800 feet thick and is composed predominately of well-sorted, clean quartzose sandstone with thin interbeds of gray siltstone and claystone. Minor lignite is also present. The Domengine sandstone is conformably overlain by the Nortonville shale, another regional marine shale unit that reaches thicknesses between 100 and 200 feet in the vicinity of King Island. The late Eocene-age Markley Formation overlies the Nortonville Shale, possibly as an unconformable surface. At King Island, it consists of 200 to 300 feet of interbedded marine mudstone, siltstone, and sandstone.

Over 3,000 feet of non-marine sediments unconformably overlie the Eocene sediments and represent the final stages of the basin filling. These sediments range in age from Miocene through the Pliocene and are capped by several hundred feet of Pleistocene to Recent alluvial and lacustrine sediments. These sediments and the groundwater resources contained within them are further described in Attachment E.

G.3 Structure

The general structure of the Upper Cretaceous formations (Starkey, H&T and Mokelumne River) is a homocline dipping from approximately 2° to 6° to the southwest, based on regional seismic data, well control, and sparse dipmeter data (Figure F-11). The structure of the Eocene formations (Capay, Domengine, Nortonville, and Markley) overlying the Mokelumne River Formation is complicated by the presence of the underlying Paleocene-age Meganos Channel, which eroded as much as 1,600 feet of the Mokelumne River Formation (Figure F-9). Subsequent filling of this large submarine canyon by varying amounts of sandstone and shale resulted in an undulating base Capay surface due to differential

compaction of Meganos Formation shales near channel edges, around the perimeter of the large erosional "island" at King Island, and over thick sandstone channels within the Meganos Channel fill sediments (Figure F-11). The resultant compaction-related synclines and anticlines are superimposed on the regional homoclinal pattern. The Capay shale is thicker over the erosional arms of the Meganos Channel to the east and west of King Island (>150 feet thick), and thinner over King Island where Meganos Channel fill onlaps the Mokelumne River Formation (mostly from 90-120 feet thick; Figure F-10). Younger Eocene formations progressively show less influence of the Meganos Channel shale compaction.

The project location regionally lies on the west-dipping homocline between two cross-valley arches, the Thornton Arch, 12 miles to the north, and the Stockton Arch (and Fault), located 14 miles to the south. These and other nearby structural features are shown on Figure F-2, based on a map modified from Beyer (1988). In an east-west direction, the project location lies equidistant between the Midland Fault, located approximately 12 miles to the west, and the Willows Fault, whose inferred location is approximately 12 miles to the east (Figure F-2). The Stockton and Midland faults are major subsurface faults that were active during the Late Cretaceous through the Eocene. Movement ceased on the Midland Fault prior to the filling of the Oligocene Markley Canyon (Pepper, Miles W. and Dane S. Johnson, 1992) and any significant movement on the Stockton Fault occurred prior to the Eocene (Sterling, Robert. H. Jr., 1992). Harwood and Helley (1987) postulated that the Willows Fault, well documented in the northern Sacramento Valley, extends into the southern Sacramento Valley, trending just to the east of the cities of Sacramento and Stockton. The inferred presence of the fault was based on an abrupt steepening to the west of basement contours at the -1500 meter contour level. Although late Cenozoic movement has been documented on the Willows fault in the northern Sacramento Valley, no displacement has been determined on the projected segment between Sacramento and Stockton. It has been postulated that this inferred segment of the Willows Fault separates oceanic crust (ophiolitic basement) to the west from Sierran granitic basement to the east. However, subsurface data does not support this interpretation. Although several wells penetrated gabbroic basement west of the fault, other wells encountered Sierran-type basement. Harwood and Helley (1987) noted granite and schist in two well south of Sacramento, quartz diorite was noted near Stockton under the Stockton gas field, and a well approximately 13 miles south-southwest of the project location (and approximately 12 miles west of Stockton) encountered quartzite at total depth. Most likely, basement rocks under King Island are a Sierran-type basement similar to those that border the Sacramento Valley to the east. Wong (1992) describes them as ". a steeply-dipping belt of late-Paleozoic to mid-Mesozoic metamorphosed volcanic and sedimentary rocks which have been intruded by basic to ultrabasic rocks of similar age. Granitic plutons of Jurassic to Cretaceous age have later intruded the entire sequence."

Major regional faults are not known to be present near the site, but a small southwest-dipping normal fault has been mapped immediately south of the King Island Gas Field in Section 33, T3N-R5E. The fault has a displacement of about 150 feet and appears to cut out Meganos Channel shales in the Piacentine #1 well and basal Domengine sand in the King Island #1-33 well (Figure F-12). Seismic reflection data suggests that the Miocene non-marine sediments have not been offset by this fault, and therefore that movement ceased on this fault prior to their deposition. This interpretation is also supported by correlation of well logs for the wells in and near King Island, which suggests the fault displaces the Nortonville Shale and was active during deposition of the Eocene-age Markley Formation, but does not displace the overlying Plio-Miocene sediments (Figure F-5). A possible fault, similar to the one that cuts the King Island #1-33 and the Piacentine #1, occurs 4 to 5 miles north-northwest of the King Island gas field (Figure F-11). The fault is based on a contouring anomaly on the relatively uniform, southwest-dipping homoclinal structure at the base Eocene Capay Shale, and on approximately 75 feet of missing Mokelumne River Formation section in the Dow Atkins-Kroll #1, located in Section 6, T3N, R5E, just

south of Sycamore Slough, approximately 4.6 miles to the northwest of the King Island gas field (Figures F-4 and F-11). The fault is interpreted to be down-thrown to the south-southwest. Movement on these two faults is most likely related to the same Eocene age tectonic activity that formed the Midland fault. Gas field summaries by the California Department of Oil, Gas, and Geothermal Resources in the southern Sacramento Valley show that faulting in fields near the project area (West Thornton-Walnut Grove, McDonald Island, etc.) does not cut Miocene and younger sediments overlying the Eocene formations.

An offset that cuts out 60 feet of Capay Shale in the Piacentine 2-27 and a similar amount of section in the overlying lower part of the Domengine Sand in the Piacentine 1-27 was mapped in the field. However, the underlying Mokelumne River Formation appears unfaulted and there is no offset of stratigraphy near the original gas/water contact in the gas reservoir as determined from the well logs. This suggests that the offset represents an ancient (Eocene) submarine landslide on the eastern side of the King Island Gas Field (Figures F-6 and F-10). On this flank, the Rio Blanco 1 well encountered nearly 70 feet of an anomalous sandy shale interval at the top Capay Shale that is interpreted as the landslide deposit. The Piacentine 1-27 and 2-27 wells lie near the head of the paleo-landslide, and the Rio Blanco well lies at its depositional toe. Sediment loading during early deposition of the Domengine Formation is believed to have triggered a glide plane failure in the underlying Capay Shale which slid a section of Capay and lower Domengine to the southeast towards the axis of the Meganos Channel. Such glide plane failures can occur at relatively low angles in shales. Based upon 3-D seismic data interpretation, deeper Mokelumne River and Starkey horizons, as well as shallower horizons, are not broken, suggesting the fault is limited to the Capay and basal Domengine Formation. Since the landslide “soled-out” in the Capay shale, the underlying, more competent, Mokelumne River Formation was not cut or displaced.

G.4 Target Air Injection Zone

The proposed air target injection zone consists of the gas-depleted (i.e., water invaded) sands of the Upper Cretaceous Mokelumne River Formation in the King Island Gas Field (Figure F-5, Figure F-13). The field has produced over 10.5 billion cubic feet of natural gas from three wells since it was discovered in 1985. Four wells have penetrated the gas pool, the Piacentine #1-27, Piacentine #2-27 (PGE’s core-well), Moresco #1 and the Citizen-Green #1 (Figure F-13). Two of the wells, the Citizen-Green #1 and the Piacentine 1-27, are producing small volumes of gas.

The fluvial sands of the Mokelumne River Formation from the base of the Capay Shale to the top of the H&T Shale) attain a maximum thickness of 1,600 feet in the King Island field (Figure 8). The total formation thins in an elliptical pattern away from the King Island gas field due to down-cutting of the Meganos Channel around the Mokelumne River erosional remnant. The Mokelumne River Formation has been sub-divided into individual sand packages separated by thin (typically 50 feet or less) correlative lower permeability siltstone and shale units, as shown on the type log in the stratigraphic column (Figure F-3). As demonstrated on the type log, the lowermost part of the Mokelumne River Formation is a coarsening-upward clastic sequence with porosity and permeability decreasing with depth.

Historical gas production data from the King Island gas field (Attachments A-1 and C-1) indicates that the gas reservoir at the top of the Mokelumne River Formation stratigraphic section is in attenuated hydraulic communication with aquifers in the underlying sand packages. As such, the entire permeable section of the Mokelumne River Formation at the King Island erosional remnant should be considered as part of the injection zone for the purpose of this permit application.

The King Island gas reservoir occurs in the uppermost sand package beneath the Capay Shale and ranges in gross thickness from approximately 130 to 245 feet (65 to 175 feet net sand thickness). The large range in gross thickness is a reflection of the domal erosional contact with the overlying Capay Shale. Around the perimeter of the erosional high, the gas reservoir thins rapidly to zero due the erosion by the Meganos Channel along the flanks of the erosional high. The gas accumulation, with up to 112 feet of net pay, is sealed at the top by the Capay shale and on all four sides by Meganos Channel fill that is comprised mostly of shale (Figures F-5, F-6 and F-7) along the Channel margins.

Average porosity and horizontal permeability of the reservoir sands, based on laboratory analysis of core collected in the Piacentine 2-27, is 31% and 807 mD, respectively (Table G-1). The permeability value of 807 mD is based on an average of 162 horizontal permeability measurements at ambient stress (250 psi), corrected to confining stress of 2700 psi based on the average ratio of ambient to stress permeability of 0.282 (Table G-1). There is a reasonably good porosity-permeability relationship (correlation coefficient of 0.77) based on a cross-plot of 162 porosity and permeability analyses of core plugs from the conventional core collected from the Piacentine 2-27 core well (Graph G-1; Attachment G-1). Vertical permeability of Mokelumne River Formation reservoir sands ranged from 278 to 17,855 mD, and the average vertical to horizontal permeability anisotropy ratio is 0.80 (Table G-2). A cross-plot of vertical and horizontal permeability measurements indicates a good correlation coefficient of 0.94 (Graph G-2).

Two approaches were used to derive the average vertical permeability of low permeability sediments considered representative of the mixed clay-silt-sand layers separating Mokelumne River Formation sand packages. The first approach took the harmonic mean of three vertical permeability measurements taken at, or corrected to, confining stress: one from the Capay Shale above the Mokelumne River Formation reservoir (0.4 mD), one from a thin sand-silt layer in the upper, mostly “shaled-out”, unit of the reservoir in the Piacentine #2-27 (78.3 mD), and one from a shaley-silty sand in the lower unit of the reservoir (142.6 mD). The harmonic mean vertical permeability derived using the first approach was 1.3 mD (Table G-3). The second approach took the harmonic mean of 86 horizontal permeability measurements in lower permeability sediments comprising the Capay Shale plus the upper mostly shaled-out reservoir unit, corrected to stress conditions using the average ratio of ambient to stress permeability of 0.282 (Table G-1), and then corrected to vertical permeability using the average vertical to horizontal permeability anisotropy ratio of 0.80 (Table G-2). The harmonic mean vertical permeability derived using the second approach was 0.06 mD (Table G-3). These two vertical permeability estimates are considered to bracket the expected range of vertical permeability in lower permeability layers in the Mokelumne River Formation.

The sequence that lies directly beneath the thin siltstone/shale unit that underlies the King Island gas reservoir has been designated as MR-2, and is approximately 390 feet thick. The MR-2 comprises two distinct sand packages: a thinner lower porosity/permeability package designated the Upper MR-2 underlain by a thicker higher porosity-permeability package designated the Lower MR-2. The Upper MR-2 includes a sand package from 70-75 feet thick (approximately 45 feet net sand) underlain by a clay-silt-sand layer from 35 to 40 feet thick. The Lower MR-2 includes a sand package from 210 to 220 feet thick (approximately 177 feet net sand) underlain by a clay-silt-sand layer from 60 to 70 feet thick. Weighted average porosity and horizontal permeability of MR-2 sands were derived based on the neutron-density porosity curve in the Citizen-Green #1 and a porosity/permeability relationship from the Piacentine #2-27 core analysis (Attachment C-2 and Graph G-1). For the Upper MR-2 sands, average porosity is 29% and average horizontal stress permeability is 103 mD. For Lower MR-2 sands, average porosity is 33% and average horizontal stress permeability is 632 mD (Table G-4).

The MR-3 sequence is approximately 300 feet thick (approximately 164 feet net sand) and sands have an average porosity and horizontal stress permeability of 28% and 10 mD, respectively (Table G-4). Sands within the upper approximately 320 feet of the MR-4 sequence have an average porosity and horizontal stress permeability of 30% and 19 mD, respectively (Table G-4). The lower approximately 300 feet interval of the MR-4 comprises a thinly-bedded and low permeability clay-silt-sand sequence that fines downward and has a gradational contact with the underlying H&T Shale.

The structure of the King Island Gas Field at the top of the Mokelumne River Formation is a northeast-southwest trending elliptical anticline (Figure F-13), with an original gas-water contact at approximately -4,783 feet subsea. The limits of the gas field were determined from well log correlations (as depicted on geologic cross-sections in Figures F-5, F-6 and F-7), from limited reservoir pressure data for wells inside and outside of the King Island field Mokelumne River Formation reservoir (Piacentine #1-27 and King Island #1-28; discussed below in Section G.5), and from a 3-D seismic survey amplitude anomaly related to the gas reservoir at the top of the Mokelumne River Formation section[1]. The high amplitude signature on the seismic data is the result of a strong acoustic impedance contrast between the relatively high impedance Capay Shale and the relatively low impedance gas-charged reservoir. The Mokelumne River Formation in the gas field is not complicated by faulting. The reservoir sand is truncated north of the fault that is mapped on the south side of the gas field, as discussed earlier in Section G.4. The above-described paleo-landslide feature is limited to overlying Eocene Capay and lower Domengine sediments above the reservoir. Neither of these structures are interpreted to affect the reservoir.

G.5 Target Water Injection Zone

The proposed water target injection zone consists of the Starkey formation underlying the King island gas field. Similar to the discussion in G.4, the geology of the Starkey formation will need to be detailed.

G.6 Confining Zones - Air

The competency of the confining zones that form the top and lateral seals for the King Island gas field is demonstrated by the fact the gas accumulation was trapped and held intact for several million years before gas production started.

The chief confining zone is the Eocene Capay Shale, which provides the overlying impermeable seal of the Mokelumne River Formation reservoir at King Island. The Capay is a regional mudstone and claystone unit that ranges in thickness from 90 to 120 feet in the vicinity of King Island. It is locally thinned to approximately 35 feet near the head scarp of the paleo-landslide discussed above (Figure F-10). The Capay provides the cap rock for many of the gas fields and pools in the southern Sacramento Valley (California Department of Oil and Gas, 1982). The competency of the seal, even at the thin area at the head of the paleo-landslide, is demonstrated by the fact that the gas accumulation has never been breached.

Static formation pressure measurements taken in March 2013 in the Piacentine #2-27 using Halliburton's Reservoir Description Tool (RDT™) demonstrate that the Capay Shale currently forms an effective pressure barrier (Attachment C-1; Table G-5). A sand at the base of the Domengine section had a static pressure of 2,022 pounds per square inch (psi) and a normal pressure gradient of 0.437 psi/ft. Sands in the Mokelumne River Formation above the original gas/water contact had depleted pressures

1 PG&E and its contractors were allowed by the King Island gas field operator to view relevant portions of its confidential 3D seismic survey.

(due to gas production and subsequent pressure rebound) ranging from 1,909 to 1,949 psi, and a pressure gradient of 0.407 psi/ft. The RDT™ results indicate that the Capay shale is an effective pressure seal in the area, even where it is thinnest (at the Piacentine #2-27), and provide further confirmation of the overall sealing capacity of the Capay Shale.

Two approaches were used to determine the harmonic mean vertical permeability at confining stress of the Capay Shale. The first approach took the harmonic mean of three caprock/threshold pressure analyses providing vertical permeability at 2600 psi confining stress and one vertical permeability analysis at ambient stress (250 psi), corrected to 2700 psi confining stress based on the average ratio of ambient to stress permeability of 0.282 (Table G-1). The harmonic mean vertical permeability based on the first approach was 0.04 mD (Table G-6). The second approach took the harmonic mean of 17 horizontal ambient stress (250 psi) permeability measurements in the Capay Shale, corrected to 2700 psi confining stress as described above, and further corrected to vertical permeability using the average vertical to horizontal permeability anisotropy ratio of 0.80 (Table G-2). The harmonic mean vertical permeability based on the second approach was 0.06 mD (Table G-6). These two vertical permeability estimates are nearly the same and represent reasonable estimates of the vertical permeability of the Capay Shale at confining stress. The caprock / threshold pressure tests done on three Capay Shale core samples at net confining stress of 2600 psi showed no brine breakthrough up to the 2,000 psi maximum injection pressure.

Lateral sealing of the King Island reservoir is created by Capay Shale drape over the Mokelumne River erosional island, as well as by older Paleocene Meganos Channel shales that underlie the Capay Shale. These Meganos channel mudstones and claystones fill the large erosional channel that created the erosional trap ay King Island. Several small gas pools are trapped by these shales, including at King Island #1-28 located 750 feet to the northwest, East Islands Gas Field located about 1.25 miles to the north, and some others located a few miles to the south of King Island (May and others, 2007). The interpreted outline for the small gas pool in Meganos Channel fill sand in the King Island 1-28 is shown on the maps in Figures F-9, F-10 and F-11. The gas pool in the King Island 1-28 occurs in thin sand that lies directly below the Capay Shale, and is sealed at the top by the Capay Shale and laterally by shales of the Meganos Channel Fill. Figure F-6 shows that the King Island 1-28 gas sand occurs within the Meganos Channel fill and is separated stratigraphically from the King Island Mokelumne River Formation gas reservoir.

The King Island gas reservoir is truncated by shale of the Meganos Channel fill just to the north of the King Island #1-33 well (Figures F-12 and F-13). In the King Island #1-33, basal channel shale cuts into the top of the clay-silt-sand layer separating the King Island reservoir and the MR-2 (Figure F-12). Both the King Island #1-33 and the Piacentine #1 occur outside the southern limit of the King Island reservoir.

Shut-in tubing head pressure measurements taken in September 2005 in the King Island #1-28 and the Piacentine #1-27 wells, located ¾-mile apart, show that the Meganos Channel fill gas reservoir sand in which the King Island #1-28 was perforated was at a different pressure than the Mokelumne River Formation gas reservoir sand in which the Piacentine #1-27 was perforated. These records are included in Attachment C-1. The King Island #1-28 well history showed a shut-in casing pressure of 1840 psi in September 2005, about 1 month after completion. The shut-in tubing pressure was reported as 1700 psig, but there was a fluid level in the tubing at 4500 feet. The weight of the water in the tubing reduced the surface pressure by about 118 psi (0.433 x [4772’ - 4500’]), which mostly accounts for the pressure difference between the shut-in tubing pressure and the shut-in casing pressure. An Excel utility program was used to translate the shut-in casing pressure to a bottom hole pressure of 2050 psig (2065 psia). This pressure translates to a hydrostatic gradient of 0.4327 psi/ft (2065 psi/4772 ft), which is

a normal hydrostatic gradient. This analysis indicates that the sand lens in the Meganos Channel fill was at hydrostatic pressure in September 2005 when the bottom hole pressure in the King Island #1-27 was 1679 psi, approximately 343 psi below a normal hydrostatic pressure ([4670 ft * 0.433 psi/ft] - 1679 ft), and supports a conclusion that the Mokelumne River Formation reservoir was not hydraulically connected to the Meganos Channel fill sand. The equations and input parameters used to derive the bottomhole pressures for the Piacentine #1-27 and King Island #1-28 wells are provided in Attachment G-3.

Additional evidence that the Meganos Channel fill and the Mokelumne River Formation reservoir are not hydraulically connected is the timing of water influx in the Moresco et. Al Unit A-1 relative to when the King Island #1-28 well was drilled. The Moresco et. Al Unit A-1 well perforations (top at 4698 ft) in the Mokelumne River Formation reservoir were overrun by water in 1995 (Attachment G-4), ten years before the King Island #1-28 was drilled and perforated at 4772-4778 ft. If the two reservoirs were in communication, the Meganos Channel fill reservoir in the King Island #1-28 well should have been wet.

Thin (generally less than 50 feet) low permeability layers composed of interbedded mudstone, claystone, and thin, silty sandstones separate the Mokelumne River Formation sand packages (including the gas reservoir and underlying MR2 and MR3 aquifers described in Section G.4). Production histories discussed earlier in Section A.5 indicate that these zones are leaky confining layers that have allowed formation water in the Mokelumne River Formation sands underlying the gas reservoir to slowly recharge and re-pressure the reservoir during periods of production cessation or decline (Attachment C-1). The RDT™ pressure data in the Piacentine #2-27 show that the pressure gradient on either side of the clay-silt-sand layer that separates the Mokelumne River Formation reservoir from the underlying upper MR-2 sand package is nearly the same, and indicate that pressure attenuation across the layer is weak (Table G-5). This pressure sealing capacity of the deeper Mokelumne River Formation lower permeability layers is expected to be similar to the layer separating the reservoir from the upper MR-2 sands, based on their similar SP and gamma ray log signatures.

The base of the Mokelumne River Formation is characterized by a regional impermeable shale unit known as the H&T Shale. It separates the fluvial-deltaic Mokelumne River sands from the underlying Upper Cretaceous marine sandstones of the Starkey Formation.

Overlying the Domengine Formation is the Nortonville shale, which is approximately 100 feet thick in the vicinity of King Island. Though the Capay shale on its own is considered an excellent seal for the Mokelumne River Formation reservoir, the Nortonville provides a competent shallower secondary seal, a redundant layer of protection to USDWs in the overlying Markley Formation and the Plio-Miocene formations.

G.7 Confining Zones - Water

The proposed water target injection zone consists of the Starkey formation underlying the King island gas field. Similar to the discussion in G.6, the confining zones for the Starkey formation will need to be detailed.

G.8 References

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ATTACHMENT H
OPERATING DATA

Operating Data

Requirements

The operating data to be submitted for all injection wells to be covered under the requested permit includes the following:

- Average and maximum daily rate and volume of the fluids to be injected;
- Average and maximum injection pressure;
- Nature of annular fluid; and
- Source and analysis of the chemical, physical, radiological and biological characteristics, including density and corrosiveness, of injection fluids.

Because the requested permit will include the proposed monitoring wells also, the above information will also be provided for these wells, to the extent applicable.

Injection Rate, Volume and Pressures of Fluids to be Injected

A description of the proposed CAES operation is required, including expected flowrates and pressures for all air injection and withdrawal activity as well as water disposal volumes, rates and pressures.

Nature of Annular Fluids

In order to protect the Injection/Withdrawal Wells and monitoring wells from potential migration of formation fluids up the well bore, and provide an additional protection against the possible intrusion of formation fluids, air, or withdrawn air mixed with formation water and natural gas into Underground Sources of Drinking Water (USDW), the annulus of these wells will be isolated using a tubing and packer system and filled with a water solution containing 4 % KCl mixed with a corrosion inhibitor and a biocide. The annular fluids in these wells will be kept pressurized to near 100 psi by injecting a nitrogen blanket in the uppermost portion of the annulus. Note that annular pressures in the Injection/Withdrawal Wells may change as a result of temperature changes during injection and withdrawal of hot air. Annular pressure-temperature changes will be evaluated to verify whether they are due to thermal effects or represent a well failure. The expected magnitude of potential pressure changes due to thermal effects will be calculated prior to the beginning of injection operations and further evaluated early during the injection process. If necessary, the annular pressure will be maintained by pumping additional pressurized nitrogen into the headspace above the annular fluid, or by bleeding off nitrogen. Such adjustments and the resulting pressure changes will be recorded.

In order to distinguish annular pressure-temperature changes due to thermal effects versus well failure, the following is considered. The well annulus will be a closed system, monitored for pressure at the wellhead. As such, the nitrogen blanket on the annular fluid will behave according to Boyles Law and changes in pressure due to thermal effects can be estimated as follows:

$$\frac{P1 \times V1}{T1} = \frac{P2 \times V2}{T2}$$

Where P is pressure measured in psi (atmospheric), or psia, and T is measured in degrees Rankin

For example, with 4,500' of fluid in the annulus and 100' of nitrogen blanket, a temperature increase of 40 degrees Fahrenheit in the entire system would increase an initial wellhead pressure of 100 psia to 136 psia. This is caused by two changes in the system: the increased temperature increases the volume of the fluid slightly, and the volume of the nitrogen blanket is compressed in addition to responding to direct temperature effects. A smaller nitrogen blanket would experience a proportionately larger pressure increase.

Normal fluctuations in pressure, both up and down, are expected to occur to the annulus pressure during injection and withdrawal operations due to changes in the temperature. The normal range of these fluctuations can be estimated based on the information available at the time that the annulus is filled with fluid. A leak, however, changes the relatively fixed volume of fluid in the annulus and as a result the wellhead pressures will trend down over time. While still fluctuating somewhat due to thermal effects, in the event of a leak, pressures would never return to the previous equilibrium pressure. It is the long term trend, not the short term pressure fluctuations that would indicate an issue with the integrity of the casing, tubing, or possibly a leaking tubing packer. Therefore, annular pressure measurements will be evaluated for trends that indicate a loss of fluid volume. If such a trend is identified, it would be reported to EPA within 24 hours and further investigation would be required to determine the exact cause of the annular pressure decrease.

Characteristics of Injection Fluids - Air

The medium injected into the depleted gas reservoir at King Island will be ambient air, the chemical makeup of the injected fluid will be as follows:

- 78 mole % nitrogen;
- 21 mole % oxygen;
- 1 mole % argon; and
- Traces of carbon dioxide and other gases.

Since air is composed mostly of nitrogen, ambient air is essentially inert to the proposed tubing and well construction materials.

The presence of oxygen in ambient air may allow combustion if a combustible gas is present at a concentration in excess of the lower combustible limit. This is important because even a depleted gas reservoir will contain some residual gas, the injected air will mix with residual gas in the reservoir to some extent, and if air is produced from the reservoir it will contain a small amount of natural gas. Combustion would require three components, known as the three legs of the combustion triangle: fuel, oxygen, and an ignition source. Evaluations conducted for the project indicate that the methane content in the withdrawn air stream during normal withdrawal operations are expected to be ____ % by volume. This is significantly below the lower combustible limit for methane established for the operating conditions of the compression test (4% v/v), and combustion cannot occur. The combustible gas content of the withdrawn air stream will be monitored continuously during testing, and a safety shut down interlock will be triggered to stop withdrawal if the combustible gas concentration reaches __%.

The gas fraction of the withdrawal air would consist primarily of methane with very low concentrations of ethane and propane. Although these gases are potentially combustible in high enough concentrations, they are inert with respect to the well casing and tubing materials. Gas chromatography

analysis of a King Island Field gas sample showed the following constituents and concentrations. A laboratory data sheet documenting this analysis is included as Attachment H-1.

TABLE H-4: Summary of Gas Chromatography Analysis of King Island Gas Field Natural Gas

Component	Concentration
Methane	91.7 %
Ethane	0.129 %
Propane	18.0 ppm
Other VOCs	Not Detected
Nitrogen	8.13 %
Carbon Dioxide	0.0138 %

Normal operation of the proposed Injection/Withdrawal Wells is expected to produce a relatively small amount of formation water with the withdrawn air. Total water production may vary, but is estimated to occur at an instantaneous maximum rate less than ___ barrels of water/day. A formation water sample was collected during drilling of an exploratory core well at the site by PG&E in March and April 2013 (Piacentine 2-27) and submitted to Zalco Laboratories in Bakersfield, California for analysis of major anions and cations (with cation/anion balance), silica, total dissolved solids, hardness, alkalinity, Langlier Index, Stiff/Davis Stability Index, total suspended solids and total organic carbon. A complete laboratory analytical report is included as Attachment H-2. No water quality analysis has ever been performed on produced water from either of the production wells (Piacentine 1-27 and Citizen Green 1), and there is no opportunity to obtain a water sample from either of these wells at this time, since the Piacentine 1-27 well is currently shut-in and the Citizen Green 1 well is not producing any water. The well and tubing materials selected for the proposed well design are appropriate to inhibit corrosion from the anticipated produced water during the course of the test.

References

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ATTACHMENT I
FORMATION TESTING PROGRAM

Formation Testing Program

I.1 Requirements

The formation testing program must be designed to obtain data on:

- Fluid pressure;
- Temperature;
- Formation parting pressure and other physical characteristics of the injection zone;
- Physical, chemical, and radiological characteristics of the formation water; and
- Physical, chemical, and radiological characteristics of the injection fluids.

I.2 Air Storage Formation Properties Testing

A full range of physical, textural, mineralogical and chemical properties of the target injection zone (Mokelumne River Formation) and overlying confining zone (Capay Shale) have been determined through petrophysical analysis of conventional core, sidewall core, and wireline logs collected from a core-well drilled by PG&E at the King Island Field in March-April 2013 (Piacentine 2-27). The data derived from these efforts to date are included in Attachment C-1 (wireline logs) and Attachment G-1 (core analysis).

During the drilling of PG&E core well Piacentine 2-27, approximately 180 feet of conventional core (4" diameter) were collected from the target injection zone (primarily sands) and overlying confining unit (primarily shale). The core was transported to CoreLab where it was slabbed, photographed, described, and underwent core spectral gamma and CT scanning. Plugs collected at 1-foot intervals from the conventional core, and 22 additional sidewall cores (SWCs), were subjected to the following routine core analyses:

- Grain density;
- Porosity;
- Horizontal permeability to air;
- Fluid saturation (water); and
- V-clay.

The following additional advanced analyses were performed on a number of samples:

- Sieve analysis (15 samples);
- Vertical permeability (15 samples);
- Porosity and permeability at four confining stresses (15 samples);
- Relative permeability (5 samples);
- Critical velocity (3 samples);

- Capillary pressure (6 samples);
- Mercury injection capillary analysis (and with confining pressure) (6 samples);
- Capillary entry pressure (shale only) (3 samples);
- Geomechanical properties, including Poisson's ratio and Young's modulus (3 samples);
- Thick wall cylinder test (3 samples);
- Scanning electron microscopy and thin section analysis (15 samples); and
- Bulk and clay x-ray diffraction (XRD) (15 samples).

In addition to standard mud logging, a comprehensive wireline open hole logging program was conducted during drilling of Piacentine 2-27 to collect information regarding formation matrix and fluid properties. The log types and information derived is summarized in the table below. A downhole thermometer was used to measure the bottom-hole temperature during each logging run, which is reported on the logs.

TABLE I-1: SUMMARY OF GEOPHYSICAL LOG TYPE AND PURPOSE

Log Type	Purpose
Sidewall coring (SWC)	Reservoir parameters. Compare routine core analysis results to those from conventional core and relate to future well SWC results.
Mud Log	Lithology, rate of penetration, gas shows.
Spontaneous Potential (SP) log	Sand layer definition, formation water salinity interpretation.
Dual induction log (DIL)	Formation water salinity, hydrocarbon indicator, water/hydrocarbon saturation (with porosity measurements).
Micro-resistivity Tool (MRT)	Flushed and invaded zone resistivity, permeability indicator.
Gamma Ray (GR) log	Shale indicator. Standard and spectral GR run, which permits more accurate V-shale determination and lithological and mineralogical analysis.
Formation Density Compensated (FDC) log	Porosity measurement, water/hydrocarbon saturation (with resistivity measurements).
Compensated Neutron Log (CNL)	Porosity measurement, water/hydrocarbon saturation (with resistivity measurements).
Sonic log (SL)	Formation velocity, geomechanical property determination and synthetic seismograms. Can also be used for porosity determination.
Nuclear Magnetic Resonance (NMR) log	Provides porosity divided into clay-bound water, irreducible water, and movable water. Effective porosity derived by subtracting clay-bound water. Permeability measurement.
Caliper log (CAL)	Show variations in borehole size and geometry.
Electrical Micro Imaging (EMI) log	Formation texture, sedimentary features, fractures, thin-bed and lamination characterization.
Repeat Formation Tester (RFT)	Depth-discrete formation water sampling (one sample), formation water resistivity and static reservoir pressure measurement. Characterization of formation pressure above, within and below the reservoir, reservoir water chemistry evaluation.

I.3 Air Storage Injection/Withdrawal Well Formation Properties Testing

Given the extensive logging and core analysis program instituted for the core well, it is not considered necessary to collect a conventional core in the proposed Injection/Withdrawal Well, due to its close proximity to the Piacentine 2-27 core-well. However, up to 30 sidewall cores will be collected and tested for routine reservoir parameters in order to verify properties, including the following:

- Lithologic description;
- Grain density;
- Porosity;
- Permeability to air; and
- Fluid saturation (water).

For the same reason, the electric logging program in the Injection/Withdrawal Well will be a subset of the Piacentine 2-27 logging program (in terms of the types of logs run). The electric logging program will include all of the logs noted above, except NMR and EMI. In addition, as further discussed in Section I.4, the RFT tool will be used only to obtain formation pressure measurements, but not to collect water samples. The suite of logs run from the bottom of the conductor casing (60 feet) to the bottom of the surface casing interval (600 feet) will include SP, MRT, GR and CAL. The suite of logs run from 600 feet to the full depth of the boring will include these logs, and also the DIL, FDC, CNL, SL, RFT, and SWC. Mud logging will be initiated from the bottom of the conductor casing throughout the entire drilling interval. A downhole thermometer will measure the bottom-hole temperature during each wireline logging run.

I.4 Water Disposal Formation Testing

Detailed formation testing will need to be conducted during the drilling and completion activity for the first disposal well drilled into the Starkey formation. Some analysis may be completed on the well logs from the three wells in the area that penetrated the Starkey formation (Citizen Green #1, Osborne Piacentine #1, and Moresco et al Unit A #1).

I.5 Formation Fluid Testing

Formation fluid physical and chemical properties were determined through analysis of an in-situ water sample collected from the Piacentine 2-27 core-well using the RFT tool, and analyzing the sample for total dissolved solids (TDS), conductivity, major anions and cations, hardness, alkalinity, Langlier Index, Stiff/Davis Stability Index, total suspended solids and total organic carbon. The results of this analysis are included as Attachment H-2. The chemistry of the subsurface formation water was further evaluated by electric and neutron-density log interpretation as discussed in Attachment E in order to assess the depth of USDW.

During completion of the proposed Injection/Withdrawal Well, a second formation water quality sample will be collected from the injection horizon during well completion, using coiled tubing and nitrogen to unload the well of drilling fluids and induce formation water flow. Produced water samples will also be collected during operation of the compression test. The initial formation water sample and three produced water samples will be submitted to a certified analytical laboratory to be analyzed as described above. In addition, the electric and neutron-density logs of the Injection/Withdrawal Well will be evaluated to assess the vertical concentration distribution of TDS in the formation water penetrated by the new well, and the results will be used to verify and update the prior analysis as needed.

Further use of the RFT tool to collect formation water samples is not proposed because our experience with formation water sampling using the RFT tool during drilling of the core well indicates that it entails significant risk of tool and borehole loss under the conditions encountered at the King Island gas field during the drilling of the Piacentine 2-27 core well. Only a single water sample was collected. The sample took approximately 4 hours to collect and it was difficult to free the RFT tool after the sample was collected; therefore, further attempts were deemed to be too risky and expensive to proceed. In our opinion, further RFT water sampling is not prudent or warranted in light of the conditions encountered and the relatively robust evaluation that has already been completed.

I.6 Formation Parting Pressure Testing

As discussed in Attachment H, the maximum bottom-hole pressures at the proposed Injection/Withdrawal well are anticipated to be below the Maximum Allowable Injection Pressure (MAIP). Nevertheless, a Step Rate Test (SRT) will be conducted in order to investigate the formation parting pressure. The test will be performed in general conformance with Society of Petroleum Engineers (SPE) Paper 16798, "Systematic Design and Analysis of Step-Rate Tests to Determine Formation Parting Pressure" (Singh et al., 1987). Prior to performing the SRT, a work plan will be submitted to EPA for review and approval at least 30 days prior to the test. The field schedule will need to be closely coordinated with EPA because the test will be performed with the drill rig on stand-by.

In order to avoid potential damage to the Injection/Withdrawal Well and gravel pack, the test is proposed to be performed in an open borehole prior to final completion of the well. Because the upper reservoir sands are anticipated to be relatively highly permeable, an 8 ¾-inch borehole will be drilled approximately 10 feet into the Mokelumne River Formation reservoir sands, circulated clean, and filled with 4% KCL water. A wireline pressure-temperature gauge with redundant sensors and a surface readout will be lowered 5 feet into the Mokelumne River Formation to record bottom-hole pressures and temperatures during the test. The test will be performed using 4% KCl water injection in rate steps of 2 barrels per minute bpm until the fracture gradient has been established based on a change in slope of the graphed pressure response as specified in the referenced paper. If the fracture pressure cannot be reached within the limitations of feasible injection rates, the maximum pressure response and injection rate will be noted.

The tentative field procedures are presented in detail in the drilling program included as Attachment L-1 and are summarized as follows:

1. An 8 ¾-inch bit will be used to drill to total depth.
2. After completion of logging, the hole will be cemented to approximately 30 feet above the top of the Mokelumne River Formation.
3. A 12 ¼-inch bit will be used to drill out the hole and cement to the top of the Mokelumne River Formation and a 9 5/8-inch casing will be cemented to the top of the Mokelumne River Formation.
4. An 8 ¾-inch bit will be used to drill out the shoe of the 9 5/8-inch casing and drill 10 feet into the Mokelumne River Formation.
5. Open ended drill pipe will be lowered into the hole to the top of the Mokelumne River Formation and the hole will be circulated clean with 4% KCl water.
6. At least 1,000 barrels of clean filtered 4% KCl water will be mobilized to the site and placed in storage tanks near the well site. The weight and viscosity of the fluid will be measured.

7. Before the start of the SRT test, the hole will be filled with 4% KCl water until water levels are stable. Record stabilized bottom hole pressure for 1/2 hour.
8. A pressure-temperature gauge with redundant sensors and surface read out (or duplicate pressure-temperature gauges) will be lowered into the hole and secured approximately at the mid-point of the clean, open 10 foot hole in the Mokelumne River Formation below the 9 5/8-inch casing. The bottomhole pressure will be allowed to stabilize and will be recorded for at least 30 minutes.
9. Two pump trucks will be moved in and connected to the drill pipe.
10. Step rate injection will be conducted using the 4% KCl water. The first step will be conducted at 2 bpm and each subsequent step will be increased at increments of an additional 2 bpm. Constant injection rates will be maintained during each step for a period of 30 minutes.
11. The resulting injection rates and pressures will be plotted and evaluated in accordance with SPE Paper 16798. Additional step rate increases will be implemented until at least two (and preferably three) rates plot past an identified break in slope that indicates the fracture pressure has been reached.
12. If a break in slope is not evident, continue the test as long as feasible, at a minimum until a bottom-hole pressure of at least 3,200 psi has been reached.

I.7 Fall-off Pressure Testing

Fall of testing will be conducted in general accordance with the EPA Region 9 Falloff Testing Requirements, dated August 8, 2002. At least 30 days prior to conducting the fall off tests, a brief work plan discussing the procedures and interpretation of the tests will be submitted for EPA for review and approval. The data will be used to verify the reservoir characteristics used to calculate the Zone of Endangering Influence (ZEI) in Attachment A, and to update calculations regarding the ZEI as necessary. The field schedule will need to be closely coordinated with EPA because the test following the SRT will be performed with the drill rig on stand-by, and the tests using air will need to be coordinated with the pilot testing schedule.

A fall-off test (FOT) will be conducted at the end of the step rate test described in Section I.5. If possible, the final step rate will be maintained for up to twice as long as prior steps in order to make the test data easier to interpret. After completion of the step rate test, the well will be shut in, and bottom-hole pressures and temperatures will continue to be recorded for 12 hours to measure the pressure falloff prior to retrieving the wireline pressure-temperature gauge.

Fall-off pressure testing will also be conducted on the Injection/Withdrawal Well using as part of the bubble-building phase of the injection testing program (see Attachment H). The FOTs will provide data to evaluate reservoir transmissibility, permeability (based on formation thickness), skin factor, pressures (well flowing and static), as well as show the completion conditions of the well and the presence of any boundaries reached during the injection period. Bottom-hole pressures during these tests will be measured using the permanent downhole pressure-temperature gauges installed in the Injection/Withdrawal Well (described in Attachment P).

The tests will involve an injection period (producing pressure build-up) long enough to reach radial flow conditions. Likewise, pressure will be monitored during the pressure fall-off period (following pump shut-down) for duration sufficient to reach radial flow conditions and to see the effects of any boundaries reached during the injection period.

I.8 References

Singh, P.K., R.G. Agarwal, and L.D. Krase, 1987. Systematic Design and Analysis of Step-Rate Tests to Determine Formation Parting Pressure: Society of Petroleum Engineers Paper 16798.

ATTACHMENT J
STIMULATION PROGRAM

Stimulation Program

J.1 Requirements

Attachment J outlines any proposed stimulation program, including the methods and materials used, monitoring, and reporting.

J.2 Description of Stimulation Program

Injection/Withdrawal Wells or water disposal wells may require stimulation to establish better connectivity with the reservoir to increase the well injection capacity. This program is optional. If a decision is made that the well would benefit from stimulation, the program will only be implemented once prior to completion of the proposed compression test.

If pressures during initial injection or the well response to initial fall-off testing indicate a lower than anticipated well injectivity, the well may be evaluated for stimulation. The well would be treated using an acid mixture premixed with chelating agent, iron control, clay stabilizer, mutual solvent, and inhibitor to break up residual mud clogging and improve the well interface with the sand formation. Details regarding the proposed program are included as Attachment J-1. Any changes or adjustments to this program would be presented to EPA for review and approval prior to implementation. In addition, EPA would be notified at least 48 hours prior to implementation of any stimulation program.

During the completion of the Injection/Withdrawal well for the testing program, a stimulation program was implemented on November 26, 2014 to help increase the formation permeability near the well. Acidizing was performed in three stages using coiled tubing placed in the open hole injection zone interval from 4,616' to 4,813' MD, while reciprocating a Roto Jet nozzle from 4,813' to 4,687' MD. During each stage, pressure was monitored at bottom hole using the Side Pocket Surface Readout (SPSRO) permanent downhole pressure gauge (see **Table IV-4** for instrument details) and at the surface at the 5-1/2" tubing head. The well was shut in for one hour between Stages 1 and 2 and for one hour between Stages 2 and 3. Details of each stage are provided below:

Stage 1: Pumped 500 gallons of 15% hydrochloric acid (HCL) (One Shot Acid) at 0.5 barrels per minute (BPM). At the end of pumping, bottom hole pressure was 2,300 pounds per square inch gage (psig) and surface tubing head pressure was 480 psig.

Stage 2: Pumped 1,000 gallons of 15% HCl and 1,000 gallons of 12% HCL/3% hydrofluoric (HF) acid at 2.2 BPM. At the end of pumping, bottom hole pressure was 2,070 psig and surface tubing head pressure was 520 psig.

Stage 3: Pumped 2,000 gallons of 12% HCL/3% HF acid and 1,500 gallons of 7.5% HCl acid at 2.5 BPM. Acid was displaced with 3,000 gallons of 5% ammonium chloride (NH_4CL). At the end of pumping, bottom hole pressure was 1,849 psig and surface tubing head pressure was 322 psig.

J.3 Stimulation Monitoring

During the proposed stimulation program wellhead pressures (tubing and annulus) and injection rate will be continuously recorded on monitoring devices and will be analyzed for indications of leakage between tubing and casing or through the packer, and formation parting pressure exceedance. During

the program, the maximum treatment pressure and rate will be based on the results of the step rate test (SRT) so as to remain below the formation parting pressure, with a safety margin. The monitoring devices used during the stimulation program include the following:

- Injection pressures will be monitored continuously using the downhole and wellhead temperature and pressure monitors installed in the Injection/Withdrawal Well described in Attachment K. Temperature and pressure readings will be recorded every 30 seconds.
- The volume and type of stimulating agents and water pumped into the well will be recorded.
- A detailed record of all stimulation activities will be maintained.

J.4 Notification and Record Keeping

A more detailed stimulation plan will be provided to EPA for review and approval at least 30 days prior to implementation, if well stimulation is conducted. If changes are made to the stimulation program, the amended program will be provided to EPA for review and approval at least 30 days prior to implementation. Treatment records and analysis will be submitted to EPA personnel within 10 days after completing the treatment program.

ATTACHMENT K
INJECTION PROCEDURES

Injection Procedures

K.1 Requirements

Attachment K is to include a description of the injection equipment and procedures (both for air storage and water disposal).

K.2 Injection/Withdrawal Well Equipment and Process Description

K.3 Site Facilities

ATTACHMENT L
CONSTRUCTION PROCEDURES

Construction Procedures

L.1 Requirements

Discuss the construction procedures to be utilized. This should include details of the casing and cementing program, logging procedures, deviation checks, and the drilling, testing and coring program, and proposed annulus fluid.

L.2 Approach and Rationale

The proposed air Injection/Withdrawal Wells will be installed as deviated wells, drilled from one of two wellpads. The proposed water disposal well(s) will be drilled from one or both wellpads, and possibly from the ECF site. All of the wells will be drilled using conventional gas well drilling equipment, and will be completed in the top of the reservoir by under-reaming and installing a screen and gravel pack to promote good communication with the reservoir sands. Air will be injected and withdrawn through 5 ½-inch tubing secured in the casing with a packer system and a pressurized annulus. The well will be completed using 600 feet of 20" surface casing, 13 3/8" intermediate casing to approximately 3,500' TVD, and then 9 5/8" long string casing cemented to the surface.

The proposed surface casing (600 feet) will extend below the anticipated Base of Fresh Water as defined by the State of California rather than to the base of Underground Sources of Drinking Water (USDW) as defined by EPA. The proposed air Injection/Withdrawal Wells are Class V Injection Wells to be used for CAES operations. This use is fundamentally different from a commercial wastewater injection well and entails a much lower risk to USDW. We believe the proposed approach is appropriate and fully protective of USDW for the following reasons:

- The proposed 4,730 feet of 9-5/8-inch long string casing will be cemented to surface and will isolate and protect USDW throughout its full vertical extent (approximately 3000 feet). A radial cement bond log will be run after completion of the cementing operation (Attachment P).
- After the well completion, Mechanical Integrity Tests will be performed to insure the integrity of 9-5/8" casing (Attachment P).
- All the air injection and production will be performed through a string of tubing which will be isolated from the 9-5/8-inch casing by a packer (Attachment M). The annulus between tubing and 9-5/8-inch casing will be pressurized and will be monitored on a continuous basis for leaks (Attachment P), providing a second verified layer of protection.
- This well is proposed to be used for a short-term pilot test for no more than approximately 90 days. The chance of well failure during this period is extremely small.
- The pilot testing program has been amended to significantly decrease both the injection rate and final volume, resulting in a considerable reduction in the anticipated pressure buildup.
- Pressures induced in the reservoir during the proposed compression pilot test will dissipate over time, eliminating the risk of fluid migration. The current reduced pressure state of the depleted gas reservoir will speed the time period over which this occurs.

- The injection gas for this well is air or oxygen-depleted air or ambient air, which are non-hazardous, compressible, and entail a lower risk of USDW contamination than commercial use to inject wastewater.

L.3 Injection/Withdrawal Well Installation Program

Detailed drilling, completion, and directional programs for the Injection/Withdrawal Well are included in Attachment L-1. A completion detail schematic of the Injection/Withdrawal Well is included in Attachment M.

Deviation checks will be performed at approximately every 500 vertical feet from 700 feet to 3,465 feet by utilizing the measured while drilling (MWD) method. This will ensure the drill hole does not deviate from the plan beyond acceptable limits.

The wellhead will be equipped with 3,000 psi double master 5-1/8" valves, a 5-1/8" wing valve, and a 2-1/16" 3,000 psi casing valve. The tubing hanger and top flange over the tubing head will be modified so that a ¼" cable can be run through the 5-1/2" tubing hanger and through the top flange of the tubing head. A detailed schematic of the surface completion for the Injection/Withdrawal Well is included in Attachment M-2.

Within 30 days following the installation of the Injection/Withdrawal Well, a well completion report will be provided to the EPA. The report will summarize the drilling, casing and cementing operations. The report will include a detailed driller's report documenting all rig activities will be provided, signed by the Engineer in Charge and the Operator. Complete logs will be appended to the report.

ATTACHMENT M
CONSTRUCTION DETAILS

Construction Details

M.1 Requirements

Submit schematic or other appropriate drawings of the surface and subsurface construction details of the well.

M.2 Approach

For both the air Injection/Withdrawal Wells and the water disposal wells, the proposed construction details for the Injection/Withdrawal Well are to be provided as a schematic drawing. Surface completion (wellhead) details are to be provided as a schematic drawing. Wellhead specifications are to be summarized. The proposed construction details for the monitoring wells are to be provided as schematic drawings.

ATTACHMENT N
CHANGES IN INJECTED FLUID

Changes in Injected Fluid

N.1 Requirements

Discuss expected changes in pressure, native fluid displacement, and direction of movement of injection fluid.

N.2 Description of Injection Testing Operations and Injectate

The CAES development involves building an approximately 8.0 billion standard cubic feet (Bscf) air bubble in a depleted (water-invaded) gas reservoir in the uppermost sands of the Mokelumne River Formation at the King Island gas field, and then utilizing the stored air to generate electrical power through a surface facility (Attachment H). The proposed volume of the air bubble will be formed in reservoir sands at the uppermost part of a permeable sandstone lobe in the King Island gas field that is enclosed laterally by shale deposited in the Meganos Channel and capped by shale of the Capay Formation (Attachments G and F). The air bubble will be created by injecting air through one or more Injection-Withdrawal Wells at flow rates of up to approximately 10 MMscfd and pressures not exceeding 2,500 psi at the well head and 3,000 psi at the bottom of the well. Withdrawal flow will occur periodically at rates ranging up to 1,100 MMscfd (Attachment H). The flow episodes are expected to range in duration from approximately four up to approximately 10 hours.

ATTACHMENT O
PLANS FOR WELL FAILURES

Plans for Well Failures

O.1 Requirements

Outline contingency plans to cope with all shut-ins or well failures so as to prevent migration of fluids into any USDW.

O.2 Plan for I/W Well Failure

Air Storage Reservoir

The proposed Injection/Withdrawal Well will be used to inject compressed air (rather than fluid) into the target injection zone in a depleted (water-invaded) gas reservoir. As such, the following summarizes the plan to address failure of the well to protect the surface environment and prevent migration of fluids into any USDW:

- The injection well will not be used until the initial mechanical integrity test is passed.
- Monitoring and periodic routine investigative procedures will be performed during operation as required under the permit, and as outlined in Attachments H, K and P. Pertinent data will be reviewed regularly by qualified operators and reported to EPA monthly. The monitoring and testing program has been designed to assure well integrity and safe operation.
- As described in Attachment K, the well and process data sensors will be connected to a hybrid data acquisition, control and safety system. The system will include an Emergency Shut Down/Fire and Gas System (EGS/FGS), and Programmable Logic Control (PLC). The system will be programmed with safety and compliance shut down interlocks that stop the injection and flow process and shut in the well using an automated control valve in the event of:
  - A high pressure condition that exceeds the allowable injection pressure;
  - High temperature;
  - High hydrocarbon vapor concentration;
  - Higher than design oxygen content;
  - Fire;
  - A manual trip; and
  - Power failure.
- In addition, audible alarms will be triggered at shut down and at below-shutdown thresholds for high hydrocarbon vapor or low oxygen content.
- EPA will be notified within 24 hours of any control system-initiated shutdowns triggered by a compliance issue or an issue that could impact safety or the environment (USDW).
- If the well fails required continuous monitoring or periodic testing standards, the well will be immediately shut-in and EPA will be notified within 24 hours in accordance with applicable regulations and permit conditions. After investigation into the cause for the failure, work plans for repairing the problem will be prepared and submitted to EPA for approval prior to implementation.
- If a system interruption, upset, or emergency occurs, the well will be shut in and contingency plans will be implemented. These contingency plans will be prepared by the contractor retained by PG&E to design, build and operate the compression testing equipment. The plans can be provided to EPA

once the contractor's engineering, process safety, and hazard and operability review processes are sufficiently advanced to finalize the plans.

- If a workover is performed on the well, mechanical integrity testing will be conducted as required by applicable regulations before the well is returned to service. Copies of all work reports and logs will be forwarded to EPA per applicable requirements.
- During the period of time the well is shut in or workovers are being performed, injection/withdrawal operations will be suspended until appropriate testing has been performed and approved by EPA.
- Should the mode of failure be beyond the limits of economic feasibility to repair, the guidelines for plugging and abandonment in Attachment Q will be followed.

Water Disposal Formation

The proposed water disposal well will be used to inject produced and waste water into the target injection formation. As such, the following summarizes the plan to address failure of the well to protect the surface environment and prevent migration of fluids into any USDW:

- The injection well will not be used until the initial mechanical integrity test is passed.
- Monitoring and periodic routine investigative procedures will be performed during operation as required under the permit, and as outlined in Attachments H, K and P. Pertinent data will be reviewed regularly by qualified operators and reported to EPA monthly. The monitoring and testing program has been designed to assure well integrity and safe operation.
- As described in Attachment K, the well and process data sensors will be connected to a hybrid data acquisition, control and safety system. The system will be programmed with safety and compliance shut down interlocks that stop the injection and flow process and shut in the well using an automated control valve in the event of:
  - A high pressure condition that exceeds the allowable injection pressure;
  - High hydrocarbon vapor concentration;
  - A manual trip; and
  - Power failure.
- In addition, audible alarms will be triggered at shut down and at below-shutdown thresholds for high hydrocarbon vapor.
- EPA will be notified within 24 hours of any control system-initiated shutdowns triggered by a compliance issue or an issue that could impact safety or the environment (USDW).
- If the well fails required continuous monitoring or periodic testing standards, the well will be immediately shut-in and EPA will be notified within 24 hours in accordance with applicable regulations and permit conditions. After investigation into the cause for the failure, work plans for repairing the problem will be prepared and submitted to EPA for approval prior to implementation.
- If a system interruption, upset, or emergency occurs, the well will be shut in and contingency plans will be implemented. These contingency plans will be prepared by the contractor retained by PG&E to design, build and operate the compression testing equipment. The plans can be provided to EPA once the contractor's engineering, process safety, and hazard and operability review processes are sufficiently advanced to finalize the plans.

- If a workover is performed on the well, mechanical integrity testing will be conducted as required by applicable regulations before the well is returned to service. Copies of all work reports and logs will be forwarded to EPA per applicable requirements.
- During the period of time the well is shut in or workovers are being performed, injection/withdrawal operations will be suspended until appropriate testing has been performed and approved by EPA.
- Should the mode of failure be beyond the limits of economic feasibility to repair, the guidelines for plugging and abandonment in Attachment Q will be followed.

O.3 Plan for Monitoring Well Failure

The following summarizes the plan to address failure of a monitoring well to protect the surface environment and prevent migration of fluids into any USDW:

- Monitoring and periodic routine investigative procedures will be performed during operation as required under the permit, and as outlined in Attachments H, K and P. Pertinent data will be reviewed regularly by qualified operators and reported to EPA monthly. The monitoring and testing program has been designed to assure well integrity and safe operation. The primary monitoring parameter for the Piacentine 1-27 monitoring well will be the annular pressure.
- If the monitoring well fails required continuous monitoring or periodic testing standards, the monitoring well and Injection/Withdrawal Well will be immediately shut-in and EPA will be notified within 24 hours in accordance with applicable regulations and permit conditions. After investigation into the cause for the failure, work plans for repairing the problem will be prepared and submitted to EPA for approval prior to implementation.
- Should the mode of failure be beyond the limits of economic feasibility to repair, the guidelines for plugging and abandonment in Attachment Q will be followed.

ATTACHMENT P
MONITORING PROGRAM

Monitoring Program

P.1 Requirements

The monitoring requirements under 40 CFR 146.13 include the following.

- Analysis of injected fluids with sufficient frequency to yield representative data;
- Installation and use of continuous recording devices to monitor injection pressure, flow rate and volume, and the pressure on the annulus between the tubing and the long string of casing;
- A demonstration of mechanical integrity pursuant to Part 146.8 at least once every five years during the life of the well; and
- The type, number, and location of wells within the AOR to be used to monitor any migration of fluids into, and pressure in, USDWs, parameters to be measured and frequency of monitoring.

Monthly reporting requirements include:

- The physical, chemical and other relevant characteristics of injection fluids;
- Monthly average, maximum and minimum values for injection pressure, flow rate and volume, and annular pressure;
- The results of other required monitoring;
- Results of mechanical integrity tests;
- Any other test of the injection well conducted by the permittee, if required by EPA; and
- Any well rehabilitation or work-over activities.

P.2 Analysis of Injected Fluids

As described in Attachment K, the injection and withdrawal flow streams will be monitored continuously by redundant oxygen and combustible gas meters, and the results recorded every 30 seconds. Summary specifications for the sensors to be used are presented in table P-1.

Table P-1: Chemical Sensor Instrumentation Specifications

Location	Equipment	Instrument Type	Model	Precision	Accuracy	Features/Remarks
I/W Manifold near Wellhead	Hydrocarbon Analyzer 1	FID on slip stream	Baseline Modcon Series 9000	± 1% full scale	± 1% full scale	Programmable automatic or manual calibration.
I/W Manifold near Wellhead	Hydrocarbon Analyzer 2	IR Detector on slip stream	Hitech Inst. IR600 series	±2 % @ span	±2.5% of f.s.d.	Complete package with in-built pump, on-board filter, temperature and pressure correction over ambient ranges.

Table P-1: Chemical Sensor Instrumentation Specifications						
Location	**Equipment**	**Instrument Type**	**Model**	**Precision**	**Accuracy**	**Features/Remarks**
I/W Manifold near Wellhead	Oxygen Sensor	Zirconia sensor	Sensotec Rapidox 2100ZF	± 0.5%	± 1%	Range is <1 ppm to 100% O_2. Response time 1 to 4 seconds for a 90% response to a step change in gas compositions. Calibration using 2 or 3 user selectable gas mixtures (air is default)
Notes: Instrument model, precision and accuracy shall be as specified or equivalent I/W = Injection/Withdrawal RTD = Resistance Temperature Detector FID = Flame Ionization Detector IR = Infrared ppm = parts per million LCD = Liquid Crystal Display						

Injection gas samples will be collected from a sampling port in the injection/withdrawal pipe manifold near the wellhead periodically as required. Withdrawal gas samples will be collected weekly and screened using portable field analyzers. Additional sampling will include vent stack samples for air emissions compliance monitoring, and sampling of produced water.

[NEED TO ADD LANGUAGE RE ANALYTICAL REQUIREMENTS FOR INJECTED WATER]

P.3 Monitoring and Recording of Injection Pressures, Injection Rates and Annular Pressures

As described in Attachment K and summarized in Table P-4, the injection and withdrawal stream temperature, pressure, flow rates and volumes, and the annular fluid pressure and temperature in the Injection/Withdrawal Well will be monitored continuously and recorded every 30 seconds by a central data acquisition and control system. In addition, annular and wellhead temperature and pressure will be monitored at the monitoring wells and recorded every 30 seconds.

The annular fluids in these wells will be kept pressurized to near 100 psi by injecting a nitrogen blanket in the uppermost portion of the annulus. Note that annular pressures in the Injection/Withdrawal Wells may change as a result of temperature changes during injection and withdrawal of hot air. Annular pressure-temperature changes will be evaluated to verify whether they are due to thermal effects or represent a well failure. The well annulus will be a closed system, monitored for pressure at the wellhead. As such, the nitrogen blanket on the annular fluid will behave according to Boyles Law and changes in pressure due to thermal effects can be estimated as follows:

$$\frac{P1 \times V1}{T1} = \frac{P2 \times V2}{T2}$$

Where P is pressure measured in psi(atmospheric), or psia, and T is measured in degrees Rankin

For example, with 4,500’ of fluid in the annulus and 100’ of nitrogen blanket, a temperature increase of 40 degrees Fahrenheit in the entire system would increase an initial wellhead pressure of 100 psia to

136 psia. This is caused by two changes in the system: the increased temperature increases the volume of the fluid slightly, and the volume of the nitrogen blanket is compressed in addition to responding to direct temperature effects. A smaller nitrogen blanket would experience a proportionately larger pressure increase.

Normal fluctuations in pressure, both up and down, are expected to occur to the annulus pressure during injection and withdrawal operations due to changes in the temperature. The normal range of these fluctuations can be estimated based on the information available at the time that the annulus is filled with fluid. A leak, however, changes the relatively fixed volume of fluid in the annulus and as a result the wellhead pressures will trend down over time. While still fluctuating somewhat due to thermal effects, in the event of a leak, pressures would never return to the previous equilibrium pressure. It is the long term trend, not the short term pressure fluctuations that would indicate an issue with the integrity of the casing, tubing, or possibly a leaking tubing packer. Therefore, annular pressure measurements will be evaluated for trends that indicate a loss of fluid volume. If such a trend is identified, it would be reported to EPA within 24 hours and further investigation would be required to determine the exact cause of the annular pressure decrease.

If necessary, the annular pressure will be maintained by pumping additional pressurized nitrogen into the headspace above the annular fluid, or by bleeding off nitrogen. Such adjustments and the resulting pressure changes will be recorded. A substantial pressure loss that is unrelated to thermal effects will be assumed to be related to a leak in the well, tubing or annulus. "Normal" pressure fluctuations are expected to occur due to changes in the thermal conditions of the annulus. The magnitude of those changes will depend on the relative volumes of the fluid and nitrogen blanket in the annulus. The range of pressure fluctuations due to changing temperature conditions during operations will be recorded during the injection/withdrawal test period. Keeping in mind that the nitrogen volume will be very small compared to the annular fluid, the effect on the annulus pressure from a change in the fluid volume will be magnified considerably. For this reason a reduction by 30% of the previously recorded low pressure during operations would be considered "substantial" and require further investigation.

P.4 Mechanical Integrity Testing

Prior to using the proposed Injection/Withdrawal Wells for air injection, a mechanical integrity test will be performed, consisting of a Radial Cement Bond Log to be run after well completion, and a pressure test of the annular fluids between the injection tubing and the long string casing up to 2,500 pounds per square inch (psi), as described in Attachment L-1. The pressure test will be performed by pressurizing the annular fluids and holding the pressure for 30 minutes. Pressures during the test will be recorded using the annular pressure-temperature sensors and tubing head pressure gauges. A chart recorder will be used to record the pressure response. The pressure change should not exceed five percent during the 30-minute test. EPA will be notified to witness the test. In addition, the mechanical integrity of the Piacentine 1-27 monitoring well will be validated prior to the compression test by conducting a pressure test of the annular fluids and tubing pressure in that well up to 2,500 psi, in similar fashion to the Injection/Withdrawal Well. As with the Injection/Withdrawal well, the pressure change should not exceed five percent during the test. EPA may require additional mechanical integrity tests prior to allowing injection, depending on the results of the formation Step Rate Test and core testing results (Attachment I).

The integrity of the injection process will be further validated using a thermal decay log and a spinner log of the Injection/Withdrawal Well. This test is proposed to be delayed slightly beyond 60 days so as not to interrupt the relatively brief 90-day compression testing schedule. Since use of the well will be limited to the short term compression test, delaying the test for approximately 30 days will not increase

the risk of well failure. Because the medium being injected is air, a tracer test is not proposed to be conducted. EPA will be provided with a work plan detailing the approach to this test at least 30 days prior to implementation.

A failure of any mechanical integrity test will be reported to EPA within 24 hours as required under 40 CFR 144.51(k)(6).

P.5 Monitoring and Reporting

The following parameters will be recorded daily and reported to EPA in monthly reports during the bubble building period and operations:

- Injection pressure, temperature flow rate, oxygen content, and total injected volume;
- Withdrawal pressure, temperature, flow rate, combustible gas content, and total withdrawn volume;
- Shut-in pressure and temperature for the Injection/Withdrawal Wells and monitoring wells; and
- Wellhead tubing and annular pressure in the Injection/Withdrawal Wells and monitoring wells.

In addition, the following information will be provided:

- Injection air chemical analysis results (for fixed gases);
- Withdrawal air chemical analysis results, as applicable (for fixed gases, combustible hydrocarbons and volatile organic compounds);
- Produced water chemical analysis results and disposal documentation, as applicable;
- Monitoring wellhead pressure and temperature readings;
- Downhole temperature and pressure readings, when recorded;
- The results of Mechanical Integrity Tests;
- The results of Falloff Tests;
- The results of Step Rate Tests;
- Any shut down events; and
- Any well maintenance or work-over activities.

The reports will include an assessment comparing the measured results to design performance parameters and expected reservoir behavior.

P.6 Record Keeping

Complete records from the above monitoring will be maintained by the operator for the Injection/Withdrawal Wells until at least 5 years after plugging and abandonment of the Injection/Withdrawal Wells. In addition, calibration and maintenance records will be maintained for all equipment. These records will only be discarded after written notification to, and approval from, EPA.

ATTACHMENT Q
PLUGGING AND ABANDONMENT PLAN

Plugging and Abandonment Plan

J.1 Requirements

Submit a plan for plugging and abandonment of the all I/W wells, water disposal wells, and monitoring wells.

Q.2 Injection/Withdrawal Well Plugging and Abandonment Plan

The proposed plugging and abandonment plan for the Injection/Withdrawal Well is provided in Attachment Q-1. A cost estimate is provided in Attachment Q-2, and the plugging and abandonment schematic is provided in Attachment Q-3. This information is also contained in EPA Form 7520-14, which is included as Attachment Q-4.

Prior to the plugging and abandonment of the injection well, a revised plugging and abandonment plan may be submitted to EPA for review and approval, based on the actual well construction, well conditions, and depth to USDW.

Q.3 Monitoring Well Plugging and Abandonment Plan

ATTACHMENT R
NECESSARY RESOURCES

Necessary Resources

R.1 Requirements

This section requires the applicant to submit evidence such as a surety bond or financial statement to verify that the resources necessary to close, plug or abandon the well are available.

R.2 Response

The response is highly dependent on the financial qualifications of the ultimate project developer/applicant and could range from providing detailed financial reports to a form of financial security acceptable to EPA.

ATTACHMENT T
LIST OF PERMITS AND CONSTRUCTION APPROVALS

List of Permits and Construction Approvals

T.1 Requirements

The UIC regulations require a list of any existing EPA permits including program and permit number, for example, National Pollution Discharge Elimination System (NPDES) permit for water discharges, Potential for Significant Deterioration (PSD) permits for air emissions, Resource Conservation and Recovery Act (RCRA) permits for hazardous waste generation, transfer, storage or disposal, and other permits. In addition, EPA has requested a list of any permits and construction approvals received or applied for under various programs, including state and local programs. Confirmation may also be requested for documentation that UIC permit applications have been provided to the appropriate State of California regulatory agencies, including the California Regional Water Quality Control Board (RWQCB), CEC and the Department of Conservation, Division of Oil, Gas and Geothermal Resources (DOGGR).

T.2 Response

The project currently holds no Federal, State or Local permits for the commercial scale development. The following permits were obtained in conjunction with the core drilling and Air Injection Testing phases of the project (2014-2015):

- National Environmental Policy Act (NEPA) compliance was required as a result of Department of Energy (DOE) funding with the DOE serving as the lead agency for that process. In culmination of that process the Final EA and Finding of No Significant Impact (FONSI) were published by DOE and are included in the DOE Administrative Record. The Final EA includes analysis of historic resources and protected species and fulfills the consultation requirements of Section 106 and Section 7 of the respective laws. A copy of the Final EA and FONSI were provided to EPA in conjunction with the UIC permit issued for the I/W test well in 2014.
- NPDES Construction Storm Water Permit from the State Water Resources Control Board.
- Permits were obtained from DOGGR for modification of the Piacentine 1-27 well and drilling of the 2-27 core well. These wells were used as observation wells during the injection program.
- An encroachment permit from Reclamation District 2044 for use of the levee road on the west bank of Bishop Cut Slough north of 8-Mile Road to access the site.

In conjunction with the CEC Application for Certification process for commercial scale development of the KICP, permits, consultation and/or related coordination with a host of various agencies will be required as discussed in detail in the ESLPA Report [cite], including but not limited to the following:

- San Joaquin County Community Development Department
- The San Joaquin Valley Air Pollution Control District
- DOGGR (installation of all I/W and observation wells)RWQCB
- Reclamation District 2044 and other relevant RDs
- PSD (refer to the Air Quality section of the ESLPA)

ATTACHMENT U
DESCRIPTION OF BUSINESS

Description of Business

U.1 Requirements

This section requires the applicant to provide a brief description of the nature of the business.

U.2 Response

This response will be developer/applicant specific.

Appendix 5.1A
Construction CalEEMod Output

King Island CAES Project
Appendix 5.1A Table 5.1A.1
Summary of Maximum Daily and Annual Construction Emissions
February 2015

Maximum Criteria Pollutant Emissions from Construction [a]

Construction Emissions	NO_x	CO	ROG	SO_2	PM_{10}	$PM_{2.5}$
Maximum Daily Emissions from ECF Construction (lb/day)	278	148	23.6	0.36	1,056	116
Maximum Daily Emissions from Well Pad/Pipeline Construction (lb/day)[b]	95	124	11.3	0.23	21.4	12.8
Maximum Daily Emissions (lb/day)	373	272	35.0	0.60	1,078	129
Maximum Annual Emissions from ECF Construction (tpy)	16.7	10.1	1.45	0.027	73.5	8.11
Maximum Annual Emissions from Well Pad/Pipeline Construction (tpy)[b]	9.7	13.1	1.29	0.025	1.78	0.78
Maximum Annual Emissions (tpy)	26.4	23.2	2.74	0.052	75.3	8.89

Notes:

tpy = ton(s) per year

[a] Maximum emissions include contributions from onsite construction equipment, offsite construction equipment, onsite vehicles, offsite vehicles, fugitive sources (PM_{10} and $PM_{2.5}$ only), and paving off-gassing (ROG only).

[b] Emissions from well pad/pipeline construction were estimated using CalEEMod.

Maximum GHG Emissions from Construction

GHG Emissions	CO_2	CH_4	N_2O	CO_2e
Maximum Daily Emissions from ECF Construction (lb/day)	35,739	1.07	0.38	35,879
Maximum Daily Emissions from Well Pad/Pipeline Construction (lb/day)[a]	21,038	1.99	0.00	21,080
Maximum Daily Emissions (lb/day)	56,777	3.06	0.38	56,960
Maximum Annual Emissions from ECF Construction (MT/yr)	2,345	0.069	0.023	2,354
Maximum Annual Emissions from Well Pad/Pipeline Construction (MT/yr)[a]	2,115	0.189	0.000	2,119
Maximum Annual Emissions (MT/yr)	4,460	0.258	0.023	4,473

Notes:

MT/yr = metric ton(s) per year

[a] Emissions from well pad/pipeline construction were estimated using CalEEMod.

King Island CAES Project
Appendix 5.1A Table 5.1A.2
Summary of Daily and Annual ECF Construction Emissions
February 2015

Emissions Summary	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	Month 13	Month 14	Month 15	Month 16	Month 17	Month 18
	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17
	ROG Emissions																	
Off-road Vehicles (lb/day)	3.54	3.32	22.3	19.9	8.50	8.50	8.50	8.50	8.50	8.50	8.50	7.45	7.28	6.80	5.25	5.25	5.25	7.61
On-road Vehicles (lb/day)	0.41	0.32	0.79	0.47	0.58	0.77	0.77	0.67	0.67	0.67	0.67	0.76	0.67	0.57	0.57	0.68	0.50	0.60
Paving (lb/day)	-	-	0.52	0.26	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Daily Emissions (lb/day)	**3.95**	**3.63**	**23.6**	**20.7**	**9.08**	**9.27**	**9.27**	**9.17**	**9.17**	**9.17**	**9.17**	**8.21**	**7.95**	**7.37**	**5.83**	**5.94**	**5.76**	**8.22**
Off-road Vehicles (tpy)	0.04	0.075	0.32	0.54	0.63	0.73	0.82	0.91	1.01	1.10	1.19	1.28	1.32	1.36	1.17	1.01	0.97	0.96
On-road Vehicles (tpy)	0.005	0.008	0.017	0.022	0.028	0.037	0.045	0.053	0.060	0.067	0.075	0.083	0.086	0.089	0.086	0.089	0.088	0.086
Paving (tpy)	-	-	0.006	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.003	-	-	-
Total Annual Emissions (tpy)	**0.04**	**0.083**	**0.34**	**0.57**	**0.67**	**0.77**	**0.87**	**0.98**	**1.08**	**1.18**	**1.28**	**1.37**	**1.41**	**1.45**	**1.26**	**1.10**	**1.06**	**1.05**
	CO Emissions																	
Off-road Vehicles (lb/day)	15.8	15.3	123	115	49.9	49.9	49.9	49.9	49.9	49.9	49.9	40.8	39.9	39.1	31.0	31.0	31.0	42.5
On-road Vehicles (lb/day)	11.3	9.79	24.5	14.8	15.8	20.6	20.6	16.3	16.3	16.3	16.3	20.2	16.3	14.5	14.5	19.7	14.6	19.0
Total Daily Emissions (lb/day)	**27.1**	**25.1**	**148**	**129**	**65.7**	**70.5**	**70.5**	**66.3**	**66.3**	**66.3**	**66.3**	**61.0**	**56.3**	**53.5**	**45.5**	**50.7**	**45.6**	**61.5**
Off-road Vehicles (tpy)	0.17	0.34	1.70	2.96	3.51	4.06	4.61	5.16	5.71	6.25	6.80	7.3	7.5	7.8	6.76	5.84	5.64	5.55
On-road Vehicles (tpy)	0.12	0.23	0.50	0.66	0.84	1.06	1.29	1.47	1.65	1.83	2.01	2.23	2.29	2.34	2.23	2.28	2.27	2.25
Total Annual Emissions (tpy)	**0.30**	**0.57**	**2.20**	**3.62**	**4.35**	**5.12**	**5.90**	**6.63**	**7.36**	**8.1**	**8.8**	**9.5**	**9.8**	**10.1**	**9.0**	**8.13**	**7.90**	**7.81**
	NO_x Emissions																	
Off-road Vehicles (lb/day)	34.7	32.2	260	239	84.8	84.8	84.8	84.8	84.8	84.8	84.8	71.4	69.5	64.4	50.9	50.9	50.9	74.6
On-road Vehicles (lb/day)	7.93	7.20	18.3	11.1	13.8	20.6	20.6	20.2	20.2	20.2	20.2	20.6	20.2	17.9	17.9	18.4	12.3	13.0
Total Daily Emissions (lb/day)	**42.6**	**39.4**	**278**	**250**	**98.6**	**105**	**105**	**105**	**105**	**105**	**105**	**92.0**	**89.7**	**82.3**	**68.8**	**69.3**	**63.2**	**87.6**
Off-road Vehicles (tpy)	0.38	0.74	3.59	6.22	7.15	8.09	9.02	9.95	10.9	11.8	12.8	13.5	13.9	14.3	12.0	9.91	9.54	9.42
On-road Vehicles (tpy)	0.087	0.17	0.37	0.49	0.64	0.87	1.10	1.32	1.54	1.76	1.98	2.21	2.35	2.46	2.46	2.54	2.52	2.44
Total Annual Emissions (tpy)	**0.47**	**0.90**	**3.96**	**6.71**	**7.79**	**8.95**	**10.1**	**11.3**	**12.4**	**13.6**	**14.7**	**15.7**	**16.3**	**16.7**	**14.4**	**12.4**	**12.1**	**11.9**
	SO_2 Emissions																	
Off-road Vehicles (lb/day)	0.03	0.03	0.24	0.22	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.07	0.07	0.07	0.06	0.06	0.06	0.08
On-road Vehicles (lb/day)	0.047	0.047	0.12	0.073	0.079	0.11	0.11	0.093	0.093	0.093	0.093	0.11	0.093	0.093	0.093	0.12	0.081	0.10
Total Daily Emissions (lb/day)	**0.08**	**0.08**	**0.36**	**0.30**	**0.16**	**0.19**	**0.19**	**0.18**	**0.18**	**0.18**	**0.18**	**0.18**	**0.16**	**0.16**	**0.15**	**0.18**	**0.14**	**0.19**
Off-road Vehicles (tpy)	0.000	0.001	0.003	0.006	0.007	0.008	0.009	0.010	0.011	0.011	0.012	0.013	0.014	0.014	0.012	0.010	0.010	0.010
On-road Vehicles (tpy)	0.001	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.010	0.011	0.012	0.012	0.013	0.012	0.013	0.013	0.013
Total Annual Emissions (tpy)	**0.001**	**0.002**	**0.006**	**0.009**	**0.011**	**0.013**	**0.015**	**0.017**	**0.019**	**0.021**	**0.023**	**0.025**	**0.026**	**0.027**	**0.025**	**0.023**	**0.023**	**0.023**

King Island CAES Project
Appendix 5.1A Table 5.1A.2
Summary of Daily and Annual ECF Construction Emissions
February 2015

Emissions Summary	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	Month 13	Month 14	Month 15	Month 16	Month 17	Month 18
	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17
	PM_{10} Emissions																	
Off-road Vehicles (lb/day)	358.6	358.5	1046	759	486	486	486	486	486	486	486	486	450	450	449	448.5	448.5	557
On-road Vehicles (lb/day)	3.78	3.76	9.59	5.83	6.02	8.03	8.03	6.44	6.44	6.44	6.44	7.88	6.44	6.41	6.41	8.64	6.28	8.19
Ground Disturbance (lb/day)	0.530	0.530	0.965	0.435	0.106	0.106	0.106	0.106	0.106	0.106	0.106	0.106	0.106	0.106	0.106	0.106	0.106	0.212
Cut and Fill (lb/day)	-	-	0.092	0.091	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Total Daily Emissions (lb/day)	**362.9**	**362.8**	**1056**	**765**	**492**	**494**	**494**	**493**	**493**	**493**	**493**	**494**	**456**	**456**	**455**	**457.3**	**454.9**	**565**
Off-road Vehicles (tpy)	3.945	7.888	19.390	27.739	33.087	38.436	43.8	49.1	54.5	59.8	65.2	70.5	71.5	72.5	66.0	62.5	62.1	62.9
On-road Vehicles (tpy)	0.042	0.083	0.188	0.253	0.319	0.407	0.495	0.566	0.637	0.708	0.779	0.866	0.895	0.924	0.889	0.920	0.923	0.925
Ground Disturbance (tpy)	0.006	0.012	0.022	0.027	0.028	0.029	0.031	0.032	0.033	0.034	0.035	0.036	0.032	0.027	0.018	0.014	0.014	0.015
Cut and Fill (tpy)	-	-	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.000	0.000	0.000
Total Annual Emissions (tpy)	**3.992**	**7.982**	**19.602**	**28.020**	**33.436**	**38.9**	**44.3**	**49.7**	**55.2**	**60.6**	**66.0**	**71.4**	**72.5**	**73.5**	**66.9**	**63.5**	**63.1**	**63.8**
	$PM_{2.5}$ Emissions																	
Off-road Vehicles (lb/day)	37.4	37.2	113.6	83.9	52.4	52.4	52.4	52.4	52.4	52.4	52.4	51.9	48.3	47.9	47.0	47.0	47.0	58.8
On-road Vehicles (lb/day)	1.10	1.07	2.72	1.66	1.75	2.34	2.34	1.91	1.91	1.91	1.91	2.30	1.91	1.88	1.88	2.48	1.80	2.32
Ground Disturbance (lb/day)	0.057	0.057	0.104	0.047	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.023
Cut and Fill (lb/day)	-	-	0.014	0.014	7.8E-05	7.8E-05	7.8E-05	7.8E-05	7.8E-05	7.8E-05	7.8E-05	7.8E-05	7.8E-05	7.8E-05	7.8E-05	7.8E-05	7.8E-05	1.6E-04
Total Daily Emissions (lb/day)	**38.5**	**38.4**	**116.4**	**85.6**	**54.2**	**54.7**	**54.7**	**54.3**	**54.3**	**54.3**	**54.3**	**54.2**	**50.2**	**49.8**	**48.9**	**49.5**	**48.8**	**61.1**
Off-road Vehicles (tpy)	0.411	0.820	2.070	2.993	3.569	4.146	4.722	5.298	5.875	6.451	7.027	7.598	7.718	7.836	7.103	6.697	6.637	6.707
On-road Vehicles (tpy)	0.012	0.024	0.054	0.072	0.091	0.117	0.143	0.164	0.185	0.206	0.226	0.252	0.261	0.269	0.260	0.269	0.270	0.270
Ground Disturbance (tpy)	0.001	0.001	0.002	0.003	0.003	0.003	0.003	0.003	0.004	0.004	0.004	0.004	0.003	0.003	0.002	0.002	0.002	0.002
Cut and Fill (tpy)	-	-	1.5E-04	3.0E-04	3.0E-04	3.0E-04	3.1E-04	3.1E-04	3.1E-04	3.1E-04	3.1E-04	3.1E-04	3.1E-04	3.1E-04	1.6E-04	1.0E-05	1.0E-05	1.1E-05
Total Annual Emissions (tpy)	**0.424**	**0.846**	**2.126**	**3.068**	**3.664**	**4.266**	**4.868**	**5.466**	**6.063**	**6.660**	**7.258**	**7.854**	**7.982**	**8.109**	**7.365**	**6.968**	**6.908**	**6.979**
	CO_2 Emissions																	
Off-road Vehicles (lb/day)	3,312	3,278	24,939	22,980	8,689	8,689	8,689	8,689	8,689	8,689	8,689	7,485	7,246	7,143	6,125	6,125	6,125	8,389
On-road Vehicles (lb/day)	4,138	4,227	10,800	6,573	7,051	9,817	9,817	8,447	8,447	8,447	8,447	9,685	8,447	8,443	8,443	10,367	7,285	8,989
Total Daily Emissions (lb/day)	**7,449**	**7,505**	**35,739**	**29,553**	**15,740**	**18,506**	**18,506**	**17,136**	**17,136**	**17,136**	**17,136**	**17,170**	**15,693**	**15,586**	**14,567**	**16,492**	**13,410**	**17,378**
Off-road Vehicles (MT/yr)	33	66	315	544	631	717	804	891	977	1,064	1,151	1,226	1,265	1,303	1,116	0,947	0,922	0,919
On-road Vehicles (MT/yr)	41	83	191	257	327	425	523	607	692	776	860	957	1,000	1,042	1,018	1,056	1,059	1,050
Total Annual Emissions (MT/yr)	**74**	**149**	**506**	**801**	**958**	**1,143**	**1,327**	**1,498**	**1,669**	**1,840**	**2,011**	**2,183**	**2,265**	**2,345**	**2,134**	**2,004**	**1,981**	**1,969**
	CH_4 Emissions																	
Off-road Vehicles (lb/day)	0.08	0.08	0.63	0.58	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.18	0.18	0.18	0.15	0.15	0.15	0.19
On-road Vehicles (lb/day)	0.17	0.17	0.44	0.27	0.27	0.36	0.36	0.28	0.28	0.28	0.28	0.35	0.28	0.28	0.28	0.39	0.29	0.38
Total Daily Emissions (lb/day)	**0.25**	**0.25**	**1.07**	**0.85**	**0.48**	**0.56**	**0.56**	**0.48**	**0.48**	**0.48**	**0.48**	**0.53**	**0.45**	**0.45**	**0.42**	**0.53**	**0.43**	**0.57**
Off-road Vehicles (MT/yr)	0.001	0.002	0.008	0.014	0.016	0.018	0.020	0.022	0.024	0.026	0.028	0.030	0.031	0.032	0.027	0.022	0.022	0.022
On-road Vehicles (MT/yr)	0.002	0.003	0.008	0.011	0.013	0.017	0.020	0.023	0.026	0.029	0.031	0.035	0.036	0.037	0.035	0.036	0.037	0.037
Total Annual Emissions (MT/yr)	**0.003**	**0.005**	**0.016**	**0.024**	**0.029**	**0.034**	**0.040**	**0.045**	**0.050**	**0.054**	**0.059**	**0.065**	**0.067**	**0.069**	**0.062**	**0.059**	**0.059**	**0.059**

King Island CAES Project
Appendix 5.1A Table 5.1A.2
Summary of Daily and Annual ECF Construction Emissions
February 2015

Emissions Summary	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	Month 13	Month 14	Month 15	Month 16	Month 17	Month 18
	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17
	N_2O Emissions																	
Off-road Vehicles (lb/day)	0.04	0.04	0.28	0.26	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.07	0.07	0.07	0.09
On-road Vehicles (lb/day)	0.04	0.04	0.10	0.06	0.06	0.08	0.08	0.07	0.07	0.07	0.07	0.08	0.07	0.07	0.07	0.09	0.07	0.09
Total Daily Emissions (lb/day)	**0.08**	**0.08**	**0.38**	**0.32**	**0.15**	**0.18**	**0.18**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.15**	**0.15**	**0.13**	**0.16**	**0.13**	**0.17**
Off-road Vehicles (MT/yr)	0.000	0.001	0.004	0.006	0.007	0.008	0.009	0.010	0.011	0.012	0.012	0.013	0.014	0.014	0.012	0.010	0.010	0.010
On-road Vehicles (MT/yr)	0.000	0.001	0.002	0.002	0.003	0.004	0.005	0.005	0.006	0.007	0.007	0.008	0.009	0.009	0.008	0.009	0.009	0.009
Total Annual Emissions (MT/yr)	**0.001**	**0.002**	**0.005**	**0.009**	**0.010**	**0.012**	**0.014**	**0.015**	**0.017**	**0.018**	**0.020**	**0.022**	**0.022**	**0.023**	**0.021**	**0.019**	**0.019**	**0.019**

	CO_2e Emissions [a]																	
Off-road Vehicles (lb/day)	3,324	3,290	25,038	23,072	8,721	8,721	8,721	8,721	8,721	8,721	8,721	7,514	7,274	7,171	6,148	6,148	6,148	8,420
On-road Vehicles (lb/day)	4,154	4,243	10,841	6,598	7,077	9,851	9,851	8,474	8,474	8,474	8,474	9,718	8,474	8,470	8,470	10,403	7,312	9,024
Total Daily Emissions (lb/day)	**7,478**	**7,534**	**35,879**	**29,670**	**15,798**	**18,572**	**18,572**	**17,195**	**17,195**	**17,195**	**17,195**	**17,233**	**15,748**	**15,641**	**14,618**	**16,552**	**13,460**	**17,444**
Off-road Vehicles (MT/yr)	33	66	316	546	633	720	807	894	981	1,068	1,155	1,230	1,270	1,308	1,120	0,951	0,925	0,922
On-road Vehicles (MT/yr)	41	84	192	258	328	427	525	610	694	779	863	960	1,003	1,046	1,022	1,060	1,062	1,054
Total Annual Emissions (MT/yr)	**75**	**150**	**508**	**804**	**962**	**1,147**	**1,332**	**1,504**	**1,675**	**1,847**	**2,019**	**2,191**	**2,273**	**2,354**	**2,142**	**2,011**	**1,988**	**1,976**

Notes:
[a] CO_2e assumes a global warming potential (GWP) of 25 for CH_4 and 298 for N_2O (40 CFR 98 Table A-1).

King Island CAES Project
Appendix 5.1A Table 5.1A.2
Summary of Daily and Annual ECF Construction E
February 2015

Emissions Summary	Month 19	Month 20	Month 21	Month 22	Month 23	Month 24	Month 25	Month 26	Month 27
	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18
Off-road Vehicles (lb/day)	7.61	7.61	7.61	7.61	7.76	3.66	0.40	0.40	0.40
On-road Vehicles (lb/day)	0.65	0.65	0.68	0.68	0.68	0.12	-	-	-
Paving (lb/day)	-	-	-	-	-	-	-	-	-
Total Daily Emissions (lb/day)	**8.27**	**8.27**	**8.29**	**8.29**	**8.44**	**3.78**	**0.40**	**0.40**	**0.40**
Off-road Vehicles (tpy)	0.95	0.94	0.93	0.92	0.91	0.87	0.80	0.73	0.67
On-road Vehicles (tpy)	0.085	0.084	0.085	0.085	0.085	0.078	-	-	-
Paving (tpy)	-	-	-	-	-	-	-	-	-
Total Annual Emissions (tpy)	**1.04**	**1.03**	**1.02**	**1.01**	**1.00**	**0.95**	**0.80**	**0.73**	**0.67**

Off-road Vehicles (lb/day)	42.5	42.5	42.5	42.5	43.3	20.8	1.69	1.69	1.69
On-road Vehicles (lb/day)	22.0	22.0	23.1	23.1	23.1	5.6	-	-	-
Total Daily Emissions (lb/day)	**64.4**	**64.4**	**65.6**	**65.6**	**66.4**	**26.4**	**1.69**	**1.69**	**1.69**
Off-road Vehicles (tpy)	5.47	5.39	5.31	5.23	5.15	4.93	4.51	4.10	3.78
On-road Vehicles (tpy)	2.27	2.33	2.40	2.48	2.55	2.39	-	-	-
Total Annual Emissions (tpy)	**7.74**	**7.72**	**7.71**	**7.70**	**7.71**	**7.32**	**4.51**	**4.10**	**3.78**

Off-road Vehicles (lb/day)	74.6	74.6	74.6	74.6	76.3	38.8	4.21	4.21	4.21
On-road Vehicles (lb/day)	12.2	12.2	12.4	12.4	12.4	0.89	-	-	-
Total Daily Emissions (lb/day)	**86.8**	**86.8**	**86.9**	**86.9**	**88.6**	**39.7**	**4.21**	**4.21**	**4.21**
Off-road Vehicles (tpy)	9.31	9.20	9.08	8.97	8.88	8.52	7.80	7.14	6.63
On-road Vehicles (tpy)	2.35	2.26	2.17	2.09	2.00	1.78	-	-	-
Total Annual Emissions (tpy)	**11.7**	**11.5**	**11.3**	**11.1**	**10.9**	**10.3**	**7.80**	**7.14**	**6.63**

Off-road Vehicles (lb/day)	0.08	0.08	0.084	0.08	0.09	0.041	0.005	0.005	0.005
On-road Vehicles (lb/day)	0.11	0.11	0.12	0.12	0.12	0.024	-	-	-
Total Daily Emissions (lb/day)	**0.20**	**0.20**	**0.20**	**0.20**	**0.20**	**0.065**	**0.005**	**0.005**	**0.005**
Off-road Vehicles (tpy)	0.010	0.010	0.010	0.010	0.010	0.010	0.009	0.008	0.008
On-road Vehicles (tpy)	0.013	0.013	0.013	0.014	0.014	0.013	-	-	-
Total Annual Emissions (tpy)	**0.023**	**0.023**	**0.023**	**0.024**	**0.024**	**0.023**	**0.009**	**0.008**	**0.008**

King Island CAES Project
Appendix 5.1A Table 5.1A.2
Summary of Daily and Annual ECF Construction E
February 2015

Emissions Summary	Month 19	Month 20	Month 21	Month 22	Month 23	Month 24	Month 25	Month 26	Month 27
	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18
Off-road Vehicles (lb/day)	557	557	556.7	557	592	198.1	89.4	89.4	89.4
On-road Vehicles (lb/day)	9.43	9.43	9.91	9.91	9.91	2.41	-	-	-
Ground Disturbance (lb/day)	0.212	0.212	0.212	0.212	0.212	0.106	-	-	-
Cut and Fill (lb/day)	0.001	0.001	0.001	0.001	0.001	0.001	-	-	-
Total Daily Emissions (lb/day)	**566**	**566**	**566.9**	**567**	**603**	**200.6**	**89.4**	**89.4**	**89.4**
Off-road Vehicles (tpy)	63.7	64.5	65.2	66.0	67.2	64.0	60.0	56.1	52.1
On-road Vehicles (tpy)	0.940	0.973	1.011	1.049	1.087	1.027	-	-	-
Ground Disturbance (tpy)	0.016	0.017	0.019	0.020	0.021	0.021	-	-	-
Cut and Fill (tpy)	0.000	0.000	0.000	0.000	0.000	0.000	-	-	-
Total Annual Emissions (tpy)	**64.6**	**65.4**	**66.3**	**67.1**	**68.3**	**65.1**	**60.0**	**56.1**	**52.1**

Off-road Vehicles (lb/day)	58.8	58.8	58.762	58.8	62.4	21.309	9.087	9.087	9.087
On-road Vehicles (lb/day)	2.65	2.65	2.78	2.78	2.78	0.66	-	-	-
Ground Disturbance (lb/day)	0.023	0.023	0.023	0.023	0.023	0.011	-	-	-
Cut and Fill (lb/day)	1.6E-04	1.6E-04	1.6E-04	1.6E-04	1.6E-04	7.8E-05	-	-	-
Total Daily Emissions (lb/day)	**61.4**	**61.4**	**61.569**	**61.6**	**65.2**	**21.976**	**9.087**	**9.087**	**9.087**
Off-road Vehicles (tpy)	6.777	6.847	6.917	6.987	7.097	6.761	6.330	5.903	5.486
On-road Vehicles (tpy)	0.273	0.281	0.291	0.301	0.310	0.292	-	-	-
Ground Disturbance (tpy)	0.002	0.002	0.002	0.002	0.002	0.002	-	-	-
Cut and Fill (tpy)	1.2E-05	1.3E-05	1.4E-05	1.5E-05	1.5E-05	1.5E-05	-	-	-
Total Annual Emissions (tpy)	**7.052**	**7.131**	**7.210**	**7.290**	**7.410**	**7.056**	**6.330**	**5.903**	**5.486**

Off-road Vehicles (lb/day)	8,389	8,389	8,389	8,389	8,624	4,110	477	477	477
On-road Vehicles (lb/day)	9,844	9,844	10,265	10,265	10,265	2,126	-	-	-
Total Daily Emissions (lb/day)	**18,233**	**18,233**	**18,654**	**18,654**	**18,889**	**6,236**	**477**	**477**	**477**
Off-road Vehicles (MT/yr)	0,916	0,913	0,910	0,907	0,906	0,873	805	739	682
On-road Vehicles (MT/yr)	1,051	1,065	1,083	1,101	1,119	1,044	-	-	-
Total Annual Emissions (MT/yr)	**1,967**	**1,978**	**1,993**	**2,008**	**2,025**	**1,916**	**805**	**739**	**682**

Off-road Vehicles (lb/day)	0.19	0.19	0.19	0.19	0.20	0.09	0.011	0.011	0.011
On-road Vehicles (lb/day)	0.45	0.45	0.47	0.47	0.47	0.12	-	-	-
Total Daily Emissions (lb/day)	**0.64**	**0.64**	**0.66**	**0.66**	**0.67**	**0.21**	**0.011**	**0.011**	**0.011**
Off-road Vehicles (MT/yr)	0.022	0.022	0.022	0.021	0.021	0.020	0.019	0.017	0.016
On-road Vehicles (MT/yr)	0.038	0.039	0.041	0.043	0.045	0.043	-	-	-
Total Annual Emissions (MT/yr)	**0.059**	**0.061**	**0.063**	**0.065**	**0.067**	**0.063**	**0.019**	**0.017**	**0.016**

King Island CAES Project
Appendix 5.1A Table 5.1A.2
Summary of Daily and Annual ECF Construction E
February 2015

Emissions Summary	Month 19	Month 20	Month 21	Month 22	Month 23	Month 24	Month 25	Month 26	Month 27
	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18
Off-road Vehicles (lb/day)	0.09	0.09	0.09	0.09	0.09	0.041	0.005	0.005	0.005
On-road Vehicles (lb/day)	0.10	0.10	0.10	0.10	0.10	0.02	-	-	-
Total Daily Emissions (lb/day)	**0.19**	**0.19**	**0.19**	**0.19**	**0.19**	**0.066**	**0.005**	**0.005**	**0.005**
Off-road Vehicles (MT/yr)	0.010	0.010	0.010	0.010	0.010	0.009	0.008	0.008	0.007
On-road Vehicles (MT/yr)	0.009	0.009	0.010	0.010	0.010	0.010	-	-	-
Total Annual Emissions (MT/yr)	**0.019**	**0.019**	**0.019**	**0.020**	**0.020**	**0.019**	**0.008**	**0.008**	**0.007**

Off-road Vehicles (lb/day)	8,420	8,420	8,420	8,420	8,656	4,125	478	478	478
On-road Vehicles (lb/day)	9,884	9,884	10,308	10,308	10,308	2,136	-	-	-
Total Daily Emissions (lb/day)	**18,304**	**18,304**	**18,728**	**18,728**	**18,964**	**6,261**	**478**	**478**	**478**
Off-road Vehicles (MT/yr)	0,919	0,916	0,913	0,910	0,910	0,876	808	741	685
On-road Vehicles (MT/yr)	1,054	1,068	1,087	1,105	1,123	1,048	-	-	-
Total Annual Emissions (MT/yr)	**1,974**	**1,985**	**2,000**	**2,015**	**2,033**	**1,923**	**808**	**741**	**685**

Notes:
[a] CO_2e assumes a global warming potential (GWP) of 25 for CH_4 an

King Island CAES Project
Appendix 5.1A Table 5.1A.3
Off-road Equipment and Vehicle Emissions
February 2015

Equipment/Vehicle Type	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	Month 13	Month 14	Month 15	Month 16	Month 17	Month 18	Month 19	Month 20	Month 21	Month 22	Month 23	Month 24	Month 25	Month 26	Month 27
	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18
	ROG Emissions (lb/day) [a]																										
Mobilization																											
Generator	0.38	0.34	0.34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Pick Up Truck	0.55	0.52	0.52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Flatbed Delivery Truck	0.36	0.33	0.33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Skip Loader	0.14	0.14	0.14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5000 gal Water Truck	0.59	0.56	0.56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Service Truck	0.42	0.39	0.39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Lube/Fuel Trucks	0.08	0.08	0.08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Track Trencher	0.83	0.80	0.80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Dump Truck	0.18	0.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Civil Improvements																											
Dozer Cat D6R	-	-	2.52	2.52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Generator	-	-	1.35	1.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scraper Cat 623	-	-	5.59	5.59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Deere 210LE Skip Loader	-	-	0.82	0.82	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cat 140H Grader	-	-	3.20	3.20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5000 gal Water Truck	-	-	1.43	1.43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Roller Vibrator/Compactor/Other	-	-	1.18	1.76	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cat BG600D Paver	-	-	0.42	0.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-site Heavy Duty Pick Up Truck	-	-	1.05	1.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Flatbed Delivery Truck	-	-	0.49	0.49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Lube/Fuel Trucks	-	-	0.31	0.31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Service Truck	-	-	0.31	0.31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Dump Truck	-	-	0.49	0.49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Compression Plant and Power Generation Plant																											
Generator	-	-	-	-	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	-	-	-	-
Air Compressor	-	-	-	-	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	-	-	-	-
Dozer Cat D6R	-	-	-	-	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-	-	-	-
Deere 210LE Skip Loader	-	-	-	-	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	-	-	-	-
Telehandler	-	-	-	-	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	-	-	-	-
Track Trencher	-	-	-	-	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.54	-	-	-	-	-	-	-	-	-	-	-	-	-
Cat 583T Pipelayer	-	-	-	-	1.05	1.05	1.05	1.05	1.05	1.05	1.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Pick Up Truck	-	-	-	-	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	-	-	-	-
On-Site Heavy Duty Pick Up Truck	-	-	-	-	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	-	-	-	-
On-Site Flatbed Delivery Truck	-	-	-	-	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	-	-	-	-
On-Site Service Truck	-	-	-	-	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	-	-	-	-
On-Site Dump Truck	-	-	-	-	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	-	-	-	-	-	-	-	-	-	-	0.15	-	-	-	-
On-Site Lube/Fuel Trucks	-	-	-	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	-	-	-	-
Building Construction																											
On-Site Heavy Duty Pick Up Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.16	0.16	0.16	0.16	0.16	0.16	0.16	-	-	-
On-Site Flatbed Delivery Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.31	0.31	0.31	0.31	0.31	0.31	0.31	-	-	-
Generator	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-	-	-
Air Compressor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.13	0.13	0.13	0.13	0.13	0.13	0.13	-	-	-
Skip Loader	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.38	0.38	0.38	0.38	0.38	0.38	0.38	-	-	-
Crane/Boom Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.08	1.08	1.08	1.08	1.08	1.08	1.08	-	-	-
Testing and Commissioning																											
On-Site Heavy Duty Pick Up Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.33	0.33	0.33	0.33
On-Site Service Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.073	0.073	0.073	0.073
Cat BG600D Paver	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.37	-	-	-
Roller Vibrator/Compactor/Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.52	-	-	-
Daily Total	**3.5**	**3.32**	**22.3**	**19.9**	**8.5**	**8.5**	**8.5**	**8.5**	**8.5**	**8.5**	**8.5**	**7.4**	**7.3**	**6.8**	**5.3**	**5.25**	**5.25**	**7.6**	**7.6**	**7.6**	**7.61**	**7.6**	**7.8**	**3.66**	**0.40**	**0.40**	**0.40**
Annual Total (tpy) [b]	**0.04**	**0.08**	**0.32**	**0.54**	**0.63**	**0.73**	**0.82**	**0.91**	**1.01**	**1.10**	**1.19**	**1.28**	**1.32**	**1.36**	**1.17**	**1.01**	**0.97**	**0.96**	**0.95**	**0.94**	**0.93**	**0.92**	**0.91**	**0.87**	**0.80**	**0.73**	**0.67**

	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	Month 13	Month 14	Month 15	Month 16	Month 17	Month 18	Month 19	Month 20	Month 21	Month 22	Month 23	Month 24	Month 25	Month 26	Month 27
	CO Emissions (lb/day) [a]																										
Mobilization																											
Generator	1.33	1.30	1.30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Pick Up Truck	2.2	2.1	2.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Flatbed Delivery Truck	1.91	1.77	1.77	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Skip Loader	0.98	0.97	0.97	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5000 gal Water Truck	2.4	2.3	2.29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Service Truck	1.67	1.60	1.60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Lube/Fuel Trucks	0.33	0.32	0.32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Track Trencher	4.07	4.04	4.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

King Island CAES Project
Appendix 5.1A Table 5.1A.3
Off-road Equipment and Vehicle Emissions
February 2015

Equipment/Vehicle Type	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	Month 13	Month 14	Month 15	Month 16	Month 17	Month 18	Month 19	Month 20	Month 21	Month 22	Month 23	Month 24	Month 25	Month 26	Month 27
	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18
	ROG Emissions (lb/day) [a]																										
On-Site Dump Truck	0.96	0.88	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Civil Improvements																											
Dozer Cat D6R	-	-	10.1	10.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Generator	-	-	5.18	5.18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scraper Cat 623	-	-	44.6	44.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Deere 210LE Skip Loader	-	-	5.82	5.82	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cat 140H Grader	-	-	11.7	11.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5000 gal Water Truck	-	-	5.9	5.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Roller Vibrator/Compactor/Other	-	-	10.4	15.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cat BG600D Paver	-	-	2.96	2.96	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-site Heavy Duty Pick Up Truck	-	-	4.3	4.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Flatbed Delivery Truck	-	-	2.65	2.65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Lube/Fuel Trucks	-	-	1.28	1.28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Service Truck	-	-	1.3	1.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Dump Truck	-	-	2.7	2.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Compression Plant and Power Generation Plant																											
Generator	-	-	-	-	3.45	3.45	3.45	3.45	3.45	3.45	3.45	3.45	3.45	3.36	3.36	3.36	3.36	3.36	3.36	3.36	3.36	3.36	3.36	-	-	-	-
Air Compressor	-	-	-	-	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	-	-	-	-
Dozer Cat D6R	-	-	-	-	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	-	-	-	-
Deere 210LE Skip Loader	-	-	-	-	5.82	5.82	5.82	5.82	5.82	5.82	5.82	5.82	5.82	5.77	5.77	5.77	5.77	5.77	5.77	5.77	5.77	5.77	5.77	-	-	-	-
Telehandler	-	-	-	-	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.27	9.27	9.27	9.27	9.27	9.27	9.27	9.27	9.27	9.27	-	-	-	-
Track Trencher	-	-	-	-	8.09	8.09	8.09	8.09	8.09	8.09	8.09	8.09	8.09	8.05	-	-	-	-	-	-	-	-	-	-	-	-	-
Cat 583T Pipelayer	-	-	-	-	9.12	9.12	9.12	9.12	9.12	9.12	9.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Pick Up Truck	-	-	-	-	4.28	4.28	4.28	4.28	4.28	4.28	4.28	4.28	4.28	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	4.11	-	-	-	-
On-Site Heavy Duty Pick Up Truck	-	-	-	-	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	-	-	-	-
On-Site Flatbed Delivery Truck	-	-	-	-	3.54	3.54	3.54	3.54	3.54	3.54	3.54	3.54	3.54	3.28	3.28	3.28	3.28	3.28	3.28	3.28	3.28	3.28	3.28	-	-	-	-
On-Site Service Truck	-	-	-	-	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	-	-	-	-
On-Site Dump Truck	-	-	-	-	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	-	-	-	-	-	-	-	-	-	-	0.82	-	-	-	-
On-Site Lube/Fuel Trucks	-	-	-	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	-	-	-	-
Building Construction																											
On-Site Heavy Duty Pick Up Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.69	0.69	0.69	0.69	0.69	0.69	0.69	-	-	-
On-Site Flatbed Delivery Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.64	1.64	1.64	1.64	1.64	1.64	1.64	-	-	-
Generator	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.26	1.26	1.26	1.26	1.26	1.26	1.26	-	-	-
Air Compressor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.41	0.41	0.41	0.41	0.41	0.41	0.41	-	-	-
Skip Loader	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.89	2.89	2.89	2.89	2.89	2.89	2.89	-	-	-
Crane/Boom Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.57	4.57	4.57	4.57	4.57	4.57	4.57	-	-	-
Testing and Commissioning																											
On-Site Heavy Duty Pick Up Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.38	1.38	1.38	1.38
On-Site Service Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.31	0.31	0.31	0.31
Cat BG600D Paver	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.94	-	-	-
Roller Vibrator/Compactor/Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.72	-	-	-
Daily Total	**15.8**	**15.3**	**123**	**115**	**49.9**	**49.9**	**49.9**	**49.9**	**49.9**	**49.9**	**49.9**	**40.8**	**39.9**	**39.1**	**31.0**	**31.0**	**31.0**	**42.5**	**42.5**	**42.5**	**42.48**	**42.5**	**43.3**	**20.8**	**1.7**	**1.7**	**1.7**
Annual Total (tpy) [b]	**0.17**	**0.34**	**1.70**	**2.96**	**3.51**	**4.06**	**4.61**	**5.16**	**5.71**	**6.25**	**6.80**	**7.3**	**7.5**	**7.8**	**6.76**	**5.84**	**5.64**	**5.55**	**5.47**	**5.39**	**5.31**	**5.23**	**5.15**	**4.93**	**4.51**	**4.10**	**3.78**

	NO_x Emissions (lb/day) [a]																										
Mobilization																											
Generator	1.43	1.38	1.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Pick Up Truck	6.1	5.6	5.6	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Flatbed Delivery Truck	4.25	3.80	3.80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Skip Loader	1.38	1.31	1.31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5000 gal Water Truck	6.6	6.1	6.1	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Service Truck	4.61	4.25	4.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Lube/Fuel Trucks	0.92	0.85	0.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Track Trencher	7.28	7.00	7.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Dump Truck	2.12	1.90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Civil Improvements																											
Dozer Cat D6R	-	-	33.9	33.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Generator	-	-	5.50	5.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scraper Cat 623	-	-	71.2	71.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Deere 210LE Skip Loader	-	-	7.9	7.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cat 140H Grader	-	-	45.5	45.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5000 gal Water Truck	-	-	15.5	15.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

King Island CAES Project
Appendix 5.1A Table 5.1A.3
Off-road Equipment and Vehicle Emissions
February 2015

Equipment/Vehicle Type	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	Month 13	Month 14	Month 15	Month 16	Month 17	Month 18	Month 19	Month 20	Month 21	Month 22	Month 23	Month 24	Month 25	Month 26	Month 27
	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18
	ROG Emissions (lb/day) [a]																										
Roller Vibrator/Compactor/Other	-	-	15.7	23.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cat BG600D Paver	-	-	4.68	4.68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-site Heavy Duty Pick Up Truck	-	-	11.4	11.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Flatbed Delivery Truck	-	-	5.7	5.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Lube/Fuel Trucks	-	-	3.4	3.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Service Truck	-	-	3.4	3.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Dump Truck	-	-	5.7	5.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Compression Plant and Power Generation Plant																											
Generator	-	-	-	-	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.54	3.54	3.54	3.54	3.54	3.54	3.54	3.54	3.54	3.54	-	-	-	-
Air Compressor	-	-	-	-	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	-	-	-	-
Dozer Cat D6R	-	-	-	-	4.24	4.24	4.24	4.24	4.24	4.24	4.24	4.24	4.24	4.04	4.04	4.04	4.04	4.04	4.04	4.04	4.04	4.04	4.04	-	-	-	-
Deere 210LE Skip Loader	-	-	-	-	7.85	7.85	7.85	7.85	7.85	7.85	7.85	7.85	7.85	7.34	7.34	7.34	7.34	7.34	7.34	7.34	7.34	7.34	7.34	-	-	-	-
Telehandler	-	-	-	-	10.73	10.73	10.73	10.73	10.73	10.73	10.73	10.73	10.73	9.55	9.55	9.55	9.55	9.55	9.55	9.55	9.55	9.55	9.55	-	-	-	-
Track Trencher	-	-	-	-	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	13.55	-	-	-	-	-	-	-	-	-	-	-	-	-
Cat 583T Pipelayer	-	-	-	-	13.43	13.43	13.43	13.43	13.43	13.43	13.43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Pick Up Truck	-	-	-	-	11.32	11.32	11.32	11.32	11.32	11.32	11.32	11.32	11.32	10.25	10.25	10.25	10.25	10.25	10.25	10.25	10.25	10.2	10.2	-	-	-	-
On-Site Heavy Duty Pick Up Truck	-	-	-	-	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.44	3.44	3.44	3.44	3.44	3.44	3.44	3.44	3.44	3.44	-	-	-	-
On-Site Flatbed Delivery Truck	-	-	-	-	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.88	6.9	6.9	-	-	-	-
On-Site Service Truck	-	-	-	-	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.31	2.3	2.3	-	-	-	-
On-Site Dump Truck	-	-	-	-	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	-	-	-	-	-	-	-	-	-	-	1.72	-	-	-	-
On-Site Lube/Fuel Trucks	-	-	-	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	-	-	-	-
Building Construction																											
On-Site Heavy Duty Pick Up Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.72	1.72	1.72	1.72	1.72	1.72	1.72	-	-	-
On-Site Flatbed Delivery Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.4	3.4	3.4	3.4	3.4	3.4	3.4	-	-	-
Generator	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.33	1.33	1.33	1.33	1.33	1.33	1.33	-	-	-
Air Compressor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.75	0.75	0.75	0.75	0.75	0.75	0.75	-	-	-
Skip Loader	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.67	3.67	3.67	3.67	3.67	3.67	3.67	-	-	-
Crane/Boom Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12.8	12.8	12.8	12.8	12.8	12.8	12.8	-	-	-
Testing and Commissioning																											
On-Site Heavy Duty Pick Up Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.44	3.44	3.44	3.44
On-Site Service Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.77	0.77	0.77	0.77
Cat BG600D Paver	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.18	-	-	-
Roller Vibrator/Compactor/Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.76	-	-	-
Daily Total	**35**	**32**	**260**	**239**	**85**	**85**	**85**	**85**	**85**	**85**	**85**	**71**	**69**	**64**	**51**	**50.9**	**50.9**	**75**	**75**	**75**	**74.6**	**75**	**76**	**38.8**	**4.2**	**4.2**	**4.2**
Annual Total (tpy) [b]	**0.38**	**0.74**	**3.59**	**6.2**	**7.2**	**8.1**	**9.0**	**10.0**	**10.9**	**11.8**	**12.8**	**13.5**	**13.9**	**14.3**	**12.0**	**9.9**	**9.5**	**9.4**	**9.3**	**9.2**	**9.1**	**9.0**	**8.9**	**8.5**	**7.8**	**7.1**	**6.6**

	SO_2 Emissions (lb/day) [a]																										
Mobilization																											
Generator	0.0021	0.0021	0.0021	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Pick Up Truck	0.006	0.006	0.006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Flatbed Delivery Truck	0.0046	0.0046	0.0046	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Skip Loader	0.0012	0.0012	0.0012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5000 gal Water Truck	0.006	0.006	0.006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Service Truck	0.0042	0.0042	0.0042	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Lube/Fuel Trucks	0.0008	0.0008	0.0008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Track Trencher	0.0050	0.0050	0.0050	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Dump Truck	0.0023	0.0023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Civil Improvements																											
Dozer Cat D6R	-	-	0.027	0.027	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Generator	-	-	0.008	0.008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scraper Cat 623	-	-	0.061	0.061	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Deere 210LE Skip Loader	-	-	0.007	0.007	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cat 140H Grader	-	-	0.039	0.039	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5000 gal Water Truck	-	-	0.015	0.015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Roller Vibrator/Compactor/Other	-	-	0.017	0.026	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cat BG600D Paver	-	-	0.0047	0.0047	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-site Heavy Duty Pick Up Truck	-	-	0.011	0.011	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Flatbed Delivery Truck	-	-	0.007	0.007	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Lube/Fuel Trucks	-	-	0.003	0.003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Service Truck	-	-	0.003	0.003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Dump Truck	-	-	0.007	0.007	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Compression Plant and Power Generation Plant																											

King Island CAES Project
Appendix 5.1A Table 5.1A.3
Off-road Equipment and Vehicle Emissions
February 2015

Equipment/Vehicle Type	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	Month 13	Month 14	Month 15	Month 16	Month 17	Month 18	Month 19	Month 20	Month 21	Month 22	Month 23	Month 24	Month 25	Month 26	Month 27
	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18
	ROG Emissions (lb/day) [a]																										
Generator	-	-	-	-	0.0055	0.0055	0.0055	0.0055	0.0055	0.0055	0.0055	0.0055	0.0055	0.0055	0.0055	0.0055	0.0055	0.0055	0.0055	0.0055	0.0055	0.0055	0.0055	-	-	-	-
Air Compressor	-	-	-	-	0.0030	0.0030	0.0030	0.0030	0.0030	0.0030	0.0030	0.0030	0.0030	0.0030	0.0030	0.0030	0.0030	0.0030	0.0030	0.0030	0.0030	0.0030	0.0030	-	-	-	-
Dozer Cat D6R	-	-	-	-	0.0034	0.0034	0.0034	0.0034	0.0034	0.0034	0.0034	0.0034	0.0034	0.0034	0.0034	0.0034	0.0034	0.0034	0.0034	0.0034	0.0034	0.0034	0.0034	-	-	-	-
Deere 210LE Skip Loader	-	-	-	-	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	-	-	-	-
Telehandler	-	-	-	-	0.0137	0.0137	0.0137	0.0137	0.0137	0.0137	0.0137	0.0137	0.0137	0.0137	0.0137	0.0137	0.0137	0.0137	0.0137	0.0137	0.0137	0.0137	0.0137	-	-	-	-
Track Trencher	-	-	-	-	0.0099	0.0099	0.0099	0.0099	0.0099	0.0099	0.0099	0.0099	0.0099	0.0099	-	-	-	-	-	-	-	-	-	-	-	-	-
Cat 583T Pipelayer	-	-	-	-	0.0117	0.0117	0.0117	0.0117	0.0117	0.0117	0.0117	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Pick Up Truck	-	-	-	-	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.0113	0.011	0.011	-	-	-	-
On-Site Heavy Duty Pick Up Truck	-	-	-	-	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	-	-	-	-
On-Site Flatbed Delivery Truck	-	-	-	-	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	-	-	-	-
On-Site Service Truck	-	-	-	-	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	-	-	-	-
On-Site Dump Truck	-	-	-	-	0.0023	0.0023	0.0023	0.0023	0.0023	0.0023	0.0023	0.0023	-	-	-	-	-	-	-	-	-	-	0.0023	-	-	-	-
On-Site Lube/Fuel Trucks	-	-	-	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	-	-	-	-
Building Construction																											
On-Site Heavy Duty Pick Up Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.002	0.002	0.002	0.002	0.002	0.002	0.002	-	-	-
On-Site Flatbed Delivery Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.005	0.005	0.005	0.005	0.005	0.005	0.005	-	-	-
Generator	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.002	0.002	0.002	0.002	0.002	0.002	0.002	-	-	-
Air Compressor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.001	0.001	0.001	0.001	0.001	0.001	0.001	-	-	-
Skip Loader	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.004	0.004	0.004	0.004	0.004	0.004	0.004	-	-	-
Crane/Boom Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.009	0.009	0.009	0.009	0.009	0.009	0.009	-	-	-
Testing and Commissioning																											
On-Site Heavy Duty Pick Up Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.004	0.004	0.004	0.004
On-Site Service Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.001	0.001	0.001	0.001
Cat BG600D Paver	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.005	-	-	-
Roller Vibrator/Compactor/Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.009	-	-	-
Daily Total	**0.03**	**0.03**	**0.24**	**0.22**	**0.09**	**0.09**	**0.09**	**0.09**	**0.09**	**0.09**	**0.09**	**0.07**	**0.07**	**0.07**	**0.06**	**0.06**	**0.06**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.09**	**0.041**	**0.005**	**0.005**	**0.005**
Annual Total (tpy) [b]	**0.000**	**0.001**	**0.003**	**0.006**	**0.007**	**0.008**	**0.009**	**0.010**	**0.011**	**0.011**	**0.012**	**0.013**	**0.014**	**0.014**	**0.012**	**0.010**	**0.010**	**0.010**	**0.010**	**0.010**	**0.010**	**0.010**	**0.010**	**0.010**	**0.009**	**0.008**	**0.008**

	PM_{10} Emissions (lb/day) [a, c]																										
Mobilization																											
Generator	0.10	0.093	0.093	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Pick Up Truck	107.3	107.3	107.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Flatbed Delivery Truck	71.5	71.5	71.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Skip Loader	0.11	0.10	0.10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5000 gal Water Truck	89.5	89.5	89.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Service Truck	35.9	35.9	35.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Lube/Fuel Trucks	17.9	17.9	17.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Track Trencher	0.57	0.55	0.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Dump Truck	35.8	35.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Civil Improvements																											
Dozer Cat D6R	-	-	1.31	1.31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Generator	-	-	0.37	0.37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scraper Cat 623	-	-	2.87	2.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Deere 210LE Skip Loader	-	-	0.60	0.60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cat 140H Grader	-	-	1.48	1.48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5000 gal Water Truck	-	-	143	143	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Roller Vibrator/Compactor/Other	-	-	0.61	0.91	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cat BG600D Paver	-	-	0.23	0.23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-site Heavy Duty Pick Up Truck	-	-	215	215	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Flatbed Delivery Truck	-	-	107	107	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Lube/Fuel Trucks	-	-	72	72	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Service Truck	-	-	72	72	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Dump Truck	-	-	107	107	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Compression Plant and Power Generation Plant																											
Generator	-	-	-	-	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	-	-	-	-
Air Compressor	-	-	-	-	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	-	-	-	-
Dozer Cat D6R	-	-	-	-	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	-	-	-	-
Deere 210LE Skip Loader	-	-	-	-	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	-	-	-	-
Telehandler	-	-	-	-	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	-	-	-	-
Track Trencher	-	-	-	-	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.06	-	-	-	-	-	-	-	-	-	-	-	-	-
Cat 583T Pipelayer	-	-	-	-	0.55	0.55	0.55	0.55	0.55	0.55	0.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Pick Up Truck	-	-	-	-	143	143	143	143	143	143	143	143	143	143	143	143	143	143	143	143	143	143	143	-	-	-	-
On-Site Heavy Duty Pick Up Truck	-	-	-	-	71.5	71.5	71.5	71.5	71.5	71.5	71.5	71.5	71.5	71.5	71.5	71.5	71.5	71.5	71.5	71.5	71.5	71.5	71.5	-	-	-	-

King Island CAES Project
Appendix 5.1A Table 5.1A.3
Off-road Equipment and Vehicle Emissions
February 2015

Equipment/Vehicle Type	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	Month 13	Month 14	Month 15	Month 16	Month 17	Month 18	Month 19	Month 20	Month 21	Month 22	Month 23	Month 24	Month 25	Month 26	Month 27
	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18
	ROG Emissions (lb/day) [a]																										
On-Site Flatbed Delivery Truck	-	-	-	-	143.0	143.0	143.0	143.0	143.0	143.0	143.0	143.0	143.0	143.0	143.0	143.0	143.0	143.0	143.0	143.0	143.0	143.0	143.0	-	-	-	-
On-Site Service Truck	-	-	-	-	53.6	53.6	53.6	53.6	53.6	53.6	53.6	53.6	53.6	53.6	53.6	53.6	53.6	53.6	53.6	53.6	53.6	53.6	53.6	-	-	-	-
On-Site Dump Truck	-	-	-	-	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8	-	-	-	-	-	-	-	-	-	-	35.7	-	-	-	-
On-Site Lube/Fuel Trucks	-	-	-	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	-	-	-	-
Building Construction																											
On-Site Heavy Duty Pick Up Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	35.8	35.8	35.8	35.8	35.8	35.8	35.8	-	-	-
On-Site Flatbed Delivery Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	71.5	71.5	71.5	71.5	71.5	71.5	71.5	-	-	-
Generator	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.08	0.08	0.08	0.08	0.08	0.08	0.08	-	-	-
Air Compressor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.04	0.04	0.04	0.04	0.04	0.04	0.04	-	-	-
Skip Loader	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.28	0.28	0.28	0.28	0.28	0.28	0.28	-	-	-
Crane/Boom Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.57	0.57	0.57	0.57	0.57	0.57	0.57	-	-	-
Testing and Commissioning																											
On-Site Heavy Duty Pick Up Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	71.5	71.5	71.5	71.5
On-Site Service Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17.9	17.9	17.9	17.9
Cat BG600D Paver	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.21	-	-	-
Roller Vibrator/Compactor/Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.26	-	-	-
Daily Total	**359**	**358**	**1046**	**759**	**486**	**486**	**486**	**486**	**486**	**486**	**486**	**486**	**450**	**450**	**449**	**449**	**449**	**557**	**557**	**557**	**557**	**557**	**592**	**198**	**89**	**89**	**89**
Annual Total (tpy) [b]	**3.94**	**7.9**	**19.4**	**27.7**	**33.1**	**38.4**	**43.8**	**49.1**	**54.5**	**59.8**	**65.2**	**71**	**72**	**73**	**66.0**	**62.5**	**62.1**	**62.9**	**63.7**	**64.5**	**65.2**	**66.0**	**67.2**	**64.0**	**60.0**	**56.1**	**52.1**

	$PM_{2.5}$ Emissions (lb/day) [a, c]																										
Mobilization																											
Generator	0.10	0.093	0.093	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Pick Up Truck	10.95	10.93	10.93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Flatbed Delivery Truck	7.29	7.27	7.27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Skip Loader	0.10	0.09	0.09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5000 gal Water Truck	9.18	9.16	9.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Service Truck	3.75	3.74	3.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Lube/Fuel Trucks	1.82	1.82	1.82	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Track Trencher	0.52	0.51	0.51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Dump Truck	3.64	3.63	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Civil Improvements																											
Dozer Cat D6R	-	-	1.20	1.20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Generator	-	-	0.37	0.37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scraper Cat 623	-	-	2.64	2.64	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Deere 210LE Skip Loader	-	-	0.56	0.56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cat 140H Grader	-	-	1.36	1.36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5000 gal Water Truck	-	-	14.9	14.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Roller Vibrator/Compactor/Other	-	-	0.56	0.84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cat BG600D Paver	-	-	0.21	0.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-site Heavy Duty Pick Up Truck	-	-	21.9	21.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Flatbed Delivery Truck	-	-	10.9	10.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Lube/Fuel Trucks	-	-	7.3	7.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Service Truck	-	-	7.3	7.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Dump Truck	-	-	10.9	10.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Compression Plant and Power Generation Plant																											
Generator	-	-	-	-	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	-	-	-	-
Air Compressor	-	-	-	-	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	-	-	-	-
Dozer Cat D6R	-	-	-	-	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	-	-	-	-
Deere 210LE Skip Loader	-	-	-	-	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	-	-	-	-
Telehandler	-	-	-	-	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	-	-	-	-
Track Trencher	-	-	-	-	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	0.98	-	-	-	-	-	-	-	-	-	-	-	-	-
Cat 583T Pipelayer	-	-	-	-	0.51	0.51	0.51	0.51	0.51	0.51	0.51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Pick Up Truck	-	-	-	-	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	-	-	-	-
On-Site Heavy Duty Pick Up Truck	-	-	-	-	7.29	7.29	7.29	7.29	7.29	7.29	7.29	7.29	7.29	7.27	7.27	7.27	7.27	7.27	7.27	7.27	7.27	7.27	7.27	-	-	-	-
On-Site Flatbed Delivery Truck	-	-	-	-	14.54	14.54	14.54	14.54	14.54	14.54	14.54	14.54	14.54	14.51	14.51	14.51	14.51	14.51	14.51	14.51	14.51	14.51	14.51	-	-	-	-
On-Site Service Truck	-	-	-	-	5.45	5.45	5.45	5.45	5.45	5.45	5.45	5.45	5.45	5.44	5.44	5.44	5.44	5.44	5.44	5.44	5.44	5.44	5.44	-	-	-	-
On-Site Dump Truck	-	-	-	-	3.63	3.63	3.63	3.63	3.63	3.63	3.63	3.63	-	-	-	-	-	-	-	-	-	-	3.63	-	-	-	-
On-Site Lube/Fuel Trucks	-	-	-	3.64	3.64	3.64	3.64	3.64	3.64	3.64	3.64	3.64	3.64	3.63	3.63	3.63	3.63	3.63	3.63	3.63	3.63	3.63	3.63	-	-	-	-
Building Construction																											
On-Site Heavy Duty Pick Up Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.64	3.64	3.64	3.64	3.64	3.64	3.64	-	-	-
On-Site Flatbed Delivery Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.25	7.25	7.25	7.25	7.25	7.25	7.25	-	-	-
Generator	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.084	0.084	0.084	0.084	0.084	0.084	0.084	-	-	-

King Island CAES Project
Appendix 5.1A Table 5.1A.3
Off-road Equipment and Vehicle Emissions
February 2015

Equipment/Vehicle Type	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	Month 13	Month 14	Month 15	Month 16	Month 17	Month 18	Month 19	Month 20	Month 21	Month 22	Month 23	Month 24	Month 25	Month 26	Month 27
	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18
	ROG Emissions (lb/day) [a]																										
Air Compressor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.039	0.039	0.039	0.039	0.039	0.039	0.039	-	-	-
Skip Loader	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.25	0.25	0.25	0.25	0.25	0.25	0.25	-	-	-
Crane/Boom Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.52	0.52	0.52	0.52	0.52	0.52	0.52	-	-	-
Testing and Commissioning																											
On-Site Heavy Duty Pick Up Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.27	7.27	7.27	7.27
On-Site Service Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.81	1.81	1.81	1.81
Cat BG600D Paver	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.19	-	-	-
Roller Vibrator/Compactor/Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.24	-	-	-
Daily Total	**37.4**	**37.2**	**114**	**84**	**52.4**	**52.4**	**52.4**	**52.4**	**52.4**	**52.4**	**52.4**	**51.9**	**48.3**	**47.9**	**47.0**	**47.0**	**47.0**	**58.8**	**58.8**	**58.8**	**58.76**	**58.8**	**62.4**	**21.3**	**9.1**	**9.1**	**9.1**
Annual Total (tpy) [b]	**0.41**	**0.82**	**2.07**	**2.99**	**3.57**	**4.15**	**4.72**	**5.30**	**5.87**	**6.45**	**7.0**	**7.6**	**7.7**	**7.8**	**7.1**	**6.70**	**6.64**	**6.71**	**6.78**	**6.85**	**6.92**	**6.99**	**7.10**	**6.76**	**6.33**	**5.90**	**5.49**

	CO_2 Emissions (lb/day) [a]																										
Mobilization																											
Generator	167	167	167	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Pick Up Truck	0,590	0,584	0,584	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Flatbed Delivery Truck	484	478	478	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Skip Loader	132	130	130	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5000 gal Water Truck	0,638	0,631	0,631	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Service Truck	447	442	442	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Lube/Fuel Trucks	89	88	88	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Track Trencher	523	517	517	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Dump Truck	242	239	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Civil Improvements																											
Dozer Cat D6R	-	-	2,847	2,847	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Generator	-	-	668	668	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scraper Cat 623	-	-	6,258	6,258	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Deere 210LE Skip Loader	-	-	0,781	0,781	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cat 140H Grader	-	-	4,107	4,107	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5000 gal Water Truck	-	-	1,616	1,616	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Roller Vibrator/Compactor/Other	-	-	1,806	2,710	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cat BG600D Paver	-	-	487	487	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-site Heavy Duty Pick Up Truck	-	-	1,187	1,187	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Flatbed Delivery Truck	-	-	0,718	0,718	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Lube/Fuel Trucks	-	-	0,354	0,354	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Service Truck	-	-	0,354	0,354	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Dump Truck	-	-	0,718	0,718	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Compression Plant and Power Generation Plant																											
Generator	-	-	-	-	445	445	445	445	445	445	445	445	445	445	445	445	445	445	445	445	445	445	445	-	-	-	-
Air Compressor	-	-	-	-	241	241	241	241	241	241	241	241	241	241	241	241	241	241	241	241	241	241	241	-	-	-	-
Dozer Cat D6R	-	-	-	-	356	356	356	356	356	356	356	356	356	351	351	351	351	351	351	351	351	351	351	-	-	-	-
Deere 210LE Skip Loader	-	-	-	-	781	781	781	781	781	781	781	781	781	768	768	768	768	768	768	768	768	768	768	-	-	-	-
Telehandler	-	-	-	-	1417	1417	1417	1417	1417	1417	1417	1417	1417	1395	1395	1395	1395	1395	1395	1395	1395	1395	1395	-	-	-	-
Track Trencher	-	-	-	-	1034	1034	1034	1034	1034	1034	1034	1034	1034	1018	-	-	-	-	-	-	-	-	-	-	-	-	-
Cat 583T Pipelayer	-	-	-	-	1204	1204	1204	1204	1204	1204	1204	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Pick Up Truck	-	-	-	-	1,179	1,179	1,179	1,179	1,179	1,179	1,179	1,179	1,179	1,161	1,161	1,161	1,161	1,161	1,161	1,161	1161	1,161	1,161	-	-	-	-
On-Site Heavy Duty Pick Up Truck	-	-	-	-	396	396	396	396	396	396	396	396	396	390	390	390	390	390	390	390	390	390	390	-	-	-	-
On-Site Flatbed Delivery Truck	-	-	-	-	0,957	0,957	0,957	0,957	0,957	0,957	0,957	0,957	0,957	0,941	0,941	0,941	0,941	0,941	0,941	0,941	941	0,941	0,941	-	-	-	-
On-Site Service Truck	-	-	-	-	0,265	0,265	0,265	0,265	0,265	0,265	0,265	0,265	0,265	0,261	0,261	0,261	0,261	0,261	0,261	0,261	261	0,261	0,261	-	-	-	-
On-Site Dump Truck	-	-	-	-	239	239	239	239	239	239	239	239	-	-	-	-	-	-	-	-	-	-	235	-	-	-	-
On-Site Lube/Fuel Trucks	-	-	-	0,177	0,177	0,177	0,177	0,177	0,177	0,177	0,177	0,177	0,177	0,174	0,174	0,174	0,174	0,174	0,174	0,174	0,174	0,174	0,174	-	-	-	-
Building Construction																											
On-Site Heavy Duty Pick Up Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	195	195	195	195	195	195	195	-	-	-
On-Site Flatbed Delivery Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,470	0,470	0,470	0,470	0,470	0,470	0,470	-	-	-
Generator	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	167	167	167	167	167	167	167	-	-	-
Air Compressor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	90	90	90	90	90	90	90	-	-	-
Skip Loader	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	384	384	384	384	384	384	384	-	-	-
Crane/Boom Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	958	958	958	958	958	958	958	-	-	-
Testing and Commissioning																											
On-Site Heavy Duty Pick Up Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,390	0,390	0,390	0,390
On-Site Service Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,087	0,087	0,087	0,087
Cat BG600D Paver	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	480	-	-	-
Roller Vibrator/Compactor/Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	890	-	-	-

King Island CAES Project
Appendix 5.1A Table 5.1A.3
Off-road Equipment and Vehicle Emissions
February 2015

Equipment/Vehicle Type	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	Month 13	Month 14	Month 15	Month 16	Month 17	Month 18	Month 19	Month 20	Month 21	Month 22	Month 23	Month 24	Month 25	Month 26	Month 27
	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18
	ROG Emissions (lb/day) [a]																										
Daily Total	3,312	3,278	24,939	22,980	8,689	8,689	8,689	8,689	8,689	8,689	8,689	7,485	7,246	7,143	6,125	6,125	6,125	8,389	8,389	8,389	8,389	8,389	8,624	4,110	0,477	0,477	0,477
Annual Total (MT/yr) [b]	33	66	315	544	631	717	804	891	977	1,064	1,151	1,226	1,265	1,303	1,116	947	922	919	916	913	910	907	906	873	805	739	682

	CH_4 Emissions (lb/day) [d]																										
Mobilization																											
Generator	0.0042	0.0042	0.0042	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Pick Up Truck	0.013	0.013	0.013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Flatbed Delivery Truck	0.0110	0.0110	0.0110	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Skip Loader	0.0029	0.0029	0.0029	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5000 gal Water Truck	0.014	0.014	0.014	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Service Truck	0.0101	0.0101	0.0101	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Lube/Fuel Trucks	0.002	0.002	0.002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Track Trencher	0.016	0.016	0.016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Dump Truck	0.005	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Civil Improvements																											
Dozer Cat D6R	-	-	0.073	0.073	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Generator	-	-	0.017	0.017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scraper Cat 623	-	-	0.181	0.181	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Deere 210LE Skip Loader	-	-	0.017	0.017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cat 140H Grader	-	-	0.101	0.101	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5000 gal Water Truck	-	-	0.037	0.037	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Roller Vibrator/Compactor/Other	-	-	0.041	0.061	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cat BG600D Paver	-	-	0.012	0.012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-site Heavy Duty Pick Up Truck	-	-	0.027	0.027	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Flatbed Delivery Truck	-	-	0.016	0.016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Lube/Fuel Trucks	-	-	0.008	0.008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Service Truck	-	-	0.008	0.008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Dump Truck	-	-	0.016	0.016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Compression Plant and Power Generation Plant																											
Generator	-	-	-	-	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	-	-	-	-
Air Compressor	-	-	-	-	0.0060	0.0060	0.0060	0.0060	0.0060	0.0060	0.0060	0.0060	0.0060	0.0060	0.0060	0.0060	0.0060	0.0060	0.0060	0.0060	0.0060	0.0060	0.0060	-	-	-	-
Dozer Cat D6R	-	-	-	-	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	0.0092	-	-	-	-
Deere 210LE Skip Loader	-	-	-	-	0.0173	0.0173	0.0173	0.0173	0.0173	0.0173	0.0173	0.0173	0.0173	0.0173	0.0173	0.0173	0.0173	0.0173	0.0173	0.0173	0.0173	0.0173	0.0173	-	-	-	-
Telehandler	-	-	-	-	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	-	-	-	-
Track Trencher	-	-	-	-	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	-	-	-	-	-	-	-	-	-	-	-	-	-
Cat 583T Pipelayer	-	-	-	-	0.021	0.021	0.021	0.021	0.021	0.021	0.021	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Pick Up Truck	-	-	-	-	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	-	-	-	-
On-Site Heavy Duty Pick Up Truck	-	-	-	-	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	-	-	-	-
On-Site Flatbed Delivery Truck	-	-	-	-	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	-	-	-	-
On-Site Service Truck	-	-	-	-	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	-	-	-	-
On-Site Dump Truck	-	-	-	-	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	-	-	-	-	-	-	-	-	-	-	0.005	-	-	-	-
On-Site Lube/Fuel Trucks	-	-	-	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	-	-	-	-
Building Construction																											
On-Site Heavy Duty Pick Up Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.005	0.005	0.005	0.005	0.005	0.005	0.005	-	-	-
On-Site Flatbed Delivery Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.011	0.011	0.011	0.011	0.011	0.011	0.011	-	-	-
Generator	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0042	0.0042	0.0042	0.0042	0.0042	0.0042	0.0042	-	-	-
Air Compressor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	-	-	-
Skip Loader	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0086	0.0086	0.0086	0.0086	0.0086	0.0086	0.0086	-	-	-
Crane/Boom Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.017	0.017	0.017	0.017	0.017	0.017	0.017	-	-	-
Testing and Commissioning																											
On-Site Heavy Duty Pick Up Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.009	0.009	0.009	0.009
On-Site Service Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.002	0.002	0.002	0.002
Cat BG600D Paver	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.012	-	-	-
Roller Vibrator/Compactor/Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.020	-	-	-
Daily Total	**0.08**	**0.08**	**0.63**	**0.58**	**0.20**	**0.20**	**0.20**	**0.20**	**0.20**	**0.20**	**0.20**	**0.18**	**0.18**	**0.18**	**0.15**	**0.15**	**0.15**	**0.19**	**0.19**	**0.19**	**0.19**	**0.19**	**0.20**	**0.09**	**0.01**	**0.01**	**0.01**
Annual Total (MT/yr) [b]	**0.0008**	**0.0016**	**0.008**	**0.014**	**0.016**	**0.018**	**0.020**	**0.022**	**0.024**	**0.026**	**0.028**	**0.030**	**0.031**	**0.032**	**0.027**	**0.022**	**0.022**	**0.022**	**0.022**	**0.022**	**0.022**	**0.021**	**0.021**	**0.020**	**0.019**	**0.017**	**0.016**

	N_2O Emissions (lb/day) [d]																										
Mobilization																											
Generator	0.0019	0.0019	0.0019	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Pick Up Truck	0.006	0.006	0.006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Flatbed Delivery Truck	0.0049	0.0049	0.0049	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

King Island CAES Project
Appendix 5.1A Table 5.1A.3
Off-road Equipment and Vehicle Emissions
February 2015

Equipment/Vehicle Type	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	Month 13	Month 14	Month 15	Month 16	Month 17	Month 18	Month 19	Month 20	Month 21	Month 22	Month 23	Month 24	Month 25	Month 26	Month 27
	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18
	ROG Emissions (lb/day) [a]																										
Skip Loader	0.0013	0.0013	0.0013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5000 gal Water Truck	0.006	0.006	0.006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Service Truck	0.0045	0.0045	0.0045	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Lube/Fuel Trucks	0.0009	0.0009	0.0009	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Track Trencher	0.0070	0.0070	0.0070	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Dump Truck	0.0025	0.0025	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Civil Improvements																											
Dozer Cat D6R	-	-	0.033	0.033	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Generator	-	-	0.0075	0.0075	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scraper Cat 623	-	-	0.081	0.081	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Deere 210LE Skip Loader	-	-	0.008	0.008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cat 140H Grader	-	-	0.045	0.045	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5000 gal Water Truck	-	-	0.017	0.017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Roller Vibrator/Compactor/Other	-	-	0.018	0.027	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cat BG600D Paver	-	-	0.005	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-site Heavy Duty Pick Up Truck	-	-	0.012	0.012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Flatbed Delivery Truck	-	-	0.007	0.007	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Lube/Fuel Trucks	-	-	0.004	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Service Truck	-	-	0.004	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Dump Truck	-	-	0.007	0.007	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Compression Plant and Power Generation Plant																											
Generator	-	-	-	-	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	-	-	-	-
Air Compressor	-	-	-	-	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	-	-	-	-
Dozer Cat D6R	-	-	-	-	0.0041	0.0041	0.0041	0.0041	0.0041	0.0041	0.0041	0.0041	0.0041	0.0041	0.0041	0.0041	0.0041	0.0041	0.0041	0.0041	0.0041	0.0041	0.0041	-	-	-	-
Deere 210LE Skip Loader	-	-	-	-	0.0078	0.0078	0.0078	0.0078	0.0078	0.0078	0.0078	0.0078	0.0078	0.0077	0.0077	0.0077	0.0077	0.0077	0.0077	0.0077	0.0077	0.0077	0.0077	-	-	-	-
Telehandler	-	-	-	-	0.0153	0.0153	0.0153	0.0153	0.0153	0.0153	0.0153	0.0153	0.0153	0.0153	0.0153	0.0153	0.0153	0.0153	0.0153	0.0153	0.0153	0.0153	0.0153	-	-	-	-
Track Trencher	-	-	-	-	0.0140	0.0140	0.0140	0.0140	0.0140	0.0140	0.0140	0.0140	0.0140	0.0140	-	-	-	-	-	-	-	-	-	-	-	-	-
Cat 583T Pipelayer	-	-	-	-	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093	0.0093	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
On-Site Pick Up Truck	-	-	-	-	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	-	-	-	-
On-Site Heavy Duty Pick Up Truck	-	-	-	-	0.0041	0.0041	0.0041	0.0041	0.0041	0.0041	0.0041	0.0041	0.0041	0.0041	0.0041	0.0041	0.0041	0.0041	0.0041	0.0041	0.0041	0.0041	0.0041	-	-	-	-
On-Site Flatbed Delivery Truck	-	-	-	-	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	-	-	-	-
On-Site Service Truck	-	-	-	-	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	-	-	-	-
On-Site Dump Truck	-	-	-	-	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	-	-	-	-	-	-	-	-	-	-	0.0025	-	-	-	-
On-Site Lube/Fuel Trucks	-	-	-	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	-	-	-	-
Building Construction																											
On-Site Heavy Duty Pick Up Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	-	-	-
On-Site Flatbed Delivery Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.005	0.005	0.005	0.005	0.005	0.005	0.005	-	-	-
Generator	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0019	0.0019	0.0019	0.0019	0.0019	0.0019	0.0019	-	-	-
Air Compressor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	-	-	-
Skip Loader	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0039	0.0039	0.0039	0.0039	0.0039	0.0039	0.0039	-	-	-
Crane/Boom Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	-	-	-
Testing and Commissioning																											
On-Site Heavy Duty Pick Up Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.004	0.004	0.004	0.004
On-Site Service Truck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.001	0.001	0.001	0.001
Cat BG600D Paver	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0054	-	-	-
Roller Vibrator/Compactor/Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0091	-	-	-
Daily Total	**0.04**	**0.04**	**0.28**	**0.26**	**0.09**	**0.09**	**0.09**	**0.09**	**0.09**	**0.09**	**0.09**	**0.08**	**0.08**	**0.08**	**0.07**	**0.07**	**0.07**	**0.09**	**0.09**	**0.09**	**0.087**	**0.09**	**0.09**	**0.041**	**0.005**	**0.005**	**0.005**
Annual Total (MT/yr) [b]	**0.0004**	**0.0007**	**0.004**	**0.006**	**0.007**	**0.008**	**0.009**	**0.010**	**0.011**	**0.012**	**0.012**	**0.013**	**0.014**	**0.014**	**0.012**	**0.010**	**0.010**	**0.010**	**0.010**	**0.010**	**0.010**	**0.010**	**0.010**	**0.009**	**0.008**	**0.008**	**0.007**

Notes:

[a] Emission rates developed from Appendix D of CalEEMod User's Guide (Environ, 2013).

[b] Annual emissions are a rolling 12-month total, assuming 22 working days per month.

[c] PM_{10} and $PM_{2.5}$ emission rates include both exhaust and road dust.

[d] Emission rates developed from The Climate Registry 2014 Default Emission Factors, Table 13.7 (TCR, 2014).

King Island CAES Project
Appendix 5.1A Table 5.1A.4
On-road Vehicle Emissions
February 2015

Vehicle Type	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	Month 13	Month 14	Month 15	Month 16	Month 17	Month 18	Month 19	Month 20	Month 21	Month 22	Month 23	Month 24
	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17
	ROG Emissions (lb/day) [a]																							
Mobilization																								
Worker Commute Bus, Small	0.014	0.012	0.012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Worker Commute Car	0.26	0.21	0.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water Delivery Truck	0.085	0.055	0.055	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Concrete Delivery	-	0.006	0.006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equipment/Material Delivery	0.053	0.034	0.034	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Civil Improvements																								
Worker Commute Car	-	-	0.33	0.33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water Delivery Truck	-	-	0.11	0.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equipment/Material Delivery	-	-	0.034	0.034	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Compression Plant and Power Generation Plant																								
Worker Commute Bus, Small	-	-	-	-	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	-
Worker Commute Car	-	-	-	-	0.33	0.43	0.43	0.33	0.33	0.33	0.33	0.42	0.33	0.26	0.26	0.37	0.27	0.27	0.34	0.34	0.34	0.34	0.34	-
Concrete Delivery	-	-	-	-	0.018	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.10	0.10	0.10	0.017	0.017	-	-	-	-	-	-
Equipment/Material Delivery	-	-	-	-	0.081	0.081	0.081	0.081	0.081	0.081	0.081	0.081	0.081	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075	-
Equipment/Material Delivery	-	-	-	-	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	-
Building Construction																								
Worker Commute Car	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.094	0.094	0.094	0.12	0.12	0.12	0.12
Equipment/Material Delivery	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.006	0.006	0.006	0.006	0.006	0.006	0.006
Daily Total	**0.41**	**0.32**	**0.79**	**0.47**	**0.58**	**0.77**	**0.77**	**0.67**	**0.67**	**0.67**	**0.67**	**0.76**	**0.67**	**0.57**	**0.57**	**0.68**	**0.50**	**0.60**	**0.65**	**0.65**	**0.68**	**0.68**	**0.68**	**0.12**
Annual Total (tpy) [b]	**0.005**	**0.008**	**0.017**	**0.022**	**0.028**	**0.037**	**0.045**	**0.053**	**0.060**	**0.067**	**0.075**	**0.083**	**0.086**	**0.089**	**0.086**	**0.089**	**0.088**	**0.086**	**0.085**	**0.084**	**0.085**	**0.085**	**0.085**	**0.078**

	CO Emissions (lb/day) [a]																							
Mobilization																								
Worker Commute Bus, Small	0.40	0.34	0.34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Worker Commute Car	10.1	8.86	8.86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water Delivery Truck	0.47	0.35	0.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Concrete Delivery	-	0.03	0.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equipment/Material Delivery	0.30	0.21	0.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Civil Improvements																								
Worker Commute Car	-	-	13.8	13.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water Delivery Truck	-	-	0.69	0.69	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equipment/Material Delivery	-	-	0.21	0.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Compression Plant and Power Generation Plant																								
Worker Commute Bus, Small	-	-	-	-	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	-
Worker Commute Car	-	-	-	-	13.8	18.0	18.0	13.8	13.8	13.8	13.8	17.6	13.8	12.0	12.0	17.2	12.7	12.7	15.7	15.7	15.7	15.7	15.7	-
Concrete Delivery	-	-	-	-	0.11	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.65	0.65	0.65	0.11	0.11	-	-	-	-	-	-
Equipment/Material Delivery	-	-	-	-	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	-
Equipment/Material Delivery	-	-	-	-	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	-
Building Construction																								
Worker Commute Car	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.41	4.41	4.41	5.55	5.55	5.55	5.55
Equipment/Material Delivery	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.041	0.041	0.041	0.041	0.041	0.041	0.041
Daily Total	**11.3**	**9.79**	**24.5**	**14.8**	**15.8**	**20.6**	**20.6**	**16.3**	**16.3**	**16.3**	**16.3**	**20.2**	**16.3**	**14.5**	**14.5**	**19.7**	**14.6**	**19.0**	**22.0**	**22.0**	**23.1**	**23.1**	**23.1**	**5.59**
Annual Total (tpy) [b]	**0.12**	**0.23**	**0.50**	**0.66**	**0.84**	**1.06**	**1.29**	**1.47**	**1.65**	**1.83**	**2.01**	**2.23**	**2.29**	**2.34**	**2.23**	**2.28**	**2.27**	**2.25**	**2.27**	**2.33**	**2.40**	**2.48**	**2.55**	**2.39**

	NO_x Emissions (lb/day) [a]																							
Mobilization																								
Worker Commute Bus, Small	0.21	0.18	0.18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Worker Commute Car	1.06	0.93	0.93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water Delivery Truck	4.65	4.00	4.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Concrete Delivery	-	0.40	0.40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equipment/Material Delivery	2.01	1.68	1.68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Civil Improvements																								
Worker Commute Car	-	-	1.46	1.46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water Delivery Truck	-	-	8.01	8.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equipment/Material Delivery	-	-	1.68	1.68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

King Island CAES Project
Appendix 5.1A Table 5.1A.4
On-road Vehicle Emissions
February 2015

Vehicle Type	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	Month 13	Month 14	Month 15	Month 16	Month 17	Month 18	Month 19	Month 20	Month 21	Month 22	Month 23	Month 24
	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17
	ROG Emissions (lb/day) [a]																							
Compression Plant and Power Generation Plant																								
Worker Commute Bus, Small	-	-	-	-	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	-
Worker Commute Car	-	-	-	-	1.45	1.90	1.90	1.45	1.45	1.45	1.45	1.85	1.45	1.29	1.29	1.84	1.35	1.35	1.68	1.68	1.68	1.68	1.68	-
Concrete Delivery	-	-	-	-	1.28	7.69	7.69	7.69	7.69	7.69	7.69	7.69	7.69	6.81	6.81	6.81	1.13	1.13	-	-	-	-	-	-
Equipment/Material Delivery	-	-	-	-	4.03	4.03	4.03	4.03	4.03	4.03	4.03	4.03	4.03	3.57	3.57	3.57	3.57	3.57	3.57	3.57	3.57	3.57	3.57	-
Equipment/Material Delivery	-	-	-	-	6.72	6.72	6.72	6.72	6.72	6.72	6.72	6.72	6.72	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	-
Building Construction																								
Worker Commute Car	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.47	0.47	0.47	0.59	0.59	0.59	0.59
Equipment/Material Delivery	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Daily Total	**7.93**	**7.20**	**18.3**	**11.1**	**13.8**	**20.6**	**20.6**	**20.2**	**20.2**	**20.2**	**20.2**	**20.6**	**20.2**	**17.9**	**17.9**	**18.4**	**12.3**	**13.0**	**12.2**	**12.2**	**12.4**	**12.4**	**12.4**	**0.89**
Annual Total (tpy) [b]	**0.087**	**0.17**	**0.37**	**0.49**	**0.64**	**0.87**	**1.10**	**1.32**	**1.54**	**1.76**	**1.98**	**2.21**	**2.35**	**2.46**	**2.46**	**2.54**	**2.52**	**2.44**	**2.35**	**2.26**	**2.17**	**2.09**	**2.00**	**1.78**

	SO_2 Emissions (lb/day) [a]																							
Mobilization																								
Worker Commute Bus, Small	0.001	0.001	0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Worker Commute Car	0.033	0.033	0.033	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water Delivery Truck	0.009	0.009	0.009	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Concrete Delivery	-	0.001	0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equipment/Material Delivery	0.004	0.004	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Civil Improvements																								
Worker Commute Car	-	-	0.052	0.052	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water Delivery Truck	-	-	0.018	0.018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equipment/Material Delivery	-	-	0.004	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Compression Plant and Power Generation Plant																								
Worker Commute Bus, Small	-	-	-	-	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	-
Worker Commute Car	-	-	-	-	0.051	0.067	0.067	0.051	0.051	0.051	0.051	0.065	0.051	0.051	0.051	0.073	0.054	0.054	0.067	0.067	0.067	0.067	0.067	-
Concrete Delivery	-	-	-	-	0.003	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.003	0.003	-	-	-	-	-	-
Equipment/Material Delivery	-	-	-	-	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	-
Equipment/Material Delivery	-	-	-	-	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	-
Building Construction																								
Worker Commute Car	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.019	0.019	0.019	0.024	0.024	0.024	0.024
Equipment/Material Delivery	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Daily Total	**0.047**	**0.047**	**0.12**	**0.073**	**0.079**	**0.109**	**0.109**	**0.093**	**0.093**	**0.093**	**0.093**	**0.108**	**0.093**	**0.093**	**0.093**	**0.116**	**0.081**	**0.10**	**0.11**	**0.11**	**0.12**	**0.12**	**0.12**	**0.024**
Annual Total (tpy) [b]	**0.001**	**0.001**	**0.002**	**0.003**	**0.004**	**0.005**	**0.006**	**0.007**	**0.008**	**0.010**	**0.011**	**0.012**	**0.012**	**0.013**	**0.012**	**0.013**	**0.013**	**0.013**	**0.013**	**0.013**	**0.013**	**0.014**	**0.014**	**0.013**

	PM_{10} Emissions (lb/day) [a, c]																							
Mobilization																								
Worker Commute Bus, Small	0.038	0.038	0.038	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Worker Commute Car	3.32	3.32	3.32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water Delivery Truck	0.29	0.26	0.26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Concrete Delivery	-	0.026	0.026	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equipment/Material Delivery	0.13	0.11	0.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Civil Improvements																								
Worker Commute Car	-	-	5.20	5.20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water Delivery Truck	-	-	0.52	0.52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equipment/Material Delivery	-	-	0.11	0.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Compression Plant and Power Generation Plant																								
Worker Commute Bus, Small	-	-	-	-	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	-
Worker Commute Car	-	-	-	-	5.16	6.75	6.75	5.16	5.16	5.16	5.16	6.60	5.16	5.16	5.16	7.39	5.44	5.44	6.75	6.75	6.75	6.75	6.75	-
Concrete Delivery	-	-	-	-	0.08	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.49	0.49	0.49	0.08	0.08	-	-	-	-	-	-
Equipment/Material Delivery	-	-	-	-	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	-
Equipment/Material Delivery	-	-	-	-	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	-
Building Construction																								
Worker Commute Car	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.89	1.89	1.89	2.38	2.38	2.38	2.38
Equipment/Material Delivery	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.022	0.022	0.022	0.022	0.022	0.022	0.022
Daily Total	**3.78**	**3.76**	**9.59**	**5.83**	**6.02**	**8.03**	**8.03**	**6.44**	**6.44**	**6.44**	**6.44**	**7.88**	**6.44**	**6.41**	**6.41**	**8.64**	**6.28**	**8.19**	**9.43**	**9.43**	**9.91**	**9.91**	**9.91**	**2.41**

King Island CAES Project
Appendix 5.1A Table 5.1A.4
On-road Vehicle Emissions
February 2015

Vehicle Type	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	Month 13	Month 14	Month 15	Month 16	Month 17	Month 18	Month 19	Month 20	Month 21	Month 22	Month 23	Month 24
	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17
	ROG Emissions (lb/day) [a]																							
Annual Total (tpy) [b]	**0.042**	**0.083**	**0.19**	**0.25**	**0.32**	**0.41**	**0.50**	**0.57**	**0.64**	**0.71**	**0.78**	**0.87**	**0.89**	**0.92**	**0.89**	**0.92**	**0.92**	**0.92**	**0.94**	**0.97**	**1.01**	**1.05**	**1.09**	**1.03**

	$PM_{2.5}$ Emissions (lb/day) [a, c]																							
Mobilization																								
Worker Commute Bus, Small	0.010	0.010	0.010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Worker Commute Car	0.90	0.90	0.90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water Delivery Truck	0.12	0.099	0.099	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Concrete Delivery	-	0.010	0.010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equipment/Material Delivery	0.062	0.046	0.046	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Civil Improvements																								
Worker Commute Car	-	-	1.41	1.41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water Delivery Truck	-	-	0.20	0.20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equipment/Material Delivery	-	-	0.046	0.046	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Compression Plant and Power Generation Plant																								
Worker Commute Bus, Small	-	-	-	-	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	-
Worker Commute Car	-	-	-	-	1.40	1.83	1.83	1.40	1.40	1.40	1.40	1.79	1.40	1.40	1.40	2.01	1.48	1.48	1.83	1.83	1.83	1.83	1.83	-
Concrete Delivery	-	-	-	-	0.032	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.18	0.18	0.18	0.030	0.030	-	-	-	-	-	-
Equipment/Material Delivery	-	-	-	-	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	-
Equipment/Material Delivery	-	-	-	-	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	-
Building Construction																								
Worker Commute Car	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.51	0.51	0.51	0.65	0.65	0.65	0.65
Equipment/Material Delivery	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.009	0.009	0.009	0.009	0.009	0.009	0.009
Daily Total	**1.10**	**1.07**	**2.72**	**1.66**	**1.75**	**2.34**	**2.34**	**1.91**	**1.91**	**1.91**	**1.91**	**2.30**	**1.91**	**1.88**	**1.88**	**2.48**	**1.80**	**2.32**	**2.65**	**2.65**	**2.78**	**2.78**	**2.78**	**0.66**
Annual Total (tpy) [b]	**0.012**	**0.024**	**0.054**	**0.072**	**0.091**	**0.12**	**0.14**	**0.16**	**0.18**	**0.21**	**0.23**	**0.25**	**0.26**	**0.27**	**0.26**	**0.27**	**0.27**	**0.27**	**0.27**	**0.28**	**0.29**	**0.30**	**0.31**	**0.29**

	CO_2 Emissions (lb/day) [a]																							
Mobilization																								
Worker Commute Bus, Small	53.2	53.2	53.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Worker Commute Car	2,864	2,865	2,865	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water Delivery Truck	872	872	872	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Concrete Delivery	-	87.2	87.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equipment/Material Delivery	349	349	349	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Civil Improvements																								
Worker Commute Car	-	-	4,479	4,479	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water Delivery Truck	-	-	1,745	1,745	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equipment/Material Delivery	-	-	349	349	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Compression Plant and Power Generation Plant																								
Worker Commute Bus, Small	-	-	-	-	85.1	85.1	85.1	85.1	85.1	85.1	85.1	85.1	85.1	85.1	85.1	85.1	85.1	85.1	85.1	85.1	85.1	85.1	85.1	-
Worker Commute Car	-	-	-	-	4,453	5,823	5,823	4,453	4,453	4,453	4,453	5,691	4,453	4,454	4,454	6,379	4,692	4,692	5,825	5,825	5,825	5,825	5,825	-
Concrete Delivery	-	-	-	-	279	1,675	1,675	1,675	1,675	1,675	1,675	1,675	1,675	1,673	1,673	1,673	279	279	0	0	0	0	0	-
Equipment/Material Delivery	-	-	-	-	838	838	838	838	838	838	838	838	838	836	836	836	836	836	836	836	836	836	836	-
Equipment/Material Delivery	-	-	-	-	1,396	1,396	1,396	1,396	1,396	1,396	1,396	1,396	1,396	1,393	1,393	1,393	1,393	1,393	1,393	1,393	1,393	1,393	1,393	-
Building Construction																								
Worker Commute Car	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,634	1,634	1,634	2,056	2,056	2,056	2,056
Equipment/Material Delivery	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	70	70	70	70	70	70	70
Daily Total	**4,138**	**4,227**	**10,800**	**6,573**	**7,051**	**9,817**	**9,817**	**8,447**	**8,447**	**8,447**	**8,447**	**9,685**	**8,447**	**8,443**	**8,443**	**10,367**	**7,285**	**8,989**	**9,844**	**9,844**	**10,265**	**10,265**	**10,265**	**2,126**
Annual Total (MT/yr) [b]	**41.3**	**83.5**	**191**	**257**	**327**	**425**	**523**	**607**	**692**	**776**	**860**	**957**	**1,000**	**1,042**	**1,018**	**1,056**	**1,059**	**1,050**	**1,051**	**1,065**	**1,083**	**1,101**	**1,119**	**1,044**

	CH_4 Emissions (lb/day) [d]																							
Mobilization																								
Worker Commute Bus, Small	0.004	0.004	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Worker Commute Car	0.17	0.17	0.17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water Delivery Truck	0.003	0.003	0.003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Concrete Delivery	-	0.0003	0.0003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equipment/Material Delivery	0.001	0.001	0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

King Island CAES Project
Appendix 5.1A Table 5.1A.4
On-road Vehicle Emissions
February 2015

Vehicle Type	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	Month 13	Month 14	Month 15	Month 16	Month 17	Month 18	Month 19	Month 20	Month 21	Month 22	Month 23	Month 24
	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17
	ROG Emissions (lb/day) [a]																							
Civil Improvements																								
Worker Commute Car	-	-	0.26	0.26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water Delivery Truck	-	-	0.006	0.006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equipment/Material Delivery	-	-	0.001	0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Compression Plant and Power Generation Plant																								
Worker Commute Bus, Small	-	-	-	-	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	-
Worker Commute Car	-	-	-	-	0.26	0.34	0.34	0.26	0.26	0.26	0.26	0.33	0.26	0.26	0.26	0.37	0.27	0.27	0.34	0.34	0.34	0.34	0.34	-
Concrete Delivery	-	-	-	-	0.001	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.001	0.001	-	-	-	-	-	-
Equipment/Material Delivery	-	-	-	-	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	-
Equipment/Material Delivery	-	-	-	-	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	-
Building Construction																								
Worker Commute Car	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.095	0.095	0.095	0.12	0.12	0.12	0.12
Equipment/Material Delivery	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Daily Total	**0.17**	**0.17**	**0.44**	**0.27**	**0.27**	**0.36**	**0.36**	**0.28**	**0.28**	**0.28**	**0.28**	**0.35**	**0.28**	**0.28**	**0.28**	**0.39**	**0.29**	**0.38**	**0.45**	**0.45**	**0.47**	**0.47**	**0.47**	**0.12**
Annual Total (MT/yr) [b]	**0.002**	**0.003**	**0.008**	**0.011**	**0.013**	**0.017**	**0.020**	**0.023**	**0.026**	**0.029**	**0.031**	**0.035**	**0.036**	**0.037**	**0.035**	**0.036**	**0.037**	**0.037**	**0.038**	**0.039**	**0.041**	**0.043**	**0.045**	**0.043**

	N_2O Emissions (lb/day) [d]																							
Mobilization																								
Worker Commute Bus, Small	0.001	0.001	0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Worker Commute Car	0.035	0.035	0.035	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water Delivery Truck	0.003	0.003	0.003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Concrete Delivery	-	0.0003	0.0003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equipment/Material Delivery	0.001	0.001	0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Civil Improvements																								
Worker Commute Car	-	-	0.054	0.054	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water Delivery Truck	-	-	0.005	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equipment/Material Delivery	-	-	0.001	0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Compression Plant and Power Generation Plant																								
Worker Commute Bus, Small	-	-	-	-	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	-
Worker Commute Car	-	-	-	-	0.054	0.070	0.070	0.054	0.054	0.054	0.054	0.069	0.054	0.054	0.054	0.077	0.057	0.057	0.070	0.070	0.070	0.070	0.070	-
Concrete Delivery	-	-	-	-	0.001	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.001	0.001	-	-	-	-	-	-
Equipment/Material Delivery	-	-	-	-	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	-
Equipment/Material Delivery	-	-	-	-	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	-
Building Construction																								
Worker Commute Car	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.020	0.020	0.020	0.025	0.025	0.025	0.025
Equipment/Material Delivery	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Daily Total	**0.040**	**0.040**	**0.100**	**0.060**	**0.064**	**0.084**	**0.084**	**0.068**	**0.068**	**0.068**	**0.068**	**0.083**	**0.068**	**0.068**	**0.068**	**0.091**	**0.066**	**0.086**	**0.099**	**0.099**	**0.104**	**0.104**	**0.104**	**0.025**
Annual Total (MT/yr) [b]	**0.0004**	**0.001**	**0.002**	**0.002**	**0.003**	**0.004**	**0.005**	**0.005**	**0.006**	**0.007**	**0.007**	**0.008**	**0.009**	**0.009**	**0.008**	**0.009**	**0.009**	**0.009**	**0.009**	**0.009**	**0.010**	**0.010**	**0.010**	**0.010**

Notes:

[a] Emission rates developed from EMFAC2011 for San Joaquin County.

[b] Annual emissions are a rolling 12-month total, assuming 22 working days per month.

[c] PM_{10} and $PM_{2.5}$ emission rates include both exhaust and road dust.

[d] Emission rates developed from The Climate Registry 2014 Default Emission Factors, Table 13.5 (TCR, 2014).

King Island CAES Project
Appendix 5.1A Table 5.1A.5
Emissions from Area Sources
February 2015

Emission Source	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	Month 13	Month 14	Month 15	Month 16	Month 17	Month 18	Month 19	Month 20	Month 21	Month 22	Month 23	Month 24
	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17
Ground Disturbance (acres/day)	0.5	0.5	0.91	0.41	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.1
Ground Disturbance PM_{10} Emissions (lb/day)	5.3E-01	5.3E-01	9.7E-01	4.3E-01	1.1E-01	1.1E-01	1.1E-01	1.1E-01	1.1E-01	1.1E-01	1.1E-01	1.1E-01	1.1E-01	1.1E-01	1.1E-01	1.1E-01	1.1E-01	2.1E-01	2.1E-01	2.1E-01	2.1E-01	2.1E-01	2.1E-01	1.1E-01
Ground Disturbance PM_{10} Emissions (tpy) [a]	5.8E-03	1.2E-02	2.2E-02	2.7E-02	2.8E-02	2.9E-02	3.1E-02	3.2E-02	3.3E-02	3.4E-02	3.5E-02	3.6E-02	3.2E-02	2.7E-02	1.8E-02	1.4E-02	1.4E-02	1.5E-02	1.6E-02	1.7E-02	1.9E-02	2.0E-02	2.1E-02	2.1E-02
Ground Disturbance $PM_{2.5}$ Emissions (lb/day)	5.7E-02	5.7E-02	1.0E-01	4.7E-02	1.1E-02	1.1E-02	1.1E-02	1.1E-02	1.1E-02	1.1E-02	1.1E-02	1.1E-02	1.1E-02	1.1E-02	1.1E-02	1.1E-02	1.1E-02	2.3E-02	2.3E-02	2.3E-02	2.3E-02	2.3E-02	2.3E-02	1.1E-02
Ground Disturbance $PM_{2.5}$ Emissions (tpy) [a]	6.3E-04	1.3E-03	2.4E-03	2.9E-03	3.0E-03	3.2E-03	3.3E-03	3.4E-03	3.6E-03	3.7E-03	3.8E-03	3.9E-03	3.4E-03	2.9E-03	1.9E-03	1.5E-03	1.5E-03	1.6E-03	1.8E-03	1.9E-03	2.0E-03	2.1E-03	2.3E-03	2.3E-03
Cut and Fill (yd^3/day)	0	0	1,770	1,760	10	10	10	10	10	10	10	10	10	10	10	10	10	20	20	20	20	20	20	10
Cut and Fill PM_{10} Emissions (lb/day)	0	0	9.2E-02	9.1E-02	5.2E-04	5.2E-04	5.2E-04	5.2E-04	5.2E-04	5.2E-04	5.2E-04	5.2E-04	5.2E-04	5.2E-04	5.2E-04	5.2E-04	5.2E-04	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03	5.2E-04
Cut and Fill PM_{10} Emissions (tpy) [a]	0	0	1.0E-03	2.0E-03	2.0E-03	2.0E-03	2.0E-03	2.0E-03	2.0E-03	2.0E-03	2.0E-03	2.1E-03	2.1E-03	2.1E-03	1.1E-03	6.8E-05	6.8E-05	7.4E-05	8.0E-05	8.5E-05	9.1E-05	9.7E-05	1.0E-04	1.0E-04
Cut and Fill $PM_{2.5}$ Emissions (lb/day)	0	0	1.4E-02	1.4E-02	7.8E-05	7.8E-05	7.8E-05	7.8E-05	7.8E-05	7.8E-05	7.8E-05	7.8E-05	7.8E-05	7.8E-05	7.8E-05	7.8E-05	7.8E-05	1.6E-04	1.6E-04	1.6E-04	1.6E-04	1.6E-04	1.6E-04	7.8E-05
Cut and Fill $PM_{2.5}$ Emissions (tpy) [a]	0	0	1.5E-04	3.0E-04	3.0E-04	3.0E-04	3.1E-04	3.1E-04	3.1E-04	3.1E-04	3.1E-04	3.1E-04	3.1E-04	3.1E-04	1.6E-04	1.0E-05	1.0E-05	1.1E-05	1.2E-05	1.3E-05	1.4E-05	1.5E-05	1.5E-05	1.5E-05
Paving (acres/day)	0	0	0.2	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Paving ROG Emissions (lb/day) [b]	0	0	0.524	0.262	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Paving ROG Emissions (tpy) [a,b]	0	0	5.8E-03	8.6E-03	8.6E-03	8.6E-03	8.6E-03	8.6E-03	8.6E-03	8.6E-03	8.6E-03	8.6E-03	8.6E-03	8.6E-03	2.9E-03	0	0	0	0	0	0	0	0	0

Notes:

[a] Annual emissions are a rolling 12-month total, assuming 22 working days per month.

[b] Paving emissions assume 2.62 lb VOC/acre paved, per Section 4.8 of Appendix A of the CalEEMod User's Guide (ENVIRON, 2013). It is assumed VOC and ROG are equivalent.

Fugitive Dust Emission Factors for Grading/Ground Disturbance

Parameter	PM_{10}	$PM_{2.5}$
S (mph) [a]	7.1	7.1
F [a]	0.6	0.031
W_b (ft) [a]	12	12
A (ft^2/acre)	43,560	43,560
L (ft/mile)	5,280	5,280
Emission Factor (lb/acre) [b]	1.061	0.115

Notes:

[a] The mean vehicle speed (S), particulate matter scaling factor (F), and average blade width (W_b) taken from Section 11.9 of AP-42 (EPA, 1998), per Section 4.3 of Appendix A of the CalEEMod User's Guide (ENVIRON, 2013).

[b] Emission factor calculated using the following equation from Section 4.3 of Appendix A of the CalEEMod User's Guide (ENVIRON, 2013):

PM_{10} Emission Factor (lb/acre) = $0.051 \times (S)^{2.0} \times F_{PM10} \times A / W_b / L$

$PM_{2.5}$ Emission Factor (lb/acre) = $0.04 \times (S)^{2.5} \times F_{PM2.5} \times A / W_b / L$

Fugitive Dust Emission Factors for Cut and Fill

Parameter	PM_{10}	$PM_{2.5}$
k [a]	0.35	0.053
U (mph) [a]	2.7	2.7
M (%) [a]	12	12
V (ton/yd^3)	1.26	1.26
Emission Factor (lb/yd^3) [b]	0.00005	0.00001

Notes:

[a] Scaling factor (k) taken from Section 13.2.4.1 of AP-42 (EPA, 2006), default soil moisture content (M) and wind speed (U) from Appendix A and Appendix D of the CalEEMod User's Guide (ENVIRON, 2013), respectively.

[b] Emission factor calculated using the following equation from Section 13.2.4.1 of AP-42 (EPA, 2006), per Section 4.3 of Appendix A of the CalEEMod User's Guide (ENVIRON, 2013):

PM Emission Factor (lb/ton) = $V \times k \times 0.0032 \times (U/5)^{1.3} / (M/2)^{1.4}$

King Island CAES Project
Appendix 5.1A Table 5.1A.6
Fugitive Road Dust Emission Rates
February 2015

Fugitive Dust Emission Factors for Unpaved Roads

Vehicles on Unpaved Surfaces at Industrial Sites

Parameter	PM_{10}	$PM_{2.5}$
Mean Vehicle Weight (tons) [a]	12.3	12.3
Silt Content (%) [b]	8.5	8.5
k (lb/mile) [c]	1.5	0.15
a [c]	0.9	0.9
b [c]	0.45	0.45
P [d]	51	51
Emission Factor (Uncontrolled, lb/mile) [e]	1.78	0.18

Notes:

[a] Mean vehicle weight based on weight distribution of onsite pickups and trucks over the course of the project.

[b] Silt content taken from Table 13.2.2-1 of Section 13.2.2 of AP-42 (EPA, 2006) for a Construction Site, Scraper Route.

[c] k, a, and b taken from Table 13.2.2-2 of Section 13.2.2 of AP-42 (EPA, 2006) for industrial roads.

[d] P taken as the CalEEMod default for the number of days per year with > 0.1 inches of precipitation for San Joaquin County.

[e] Emission factor calculated using Equations 1a and 2 from Section 13.2.2 of AP-42 (EPA, 2006):

Emission Factor (lb/mile) = $[k \times (\text{Silt Content} / 12)^{a} \times (\text{Mean Vehicle Weight} / 3)^{b}] \times [(365 - P) / 365]$

Derivation of Paved Road Emission Factors

Vehicles on Paved Roads

Parameter	PM_{10}	$PM_{2.5}$
Average Weight (tons) [a]	2.4	2.4
k (g/mile) [b]	1.0	0.25
sL (g/m^2) [a]	0.1	0.1
Emission Factor (g/mile) [c]	0.300	0.075

Notes:

[a] Average Weight and sL taken as the default value from CalEEMod.

[b] k taken from Table 13.2.1-1 of Section 13.2.1 of AP-42 (EPA, 2011).

[c] Emission factor calculated using Equation 1 from Section 13.2.1 of AP-42 (EPA, 2011):

Emission Factor (g/mile) = $k \times (sL)^{0.91} \times (\text{Average Weight})^{1.02}$

King Island CAES Project
Appendix 5.1A Table 5.1A.7
List of Off-road Equipment and Vehicle Activity
February 2015

Equipment/Vehicle Type	Description	HP	Hours / Day / Vehicle	Miles / Day / Vehicle Round Trip	Miles / Hour / Vehicle	Weight (lb)	FD Weight (lb)	Month 1 Dec-15	Month 2 Jan-16	Month 3 Feb-16	Month 4 Mar-16	Month 5 Apr-16	Month 6 May-16	Month 7 Jun-16
Mobilization														
Generator	Multiquip WshpWatt	30	6	-	-	1,000		1	1	1	0	0	0	0
On-Site Pick Up Truck	Ford F-150	185	2.5	20	8	21,000	189,000	3	3	3	0	0	0	0
On-Site Flatbed Delivery Truck	One-Ton	280	2	20	10	30,000	180,000	2	2	2	0	0	0	0
Deere 210LE Skip Loader	Case 586G	78	4	-	-	14,000		1	1	1	0	0	0	0
5000 gal Water Truck	FrtLiner 5000 gal	240	1.25	10	8	34,000	510,000	5	5	5	0	0	0	0
On-Site Service Truck	Ford F-150	210	5	20	4	21,000	63,000	1	1	1	0	0	0	0
On-Site Lube/Fuel Trucks	Ford F-150	210	1	10	10	21,000	63,000	1	1	1	0	0	0	0
Track Trencher	HT115	115	8	-	-	12,000		1	1	1	0	0	0	0
On-Site Dump Truck	One Ton	280	2	20	10	30,000	60,000	1	1	0	0	0	0	0
Civil Improvements														
Dozer Cat D6R	Cat D6	185	8	-	-	42,000		0	0	4	4	0	0	0
Generator	Multiquip WshpWatt	30	6	-	-	1,000		0	0	4	4	0	0	0
Scraper Cat 623	Cat-623	365	8	-	-	83,000		0	0	4	4	0	0	0
Deere 210LE Skip Loader	Case 586G	78	6	-	-	14,000		0	0	4	4	0	0	0
Cat 140H Grader	Cat 14G	185	8	-	-	33,000		0	0	6	6	0	0	0
5000 gal Water Truck	FrtLiner 5000 gal	240	2	10	5	34,000	544,000	0	0	8	8	0	0	0
Roller Vibrator/Compactor/Other	Cat 826H	350	6	-	-	30,000		0	0	2	3	0	0	0
Cat BG600D Paver	AC Paver	173	6	-	-	64,000		0	0	1	1	0	0	0
On-Site Heavy Duty Pick Up Truck	Ford F-150	235	2	20	10	21,000	252,000	0	0	6	6	0	0	0
On-Site Flatbed Delivery Truck	One-Ton	280	2	20	10	30,000	180,000	0	0	3	3	0	0	0
On-Site Lube/Fuel Trucks	Ford F-150	210	1	10	10	21,000	168,000	0	0	4	4	0	0	0
On-Site Service Truck	Ford F-150	210	1	10	10	21,000	168,000	0	0	4	4	0	0	0
On-Site Dump Truck	One Ton	280	2	20	10	30,000	180,000	0	0	3	3	0	0	0
Compression Plant and Power Generation Plant														
Generator	Multiquip WshpWatt	30	8	-	-	1,000		0	0	0	0	2	2	2
Air Compressor	Ingersol Rand - 250 CFM	25	8	-	-	500		0	0	0	0	2	2	2
Dozer Cat D6R	Cat D6	185	4	-	-	42,000		0	0	0	0	1	1	1
Deere 210LE Skip Loader	Case 586G	78	8	-	-	14,000		0	0	0	0	3	3	3
Telehandler	Cat TL943	99	8	-	-	21,000		0	0	0	0	4	4	4
Track Trencher	HT115	115	8	-	-	12,000		0	0	0	0	2	2	2
Cat 583T Pipelayer	Cat 583T	310	6	-	-	45,000		0	0	0	0	2	2	2
On-Site Pick Up Truck	Ford F-150	210	3.33	20	6	21,000	1,596,000	0	0	0	0	4	4	4
On-Site Heavy Duty Pick Up Truck	Ford F-150	235	2	20	10	21,000	798,000	0	0	0	0	2	2	2
On-Site Flatbed Delivery Truck	One-Ton	280	2	20	10	30,000	2,280,000	0	0	0	0	4	4	4
On-Site Service Truck	Ford F-150	210	1	10	10	21,000	1,197,000	0	0	0	0	3	3	3
On-Site Dump Truck	One Ton	280	2	20	10	30,000	270,000	0	0	0	0	1	1	1
On-Site Lube/Fuel Trucks	Ford F-150	210	1	10	10	21,000	840,000	0	0	0	2	2	2	2

King Island CAES Project
Appendix 5.1A Table 5.1A.7
List of Off-road Equipment and Vehicle Activity
February 2015

Equipment/Vehicle Type	Description	HP	Hours / Day / Vehicle	Miles / Day / Vehicle Round Trip	Miles / Hour / Vehicle	Weight (lb)	FD Weight (lb)	Month 1 Dec-15	Month 2 Jan-16	Month 3 Feb-16	Month 4 Mar-16	Month 5 Apr-16	Month 6 May-16	Month 7 Jun-16
Building Construction														
On-Site Heavy Duty Pick Up Truck	Ford F-150	235	2	20	10	21,000	147,000	0	0	0	0	0	0	0
On-Site Flatbed Delivery Truck	One-Ton	280	2	20	10	30,000	420,000	0	0	0	0	0	0	0
Generator	Multiquip WshpWatt	30	6	-	-	1,000		0	0	0	0	0	0	0
Air Compressor	Ingersol Rand - 250 CFM	25	6	-	-	500		0	0	0	0	0	0	0
Deere 210LE Skip Loader	Case 586G	78	6	-	-	14,000		0	0	0	0	0	0	0
Crane/Boom Truck	Grove 25 Ton Rough Terrain	250	6	-	-	21,000		0	0	0	0	0	0	0
Testing and Commissioning														
On-Site Heavy Duty Pick Up Truck	Ford F-150	235	2	20	10	21,000	42,000	0	0	0	0	0	0	0
On-Site Service Truck	Ford F-150	210	1	10	10	21,000	21,000	0	0	0	0	0	0	0
Cat BG600D Paver	AC Paver	173	6	-	-	64,000		0	0	0	0	0	0	0
Roller Vibrator/Compactor/Other	Cat 826H	350	6	-	-	30,000		0	0	0	0	0	0	0
						Subtotal	**414**	**16**	**16**	**68**	**56**	**32**	**32**	**32**

Notes:

Equipment activity data was taken from the Worley Parsons Construction Equipment Estimate tables for each construction phase (pages 3-7).

King Island CAES Project
Appendix 5.1A Table 5.1A.7
List of Off-road Equipment and Vehicle Activity
February 2015

Equipment/Vehicle Type	Description	HP	Hours / Day / Vehicle	Miles / Day / Vehicle Round Trip	Miles / Hour / Vehicle	Weight (lb)	FD Weight (lb)	Month 8 Jul-16	Month 9 Aug-16	Month 10 Sep-16	Month 11 Oct-16	Month 12 Nov-16	Month 13 Dec-16	Month 14 Jan-17	Month 15 Feb-17	Month 16 Mar-17	Month 17 Apr-17	Month 18 May-17
Mobilization														**Daily Count**				
Generator	Multiquip WshpWatt	30	6	-	-	1,000		0	0	0	0	0	0	0	0	0	0	0
On-Site Pick Up Truck	Ford F-150	185	2.5	20	8	21,000	189,000	0	0	0	0	0	0	0	0	0	0	0
On-Site Flatbed Delivery Truck	One-Ton	280	2	20	10	30,000	180,000	0	0	0	0	0	0	0	0	0	0	0
Deere 210LE Skip Loader	Case 586G	78	4	-	-	14,000		0	0	0	0	0	0	0	0	0	0	0
5000 gal Water Truck	FrtLiner 5000 gal	240	1.25	10	8	34,000	510,000	0	0	0	0	0	0	0	0	0	0	0
On-Site Service Truck	Ford F-150	210	5	20	4	21,000	63,000	0	0	0	0	0	0	0	0	0	0	0
On-Site Lube/Fuel Trucks	Ford F-150	210	1	10	10	21,000	63,000	0	0	0	0	0	0	0	0	0	0	0
Track Trencher	HT115	115	8	-	-	12,000		0	0	0	0	0	0	0	0	0	0	0
On-Site Dump Truck	One Ton	280	2	20	10	30,000	60,000	0	0	0	0	0	0	0	0	0	0	0
Civil Improvements														**Daily Count**				
Dozer Cat D6R	Cat D6	185	8	-	-	42,000		0	0	0	0	0	0	0	0	0	0	0
Generator	Multiquip WshpWatt	30	6	-	-	1,000		0	0	0	0	0	0	0	0	0	0	0
Scraper Cat 623	Cat-623	365	8	-	-	83,000		0	0	0	0	0	0	0	0	0	0	0
Deere 210LE Skip Loader	Case 586G	78	6	-	-	14,000		0	0	0	0	0	0	0	0	0	0	0
Cat 140H Grader	Cat 14G	185	8	-	-	33,000		0	0	0	0	0	0	0	0	0	0	0
5000 gal Water Truck	FrtLiner 5000 gal	240	2	10	5	34,000	544,000	0	0	0	0	0	0	0	0	0	0	0
Roller Vibrator/Compactor/Other	Cat 826H	350	6	-	-	30,000		0	0	0	0	0	0	0	0	0	0	0
Cat BG600D Paver	AC Paver	173	6	-	-	64,000		0	0	0	0	0	0	0	0	0	0	0
On-Site Heavy Duty Pick Up Truck	Ford F-150	235	2	20	10	21,000	252,000	0	0	0	0	0	0	0	0	0	0	0
On-Site Flatbed Delivery Truck	One-Ton	280	2	20	10	30,000	180,000	0	0	0	0	0	0	0	0	0	0	0
On-Site Lube/Fuel Trucks	Ford F-150	210	1	10	10	21,000	168,000	0	0	0	0	0	0	0	0	0	0	0
On-Site Service Truck	Ford F-150	210	1	10	10	21,000	168,000	0	0	0	0	0	0	0	0	0	0	0
On-Site Dump Truck	One Ton	280	2	20	10	30,000	180,000	0	0	0	0	0	0	0	0	0	0	0
Compression Plant and Power Generation Plant														**Daily Count**				
Generator	Multiquip WshpWatt	30	8	-	-	1,000		2	2	2	2	2	2	2	2	2	2	2
Air Compressor	Ingersol Rand - 250 CFM	25	8	-	-	500		2	2	2	2	2	2	2	2	2	2	2
Dozer Cat D6R	Cat D6	185	4	-	-	42,000		1	1	1	1	1	1	1	1	1	1	1
Deere 210LE Skip Loader	Case 586G	78	8	-	-	14,000		3	3	3	3	3	3	3	3	3	3	3
Telehandler	Cat TL943	99	8	-	-	21,000		4	4	4	4	4	4	4	4	4	4	4
Track Trencher	HT115	115	8	-	-	12,000		2	2	2	2	2	2	2	0	0	0	0
Cat 583T Pipelayer	Cat 583T	310	6	-	-	45,000		2	2	2	2	0	0	0	0	0	0	0
On-Site Pick Up Truck	Ford F-150	210	3.33	20	6	21,000	1,596,000	4	4	4	4	4	4	4	4	4	4	4
On-Site Heavy Duty Pick Up Truck	Ford F-150	235	2	20	10	21,000	798,000	2	2	2	2	2	2	2	2	2	2	2
On-Site Flatbed Delivery Truck	One-Ton	280	2	20	10	30,000	2,280,000	4	4	4	4	4	4	4	4	4	4	4
On-Site Service Truck	Ford F-150	210	1	10	10	21,000	1,197,000	3	3	3	3	3	3	3	3	3	3	3
On-Site Dump Truck	One Ton	280	2	20	10	30,000	270,000	1	1	1	1	1	0	0	0	0	0	0
On-Site Lube/Fuel Trucks	Ford F-150	210	1	10	10	21,000	840,000	2	2	2	2	2	2	2	2	2	2	2

King Island CAES Project
Appendix 5.1A Table 5.1A.7
List of Off-road Equipment and Vehicle Activity
February 2015

Equipment/Vehicle Type	Description	HP	Hours / Day / Vehicle	Miles / Day / Vehicle Round Trip	Miles / Hour / Vehicle	Weight (lb)	FD Weight (lb)	Month 8 Jul-16	Month 9 Aug-16	Month 10 Sep-16	Month 11 Oct-16	Month 12 Nov-16	Month 13 Dec-16	Month 14 Jan-17	Month 15 Feb-17	Month 16 Mar-17	Month 17 Apr-17	Month 18 May-17
Building Construction														**Daily Count**				
On-Site Heavy Duty Pick Up Truck	Ford F-150	235	2	20	10	21,000	147,000	0	0	0	0	0	0	0	0	0	0	1
On-Site Flatbed Delivery Truck	One-Ton	280	2	20	10	30,000	420,000	0	0	0	0	0	0	0	0	0	0	2
Generator	Multiquip WshpWatt	30	6	-	-	1,000		0	0	0	0	0	0	0	0	0	0	1
Air Compressor	Ingersol Rand - 250 CFM	25	6	-	-	500		0	0	0	0	0	0	0	0	0	0	1
Deere 210LE Skip Loader	Case 586G	78	6	-	-	14,000		0	0	0	0	0	0	0	0	0	0	2
Crane/Boom Truck	Grove 25 Ton Rough Terrain	250	6	-	-	21,000		0	0	0	0	0	0	0	0	0	0	2
Testing and Commissioning														**Daily Count**				
On-Site Heavy Duty Pick Up Truck	Ford F-150	235	2	20	10	21,000	42,000	0	0	0	0	0	0	0	0	0	0	0
On-Site Service Truck	Ford F-150	210	1	10	10	21,000	21,000	0	0	0	0	0	0	0	0	0	0	0
Cat BG600D Paver	AC Paver	173	6	-	-	64,000		0	0	0	0	0	0	0	0	0	0	0
Roller Vibrator/Compactor/Other	Cat 826H	350	6	-	-	30,000		0	0	0	0	0	0	0	0	0	0	0
						Subtotal	**414**	**32**	**32**	**32**	**32**	**30**	**29**	**29**	**27**	**27**	**27**	**36**

Notes:

Equipment activity data was taken from the Worley Parsons Construction Equipment Estimate tables for each construction phase (pages 3-7).

King Island CAES Project
Appendix 5.1A Table 5.1A.7
List of Off-road Equipment and Vehicle Activity
February 2015

Equipment/Vehicle Type	Description	HP	Hours / Day / Vehicle	Miles / Day / Vehicle Round Trip	Miles / Hour / Vehicle	Weight (lb)	FD Weight (lb)	Month 19 Jun-17	Month 20 Jul-17	Month 21 Aug-17
Mobilization										
Generator	Multiquip WshpWatt	30	6	-	-	1,000		0	0	0
On-Site Pick Up Truck	Ford F-150	185	2.5	20	8	21,000	189,000	0	0	0
On-Site Flatbed Delivery Truck	One-Ton	280	2	20	10	30,000	180,000	0	0	0
Deere 210LE Skip Loader	Case 586G	78	4	-	-	14,000		0	0	0
5000 gal Water Truck	FrtLiner 5000 gal	240	1.25	10	8	34,000	510,000	0	0	0
On-Site Service Truck	Ford F-150	210	5	20	4	21,000	63,000	0	0	0
On-Site Lube/Fuel Trucks	Ford F-150	210	1	10	10	21,000	63,000	0	0	0
Track Trencher	HT115	115	8	-	-	12,000		0	0	0
On-Site Dump Truck	One Ton	280	2	20	10	30,000	60,000	0	0	0
Civil Improvements										
Dozer Cat D6R	Cat D6	185	8	-	-	42,000		0	0	0
Generator	Multiquip WshpWatt	30	6	-	-	1,000		0	0	0
Scraper Cat 623	Cat-623	365	8	-	-	83,000		0	0	0
Deere 210LE Skip Loader	Case 586G	78	6	-	-	14,000		0	0	0
Cat 140H Grader	Cat 14G	185	8	-	-	33,000		0	0	0
5000 gal Water Truck	FrtLiner 5000 gal	240	2	10	5	34,000	544,000	0	0	0
Roller Vibrator/Compactor/Other	Cat 826H	350	6	-	-	30,000		0	0	0
Cat BG600D Paver	AC Paver	173	6	-	-	64,000		0	0	0
On-Site Heavy Duty Pick Up Truck	Ford F-150	235	2	20	10	21,000	252,000	0	0	0
On-Site Flatbed Delivery Truck	One-Ton	280	2	20	10	30,000	180,000	0	0	0
On-Site Lube/Fuel Trucks	Ford F-150	210	1	10	10	21,000	168,000	0	0	0
On-Site Service Truck	Ford F-150	210	1	10	10	21,000	168,000	0	0	0
On-Site Dump Truck	One Ton	280	2	20	10	30,000	180,000	0	0	0
Compression Plant and Power Generation Plant										
Generator	Multiquip WshpWatt	30	8	-	-	1,000		2	2	2
Air Compressor	Ingersol Rand - 250 CFM	25	8	-	-	500		2	2	2
Dozer Cat D6R	Cat D6	185	4	-	-	42,000		1	1	1
Deere 210LE Skip Loader	Case 586G	78	8	-	-	14,000		3	3	3
Telehandler	Cat TL943	99	8	-	-	21,000		4	4	4
Track Trencher	HT115	115	8	-	-	12,000		0	0	0
Cat 583T Pipelayer	Cat 583T	310	6	-	-	45,000		0	0	0
On-Site Pick Up Truck	Ford F-150	210	3.33	20	6	21,000	1,596,000	4	4	4
On-Site Heavy Duty Pick Up Truck	Ford F-150	235	2	20	10	21,000	798,000	2	2	2
On-Site Flatbed Delivery Truck	One-Ton	280	2	20	10	30,000	2,280,000	4	4	4
On-Site Service Truck	Ford F-150	210	1	10	10	21,000	1,197,000	3	3	3
On-Site Dump Truck	One Ton	280	2	20	10	30,000	270,000	0	0	0
On-Site Lube/Fuel Trucks	Ford F-150	210	1	10	10	21,000	840,000	2	2	2

King Island CAES Project
Appendix 5.1A Table 5.1A.7
List of Off-road Equipment and Vehicle Activity
February 2015

Equipment/Vehicle Type	Description	HP	Hours / Day / Vehicle	Miles / Day / Vehicle Round Trip	Miles / Hour / Vehicle	Weight (lb)	FD Weight (lb)	Month 19 Jun-17	Month 20 Jul-17	Month 21 Aug-17
Building Construction										
On-Site Heavy Duty Pick Up Truck	Ford F-150	235	2	20	10	21,000	147,000	1	1	1
On-Site Flatbed Delivery Truck	One-Ton	280	2	20	10	30,000	420,000	2	2	2
Generator	Multiquip WshpWatt	30	6	-	-	1,000		1	1	1
Air Compressor	Ingersol Rand - 250 CFM	25	6	-	-	500		1	1	1
Deere 210LE Skip Loader	Case 586G	78	6	-	-	14,000		2	2	2
Crane/Boom Truck	Grove 25 Ton Rough Terrain	250	6	-	-	21,000		2	2	2
Testing and Commissioning										
On-Site Heavy Duty Pick Up Truck	Ford F-150	235	2	20	10	21,000	42,000	0	0	0
On-Site Service Truck	Ford F-150	210	1	10	10	21,000	21,000	0	0	0
Cat BG600D Paver	AC Paver	173	6	-	-	64,000		0	0	0
Roller Vibrator/Compactor/Other	Cat 826H	350	6	-	-	30,000		0	0	0
						Subtotal	**414**	**36**	**36**	**36**

Notes:

Equipment activity data was taken from the Worley Parsons Construction Equipment Estimate tables for each construction phase (pages 3-7).

King Island CAES Project
Appendix 5.1A Table 5.1A.7
List of Off-road Equipment and Vehicle Activity
February 2015

Equipment/Vehicle Type	Description	HP	Hours / Day / Vehicle	Miles / Day / Vehicle Round Trip	Miles / Hour / Vehicle	Weight (lb)	FD Weight (lb)	Month 22 Sep-17	Month 23 Oct-17	Month 24 Nov-17	Month 25 Dec-17	Month 26 Jan-18	Month 27 Feb-18
Mobilization													
Generator	Multiquip WshpWatt	30	6	-	-	1,000		0	0	0	0	0	0
On-Site Pick Up Truck	Ford F-150	185	2.5	20	8	21,000	189,000	0	0	0	0	0	0
On-Site Flatbed Delivery Truck	One-Ton	280	2	20	10	30,000	180,000	0	0	0	0	0	0
Deere 210LE Skip Loader	Case 586G	78	4	-	-	14,000		0	0	0	0	0	0
5000 gal Water Truck	FrtLiner 5000 gal	240	1.25	10	8	34,000	510,000	0	0	0	0	0	0
On-Site Service Truck	Ford F-150	210	5	20	4	21,000	63,000	0	0	0	0	0	0
On-Site Lube/Fuel Trucks	Ford F-150	210	1	10	10	21,000	63,000	0	0	0	0	0	0
Track Trencher	HT115	115	8	-	-	12,000		0	0	0	0	0	0
On-Site Dump Truck	One Ton	280	2	20	10	30,000	60,000	0	0	0	0	0	0
Civil Improvements													
Dozer Cat D6R	Cat D6	185	8	-	-	42,000		0	0	0	0	0	0
Generator	Multiquip WshpWatt	30	6	-	-	1,000		0	0	0	0	0	0
Scraper Cat 623	Cat-623	365	8	-	-	83,000		0	0	0	0	0	0
Deere 210LE Skip Loader	Case 586G	78	6	-	-	14,000		0	0	0	0	0	0
Cat 140H Grader	Cat 14G	185	8	-	-	33,000		0	0	0	0	0	0
5000 gal Water Truck	FrtLiner 5000 gal	240	2	10	5	34,000	544,000	0	0	0	0	0	0
Roller Vibrator/Compactor/Other	Cat 826H	350	6	-	-	30,000		0	0	0	0	0	0
Cat BG600D Paver	AC Paver	173	6	-	-	64,000		0	0	0	0	0	0
On-Site Heavy Duty Pick Up Truck	Ford F-150	235	2	20	10	21,000	252,000	0	0	0	0	0	0
On-Site Flatbed Delivery Truck	One-Ton	280	2	20	10	30,000	180,000	0	0	0	0	0	0
On-Site Lube/Fuel Trucks	Ford F-150	210	1	10	10	21,000	168,000	0	0	0	0	0	0
On-Site Service Truck	Ford F-150	210	1	10	10	21,000	168,000	0	0	0	0	0	0
On-Site Dump Truck	One Ton	280	2	20	10	30,000	180,000	0	0	0	0	0	0
Compression Plant and Power Generation Plant													
Generator	Multiquip WshpWatt	30	8	-	-	1,000		2	2	0	0	0	0
Air Compressor	Ingersol Rand - 250 CFM	25	8	-	-	500		2	2	0	0	0	0
Dozer Cat D6R	Cat D6	185	4	-	-	42,000		1	1	0	0	0	0
Deere 210LE Skip Loader	Case 586G	78	8	-	-	14,000		3	3	0	0	0	0
Telehandler	Cat TL943	99	8	-	-	21,000		4	4	0	0	0	0
Track Trencher	HT115	115	8	-	-	12,000		0	0	0	0	0	0
Cat 583T Pipelayer	Cat 583T	310	6	-	-	45,000		0	0	0	0	0	0
On-Site Pick Up Truck	Ford F-150	210	3.33	20	6	21,000	1,596,000	4	4	0	0	0	0
On-Site Heavy Duty Pick Up Truck	Ford F-150	235	2	20	10	21,000	798,000	2	2	0	0	0	0
On-Site Flatbed Delivery Truck	One-Ton	280	2	20	10	30,000	2,280,000	4	4	0	0	0	0
On-Site Service Truck	Ford F-150	210	1	10	10	21,000	1,197,000	3	3	0	0	0	0
On-Site Dump Truck	One Ton	280	2	20	10	30,000	270,000	0	1	0	0	0	0
On-Site Lube/Fuel Trucks	Ford F-150	210	1	10	10	21,000	840,000	2	2	0	0	0	0

King Island CAES Project
Appendix 5.1A Table 5.1A.7
List of Off-road Equipment and Vehicle Activity
February 2015

Equipment/Vehicle Type	Description	HP	Hours / Day / Vehicle	Miles / Day / Vehicle Round Trip	Miles / Hour / Vehicle	Weight (lb)	FD Weight (lb)	Month 22 Sep-17	Month 23 Oct-17	Month 24 Nov-17	Month 25 Dec-17	Month 26 Jan-18	Month 27 Feb-18
Building Construction													
On-Site Heavy Duty Pick Up Truck	Ford F-150	235	2	20	10	21,000	147,000	1	1	1	0	0	0
On-Site Flatbed Delivery Truck	One-Ton	280	2	20	10	30,000	420,000	2	2	2	0	0	0
Generator	Multiquip WshpWatt	30	6	-	-	1,000		1	1	1	0	0	0
Air Compressor	Ingersol Rand - 250 CFM	25	6	-	-	500		1	1	1	0	0	0
Deere 210LE Skip Loader	Case 586G	78	6	-	-	14,000		2	2	2	0	0	0
Crane/Boom Truck	Grove 25 Ton Rough Terrain	250	6	-	-	21,000		2	2	2	0	0	0
Testing and Commissioning													
On-Site Heavy Duty Pick Up Truck	Ford F-150	235	2	20	10	21,000	42,000	0	0	2	2	2	2
On-Site Service Truck	Ford F-150	210	1	10	10	21,000	21,000	0	0	1	1	1	1
Cat BG600D Paver	AC Paver	173	6	-	-	64,000		0	0	1	0	0	0
Roller Vibrator/Compactor/Other	Cat 826H	350	6	-	-	30,000		0	0	1	0	0	0
						Subtotal	**414**	**36**	**37**	**14**	**3**	**3**	**3**

Notes:

Equipment activity data was taken from the Worley Parsons Construction Equipment Estimate tables for each construction phase (pages 3-7).

King Island CAES Project
Appendix 5.1A Table 5.1A.8
List of On-road Vehicle Activity
February 2015

Equipment/Vehicle Type	EMFAC Vehicle Type	Miles / Day / Vehicle Round Trip	Miles / Hour / Vehicle	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	Month 13
				Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16
Mobilization																**Daily Count**
Worker Commute Bus, Small	OBUS	50	55	1	1	1	0	0	0	0	0	0	0	0	0	0
Worker Commute Car	LDA	50	55	87	87	87	0	0	0	0	0	0	0	0	0	0
Water Delivery Truck	T7 single construction	50	55	5	5	5	0	0	0	0	0	0	0	0	0	0
Concrete Delivery	T7 single construction	50	55	0	0.5	0.5	0	0	0	0	0	0	0	0	0	0
Equipment/Material Delivery	T7 tractor construction	50	55	2	2	2	0	0	0	0	0	0	0	0	0	0
Civil Improvements																**Daily Count**
Worker Commute Car	LDA	50	55	0	0	136	136	0	0	0	0	0	0	0	0	0
Water Delivery Truck	T7 single construction	50	55	0	0	10	10	0	0	0	0	0	0	0	0	0
Equipment/Material Delivery	T7 tractor construction	50	55	0	0	2	2	0	0	0	0	0	0	0	0	0
Compression Plant and Power Generation Plant																**Daily Count**
Worker Commute Bus, Small	OBUS	40	55	0	0	0	0	2	2	2	2	2	2	2	2	2
Worker Commute Car	LDA	40	55	0	0	0	0	169	221	221	169	169	169	169	216	169
Concrete Delivery	T7 single construction	40	55	0	0	0	0	2	12	12	12	12	12	12	12	12
Equipment/Material Delivery	T7 tractor construction	40	55	0	0	0	0	6	6	6	6	6	6	6	6	6
Equipment/Material Delivery	T7 tractor construction	100	55	0	0	0	0	4	4	4	4	4	4	4	4	4
Building Construction																**Daily Count**
Worker Commute Car	LDA	40	55	0	0	0	0	0	0	0	0	0	0	0	0	0
Equipment/Material Delivery	T7 tractor construction	40	55	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes:

No offsite vehicles are expected during the the testing and commissioning phase of the project.

King Island CAES Project
Appendix 5.1A Table 5.1A.8
List of On-road Vehicle Activity
February 2015

Equipment/Vehicle Type	EMFAC Vehicle Type	Miles / Day / Vehicle Round Trip	Miles / Hour / Vehicle	Month 14 Jan-17	Month 15 Feb-17	Month 16 Mar-17	Month 17 Apr-17	Month 18 May-17	Month 19 Jun-17	Month 20 Jul-17	Month 21 Aug-17	Month 22 Sep-17	Month 23 Oct-17	Month 24 Nov-17
Mobilization														
Worker Commute Bus, Small	OBUS	50	55	0	0	0	0	0	0	0	0	0	0	0
Worker Commute Car	LDA	50	55	0	0	0	0	0	0	0	0	0	0	0
Water Delivery Truck	T7 single construction	50	55	0	0	0	0	0	0	0	0	0	0	0
Concrete Delivery	T7 single construction	50	55	0	0	0	0	0	0	0	0	0	0	0
Equipment/Material Delivery	T7 tractor construction	50	55	0	0	0	0	0	0	0	0	0	0	0
Civil Improvements														
Worker Commute Car	LDA	50	55	0	0	0	0	0	0	0	0	0	0	0
Water Delivery Truck	T7 single construction	50	55	0	0	0	0	0	0	0	0	0	0	0
Equipment/Material Delivery	T7 tractor construction	50	55	0	0	0	0	0	0	0	0	0	0	0
Compression Plant and Power Generation Plant														
Worker Commute Bus, Small	OBUS	40	55	2	2	2	2	2	2	2	2	2	2	0
Worker Commute Car	LDA	40	55	169	169	242	178	178	221	221	221	221	221	0
Concrete Delivery	T7 single construction	40	55	12	12	12	2	2	0	0	0	0	0	0
Equipment/Material Delivery	T7 tractor construction	40	55	6	6	6	6	6	6	6	6	6	6	0
Equipment/Material Delivery	T7 tractor construction	100	55	4	4	4	4	4	4	4	4	4	4	0
Building Construction														
Worker Commute Car	LDA	40	55	0	0	0	0	62	62	62	78	78	78	78
Equipment/Material Delivery	T7 tractor construction	40	55	0	0	0	0	0.5	0.5	0.5	0.5	0.5	0.5	0.5

Notes:

No offsite vehicles are expected during the the testing and commissioning phase of the project.

King Island CAES Project
Appendix 5.1A Table 5.1A.9
Off-road Equipment and Vehicle Emission Rates
February 2015

Equipment/Vehicle Type	Description	HP	OFFROAD Equipment Type	Load Factor [a]	2015 Emission Factors (g/hp-hr)								
					ROG	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O
Mobilization													
Generator	Multiquip WshpWatt	30	Generator Sets	0.74	1.281	4.538	4.858	0.007	0.353	0.353	568.3	0.014	0.006
On-Site Pick Up Truck	Ford F-150	185	Off-Highway Trucks	0.38	0.473	1.9	5.242	0.005	0.227	0.209	507.8	0.012	0.005
On-Site Flatbed Delivery Truck	One-Ton	280	Off-Highway Trucks	0.38	0.385	2.037	4.528	0.005	0.173	0.159	515.8	0.012	0.005
Deere 210LE Skip Loader	Case 586G	78	Tractors/Loaders/Backhoes	0.37	0.569	3.832	5.422	0.005	0.424	0.39	517.4	0.011	0.005
5000 gal Water Truck	FrtLiner 5000 gal	240	Off-Highway Trucks	0.38	0.473	1.9	5.242	0.005	0.227	0.209	507.8	0.012	0.005
On-Site Service Truck	Ford F-150	210	Off-Highway Trucks	0.38	0.473	1.9	5.242	0.005	0.227	0.209	507.8	0.012	0.005
On-site Lube/Fuel Trucks	Ford F-150	210	Off-Highway Trucks	0.38	0.473	1.9	5.242	0.005	0.227	0.209	507.8	0.012	0.005
Track Trencher	HT115	115	Trenchers	0.50	0.817	4.014	7.179	0.005	0.562	0.517	515.4	0.015	0.007
On-Site Dump Truck	One Ton	280	Off-Highway Trucks	0.38	0.385	2.037	4.528	0.005	0.173	0.159	515.8	0.012	0.005
Civil Improvements													
Dozer Cat D6R	Cat D6	185	Crawler Tractors	0.43	0.451	1.816	6.143	0.005	0.237	0.218	512.9	0.013	0.006
Generator	Multiquip WshpWatt	30	Generator Sets	0.74	1.281	4.538	4.858	0.007	0.353	0.353	568.3	0.014	0.006
Scraper Cat 623	Cat-623	365	Scrapers	0.48	0.472	3.788	6.086	0.005	0.246	0.226	511.9	0.015	0.007
Deere 210LE Skip Loader	Case 586G	78	Tractors/Loaders/Backhoes	0.37	0.569	3.832	5.422	0.005	0.424	0.39	517.4	0.011	0.005
Cat 140H Grader	Cat14G	185	Graders	0.41	0.396	1.466	5.728	0.005	0.186	0.171	517.1	0.013	0.006
5000 gal Water Truck	FrtLiner 5000 gal	240	Off-Highway Trucks	0.38	0.473	1.9	5.242	0.005	0.227	0.209	507.8	0.012	0.005
Roller Vibrator/Compactor/Other	Cat 826H	350	Rollers	0.38	0.371	3.245	5.031	0.005	0.195	0.179	517.3	0.012	0.005
Cat BG600D Paver	AC Paver	173	Pavers	0.42	0.489	3.115	5.537	0.005	0.277	0.255	511.6	0.013	0.006
On-site Heavy Duty Pick Up Truck	Ford F-150	235	Off-Highway Trucks	0.38	0.473	1.9	5.242	0.005	0.227	0.209	507.8	0.012	0.005
On-Site Flatbed Delivery Truck	One-Ton	280	Off-Highway Trucks	0.38	0.385	2.037	4.528	0.005	0.173	0.159	515.8	0.012	0.005
On-Site Lube/Fuel Trucks	Ford F-150	210	Off-Highway Trucks	0.38	0.473	1.9	5.242	0.005	0.227	0.209	507.8	0.012	0.005
On-Site Service Truck	Ford F-150	210	Off-Highway Trucks	0.38	0.473	1.9	5.242	0.005	0.227	0.209	507.8	0.012	0.005
On-Site Dump Truck	One Ton	280	Off-Highway Trucks	0.38	0.385	2.037	4.528	0.005	0.173	0.159	515.8	0.012	0.005
Compression Plant and Power Generation Plant													
Generator	Multiquip WshpWatt	30	Generator Sets	0.74	1.281	4.538	4.858	0.007	0.353	0.353	568.3	0.014	0.006
Air Compressor	Ingersol Rand - 250 CFM	25	Air Compressors	0.48	0.894	2.666	4.89	0.007	0.27	0.27	568.3	0.014	0.006
Dozer Cat D6R	Cat D6	185	Crawler Tractors	0.43	0.451	1.816	6.143	0.005	0.237	0.218	512.9	0.013	0.006
Deere 210LE Skip Loader	Case 586G	78	Tractors/Loaders/Backhoes	0.37	0.569	3.832	5.422	0.005	0.424	0.39	517.4	0.011	0.005
Telehandler	Cat TL943	99	Rough Terrain Forklifts	0.40	0.338	3.366	4.28	0.005	0.247	0.228	512.1	0.012	0.005
Track Trencher	HT115	115	Trenchers	0.50	0.817	4.014	7.179	0.005	0.562	0.517	515.4	0.015	0.007
Cat 583T Pipelayer	Cat 583T	310	Cranes	0.29	0.475	4.11	6.124	0.005	0.253	0.233	511.2	0.009	0.004
On-Site Pick Up Truck	Ford F-150	210	Off-Highway Trucks	0.38	0.473	1.9	5.242	0.005	0.227	0.209	507.8	0.012	0.005
On-Site Heavy Duty Pick Up Truck	Ford F-150	235	Off-Highway Trucks	0.38	0.473	1.9	5.242	0.005	0.227	0.209	507.8	0.012	0.005
On-Site Flatbed Delivery Truck	One-Ton	280	Off-Highway Trucks	0.38	0.385	2.037	4.528	0.005	0.173	0.159	515.8	0.012	0.005
On-Site Service Truck	Ford F-150	210	Off-Highway Trucks	0.38	0.473	1.9	5.242	0.005	0.227	0.209	507.8	0.012	0.005
On-Site Dump Truck	One Ton	280	Off-Highway Trucks	0.38	0.385	2.037	4.528	0.005	0.173	0.159	515.8	0.012	0.005
On-Site Lube/Fuel Trucks	Ford F-150	210	Off-Highway Trucks	0.38	0.473	1.9	5.242	0.005	0.227	0.209	507.8	0.012	0.005

King Island CAES Project
Appendix 5.1A Table 5.1A.9
Off-road Equipment and Vehicle Emission Rates
February 2015

Equipment/Vehicle Type	Description	HP	OFFROAD Equipment Type	Load Factor [a]	2015 Emission Factors (g/hp-hr)								
					ROG	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O
Building Construction													
On-Site Heavy Duty Pick Up Truck	Ford F-150	235	Off-Highway Trucks	0.38	0.473	1.9	5.242	0.005	0.227	0.209	507.8	0.012	0.005
On-Site Flatbed Delivery Truck	One-Ton	280	Off-Highway Trucks	0.38	0.385	2.037	4.528	0.005	0.173	0.159	515.8	0.012	0.005
Generator	Multiquip WshpWatt	30	Generator Sets	0.74	1.281	4.538	4.858	0.007	0.353	0.353	568.3	0.014	0.006
Air Compressor	Ingersol Rand - 250 CFM	25	Air Compressors	0.48	0.894	2.666	4.89	0.007	0.27	0.27	568.3	0.014	0.006
Deere 210LE Skip Loader	Case 586G	78	Tractors/Loaders/Backhoes	0.37	0.569	3.832	5.422	0.005	0.424	0.39	517.4	0.011	0.005
Crane/Boom Truck	Grove 25 Ton Rough Terrain	250	Cranes	0.29	0.642	2.653	7.622	0.005	0.348	0.32	512.4	0.009	0.004
Testing and Commissioning													
On-Site Heavy Duty Pick Up Truck	Ford F-150	235	Off-Highway Trucks	0.38	0.473	1.9	5.242	0.005	0.227	0.209	507.8	0.012	0.005
On-Site Service Truck	Ford F-150	210	Off-Highway Trucks	0.38	0.473	1.9	5.242	0.005	0.227	0.209	507.8	0.012	0.005
Cat BG600D Paver	AC Paver	173	Pavers	0.42	0.489	3.115	5.537	0.005	0.277	0.255	511.6	0.013	0.006
Roller Vibrator/Compactor/Other	Cat 826H	350	Rollers	0.38	0.371	3.245	5.031	0.005	0.195	0.179	517.3	0.012	0.005

Notes:

[a] Equipment load factors from CalEEMod Appendix D Table 3.3.

King Island CAES Project
Appendix 5.1A Table 5.1A.9
Off-road Equipment and Vehicle Emission Rates
February 2015

Equipment/Vehicle Type	Description	HP	OFFROAD Equipment Type	Load Factor [a]	2016 Emission Factors (g/hp-hr)									2017 Emission Factors (g/hp-hr)								
					ROG	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O	ROG	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O
Mobilization																						
Generator	Multiquip WshpWatt	30	Generator Sets	0.74	1.146	4.41	4.685	0.007	0.318	0.318	568.3	0.014	0.006	1.017	4.292	4.522	0.007	0.285	0.285	568.3	0.014	0.006
On-Site Pick Up Truck	Ford F-150	185	Off-Highway Trucks	0.38	0.446	1.824	4.826	0.005	0.208	0.191	502.5	0.012	0.005	0.417	1.753	4.368	0.005	0.189	0.174	494.8	0.012	0.005
On-Site Flatbed Delivery Truck	One-Ton	280	Off-Highway Trucks	0.38	0.351	1.885	4.048	0.005	0.153	0.141	509.9	0.012	0.005	0.325	1.748	3.668	0.005	0.136	0.125	501.4	0.012	0.005
Deere 210LE Skip Loader	Case 586G	78	Tractors/Loaders/Backhoes	0.37	0.538	3.811	5.142	0.005	0.396	0.364	511.3	0.011	0.005	0.501	3.782	4.809	0.005	0.362	0.333	502.8	0.011	0.005
5000 gal Water Truck	FrtLiner 5000 gal	240	Off-Highway Trucks	0.38	0.446	1.824	4.826	0.005	0.208	0.191	502.5	0.012	0.005	0.417	1.753	4.368	0.005	0.189	0.174	494.8	0.012	0.005
On-Site Service Truck	Ford F-150	210	Off-Highway Trucks	0.38	0.446	1.824	4.826	0.005	0.208	0.191	502.5	0.012	0.005	0.417	1.753	4.368	0.005	0.189	0.174	494.8	0.012	0.005
On-site Lube/Fuel Trucks	Ford F-150	210	Off-Highway Trucks	0.38	0.446	1.824	4.826	0.005	0.208	0.191	502.5	0.012	0.005	0.417	1.753	4.368	0.005	0.189	0.174	494.8	0.012	0.005
Track Trencher	HT115	115	Trenchers	0.50	0.788	3.988	6.902	0.005	0.541	0.498	509.9	0.015	0.007	0.762	3.968	6.679	0.005	0.523	0.481	502	0.015	0.007
On-Site Dump Truck	One Ton	280	Off-Highway Trucks	0.38	0.351	1.885	4.048	0.005	0.153	0.141	509.9	0.012	0.005	0.325	1.748	3.668	0.005	0.136	0.125	501.4	0.012	0.005
Civil Improvements																						
Dozer Cat D6R	Cat D6	185	Crawler Tractors	0.43	0.449	1.803	6.047	0.005	0.233	0.215	507.4	0.013	0.006	0.43	1.742	5.76	0.005	0.22	0.202	499.8	0.013	0.006
Generator	Multiquip WshpWatt	30	Generator Sets	0.74	1.146	4.41	4.685	0.007	0.318	0.318	568.3	0.014	0.006	1.017	4.292	4.522	0.007	0.285	0.285	568.3	0.014	0.006
Scraper Cat 623	Cat-623	365	Scrapers	0.48	0.452	3.606	5.757	0.005	0.232	0.214	506.4	0.015	0.007	0.425	3.337	5.34	0.005	0.214	0.197	498.5	0.015	0.007
Deere 210LE Skip Loader	Case 586G	78	Tractors/Loaders/Backhoes	0.37	0.538	3.811	5.142	0.005	0.396	0.364	511.3	0.011	0.005	0.501	3.782	4.809	0.005	0.362	0.333	502.8	0.011	0.005
Cat 140H Grader	Cat14G	185	Graders	0.41	0.398	1.459	5.663	0.005	0.184	0.169	511.7	0.013	0.006	0.396	1.449	5.525	0.005	0.18	0.166	503.8	0.013	0.006
5000 gal Water Truck	FrtLiner 5000 gal	240	Off-Highway Trucks	0.38	0.446	1.824	4.826	0.005	0.208	0.191	502.5	0.012	0.005	0.417	1.753	4.368	0.005	0.189	0.174	494.8	0.012	0.005
Roller Vibrator/Compactor/Other	Cat 826H	350	Rollers	0.38	0.334	2.956	4.456	0.005	0.173	0.159	513.4	0.012	0.005	0.297	2.685	3.84	0.005	0.15	0.138	505.8	0.012	0.005
Cat BG600D Paver	AC Paver	173	Pavers	0.42	0.433	3.08	4.874	0.005	0.242	0.223	506.5	0.013	0.006	0.389	3.063	4.353	0.005	0.214	0.197	499	0.013	0.006
On-site Heavy Duty Pick Up Truck	Ford F-150	235	Off-Highway Trucks	0.38	0.446	1.824	4.826	0.005	0.208	0.191	502.5	0.012	0.005	0.417	1.753	4.368	0.005	0.189	0.174	494.8	0.012	0.005
On-Site Flatbed Delivery Truck	One-Ton	280	Off-Highway Trucks	0.38	0.351	1.885	4.048	0.005	0.153	0.141	509.9	0.012	0.005	0.325	1.748	3.668	0.005	0.136	0.125	501.4	0.012	0.005
On-Site Lube/Fuel Trucks	Ford F-150	210	Off-Highway Trucks	0.38	0.446	1.824	4.826	0.005	0.208	0.191	502.5	0.012	0.005	0.417	1.753	4.368	0.005	0.189	0.174	494.8	0.012	0.005
On-Site Service Truck	Ford F-150	210	Off-Highway Trucks	0.38	0.446	1.824	4.826	0.005	0.208	0.191	502.5	0.012	0.005	0.417	1.753	4.368	0.005	0.189	0.174	494.8	0.012	0.005
On-Site Dump Truck	One Ton	280	Off-Highway Trucks	0.38	0.351	1.885	4.048	0.005	0.153	0.141	509.9	0.012	0.005	0.325	1.748	3.668	0.005	0.136	0.125	501.4	0.012	0.005
Compression Plant and Power Generation Plant																						
Generator	Multiquip WshpWatt	30	Generator Sets	0.74	1.146	4.41	4.685	0.007	0.318	0.318	568.3	0.014	0.006	1.017	4.292	4.522	0.007	0.285	0.285	568.3	0.014	0.006
Air Compressor	Ingersol Rand - 250 CFM	25	Air Compressors	0.48	0.855	2.604	4.803	0.007	0.255	0.255	568.3	0.014	0.006	0.83	2.564	4.729	0.007	0.243	0.243	568.3	0.014	0.006
Dozer Cat D6R	Cat D6	185	Crawler Tractors	0.43	0.449	1.803	6.047	0.005	0.233	0.215	507.4	0.013	0.006	0.43	1.742	5.76	0.005	0.22	0.202	499.8	0.013	0.006
Deere 210LE Skip Loader	Case 586G	78	Tractors/Loaders/Backhoes	0.37	0.538	3.811	5.142	0.005	0.396	0.364	511.3	0.011	0.005	0.501	3.782	4.809	0.005	0.362	0.333	502.8	0.011	0.005
Telehandler	Cat TL943	99	Rough Terrain Forklifts	0.40	0.302	3.342	3.84	0.005	0.213	0.196	507.1	0.012	0.005	0.271	3.318	3.418	0.005	0.182	0.167	499.2	0.012	0.005
Track Trencher	HT115	115	Trenchers	0.50	0.788	3.988	6.902	0.005	0.541	0.498	509.9	0.015	0.007	0.762	3.968	6.679	0.005	0.523	0.481	502	0.015	0.007
Cat 583T Pipelayer	Cat 583T	310	Cranes	0.29	0.443	3.834	5.649	0.005	0.233	0.215	506.1	0.009	0.004	0.41	3.547	5.232	0.005	0.212	0.195	498.4	0.009	0.004
On-Site Pick Up Truck	Ford F-150	210	Off-Highway Trucks	0.38	0.446	1.824	4.826	0.005	0.208	0.191	502.5	0.012	0.005	0.417	1.753	4.368	0.005	0.189	0.174	494.8	0.012	0.005
On-Site Heavy Duty Pick Up Truck	Ford F-150	235	Off-Highway Trucks	0.38	0.446	1.824	4.826	0.005	0.208	0.191	502.5	0.012	0.005	0.417	1.753	4.368	0.005	0.189	0.174	494.8	0.012	0.005
On-Site Flatbed Delivery Truck	One-Ton	280	Off-Highway Trucks	0.38	0.351	1.885	4.048	0.005	0.153	0.141	509.9	0.012	0.005	0.325	1.748	3.668	0.005	0.136	0.125	501.4	0.012	0.005
On-Site Service Truck	Ford F-150	210	Off-Highway Trucks	0.38	0.446	1.824	4.826	0.005	0.208	0.191	502.5	0.012	0.005	0.417	1.753	4.368	0.005	0.189	0.174	494.8	0.012	0.005
On-Site Dump Truck	One Ton	280	Off-Highway Trucks	0.38	0.351	1.885	4.048	0.005	0.153	0.141	509.9	0.012	0.005	0.325	1.748	3.668	0.005	0.136	0.125	501.4	0.012	0.005
On-Site Lube/Fuel Trucks	Ford F-150	210	Off-Highway Trucks	0.38	0.446	1.824	4.826	0.005	0.208	0.191	502.5	0.012	0.005	0.417	1.753	4.368	0.005	0.189	0.174	494.8	0.012	0.005

King Island CAES Project
Appendix 5.1A Table 5.1A.9
Off-road Equipment and Vehicle Emission Rates
February 2015

Equipment/Vehicle Type	Description	HP	OFFROAD Equipment Type	Load Factor [a]	2016 Emission Factors (g/hp-hr)									2017 Emission Factors (g/hp-hr)								
					ROG	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O	ROG	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O
Building Construction																						
On-Site Heavy Duty Pick Up Truck	Ford F-150	235	Off-Highway Trucks	0.38	0.446	1.824	4.826	0.005	0.208	0.191	502.5	0.012	0.005	0.417	1.753	4.368	0.005	0.189	0.174	494.8	0.012	0.005
On-Site Flatbed Delivery Truck	One-Ton	280	Off-Highway Trucks	0.38	0.351	1.885	4.048	0.005	0.153	0.141	509.9	0.012	0.005	0.325	1.748	3.668	0.005	0.136	0.125	501.4	0.012	0.005
Generator	Multiquip WshpWatt	30	Generator Sets	0.74	1.146	4.41	4.685	0.007	0.318	0.318	568.3	0.014	0.006	1.017	4.292	4.522	0.007	0.285	0.285	568.3	0.014	0.006
Air Compressor	Ingersol Rand - 250 CFM	25	Air Compressors	0.48	0.855	2.604	4.803	0.007	0.255	0.255	568.3	0.014	0.006	0.83	2.564	4.729	0.007	0.243	0.243	568.3	0.014	0.006
Deere 210LE Skip Loader	Case 586G	78	Tractors/Loaders/Backhoes	0.37	0.538	3.811	5.142	0.005	0.396	0.364	511.3	0.011	0.005	0.501	3.782	4.809	0.005	0.362	0.333	502.8	0.011	0.005
Crane/Boom Truck	Grove 25 Ton Rough Terrain	250	Cranes	0.29	0.623	2.582	7.381	0.005	0.335	0.308	507.2	0.009	0.004	0.561	2.385	6.655	0.005	0.297	0.273	499.4	0.009	0.004
Testing and Commissioning																						
On-Site Heavy Duty Pick Up Truck	Ford F-150	235	Off-Highway Trucks	0.38	0.446	1.824	4.826	0.005	0.208	0.191	502.5	0.012	0.005	0.417	1.753	4.368	0.005	0.189	0.174	494.8	0.012	0.005
On-Site Service Truck	Ford F-150	210	Off-Highway Trucks	0.38	0.446	1.824	4.826	0.005	0.208	0.191	502.5	0.012	0.005	0.417	1.753	4.368	0.005	0.189	0.174	494.8	0.012	0.005
Cat BG600D Paver	AC Paver	173	Pavers	0.42	0.433	3.08	4.874	0.005	0.242	0.223	506.5	0.013	0.006	0.389	3.063	4.353	0.005	0.214	0.197	499	0.013	0.006
Roller Vibrator/Compactor/Other	Cat 826H	350	Rollers	0.38	0.334	2.956	4.456	0.005	0.173	0.159	513.4	0.012	0.005	0.297	2.685	3.84	0.005	0.15	0.138	505.8	0.012	0.005

Notes:

[a] Equipment load factors from CalEEMod Appendix D Table 3.3.

King Island CAES Project
Appendix 5.1A Table 5.1A.10
EMFAC2011 Emission Rates
February 2015

Region_Type	Region	CalYr	Season	Veh	Fuel	Veh & Tech	MdlYr	Speed	ROG_RUNEX (g/mi)	TOG_RUNEX (g/mi)	CO_RUNEX (g/mi)
County	San Joaquin	2015	Annual	LDA	TOT	LDA - TOT	AllMYr	55 MPH	0.0271	0.0374	1.0539
County	San Joaquin	2015	Annual	OBUS	TOT	OBUS - TOT	AllMYr	55 MPH	0.1252	0.1519	3.5966
County	San Joaquin	2015	Annual	T7 single construction	TOT	T7 single construction - TOT	AllMYr	55 MPH	0.1539	0.1753	0.8508
County	San Joaquin	2015	Annual	T7 tractor construction	TOT	T7 tractor construction - TOT	AllMYr	55 MPH	0.2414	0.2748	1.3599
County	San Joaquin	2016	Annual	LDA	TOT	LDA - TOT	AllMYr	55 MPH	0.0220	0.0313	0.9235
County	San Joaquin	2016	Annual	OBUS	TOT	OBUS - TOT	AllMYr	55 MPH	0.1080	0.1316	3.0626
County	San Joaquin	2016	Annual	T7 single construction	TOT	T7 single construction - TOT	AllMYr	55 MPH	0.1002	0.1141	0.6281
County	San Joaquin	2016	Annual	T7 tractor construction	TOT	T7 tractor construction - TOT	AllMYr	55 MPH	0.1528	0.1740	0.9749
County	San Joaquin	2017	Annual	LDA	TOT	LDA - TOT	AllMYr	55 MPH	0.0172	0.0257	0.8063
County	San Joaquin	2017	Annual	OBUS	TOT	OBUS - TOT	AllMYr	55 MPH	0.0949	0.1160	2.6799
County	San Joaquin	2017	Annual	T7 single construction	TOT	T7 single construction - TOT	AllMYr	55 MPH	0.0941	0.1071	0.6135
County	San Joaquin	2017	Annual	T7 tractor construction	TOT	T7 tractor construction - TOT	AllMYr	55 MPH	0.1419	0.1616	0.9375

Region_Type	Region	CalYr	Season	Veh	Fuel	Veh & Tech	MdlYr	Speed	PM10_PMTW (g/mi)	PM10_PMBW (g/mi)	PM2_5_PMTW (g/mi)
County	San Joaquin	2015	Annual	LDA	TOT	LDA - TOT	AllMYr	AllSpeeds Combined	0.0080	0.0367	0.0020
County	San Joaquin	2015	Annual	OBUS	TOT	OBUS - TOT	AllMYr	AllSpeeds Combined	0.0080	0.0367	0.0020
County	San Joaquin	2015	Annual	T7 single construction	TOT	T7 single construction - TOT	AllMYr	AllSpeeds Combined	0.0360	0.0617	0.0090
County	San Joaquin	2015	Annual	T7 tractor construction	TOT	T7 tractor construction - TOT	AllMYr	AllSpeeds Combined	0.0360	0.0617	0.0090
County	San Joaquin	2016	Annual	LDA	TOT	LDA - TOT	AllMYr	AllSpeeds Combined	0.0080	0.0367	0.0020
County	San Joaquin	2016	Annual	OBUS	TOT	OBUS - TOT	AllMYr	AllSpeeds Combined	0.0080	0.0367	0.0020
County	San Joaquin	2016	Annual	T7 single construction	TOT	T7 single construction - TOT	AllMYr	AllSpeeds Combined	0.0360	0.0617	0.0090
County	San Joaquin	2016	Annual	T7 tractor construction	TOT	T7 tractor construction - TOT	AllMYr	AllSpeeds Combined	0.0360	0.0617	0.0090
County	San Joaquin	2017	Annual	LDA	TOT	LDA - TOT	AllMYr	AllSpeeds Combined	0.0080	0.0367	0.0020
County	San Joaquin	2017	Annual	OBUS	TOT	OBUS - TOT	AllMYr	AllSpeeds Combined	0.0080	0.0367	0.0020
County	San Joaquin	2017	Annual	T7 single construction	TOT	T7 single construction - TOT	AllMYr	AllSpeeds Combined	0.0360	0.0617	0.0090
County	San Joaquin	2017	Annual	T7 tractor construction	TOT	T7 tractor construction - TOT	AllMYr	AllSpeeds Combined	0.0360	0.0617	0.0090

Notes:

[a] CH_4 and N_2O emission factors from Table 13.5 of The Climate Registry Default 2014 Emission Factors (TCR, 2014).

King Island CAES Project
Appendix 5.1A Table 5.1A.10
EMFAC2011 Emission Rates
February 2015

Region_Type	Region	CalYr	Season	Veh	Fuel	Veh & Tech	MdlYr	Speed	NOx_RUNEX (g/mi)	CO2_RUNEX (g/mi)	CO2(Pavley I + LCFS)_RUNEX (g/mi)	PM10_RUNEX (g/mi)	PM2_5_RUNEX (g/mi)	SOx_RUNEX (g/mi)	CH4_TCR (g/mi) [a]	N2O_TCR (g/mi) [a]
County	San Joaquin	2015	Annual	LDA	TOT	LDA - TOT	AllMYr	55 MPH	0.1102	299	250	0.0014	0.0013	0.0034	0.0173	0.0036
County	San Joaquin	2015	Annual	OBUS	TOT	OBUS - TOT	AllMYr	55 MPH	1.8939	482	470	0.0005	0.0005	0.0069	0.0333	0.0134
County	San Joaquin	2015	Annual	T7 single construction	TOT	T7 single construction - TOT	AllMYr	55 MPH	8.4448	1581	1542	0.1241	0.1141	0.0166	0.0051	0.0048
County	San Joaquin	2015	Annual	T7 tractor construction	TOT	T7 tractor construction - TOT	AllMYr	55 MPH	9.1311	1585	1545	0.1874	0.1724	0.0166	0.0051	0.0048
County	San Joaquin	2016	Annual	LDA	TOT	LDA - TOT	AllMYr	55 MPH	0.0974	299	240	0.0013	0.0012	0.0034	0.0173	0.0036
County	San Joaquin	2016	Annual	OBUS	TOT	OBUS - TOT	AllMYr	55 MPH	1.6774	482	466	0.0004	0.0004	0.0069	0.0333	0.0134
County	San Joaquin	2016	Annual	T7 single construction	TOT	T7 single construction - TOT	AllMYr	55 MPH	7.2634	1583	1528	0.0756	0.0695	0.0166	0.0051	0.0048
County	San Joaquin	2016	Annual	T7 tractor construction	TOT	T7 tractor construction - TOT	AllMYr	55 MPH	7.6155	1583	1528	0.1080	0.0993	0.0166	0.0051	0.0048
County	San Joaquin	2017	Annual	LDA	TOT	LDA - TOT	AllMYr	55 MPH	0.0863	299	229	0.0013	0.0012	0.0034	0.0173	0.0036
County	San Joaquin	2017	Annual	OBUS	TOT	OBUS - TOT	AllMYr	55 MPH	1.4891	482	458	0.0004	0.0004	0.0069	0.0333	0.0134
County	San Joaquin	2017	Annual	T7 single construction	TOT	T7 single construction - TOT	AllMYr	55 MPH	6.4310	1581	1502	0.0656	0.0604	0.0166	0.0051	0.0048
County	San Joaquin	2017	Annual	T7 tractor construction	TOT	T7 tractor construction - TOT	AllMYr	55 MPH	6.7491	1580	1501	0.0942	0.0867	0.0166	0.0051	0.0048

Region_Type	Region	CalYr	Season	Veh	Fuel	Veh & Tech	MdlYr	Speed	PM2_5_PMBW (g/mi)	PM10 TOT (g/mi)	PM2.5 TOT (g/mi)
County	San Joaquin	2015	Annual	LDA	TOT	LDA - TOT	AllMYr	AllSpeeds Combined	0.0157	0.0447	0.0177
County	San Joaquin	2015	Annual	OBUS	TOT	OBUS - TOT	AllMYr	AllSpeeds Combined	0.0157	0.0447	0.0177
County	San Joaquin	2015	Annual	T7 single construction	TOT	T7 single construction - TOT	AllMYr	AllSpeeds Combined	0.0265	0.0977	0.0355
County	San Joaquin	2015	Annual	T7 tractor construction	TOT	T7 tractor construction - TOT	AllMYr	AllSpeeds Combined	0.0265	0.0977	0.0355
County	San Joaquin	2016	Annual	LDA	TOT	LDA - TOT	AllMYr	AllSpeeds Combined	0.0157	0.0447	0.0177
County	San Joaquin	2016	Annual	OBUS	TOT	OBUS - TOT	AllMYr	AllSpeeds Combined	0.0157	0.0447	0.0177
County	San Joaquin	2016	Annual	T7 single construction	TOT	T7 single construction - TOT	AllMYr	AllSpeeds Combined	0.0265	0.0977	0.0355
County	San Joaquin	2016	Annual	T7 tractor construction	TOT	T7 tractor construction - TOT	AllMYr	AllSpeeds Combined	0.0265	0.0977	0.0355
County	San Joaquin	2017	Annual	LDA	TOT	LDA - TOT	AllMYr	AllSpeeds Combined	0.0157	0.0447	0.0177
County	San Joaquin	2017	Annual	OBUS	TOT	OBUS - TOT	AllMYr	AllSpeeds Combined	0.0157	0.0447	0.0177
County	San Joaquin	2017	Annual	T7 single construction	TOT	T7 single construction - TOT	AllMYr	AllSpeeds Combined	0.0265	0.0977	0.0355
County	San Joaquin	2017	Annual	T7 tractor construction	TOT	T7 tractor construction - TOT	AllMYr	AllSpeeds Combined	0.0265	0.0977	0.0355

Notes:

[a] CH_4 and N_2O emission factors from Table 13.5 of The Climate Registry Default 2014 Emission Factors (TCR, 2014).

King Island CAES Project
Appendix 5.1A Table 5.1A.11
OFFROAD Emission Rates
February 2015

Table 3.3 OFFROAD Default Horsepower and Load Factors

OFFROAD Equipment Type	Horsepower	Load Factors	2015 Emission Factors (g/hp-hr)							2016 Emission Factors (g/hp-hr)						
			ROG	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO_2	ROG	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO_2
Air Compressors	25	0.48	0.894	2.666	4.89	0.007	0.27	0.27	568.299	0.855	2.604	4.803	0.007	0.255	0.255	568.299
Cranes	250	0.29	0.6422	2.65334	7.62156	0.0049	0.3479	0.3201	512.4484	0.6229	2.5822	7.38068	0.0049	0.3349	0.3081	507.1552
Cranes	310	0.29	0.475	4.10962	6.12404	0.0049	0.2534	0.2331	511.1972	0.443	3.83445	5.64865	0.0049	0.2332	0.2145	506.0882
Crawler Tractors	185	0.43	0.4511	1.81586	6.14312	0.0049	0.2369	0.2179	512.8973	0.4487	1.80295	6.04745	0.0049	0.2332	0.2145	507.355
Generator Sets	30	0.74	1.281	4.538	4.858	0.007	0.353	0.353	568.299	1.146	4.41	4.685	0.007	0.318	0.318	568.299
Graders	185	0.41	0.396	1.46577	5.72754	0.0049	0.1856	0.1708	517.1275	0.3983	1.45911	5.6628	0.0049	0.184	0.1692	511.6959
Off-Highway Trucks	185	0.38	0.4734	1.89994	5.24228	0.0048	0.2267	0.2086	507.8087	0.4458	1.82377	4.82646	0.0048	0.2077	0.1911	502.4732
Off-Highway Trucks	210	0.38	0.4734	1.89994	5.24228	0.0048	0.2267	0.2086	507.8087	0.4458	1.82377	4.82646	0.0048	0.2077	0.1911	502.4732
Off-Highway Trucks	235	0.38	0.4734	1.89994	5.24228	0.0048	0.2267	0.2086	507.8087	0.4458	1.82377	4.82646	0.0048	0.2077	0.1911	502.4732
Off-Highway Trucks	240	0.38	0.4734	1.89994	5.24228	0.0048	0.2267	0.2086	507.8087	0.4458	1.82377	4.82646	0.0048	0.2077	0.1911	502.4732
Off-Highway Trucks	280	0.38	0.3845	2.0367	4.52794	0.0049	0.173	0.1591	515.8419	0.3514	1.88523	4.04798	0.0049	0.1527	0.1405	509.8604
Off-Highway Trucks	350	0.38	0.3845	2.0367	4.52794	0.0049	0.173	0.1591	515.8419	0.3514	1.88523	4.04798	0.0049	0.1527	0.1405	509.8604
Pavers	173	0.42	0.4894	3.11546	5.53669	0.0049	0.2774	0.2552	511.6457	0.4332	3.08023	4.87397	0.0049	0.2422	0.2228	506.5401
Rollers	350	0.38	0.3709	3.24549	5.03147	0.0049	0.195	0.1794	517.2848	0.334	2.95647	4.45617	0.0049	0.1731	0.1592	513.4154
Rough Terrain Forklifts	99	0.40	0.3377	3.36619	4.28003	0.0049	0.2474	0.2276	512.0859	0.3016	3.34169	3.84005	0.0049	0.2131	0.1961	507.0659
Scrapers	365	0.48	0.4722	3.788	6.08577	0.0049	0.2458	0.2261	511.9471	0.4524	3.60633	5.75749	0.0049	0.2321	0.2135	506.3503
Tractors/Loaders/Backhoes	78	0.37	0.5693	3.83198	5.4221	0.0049	0.4244	0.3904	517.3652	0.538	3.81146	5.14235	0.0049	0.3959	0.3643	511.3456
Trenchers	115	0.50	0.8171	4.01434	7.17857	0.0049	0.5616	0.5167	515.3955	0.788	3.98822	6.90219	0.0049	0.5413	0.498	509.9027

King Island CAES Project
Appendix 5.1A Table 5.1A.11
OFFROAD Emission Rates
February 2015

Table 3.3 OFFROAD Default Horse

OFFROAD Equipment Type	2017 Emission Factors (g/hp-hr)						
	ROG	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO_2
Air Compressors	0.83	2.564	4.729	0.007	0.243	0.243	568.299
Cranes	0.5606	2.38452	6.65526	0.0049	0.2967	0.273	499.3721
Cranes	0.4101	3.54746	5.23184	0.0049	0.2124	0.1954	498.439
Crawler Tractors	0.4295	1.7418	5.75969	0.0049	0.2199	0.2023	499.832
Generator Sets	1.017	4.292	4.522	0.007	0.285	0.285	568.299
Graders	0.3961	1.44905	5.52488	0.0049	0.1802	0.1658	503.8022
Off-Highway Trucks	0.4172	1.75281	4.36785	0.0048	0.1887	0.1736	494.7935
Off-Highway Trucks	0.4172	1.75281	4.36785	0.0048	0.1887	0.1736	494.7935
Off-Highway Trucks	0.4172	1.75281	4.36785	0.0048	0.1887	0.1736	494.7935
Off-Highway Trucks	0.4172	1.75281	4.36785	0.0048	0.1887	0.1736	494.7935
Off-Highway Trucks	0.3253	1.74773	3.66841	0.0049	0.1362	0.1253	501.4368
Off-Highway Trucks	0.3253	1.74773	3.66841	0.0049	0.1362	0.1253	501.4368
Pavers	0.3889	3.06282	4.35312	0.0049	0.2142	0.1971	498.967
Rollers	0.2968	2.68487	3.84047	0.0049	0.1501	0.1381	505.8318
Rough Terrain Forklifts	0.271	3.31778	3.41759	0.0049	0.1816	0.1671	499.1682
Scrapers	0.4251	3.33699	5.33951	0.0049	0.2143	0.1971	498.4571
Tractors/Loaders/Backhoes	0.5005	3.7818	4.8087	0.0049	0.3616	0.3327	502.7952
Trenchers	0.7615	3.96827	6.67876	0.0049	0.5232	0.4813	501.9916

King Island CAES Project
Appendix 5.1A Table 5.1A.12
OFFROAD Fuel Consumption
February 2015

CalendarYear	AirBasin	Equipment Class	EquipmentTypeID	Equipment Type	HorsepowerBin	BaseBSFC (lb/yr)	BaseActivity (hrs)	BasePopulation	BaseAvgHP	BSFC (gal/hp-hr)
2015	SJV	Construction and Mining	12	Cranes	250	1828881	79545	184.1	217	0.015
2015	SJV	Construction and Mining	12	Cranes	500	2800960	78832	176.6	336	0.015
2015	SJV	Construction and Mining	13	Crawler Tractors	250	2548412	79637	189.1	203	0.023
2015	SJV	Construction and Mining	15	Graders	250	6037496	194806	283.9	204	0.022
2015	SJV	Construction and Mining	17	Off-Highway Trucks	250	4041921	137597	117.9	211	0.020
2015	SJV	Construction and Mining	17	Off-Highway Trucks	500	17180202	326516	262.0	372	0.020
2015	SJV	Construction and Mining	18	Other Construction Equipment	50	469928	72381	166.5	38	0.024
2015	SJV	Construction and Mining	19	Pavers	175	756197	31354	88.6	158	0.022
2015	SJV	Construction and Mining	21	Rollers	500	189886	4071	14.8	335	0.020
2015	SJV	Construction and Mining	22	Rough Terrain Forklifts	120	4838944	340016	1326.5	96	0.021
2015	SJV	Construction and Mining	25	Scrapers	500	18226235	269584	627.7	381	0.025
2015	SJV	Construction and Mining	28	Tractors/Loaders/Backhoes	120	28530856	2521815	4487.3	83	0.020
2015	SJV	Construction and Mining	29	Trenchers	120	453783	29743	100.5	82	0.027
2016	SJV	Construction and Mining	12	Cranes	250	1980061	86131	196.5	217	0.015
2016	SJV	Construction and Mining	12	Cranes	500	3033464	85359	188.5	336	0.015
2016	SJV	Construction and Mining	13	Crawler Tractors	250	2759258	86230	201.9	203	0.023
2016	SJV	Construction and Mining	15	Graders	250	6536953	210934	303.1	204	0.022
2016	SJV	Construction and Mining	17	Off-Highway Trucks	250	4374805	148989	125.9	211	0.020
2016	SJV	Construction and Mining	17	Off-Highway Trucks	500	18595587	353549	279.7	372	0.020
2016	SJV	Construction and Mining	18	Other Construction Equipment	50	508843	78373	177.7	38	0.024
2016	SJV	Construction and Mining	19	Pavers	175	819080	33950	94.6	158	0.022
2016	SJV	Construction and Mining	21	Rollers	500	205968	4408	15.8	335	0.020
2016	SJV	Construction and Mining	22	Rough Terrain Forklifts	120	5242244	368167	1416.4	96	0.021
2016	SJV	Construction and Mining	25	Scrapers	500	19728137	291904	670.2	381	0.025
2016	SJV	Construction and Mining	28	Tractors/Loaders/Backhoes	120	30857080	2730602	4791.2	83	0.020
2016	SJV	Construction and Mining	29	Trenchers	120	491312	32206	107.3	82	0.027
2017	SJV	Construction and Mining	12	Cranes	250	2137874	92978	209.3	217	0.015
2017	SJV	Construction and Mining	12	Cranes	500	3275922	92145	200.8	336	0.015
2017	SJV	Construction and Mining	13	Crawler Tractors	250	2980258	93086	215.0	203	0.023
2017	SJV	Construction and Mining	15	Graders	250	7058107	227704	322.8	204	0.022
2017	SJV	Construction and Mining	17	Off-Highway Trucks	250	4723308	160834	134.1	211	0.020
2017	SJV	Construction and Mining	17	Off-Highway Trucks	500	20058022	381656	297.9	372	0.020
2017	SJV	Construction and Mining	18	Other Construction Equipment	50	549131	84604	189.3	38	0.024
2017	SJV	Construction and Mining	19	Pavers	175	884776	36649	100.7	158	0.022
2017	SJV	Construction and Mining	21	Rollers	500	222511	4759	16.8	335	0.020
2017	SJV	Construction and Mining	22	Rough Terrain Forklifts	120	5658398	397437	1508.3	96	0.021
2017	SJV	Construction and Mining	25	Scrapers	500	21296331	315110	713.7	381	0.025
2017	SJV	Construction and Mining	28	Tractors/Loaders/Backhoes	120	33269418	2947686	5102.3	83	0.020
2017	SJV	Construction and Mining	29	Trenchers	120	529961	34766	114.3	82	0.027

Appendix 5.1B
KICP Operations Emissions

King Island CAES Project
Appendix 5.1B, Table 5.1B.1
Summary of Turbo-Expander Emissions - Criteria Pollutants
February 2015

Combined Compression and Expansion HMB Cases (All data is per turbo-expander)

Case Number	**201**
Fuel Type	**NG**
Load	**100.00%**
Ambient Temperature (°F)	64
Relative Humidity (%)	61.8
Maximum Fuel Sulfur Content (gr/100 scf)	0.75
Power Output (at Terminals) (MW)	158
Power Input (Compression) (MW)	126
Gross Heat Rate (Btu/kWh) [a]	4,266
Combined Heat Rate (Btu/kWh) [a]	18,287
Fuel Heat Content (Btu/lb, HHV) [b]	22,525
Heat Input (MMBtu/hr, HHV)	674
NO_x (ppmvd, 15% O_2)	2.0
NO_x (lb/hr as NO_2)	5.31
NO_x (lb/MMBtu, HHV as NO_2)	0.0079
NO_x (lb/MWh as NO_2)	0.034
CO (ppmvd, 15% O_2)	2.0
CO (lb/hr)	3.23
CO (lb/MMBtu, HHV)	0.0048
CO (lb/MWh)	0.020
SO_2 (ppmvd, 15% O_2)	0.40
SO_2 (lb/hr) - Fuel Sulfur Content of 0.75 grains/100 SCF	1.38
SO_2 (lb/MMBtu, HHV)	0.0020
SO_2 (lb/hr) - Fuel Sulfur Content of 0.25 grains/100 SCF	0.46
SO_2 (lb/MWh) - Fuel Sulfur Content of 0.75 grains/100 SCF	0.0087
VOC (ppmvd, 15% O_2)	1.3
VOC (lb/hr as CH_4)	1.12
VOC (lb/MMBtu, HHV)	0.0017
VOC (lb/MWh)	0.007
PM_{10} (lb/hr) [c]	10.00
PM_{10} (lb/MMBtu, HHV)	0.0148
PM_{10} (lb/MWh)	0.063
$PM_{2.5}$ (lb/hr) [c]	10.00
$PM_{2.5}$ (lb/MMBtu, HHV)	0.0148
$PM_{2.5}$ (lb/MWh)	0.063

Notes:

[a] Gross heat rate calculation accounts for the energy output by the expanders only. Combined heat rate calculation accounts for the amount of energy used by the compressors relative to how much energy is output by the expanders. On a weekly basis, it would require 47.6 hours of compression per 49.7 hours of expander output.

[b] Fuel HHV taken from Table 5.1A-1 of the Lodi Energy Center AFC (08-AFC-10).

[c] PM_{10}/$PM_{2.5}$ emissions are based on 10 lb/hr/expander emission rates provided in the Worley Parsons estimated emission calculations, dated January 28, 2015.

Calculation for Grains of PM/dscf (Expander Only)

0.0148	lb/MMBtu
8,710	F-Factor (dscf/MMBtu)
7,000	grains/pound
0.0422	Grains of PM/dscf

Calculation for Fuel Sulfur Content (ppm):

0.00205	lb/MMBtu
1,047	Btu/scf
1.66E-07	Conversion factor for lb/scf to ppm
12.92	ppm Sulfur

Cd = Pollutant MW x 2.59 x 10^-9

Cd for NO_x:	1.191E-07
Cd for CO:	7.252E-08
Cd for VOC as Methane:	4.144E-08
Cd for SO_2:	1.659E-07
Fd:	8,710

King Island CAES Project
Appendix 5.1B Table 5.1B.2
Hourly, Daily, and Annual Emission Scenarios
February 2015

Number of Turbo-Expanders	2
Daily Operating Hours (per Turbo-Expander) [a]	9.9
Annual Operating Hours (per Turbo-Expander) [b]	2,500

Notes:

[a] Assumes 49.7 hours of weekly operation, 5 days per week.

[b] Annual Operating Hours provided in the Worley Parsons estimated emission calculations, dated January 28, 2015.

Maximum Hourly Emissions	1 Turbo-Expander	Facility (All Turbo-Expanders)
NO_x (lb/hr)	5.31	10.6
CO (lb/hr)	3.23	6.46
VOC (lb/hr)	1.12	2.24
SO_2 (lb/hr)	1.38	2.76
Particulates (lb/hr)	10.0	20.0

Daily Emissions	1 Turbo-Expander	Facility (All Turbo-Expanders)
NO_x (lb/day)	52.8	106
CO (lb/day)	32.1	64.2
VOC (lb/day)	11.14	22.3
SO_2 (lb/day)	13.7	27.4
PM_{10} (lb/day)	99.4	199
$PM_{2.5}$ (lb/day)	99.4	199
GHG (kg/day)	357,697	715,394

Annual Emissions	1 Turbo-Expander	Facility (All Turbo-Expanders)
NO_x (tpy)	6.64	13.3
CO (tpy)	4.04	8.08
VOC (tpy)	1.40	2.80
SO_2 (tpy)	1.73	3.45
PM_{10} (tpy)	12.5	25.0
$PM_{2.5}$ (tpy)	12.5	25.0
GHG (metric tons/yr)	89,964	179,928

King Island CAES Project
Appendix 5.1B Table 5.1B.3
Natural Gas Fuel Use
February 2015

Number of Turbo-Expanders	2
Daily Operating Hours (per Turbo-Expander) [a]	9.9
Annual Operating Hours (per Turbo-Expander) [b]	2,500

Notes:

[a] Assumes 49.7 hours of weekly operation, 5 days per week.

[b] Annual Operating Hours provided in the Worley Parsons estimated emission calculations, dated January 28, 2015.

Max Fuel Use	Turbo-Expander (per unit)	Total
Max Fuel Use Per Hour (MMBtu)	674	1,348
Max Fuel Use Per Day (MMBtu)	6,701	13,401
Annual Average Fuel Use Per Year (MMBtu)	1,685,250	3,370,500

King Island CAES Project
Appendix 5.1B Table 5.1B.4
Summary of Turbo-Expander Operation Emissions – Greenhouse Gas Pollutants
February 2015

Facility Heat Input

KICP Turbo-Expander Natural Gas Use - Facility (PTE)	3,370,500	MMBtu/yr

GHG Netting	KICP PTE Emissions (metric tons/yr)
CO_2	178,704
CH_4	12.8
N_2O	3.03
CO_2 Equivalent (Total)	179,928

GHG Emission Factors	Gas-Fired Turbines > 3 MW Emission Factor (kg/MMBtu) [a]
CO_2 [b]	53.02
CH_4 [c]	0.0038
N_2O [c]	0.0009

Notes:

[a] Emission factors for Gas-Fired Turbines assumed to best represent the Turbo-Expanders utilized by the KICP.

[b] CO_2 emission factor from Table 12.1 of TCR's General Reporting Protocol (updated April 11, 2014).

[c] CH_4 and N_2O emission factors from Table 12.5 of TCR's General Reporting Protocol (updated April 11, 2014).

Global Warming Potential

CH_4	25
N_2O	298

Source: 40 CFR Part 98, Table A-1

King Island CAES Project
Appendix 5.1B Table 5.1B.5
Summary of Blackstart Emergency Diesel Engine Emissions
February 2015

Assumptions:

Blackstart diesel generator to be driven by an engine with an approximate rating of 489 bhp.
Engine operates a maximum of 1 hour per day and 50 hours per year for maintenance and reliability testing.

Rated Horsepower:	489		
Maximum Test Time:	1	hour	
Tests/Day:	1		
Hours/Year:	50		
Maximum Fuel Usage:	23.2	gallons/hr	(at Full Load)
	23.2	gallons/day	
	1,160	gallons/yr	

Engine Data Source: PG&E provided generator engine size (in horsepower) via e-mail dated 9/4/2014; fuel usage is taken from Cummins 300DQHAB Specifications Sheet - September 8, 2014.

	Emission Factor [a]	Emissions		
Pollutant	**g/bhp-hr**	**lb/hr**	**lb/day**	**lb/yr**
Hydrocarbons	0.08	0.086	0.086	4.31
NO_x	4.8	5.17	5.17	259
CO	2.6	2.80	2.80	140
Particulates	0.15	0.16	0.16	8.09
SO_2 [b]	-	0.0049	0.0049	0.25
	Emission Factor	**Emissions**		
Pollutant	**kg/gal**	**lb/hr**	**lb/day**	**metric tons/yr**
CO_2 [c]	10.21	522	522	11.8
CH_4 [d]	0.00058	0.030	0.030	6.73E-04
N_2O [d]	0.00026	0.013	0.013	3.02E-04

Notes:

[a] PG&E provided emission factors for NOx, CO and PM via e-mail dated 9/4/2014. Hydrocarbon emissions from Cummins 300DQHAB Specifications Sheet - September 8, 2014.

[b] Calculated from the maximum fuel use of 23.2 gallons/hr, a fuel density of 7.05 lb/gallon, and a sulfur content of 15 ppmw.

[c] CO_2 emission factor from Table 12.1 of TCR's General Reporting Protocol (updated April 11, 2014).

[d] CH_4 and N_2O emission factors from Table 13.7 of TCR's General Reporting Protocol (updated April 11, 2014), assuming the blackstart generator functions similarly to a non-highway vehicle.

King Island CAES Project
Appendix 5.1B Table 5.1B.6
Summary of Fire Water Pump Engine Emissions
February 2015

Assumptions:

Cummins Model CFP7E-F60 (or equivalent) diesel fire water pump engine to be driven by a Tier 3 engine with an approximate rating of 250 bhp.

Engine operates a maximum of 1 hour per day and 50 hours per year for maintenance and reliability testing.

Rated Horsepower:	249	(per Cummins Specifications)	
Maximum Test Time:	1	hour	
Tests/Day:	1		
Hours/Year:	50		
Maximum Fuel Usage:	14.0	gallons/hr	(at 249 bhp, 2,600 RPM)
	14.0	gallons/day	
	700	gallons/yr	

Engine Data Source: Cummins CFP7E-F60 specifications sheet - June 2014.

Pollutant	Emission Factor [a]	Emissions		
	g/bhp-hr	lb/hr	lb/day	lb/yr
Hydrocarbons	0.062	0.034	0.034	1.70
NO_x	2.475	1.36	1.36	67.93
CO	1.193	0.65	0.65	32.7
Particulates	0.111	0.061	0.061	3.05
SO_2 [b]	-	0.0030	0.0030	0.15
Pollutant	**Emission Factor**	**Emissions**		
	kg/gal	**lb/hr**	**lb/day**	**metric tons/yr**
CO_2 [c]	10.21	315	315	7.15
CH_4 [d]	0.00058	0.018	0.018	4.06E-04
N_2O [d]	0.00026	0.0080	0.0080	1.82E-04

Notes:

[a] Emission factors from the Cummins CFP7E-F60 specifications sheet - June 2014.

[b] Calculated from the maximum fuel use of 14.0 gallons/hr, a fuel density of 7.05 lb/gallon, and a sulfur content of 15 ppmw.

[c] CO_2 emission factor from Table 12.1 of TCR's General Reporting Protocol (updated April 11, 2014).

[d] CH_4 and N_2O emission factors from Table 13.7 of TCR's General Reporting Protocol (updated April 11, 2014), assuming the fire water pump engine functions similarly to a non-highway vehicle.

King Island CAES Project
Appendix 5.1B Table 5.1B.7
Summary of Cooling Tower Emissions
February 2015

Assumptions:

Cooling Tower Drift Rate:	0.31	gpm
	157	lb/hr
TDS Concentration of Water: [a]	1,123	ppm

Pollutant	Emissions		
	lb/hr	lb/day	lb/yr [b]
PM_{10}	0.18	4.23	863

Notes:

[a] TDS concentration is based on Worley Parsons estimated emissions calculations, dated January 28, 2015.

[b] Assumes 4,900 hours of cooling tower operation per year.

TABLE 5.1-8

Maximum KICP Emission Rates

Emissions/Equipment	NO_x	SO_2	CO	VOC	$PM_{10}/PM_{2.5}$
Maximum Hourly Emissions (lb/hr)					
Turbo-Expanders	10.6	2.76	6.46	2.24	20.0
Blackstart Generator	5.17	4.91E-03	2.80	8.62E-02	0.16
Fire Pump	1.36	2.96E-03	0.65	3.40E-02	6.09E-02
Cooling Tower	-	-	-	-	0.18
Total	**17.2**	**2.77**	**9.92**	**2.36**	**20.4**
Maximum Daily Emissions (lb/day)					
Turbo-Expanders	106	27.4	64.2	22.3	199
Blackstart Generator	5.17	4.91E-03	2.80	8.62E-02	0.16
Fire Pump	1.36	2.96E-03	0.65	3.40E-02	6.09E-02
Cooling Tower	-	-	-	-	4.23
Total	**112**	**27.5**	**67.7**	**22.4**	**203**
Maximum Annual Emissions (tpy)					
Turbo-Expanders	13.3	3.45	8.08	2.80	25.0
Blackstart Generator	0.13	1.23E-04	7.01E-02	2.16E-03	4.04E-03
Fire Pump	3.40E-02	7.40E-05	1.64E-02	8.51E-04	1.52E-03
Cooling Tower	-	-	-	-	0.43
Total	**13.4**	**3.45**	**8.16**	**2.80**	**25.4**

TABLE 5.1-14

GHG Emissions from KICP Operation (metric tons/yr)

Emissions/Equipment	CO_2	CH_4	N_2O	CO_2e
Turbo-Expanders	178,704	12.8	3.03	179,928
Blackstart Generator	11.8	6.73E-04	3.02E-04	12.0
Fire Pump	7.15	4.06E-04	1.82E-04	7.21
Total	**178,723**	**12.8**	**3.03**	**179,947**

Appendix 5.2A
PG&E King Island Compressed Air Energy Storage Project Biological Reconnaissance

PG&E KING ISLAND COMPRESSED AIR ENERGY STORAGE PROJECT

Biological Reconnaissance

January 2015

Prepared for:
Pacific Gas and Electric Company
At the request of CH2MHill
Sacramento, CA

Prepared by:

North State Resources, Inc.
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NSR Project No. 26622

PG&E King Island Compressed Air Energy Storage Project

Biological Reconnaissance

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Appendix B Representative Photographs
Appendix C Wildlife Species Observed during Reconnaissance Survey
Appendix D Plant Species Observed during Botany Survey

1. INTRODUCTION

This report summarizes the results of the biological field reconnaissance conducted for the PG&E King Island Compressed Air Energy Storage (CAES) Project study area (study area). The study area is located west of Interstate 5 (I-5) within the White Slough Water Pollution Control Facility (White Slough WPCF) in Lodi and extends to the west to King Island. The purpose of this biological study is to identify baseline conditions including characterize the habitats and vegetation communities present; evaluate the potential for the occurrence of special-status plant and animal species; determine the presence or absence of waters of the United States; and determine the presence or absence of other sensitive biological resources (e.g., riparian habitats, tree resources).

The project consists of developing an energy conversion facility (ECF), the air pipeline between the compressed air energy storage (CAES) well field, and the supporting infrastructure including distribution lines, water lines, and gas supply lines.

The study area is approximately 6.8 miles southwest of the city of Lodi in San Joaquin County, California. The center of the ECF site is located at approximately Latitude 38.095845°, Longitude -121.390257° (Figure 1).

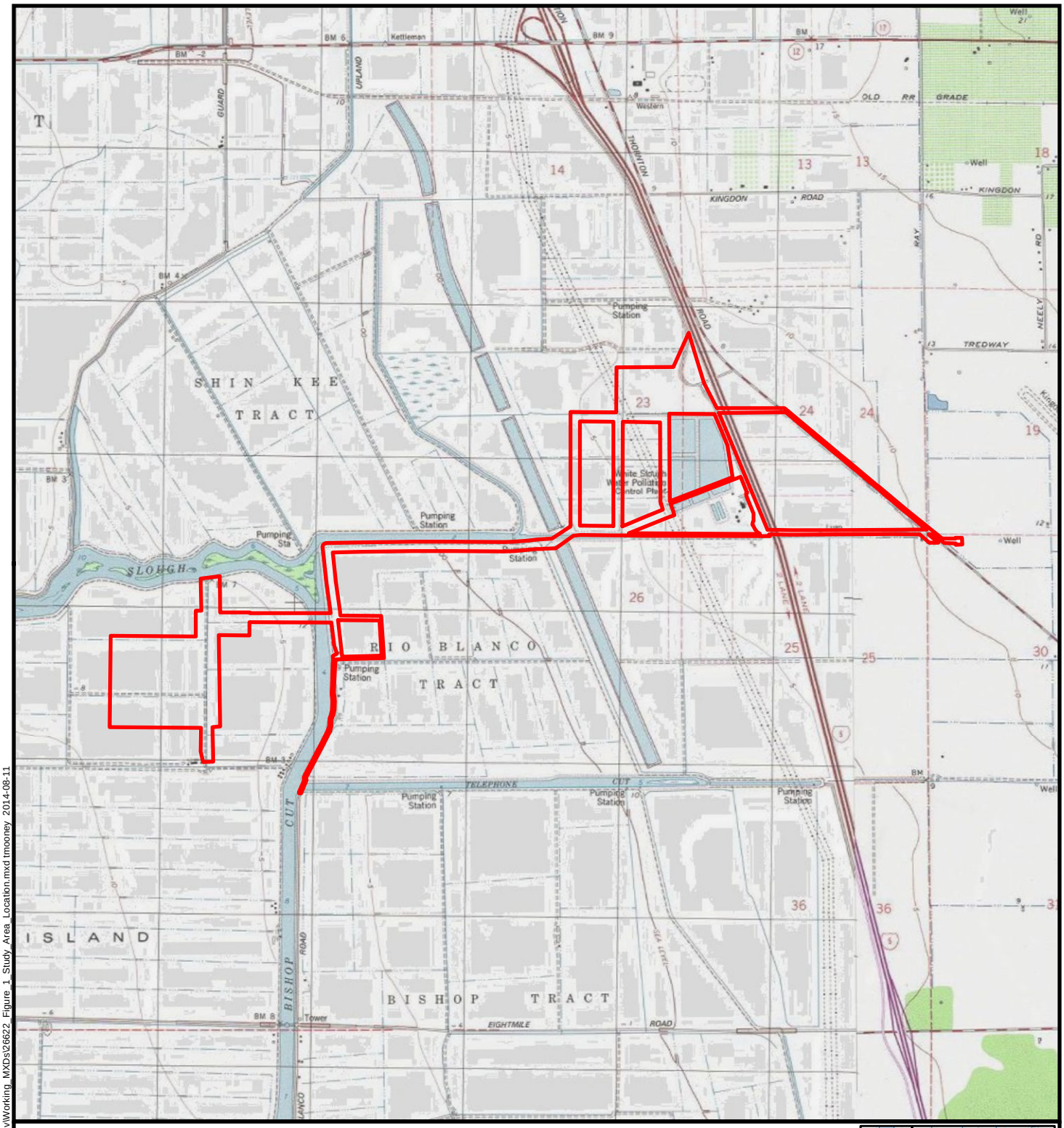
2. METHODS

The status of habitat for special-status species, waters of the United States, and other sensitive biological resources within the study area was determined through desktop analysis and a field reconnaissance. A discussion of the methods for the desktop analysis and field reconnaissance is provided below.

2.1 Desktop Analysis

Prior to the field reconnaissance, the following information was reviewed to assess the potential for the study area to support habitat for special-status species and/or waters of the United States:

- The U.S. Geological Survey *Terminous and Lodi South, California* 7.5-minute topographic quadrangles,
- Color aerial photographs of the study area and vicinity,
- The U.S. Fish and Wildlife Service (USFWS) official list of endangered and threatened species that may occur, or be affected by projects, in the *Terminous and Lodi South, California* USGS 7.5-minute quadrangles (U.S. Fish and Wildlife Service 2014) (Appendix A),
- The California Department of Fish and Wildlife (CDFW) California Natural Diversity Database (CNDDB) reported occurrences within the *Terminous, California* USGS 7.5-minute quadrangle and the eight surrounding quadrangles (California Department of Fish and Game 2014) (Appendix A), and



Study Area (311.68 acres)

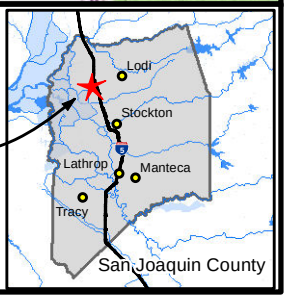
Public Land Survey:
T03N, R05E, Sec. 24 and 25
T03N, R06E, Sec. 19 and 30

USGS 7.5 Quad:
Lodi South - 1976
Terminous - 1993

N

3,000 1,500 0 3,000
Feet

Study Area Location



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PG&E King Island Compressed Air Energy Storage Project

Figure 1
Study Area Location

- The California Native Plant Society (CNPS) online Inventory of Rare and Endangered Plants records for the *Terminous, California* and eight adjacent quadrangles (California Native Plant Society 2014) (Appendix A).

For the purpose of this evaluation, special-status plant species include plants that are listed as threatened or endangered under the California Endangered Species Act (CESA) or the federal Endangered Species Act (ESA), proposed for federal listing as threatened or endangered, state or federal candidate species, designated as rare by the CDFW, and California Rare Plant Rank (RPR) 1A, 1B, 2A, or 2B. Special-status animal species include species that are listed as threatened or endangered under the CESA or ESA, proposed for federal listing as threatened or endangered, state or federal candidate species, and identified by the CDFW as species of special concern or fully protected species.

NSR compiled a list of regionally occurring special-status species based on a review of pertinent literature, the review of the USFWS species list, and CNDDB and CNPS database records. For each species, we assessed habitat requirements and compared their requirements to the habitats within the study area and immediate vicinity in order to determine their potential to occur within the study area (Table 1).

2.2 Field Reconnaissance

A biological field reconnaissance was conducted by NSR biologist, Brandon Amrhein, on April 17 and 18, 2014 to evaluate the potential for the study area to support habitat for special-status species, waters of the United States, and other sensitive biological resources. Brandon Amrhein, NSR Biologist, Heather Kelly, NSR Senior Biologist, and Catalina Reyes, PG&E Aquatic Biologist, conducted a field reconnaissance of aquatic habitat on October 6, 2014 to further evaluate the potential for the aquatic habitat to support special-status fish. The biological field reconnaissance consisted of pedestrian surveys to view all areas to the extent necessary to document the existing conditions. Mr. Eric Hansen, Consulting Biologist, reviewed the TSF pad, access road and ECF site to assess potential giant garter snake aquatic and upland habitat on January 17 and April 15, 2013 (Hansen 2013a, 2013b).

NSR botanist, Paul Kirk, conducted the botanical surveys on April 18 and July 2, 2014, in general accordance with the *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities* (California Department of Fish and Game 2009). Per the CDFW guidelines, a target list of special-status plant species with the potential to occur on the site was developed prior to the survey through interpretation of the CNDDB and CNPS query results (Table 1). NSR conducted pedestrian surveys so that all plant species encountered within the study area were identified to the highest taxonomic level needed to determine their regulatory status. Taxonomic nomenclature for plant species is in accordance with *The Jepson Manual: Vascular Plants of California* (Baldwin et al. 2012).

Determination of wetlands was based on the approach outlined in the Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory 1987) and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0) (U.S. Army Corps of Engineers 2008). Additionally, the assessment for potential "other waters" was based on the presence

of an ordinary high water mark as defined in U.S. Army Corps of Engineers (Corps) regulations (33 CFR 328.3 and 33 CFR 328.4).

3. ENVIRONMENTAL SETTING

3.1 General Setting

The study area is situated in a landscape that currently supports active agricultural operations, access roads, several agricultural residences, and appurtenant facilities/equipment (e.g., farm equipment, staging area, and barn). It also includes a well pad previously developed for the testing phase of the project in the western portion of the study area. The City of Lodi White Slough WPCF and Lodi Energy Center are located adjacent to the study area in the eastern portion of the study area. Portions of the study area border Interstate-5 (I-5) and N. Thornton Road. The study area is located within the "Delta Islands," which are areas of former marshlands of the Sacramento–San Joaquin Delta that were historically reclaimed for agricultural use by the construction of levees/dikes and draining.

The study area is generally level and ranges in elevation from approximately 5 feet above to 10 feet below sea level. Water levels in White Slough and Bishop Cut are slightly above sea level and are separated from King Island by a series of levees topped by paved and unpaved roads. Dirt and gravel ranch roads provide access.

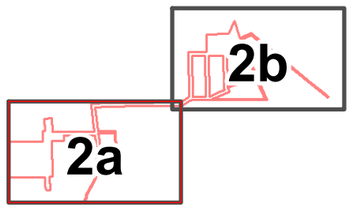
Most of the study area occurs in agricultural fields that are frequently disturbed and nearly all native vegetation has been removed. The study area includes a small portion of Bishop Cut and White Slough, and a portion of White Slough Wildlife Area.

3.2 Vegetation Communities

Vegetation communities within the study area include annual grassland, fresh emergent wetland, orchard/cropland, artificial channel, ruderal, and valley foothill riparian (Figure 2a and 2b). Vegetation communities are classified based on descriptions provided in *A Guide to Wildlife Habitats of California* (Mayer and Laudenslayer 1988). Photographs of the vegetation communities are presented in Appendix B.

Annual grasslands are present in small acreages adjacent to I-5. Several valley oaks (*Quercus lobata*), two cottonwoods (*Populus fremontii*), and one Goodding's black willow (*Salix goodingii*) are scattered through the grassland community near I-5 Frontage Road. The annual grassland is mowed during the spring and is densely vegetated with milk thistle (*Silybum marianum*), black mustard (*Brassica nigra*), long-beaked stork's bill (*Erodium botrys*), and ripgut brome (*Bromus diandrus*).

Map Index



White Slough

Dredger Cut

Bishop Cut

King Island

Rio Blanco Tract

Telephone Cut

Project Area

Excluded From Study

Potential Waters of the U.S.

Irrigation Canal

Open Water

Riparian Wetland

Vegetated Ditch

Non-Vegetated Ditch

Vegetation Communities

Annual Grassland

Cropland

Fresh Emergent Wetland

Orchard/Vineyard

Ruderal

Urban

Valley Foothill Riparian

600 0 600

Feet

N

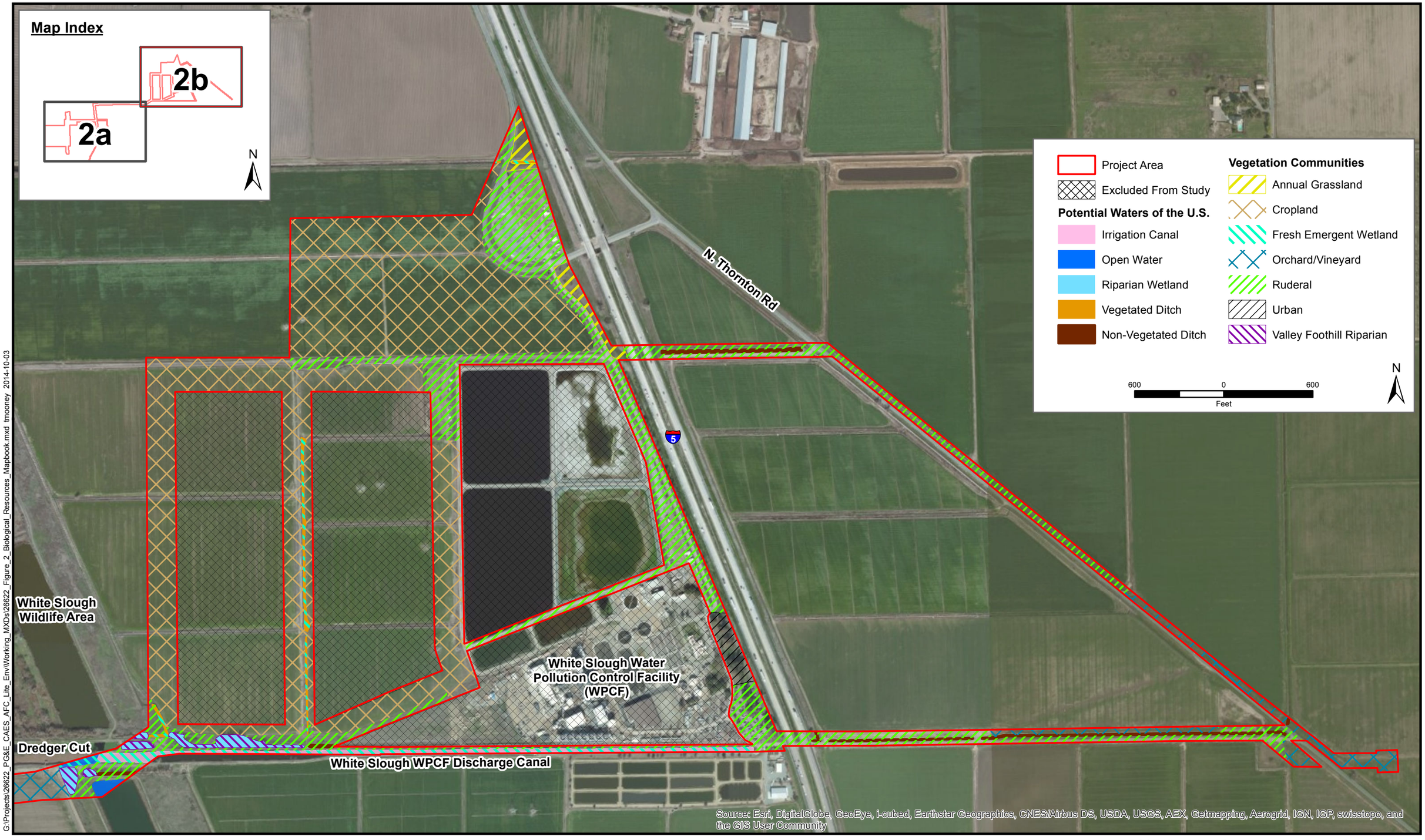
Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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Figure 2a
Biological Resources



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North State Resources, Inc.

PG&E King Island Compressed Air Energy Storage Project

Figure 2b
Biological Resources

Irrigation ditches throughout the study area that are sufficiently hydrated contain fresh emergent wetland vegetation Irrigation ditches appear to be subject to regular vegetation management using both mechanical and chemical techniques. Fresh emergent wetlands within the study area are dominated by water primrose (*Ludwigia* sp.), cattails (*Typha* sp.), smartweed (*Persicaria* sp.), mosquito fern (*Azolla* sp.), and water hyacinth (*Eichhornia* sp.).

Cropland/orchard (e.g., corn, winter wheat, safflower, walnut orchard) occurs throughout most of the study area. The open areas between the rows in the walnut orchards are disked and or mowed annually. All fields are actively farmed and annually disked, harvested and/or disturbed up to the edge of existing roads.

Bishop Cut and White Slough are Sacramento-San Joaquin Delta waterways that provides habitat for aquatic species. The Bishop Cut is an artificially lined navigation channel connecting White Slough to the north and Disappointment Slough to the south. White Slough is a semi-natural water body that contains islands of fresh emergent and riparian vegetation. Dredger Cut is an artificial channel that connects WPCF discharge canal south of the White Slough WPCF to the natural portion of White Slough. The eastern end of the Dredger Cut is revetted with rip-rap, but vegetation has colonized the banks. Dredger Cut is vegetated with waterweed (*Elodea* sp.) and water hyacinth and its banks are vegetated with hardstem bulrush (*Schoenoplectus acutu*s). The levee banks of Bishop Cut are rip-rapped with large rock and the channels are generally devoid of vegetation. Small patches of hardstem bulrush and water hyacinth are located along its banks. The waterways in the project area are tidally influenced.

Areas that are often disturbed (e.g., mowed, disked) were classified as ruderal. Ruderal areas are located along the levee banks of Bishop Cut, White Slough, Dredger Cut, open areas around farm yards, and adjacent road shoulders. Dominant plant species include common mallow (*Malva neglecta*), poison hemlock (*Conium maculatum*), mustard (*Brassica* sp.), milk thistle, Johnson grass, redroot pigweed (*Amaranthus retroflexus*), and common knotweed (*Polygonum aviculare*).

Valley foothill riparian occurs in the White Slough Wildlife Area eastern portion of the study area. Riparian areas are also located adjacent to ditches and canals. Dominant plant species include Fremont cottonwood (*Populus fremontii*), arroyo willow (*Salix lasiolepis*), coyote bush (*Baccharis pilularis*), and Himalayan blackberry (*Rubus armeniacus*).

3.3 Special-Status Species

The results of the reconnaissance survey were used to determine the likelihood of special-status species present in the study area (Table 1). The potential for special-status species to occur in the study area was based on: 1) the habitat requirements and distribution of special-status species known to occur in the region, and 2) the habitats present in the study area. Table 1 lists special-status species that have potential to occur within the survey area based on habitat observed during the field reconnaissance. Species for which habitat does not exist within the study area are not discussed further in this document. Federal and state listed species and other special-status species potentially occurring in the study area are discussed in more detail below. A list of wildlife species observed during the reconnaissance survey are provided in Appendix C.

Botanical surveys conducted on April 18 and July 2, 2014 did not detect any special-status plant species and these species are not expected to occur within the study area. A list of all plant species observed is provided in Appendix D.

Table 1. Special-Status Species Potentially Occurring in the Study Area

Common Name *Scientific Name*	Status[1] (Fed/State/ RPR)	Habitat Requirements	Potential for Occurrence
Plants			
Watershield *Brasenia schreberi*	—/—/2B.3	Marshes and swamps/ freshwater. Elevation: 100-7220 feet. Bloom: Jun-Sep.	None. Surveys conducted on April 18 and July 2, 2014 did not detect this species and it is presumed absent.
Round-leaved filaree *California macrophylla*	—/—/1B.1	Cismontane woodland, Valley and foothill grassland/clay. Elevation: 50-3940 feet. Bloom: Mar-May.	None. Surveys conducted on April 18 and July 2, 2014 did not detect this species and it is presumed absent.
Bristly sedge *Carex comosa*	—/—/2B.1	Coastal prairie, Marshes and swamps (lake margins), Valley and foothill grassland. Elevation: 0-2050 feet. Bloom: May-Sep.	None. Surveys conducted on April 18 and July 2, 2014 did not detect this species and it is presumed absent.
Delta button-celery *Eryngium racemosum*	—/E/1B.1	Riparian scrub (vernally mesic clay depressions). Elevation: 10-100 feet. Bloom: Jun-Oct.	None. Surveys conducted on April 18 and July 2, 2014 did not detect this species and it is presumed absent.
Delta tule pea *Lathyrus jepsonii* var. *jepsonii*	—/—/1B.2	Marshes and swamps (freshwater and brackish). Elevation: 0-20 feet. Bloom: May-Jul (Aug),(Sep).	None. Surveys conducted on April 18 and July 2, 2014 did not detect this species and it is presumed absent.
Woolly rose mallow *Hibiscus lasiocarpus*	—/—/1B.2	Often in riprap on sides of levees. Marshes and swamps (freshwater). Elevation: 0-360 feet. Bloom: June-Sep.	None. Surveys conducted on April 18 and July 2, 2014 did not detect this species and it is presumed absent.
Mason's lilaeopsis *Lilaeopsis masonii*	—/Rare/1B.1	Marshes and swamps (brackish or freshwater), Riparian scrub. Elevation: 0-30 feet. Bloom: Apr-Nov.	None. Surveys conducted on April 18 and July 2, 2014 did not detect this species and it is presumed absent.
Delta mudwort *Limosella australis*	—/—/2B.1	Marshes and swamps (freshwater or brackish), Riparian scrub/Usually mud banks. Elevation: 0-10 feet. Bloom: May-Aug.	None. Surveys conducted on April 18 and July 2, 2014 did not detect this species and it is presumed absent.
Eel-grass pondweed *Potamogeton zosteriformis*	—/—/2B.2	Marshes and swamps (assorted freshwater). Elevation: 0-6100 feet. Bloom: Jun-Jul.	None. Surveys conducted on April 18 and July 2, 2014 did not detect this species and it is presumed absent.

Table 1. Special-Status Species Potentially Occurring in the Study Area

Common Name *Scientific Name*	Status[1] (Fed/State/ RPR)	Habitat Requirements	Potential for Occurrence
Sanford's arrowhead *Sagittaria sanfordii*	—/—/1B.2	Marshes and swamps (assorted shallow freshwater). Elevation: 0-2130 feet. Bloom: May-Oct.	None. Surveys conducted on April 18 and July 2, 2014 did not detect this species and it is presumed absent.
Marsh skullcap *Scutellaria galericulata*	—/—/2B.2	Lower montane coniferous forest, Meadows and seeps (mesic), Marshes and swamps. Elevation: 0-6890 feet. Bloom: Jun-Sep.	None. Surveys conducted on April 18 and July 2, 2014 did not detect this species and it is presumed absent.
Side-flowering skullcap *Scutellaria lateriflora*	—/—/2B.2	Meadows and seeps (mesic), Marshes and swamps. Elevation: 0-1640 feet. Bloom: Jul-Sep.	None. Surveys conducted on April 18 and July 2, 2014 did not detect this species and it is presumed absent.
Suisun Marsh aster *Symphyotrichum lentum*	—/—/1B.2	Marshes and swamps (brackish and freshwater). Elevation: 0-10 feet. Bloom: May-Nov.	None. Surveys conducted on April 18 and July 2, 2014 did not detect this species and it is presumed absent.
Fish and Wildlife			
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	T/—	Elderberry shrubs associated with riparian forests which occur along rivers and streams.	None. No elderberry shrubs were observed within the study area.
Delta smelt *Hypomesus transpacificus*	T/E	Estuarine systems in the Sacramento-San Joaquin Delta.	Moderate. Bishop Cut potentially provides limited spawning and juvenile rearing habitat and is a seasonal migratory corridor for this species. Project is within designated critical habitat. Species present near Bishop Cut in Little Potato Slough and Little Venice Island CDFW sampling points approximately 3 and 4 miles west of Bishop Cut, respectively (California Department of Fish and Wildlife 2014).
Central Valley steelhead distinct population segment (DPS) *Oncorhynchus mykiss*	T/—	Spawns in cool, moderately fast flowing water with gravel bottom.	Moderate. Bishop Cut provides a seasonal migratory corridor for this species and is designated critical habitat. Bishop Cut is within known distribution of the species (National Marine Fisheries Service 2014).

Table 1. Special-Status Species Potentially Occurring in the Study Area

Common Name *Scientific Name*	Status[1] (Fed/State/ RPR)	Habitat Requirements	Potential for Occurrence
Winter-run Chinook salmon evolutionary significant unit (ESU) *Oncorhynchus tshawytscha*	E/E	Spawn and rear in main-stem Sacramento River. Require cool year-round water temperatures, since spawning occurs during the summer. Requires deep pools and riffles, and clean gravel and cobble substrate to spawn.	None. Bishop Cut is outside of the geographically occupied area for this species (National Marine Fisheries Service 2014).
Central Valley spring-run Chinook salmon ESU Oncorhynchus tshawytscha	T/T	Cool streams that reach the ocean and that have shallow, partly shaded pools and clear-water depression pools.	Moderate. Bishop Cut provides a seasonal migratory corridor for this species and is within known the distribution of the species (National Marine Fisheries Service 2014), however it is not part of designated critical habitat for this species (70 FR 52488).
Green sturgeon, southern DPS *Acipenser medirostris*	T/SC	DPS includes green sturgeon that spawn in rivers south of the Eel River and includes the Sacramento-San Joaquin Delta. Preferred spawning substrate is large cobble, but can range from clean sand to bedrock.	Low. Species known to occur throughout the Sacramento-San Joaquin Delta (Beamesderfer et. al 2006). Bishop Cut may provide seasonal transient rearing and a migratory corridor for this species and is designated critical habitat.
Longfin smelt San Francisco Bay-Delta DPS *Spirinchus thaleichthys*	—/T	Sloughs of Suisun Bay and Delta.	Low. Bishop Cut provides a migratory corridor for this species. Species present near Bishop Cut in Little Potato Slough and Little Venice Island CDFW sampling points approximately 3 and 4 miles west of Bishop Cut, respectively (California Department of Fish and Wildlife 2014). However, there presence in this area is considered rare (Moyle 2002).
Central Valley fall/late fall-run Chinook salmon ESU *Oncorhynchus tshawytscha*	SC/SC	Spawn and rear in main-stem Sacramento River and suitable perennial tributaries. Requires cool water temperatures for spawning, egg-incubation and juvenile rearing. Spawn in riffles with gravel and cobble.	Moderate. Bishop Cut provides transient rearing and a migratory corridor for this species. Species likely to occur in Bishop Cut (Moyle 2002).

Table 1. Special-Status Species Potentially Occurring in the Study Area

Common Name *Scientific Name*	Status[1] (Fed/State/ RPR)	Habitat Requirements	Potential for Occurrence
Sacramento splittail *Pogonichthys macrolepidotus*	—/SC	Splittail utilize a variety of estuarine and riverine habitats. Generally spawn and rear in shallow, dead-end sloughs with submerged vegetation, bypasses and seasonally flooded lowlands with flooded vegetation.	Moderate. Species is known to occur throughout the Sacramento-San Joaquin Delta (Moyle 2002). Suitable habitat occurs in both Bishop Cut, Dredger Cut, and White Slough, although it is suspected that the habitat in the project area is most likely utilized for transient rearing and migration.
River lamprey *Lampetra ayresi*	—/SC	Anadromous fish found in rivers from San Francisco Bay watershed north to Alaska. Spawn in similar habitat as salmon.	Moderate. Species known to occur throughout the Sacramento-San Joaquin Delta (Moyle 2002). Bishop Cut provides a migratory corridor for this species.
California red-legged frog *Rana draytonii*	T/SC	Require aquatic habitat for breeding, also uses a variety of other habitat types including riparian and upland areas. Adults prefer dense, shrubby or emergent vegetation associated with deep-water pools with fringes of cattails and dense stands of overhanging vegetation. This species also breeds in ephemeral ponds that support little or no vegetation.	None. This species is outside the current known range (CWHR) and there are no occurrences within 5 miles of the study area. The California red-legged frog recovery plan (U.S. Fish and Wildlife Service 2002) and the San Joaquin County Multispecies Habitat Conservation and Open Space Plan (SJMHCP) conclude that CRLF is extirpated from the valley floor (San Joaquin County 2000).
Giant garter snake *Thamnophis gigas*	T/T	Freshwater marshes and low gradient streams with emergent vegetation. Adapted to drainage canals and irrigation ditches with mud substrate.	Moderate. Habitat is present in the waste water treatment ponds, White Slough Wildlife Area, irrigation ditches, and wetted irrigation canals, and associated wetlands throughout the study area. The nearest extant population of GGS are located in Coldani Marsh 1 mi northwest of the ECF site (Hansen 2013a).
Western pond turtle *Emys marmorata*	—/SC	Slow water aquatic habitat with available basking sites. Hatchlings require shallow water with dense submergent or short emergent vegetation. Requires an upland oviposition site near the aquatic site.	High. Observed in White Slough and the ECF site. White Slough, Bishop Cut wetted irrigation ditches, and canals provide aquatic habitat. Uplands adjacent to aquatic habitat provide upland nesting habitat. Western pond turtles were observed in White Slough and an irrigation ditch on the east side of the study area.

Table 1. Special-Status Species Potentially Occurring in the Study Area

Common Name *Scientific Name*	Status[1] (Fed/State/ RPR)	Habitat Requirements	Potential for Occurrence
California black rail *Laterallus jamaicensis coturniculus*	—/T, FP	Coastal and inland marsh habitat. Needs water about 1-inch deep that does not fluctuate during the year. Dense vegetation for nesting habitat.	Moderate. Marsh habitat in the White Slough Wildlife Area in the central portion of the study area provides habitat for this species. The study area is within a CNDDB occurrence polygon for this species.
Swainson's hawk *Buteo swainsoni*	—/T	Breeds in stands with few trees in juniper-sage flats, riparian areas, and oak savannah; forages in adjacent livestock pasture, grassland or grain fields.	High. Isolated or groups of trees nesting habitat for Swainson's hawk. Swainson's hawks were observed nesting in a tree along N. Thornton Road in the eastern portion of the study area and on the north bank of White Slough approximately 0.2 mi northwest of the study area.
White-tailed kite *Elanus leucurus*	—/FP	Nests in tall shrubs and trees, forages in grasslands, agricultural fields and marshes.	Moderate. Isolated trees and shrubs near the study area provide nesting habitat. The nearest CNDDB occurrence is in the southern portion of the study area near the White Slough WPCF.
Northern harrier *Circus cyaneus*	—/SC	Forages in marshes, grasslands, and ruderal habitats; nests in extensive marshes and wet fields.	Moderate. Wet meadows and wetlands in the White Slough Wildlife Area provide nesting habitat for northern harrier. Nesting observed 1.25 mi northwest (North State Resources 2013).
Western burrowing owl *Athene cunicularia*	—/SC	Grasslands and ruderal habitats.	Moderate. Ground squirrel burrows occurring along levees, roads, and ruderal areas throughout the study area are of sufficient size to accommodate owls. However, low growing vegetation is limited to the access road and margins. Due to the limited foraging area it is unlikely that burrowing owl will occupy the study area. The nearest CNDDB occurrence is 3.2 miles southeast of the study area.
Short-eared owl *Asio flammeus*	—/SC	Breeds in dense vegetation in open grassland and marshes.	Low. Wet meadows and wetlands in the White Slough Wildlife Area provide nesting habitat for this species.

Table 1. Special-Status Species Potentially Occurring in the Study Area

Common Name *Scientific Name*	Status[1] (Fed/State/ RPR)	Habitat Requirements	Potential for Occurrence
Loggerhead shrike *Lanius ludovicianus*	—/SC	Nests in tall shrubs and dense trees, forages in grasslands, marshes, and ruderal habitats.	Moderate. Isolated trees and shrubs near the study area could provide potential nesting habitat for this species.
Yellow warbler *Dendroica petechia*	—/SC	Breeds in riparian woodlands, particularly those dominated by willows and cottonwoods.	Low. Valley foothill riparian habitat within White Slough Wildlife Area provides habitat for this species.
Yellow-breasted chat *Icteria virens*	—/SC	Breeds in riparian habitats having dense understory vegetation, such as willow and blackberry.	Low. Valley foothill riparian habitat within White Slough Wildlife Area provides habitat for this species.
Western red bat *Lasiurus blossevillii*	—/SC	Prefers sites with a mosaic of habitats that includes trees for roosting and open areas for foraging. Strongly associated with extensive stands of riparian.	Moderate. Trees within valley foothill riparian in the White Slough Wildlife Area may provide habitat for this species.

[1]Status Codes: Federal and State: E = Endangered; T = Threatened; D = Delisted; C = Candidate ; FP = California Fully Protected species
California Rare Plant Rank (RPR) Codes:
List 1B Plants rare, threatened, or endangered in California and elsewhere.
List 2B Plants rare, threatened, or endangered in California but more common elsewhere.
Extensions
.3 Not very threatened in California
.2 Moderately threatened in California
.1 Seriously threatened in California

Delta Smelt (*Hypomesus transpacificus*). Federal status: Threatened; State status: Endangered. Delta smelt are endemic to the Sacramento-San Joaquin estuary. The species is typically found in shallow water (<10 feet) where salinity ranges from 2 to 7 parts per thousand (ppt) (Moyle 2002). Delta smelt abundance and geographic distribution are dependent on freshwater outflows and the salinity of the San Francisco Estuary and Delta. Delta smelt are semi-anadromous. During their spawning migration, adults move into the freshwater channels and sloughs of the Delta between December and January. Larval and juvenile transport and rearing occurs between February and August. Spawning habitat includes shallow, freshwater (i.e., less than 2ppt salinity) river, and backwater slough edgewater. Spawning, larval/juvenile transport, and rearing habitat must be free of physical disturbance. Additionally, larvae and juveniles require shallow, protective, food-rich environment in which to mature (California Department of Fish and Game 2005).

Spawning occurs between January and July, with peak spawning from April through mid-May. Eggs are usually attached to substrate, likely composed of gravel, sand, or other submerged material (Wang 1986; Moyle 2002). Newly hatched larvae contain a large oil globule that makes them semi-buoyant and allows them to stay near the bottom. As their fins and swim bladder develop, they move higher into the water column and are washed downstream to the open waters of the estuary (Moyle 2002).

Bishop Cut provides limited spawning and juvenile rearing habitat and is a seasonal migratory corridor for this species. Project is within designated critical habitat. This species is known to occur near Bishop Cut and White Slough in Little Potato Slough and Little Venice Island sampling points approximately 3 and 4 miles west of Bishop Cut, respectively (California Department of Fish and Wildlife 2014).

Central Valley Steelhead DPS (*Oncorhynchus mykiss*). Federal status: Threatened; State status: None. This Distinct Population Segment (DPS) occurs in the Sacramento and San Joaquin rivers and their tributaries. Central Valley steelhead mature in the ocean and arrive on the spawning grounds (*i.e.*, rivers and tributaries of the Central Valley) nearly ready to spawn. Adult migration from the ocean to spawning grounds may occur throughout the year, with peak migration occurring in the fall or early winter. Migration in the through the Delta takes place from as early as July and runs through April, with peak migration generally occurring between August and October (Moyle 2002).

Bishop Cut and White Slough provide a migratory corridor and juvenile rearing habitat for this species and are designated critical habitat. Bishop Cut is within known distribution of the species (National Marine Fisheries Service 2014).

Central Valley spring-run Evolutionary Significant Unit (ESU) Chinook Salmon (*Oncorhynchus tshawytscha*). Federal status: Threatened; State status: Threatened.

Central Valley fall/late fall-run Chinook salmon ESU Federal status: Species of Concern; State status: Species of Special Concern.

Bishop Cut and White Slough provide a migratory corridor for adult and juvenile Central Valley spring-run and fall/late-fall run Chinook salmon, although it is not part of designated critical habitat for spring-run Chinook salmon. Juvenile and adult migration through the project area to and from natal streams for these runs would be from October through June. As with steelhead, Chinook salmon migrate from the ocean to spawning grounds to spawn and juveniles emigrate from spawning grounds to the ocean.

Green Sturgeon Southern Distinct Population Segment (DPS) (*Acipenser medirostris*). Federal Status: Threatened; State Status: Species of Special Concern. Adult green sturgeon migrate upstream primarily through the western edge of the Delta into the lower Sacramento River between March and June (Adams et al. 2002). Larvae and post-larvae are present in the lower Sacramento and north Delta between May and October, primarily in June and July (California Department of Fish and Game 2002). Green sturgeon spawning has not been documented in the San Joaquin River and the distribution of juvenile green sturgeon through the Delta is not well understood, however, because of the connectivity of waters of the Delta and critical habitat in the project area, the potential presence of green sturgeon could not be eliminated. However, the potential for green sturgeon to occur in the project area is very low. Bishop Cut provides a migratory corridor for this species.

Longfin Smelt (*Spirinchus thaleichthys*). Federal status: None; State status: Threatened. Historically, this species is known from the San Francisco Estuary, Humboldt Bay, Eel River Estuary, and the Klamath River Estuary. In the Delta, longfin smelt are rarely found north of Rio Vista and Medford Island (Moyle 2002). They generally move down the estuary during the summer and upstream to spawn in the fall and winter. Spawning takes place in the winter in fresh water over

sandy or gravel substrates, rocks, and aquatic plants. Spawning appears to take place below Medford Island in the San Joaquin River and below Rio Vista in the Sacramento River (Moyle 2002). Newly hatched embryos are buoyant and move into the upper part of the water column where they are swept to the lower delta to Suisun Marsh and San Pablo Bay estuaries to rear (Moyle 2002).

Bishop Cut provides limited a seasonal migratory corridor for this species. This species is known to occur near Bishop Cut in Little Potato Slough and Little Venice Island sampling points approximately 3 and 4 miles west of Bishop Cut, respectively (California Department of Fish and Wildlife 2014); however, occurrence in or near the project area is assumed to be rare given their known distribution and documented occurrences.

Sacramento Splittail (*Pogonichthys macrolepidotus*). Federal status: None; State status: Species of Special Concern. This species is found most often in slow moving sections of rivers and sloughs of the Delta. This species is often most abundant in the north west portions of the Delta, but are often more widespread and abundant following years of successful reproduction, often following extended periods of floodplain inundation (Moyle 2002). Adults gradually move upstream during the winter and spring months to forage and spawn in flooded areas. Peak spawning is in March and April and eggs are attached to submerged vegetation of flooded areas. (Moyle 2002).

Bishop Cut, Dredger Cut, and White Slough, provides suitable migratory and transient rearing habitat; however, they lack the typical shallow floodplain habitat preferred for spawning.

River Lamprey (*Lampetra ayresi*). Federal status: None; State status: Species of Special Concern. Adult river lamprey migrate to freshwater in the autumn to spawn although the exact timing of these migrations in California streams is poorly known. After 3 to 5 years in the natal stream the river lamprey return to the ocean until ready to spawn.

Bishop Cut provides a migratory corridor for this species. This species is known to occur throughout the Sacramento-San Joaquin Delta (Moyle 2002).

Giant Garter Snake (*Thamnophis gigas*). Federal status: Threatened; State status: Threatened. Giant garter snakes are distributed in portions of the rice production zones of Sacramento, Sutter, Butte, Colusa, and Glenn Counties; along the western border of the Yolo Bypass in Yolo County; and along the eastern fringes of the Sacramento-San Joaquin River delta from the Laguna Creek-Elk Grove region of central Sacramento County southward to the Stockton area of San Joaquin County.

Giant garter snakes inhabit marshes, sloughs, ponds, small lakes, low gradient streams, and other waterways as well as agricultural wetlands, such as vegetated canals and rice fields. They feed on a variety of small vertebrates including fishes, tadpoles, and frogs (Hansen 1980). Giant garter snakes are typically absent from larger rivers and other water bodies that support introduced populations of large, predatory fish, and from wetlands with sand, gravel, or rock substrates. Giant garter snakes inhabit small mammal burrows and other soil crevices above prevailing flood elevations throughout its winter dormancy period (i.e., November to mid-March). They typically utilize upland habitat within 200 feet of appropriate aquatic and bankside habitat (Miller et al. 1999).

The GGS breeding season extends through March and April, and females give birth to live young from late July through early September (Miller et al. 1999).

Wetted fresh emergent wetlands, ditches, irrigation canals, and waste water treatment ponds within or adjacent to the study area provide aquatic habitat for this species. Refugia (i.e., mammal burrows, rock piles) within 200 feet of aquatic habitat provide upland wintering habitat. The nearest extant population is located approximately 1 mile north of the study area (Hansen 2013a).

Western Pond Turtle (*Emys marmorata*). Federal status: None; State status: Species of Special Concern. This species occurs throughout California west of the Sierra crest and are absent from desert regions except for along the Mojave River (Zeiner et al. 1988). The western pond turtle is found in the quiet waters of ponds, marshes, creeks, and irrigation ditches. This species requires basking sites such as partially submerged logs, rocks, mats of floating vegetation, or open mud banks. Hibernation in colder areas is passed underwater in bottom mud. Mating typically occurs in late April or early May, but may occur year-round. Nests are located in an upland location that may be a considerable distance from the aquatic site (up to 0.25 mile) (Jennings and Hayes 1994). Hatchling turtles are thought to emerge from the nest and move to the aquatic site in the spring.

Fresh emergent wetlands, ditches, irrigation canals, and waste water treatment ponds within or adjacent to the study area provide aquatic habitat and adjacent uplands provide upland habitat for this species. Western pond turtles were observed in White Slough north of the study area during the field reconnaissance visit.

Swainson's Hawk (*Buteo swainsoni*). Federal Status: None; State Status: Threatened. Swainson's hawk nesting range is primarily restricted to portions of the Sacramento and San Joaquin Valleys and northeast California (Bloom 1980). Swainson's hawks require large amounts of foraging habitat, preferably grassland or pasture habitats. They have also adapted to some croplands, particularly alfalfa, but also hay, grain, tomatoes, beets and other row crops (Estep 1989). Crops such as cotton, corn, rice, orchards, and vineyards are not suitable since they either lack suitable prey or the prey is unavailable to the Swainson's hawks due to the crops structure. In the Central Valley, Swainson's hawks are generally tied to riparian habitat for nesting sites (Bloom 1980). Their preferred prey items are voles (*Microtus* sp), gophers, birds, and insects such as grasshoppers (Estep 1989). Nests in March and young typically fledge by late-July (Swainson's Hawk Technical Advisory Committee 2000).

Foraging habitat is abundant in the study area and isolated trees may provide nesting habitat. Two potential nests were observed during the reconnaissance survey: one is located in the western portion of the study area approximately 0.2 mile northwest of the study area and one is located in the eastern portion of the study area along N. Thornton Road. During surveys conducted in 2013 North State Resources, Inc. observed a Swainson's hawk pair build a nest approximately 1.5 miles north of the project area (North State Resources 2013).

California black rail (*Laterallus jamaicensis coturniculus*). Federal Status: None; State Status: Threatened, Fully Protected. Resident of saline, brackish and fresh emergent wetlands in the San Francisco Bay area, Sacramento-San Joaquin Delta, and near Morro Bay. Nests in bulrush, cattails and salt grass in the upper limits of tidal flooding where there is little daily or annual fluctuations.

Nests in late-spring to early-summer. Marsh habitat in the White Slough Wildlife Area may provide habitat for this species. The study area is within the reported area for a CNDDB record of this species.

White-tailed Kite (*Elanus leucurus*). Federal status: None; State status: Fully Protected Species. The white-tailed kite can be found in association with the herbaceous and open stages of a variety of habitat types, including open grasslands, meadows, emergent wetlands, and agricultural lands. Nests are constructed near the top of dense oaks, willows, or other tree stands located adjacent to foraging areas. Nesting occurs from February through October. The species forages in undisturbed, open grasslands, meadows, farmlands, and emergent wetlands. White-tailed kites are seldom observed more than 0.5 mi (0.8 km) from an active nest during the breeding season (Zeiner et al. 1990a). Isolated trees within and adjacent to the study area provide suitable nesting habitat for white-tailed kite. The nearest CNDDB occurrence is in the southern portion of the study area near the waste water treatment plant.

Northern Harrier (*Circus cyaneus*). Federal Status: None; State Status: Species of Special Concern. The northern harrier is commonly found in open grasslands, agricultural areas, and marshes. Nests are built on the ground in areas where long grasses or marsh plants provide cover and protection. Nesting usually occurs in late-spring through September. Harriers hunt for a variety of prey, including rodents, birds, frogs, reptiles, and insects by flying low and slow in a traversing manner utilizing both sight and sound to detect prey items. Northern harriers are common in the Central Valley, especially during winter. In the study area, the species may nest along White Slough and/or in grasslands and agricultural habitat. One northern harrier was observed nesting 1.25 miles northwest of the project in 2013 (North State Resources 2013).

Western Burrowing Owl (*Athene cunicularia hypugaea*). Federal status: None; State status: Species of Special Concern. The western burrowing owl inhabits open, dry grasslands and deserts, as well as open stages of pinyon-juniper and ponderosa pine. The nesting season is between February 1 and August 31. Western burrowing owls typically nest in abandoned rodent burrows, particularly those of California ground squirrels, which they modify each year. Burrowing owls forage in open grassland areas adjacent to nest sites. The species has also been documented in open areas near human habitation, especially airports and golf courses. Ruderal areas agricultural fields may provide habitat for this species. The nearest known occurrence of a burrowing owl is approximately 3.2 miles to the southeast of the study area.

Short-eared Owl (*Asio flammeus*). Federal Status: None; State Status: Species of Special Concern. In California, short-eared owls nest at only a few of their former breeding locations, and in northwestern California breed only in coastal areas where conditions are prime. The short-eared owl is a ground nester and occurs in open country, including grasslands, wet meadows, and cleared forests with enough herbaceous cover to conceal their nests from predators (Shuford and Gardali 2008a). They breed from early March through July (Zeiner et al. 1990b). Short-eared owls are crepuscular hunters that prey on small mammals. Open areas within White Slough WA may provide habitat for this species.

Loggerhead Shrike (*Lanius ludovicianus*). Federal listing status: None; State listing status: Species of Special Concern. The loggerhead shrike prefers open habitats with scattered shrubs,

trees, posts, fences, utility lines, or other perches located in open-canopied valley foothill hardwood, valley foothill hardwood-conifer, valley foothill riparian, pinyon-juniper, juniper, desert riparian, and Joshua tree habitats. Breeding occurs from March through August. The loggerhead shrike is a common resident and winter visitor in lowlands and foothills throughout California (Zeiner et al. 1990c). Trees and shrubs within the study area may provide nesting habitat for this species.

Yellow Warbler (*Dendroica petechia*). Federal Status: None, State Status: Species of Special Concern. The yellow warbler is a Neotropical migrant, that principally occurs in California as a migrant and summer resident from late March through early October (Shuford and Gardali 2008b). It is usually found in dense riparian deciduous habitats with cottonwoods, willows, alders, and other small trees and shrubs typical of open-canopy riparian woodlands. The species breeds from mid-April to early August, building an open cup nest in a tree or shrub. Nesting habitat is present in the valley foothill riparian habitat within the White Slough Wildlife Area.

Yellow-breasted Chat (*Icteria virens)*. Federal Status: None, State Status: Species of Special Concern. A Neotropical migrant, yellow-breasted chat usually arrives in California in April and departs by late September. In California, they typically occur in early successional riparian habitats with a well-developed shrub layer and an open canopy (Shuford and Gardali 2008b). Nesting habitat is usually restricted to the narrow border of streams, creeks, sloughs, and rivers (Shuford and Gardali 2008b). Breeding occurs from early May to early August. (Zeiner et al. 1990c). Nesting habitat is present in the valley foothill riparian habitat within the White Slough Wildlife Area.

Western Red Bat (*Lasiurus blossevillii)*. Federal listing status: None; State listing status: Species of Special Concern. The western red bat is a migratory species occurring in California from Shasta County to the Mexican border, west of the Sierra Nevada/Cascade crest and deserts. The species prefers sites with a mosaic of habitats that includes trees for roosting and open areas for foraging. Western red bats typically roost solitarily in dense tree foliage, particularly in willows, cottonwoods, and sycamores. They appear to be strongly associated with riparian habitats, particularly mature stands of cottonwood/sycamore (Pierson et al. 2006). Births are from late May to early August. They forage over a wide assortment of habitat types for a variety of insects, but primarily feed on moths. Trees within valley-foothill riparian habitat could provide roost sites for the western red bat.

3.4 Rare Natural Communities

In addition to inventorying reported occurrences of special-status species, the CNDDB inventories the locations of rare natural communities. Communities respond to environmental changes and can be thought of as an indicator of the overall health of an ecosystem and its component species. Rare natural communities are those communities that are of highly limited distribution. They may or may not contain rare, threatened, or endangered species. The CNDDB ranks natural communities according to their rarity and endangerment in California. White Slough is designated as Coastal and Valley Freshwater Marsh by the CDFW.

3.5 Waters of the United States

Potential waters of the United States occur as irrigation canal, open water, riparian wetland, vegetated ditch, wetland swale, and non-vegetated ditch (Figure 2a and 2b).

Two irrigation canals are present in the study area. One irrigation canal, which parallels the southern portion of the White Slough WPCF supports fresh emergent vegetation along the banks of the canal. The second irrigation canal is the linear feature located south of the White Slough Wildlife Area. Because this features are relatively permanent and support hydrophytic vegetation and connect two or more wetlands, they would qualify as a potential waters of the United States.

Bishop Cut is is an open water channel that connects White and Disappointment sloughs. It is located in the western portion of the study area (Figure 2a). It is a perennial water that is generally devoid of vegetation. It is a navigable water and a waters of the United States.

Riparian wetlands are located in the western portion of the study area on King Island and in the White Slough Wildlife Area west of the White Slough WPCF. The western feature is dominated by Fremont cottonwood and the irrigation ditch provides hydrology. The riparian wetlands in the White Slough Wildlife Area are dominated by hydrophytic vegetation including poison hemlock (*Conium maculatum*), pepperweed (*Lepidium latifolium*), and willow smartweed (*Persicaria lapathifolium*), and rough cocklebur (*Xanthium strumarium*). Due to the dominance of hydrophytic vegetation and adjacency to waters of the United States these would features qualify as potential waters of the United States.

Vegetated ditches are present along the agricultural fields throughout the study area. Water is generally pumped in or out of White Slough or Bishop Cut depending on need to irrigate farmland or to keep the area from flooding. The irrigation ditches within the project area are adjacent (separated by a levee) to White Slough or Bishop Cut, which qualify as waters of the United States. Given that the irrigation ditches support hydrophytic vegetation, are subject to extended inundation and/or saturation, and are adjacent to waters of the United States, the features are considered as potential waters of the United States.

Two non-vegetated ditches are located east of I-5. These ditches are devoid of vegetation; however, they exhibit an ordinary highwater mark and may drain other waters of the United States. Because they may connect two or more waters of the United States, they would qualify as potential waters of the United States.

There are many agricultural ditches throughout the site that do not qualify as waters of the United States and are thus not depicted on the map. These ditches do not qualify as waters of the United States because they 1) are not a natural stream that has been altered, 2) are not excavated in waters of the United States, 3) do not have relatively permanent flowing or standing water, 4) do not connect two or more jurisdictional waters of the United States, and 5) do not drain natural water bodies (including wetlands) into the tributary system of a traditional navigable or interstate water (U.S. Army Corps of Engineers 2011).

It is important to note that the field assessment did not involve a formal delineation using U.S. Army Corps of Engineers (USACE) methodology and no detailed investigations for wetland hydrology were conducted. All determinations provided in this document concerning waters of the United States should be considered preliminary and tentative unless verified in writing by the (USACE).

3.6 Other Sensitive Biological Resources

Migratory birds and raptors (i.e., birds of prey) protected under the federal Migratory Bird Treaty Act and California Fish and Game Code may nest on open ground, vegetation, or structures within the project area. Multiple stick nests and mud nests were observed during the field visits. Cliff swallow (*Petrochelidon pyrrhonota*) nests were observed under the Rio Blanco Road bridge over Telephone Cut.

The study area occurs within the San Joaquin County Multispecies Habitat Conservation and Open Space Plan (SJMSCP) planning area. The proposed project is not subject to discretionary approval by San Joaquin County, and as such would not conflict with the SJMSCP.

The San Joaquin County Development Title (Ordinance 4368, Chapter 9-1500) requires an improvement plan and replacement plantings at specified ratios for the removal of significant tree resources (e.g., native oak trees, heritage trees and riparian habitat). Riparian trees may also be jurisdiction under the CDFW Lake and Streambed Alteration Agreement if notification is required. The City of Lodi does not require any tree removal permits on private property.

4. RECOMMENDATIONS

The reconnaissance level survey determined the biological resources that potentially occur within the study area including special-status plant and animal species, waters of the United States, migratory birds and raptors, and tree resources. The following studies are recommended or may be required to support permitting and other authorizations.

- For most species, standard minimization and avoidance measures, and best management practices would be implemented to avoid impacts on these resources (e.g., special-status fish, giant garter snake, western pond turtle, and special-status birds and bats). Standard measures may include pre-construction surveys, construction monitoring, limited operating period, and resource avoidance by applying no-construction buffers around nests or other sensitive habitat (e.g., burrows).
- A formal delineation may be needed to support Corps authorization under Section 10 of the Rivers and Harbors Act, which would be required to drill under Bishop Cut. A determination of waters of the United States would also assist in project design to avoid impacts on the waters of the United States, which could reduce or eliminate permitting or permit conditions. If it appears that potential waters of the United States cannot be avoided, a formal delineation of waters of the United States would be required to support the permit application for a Clean Water Act Section 404 and 401 authorizations by the U.S. Army Corps of Engineers and Regional Water Quality Control Board, respectively.
- Because the project design, permitting and construction period is undefined, the California Department of Fish and Wildlife may ask for additional plant surveys.
- Removal of native oak trees, heritage trees or riparian trees may be subject to measures

provided in the San Joaquin County Development Title.

- Removal of riparian trees may also be subject to the jurisdiction of the CDFW if a notification of streambed alteration is required.

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APPENDIX A

U.S. Fish and Wildlife Service Species List
CNPS Electronic Inventory Query Results
CNDDB Query Results

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825

August 1, 2014

Document Number: 140801095119

Heather L. Kelly
North State Resources
5000 Bechelli Lane Ste 203
Redding, CA 96002

Subject: Species List for CAES Project

Dear: Ms. Kelly

We are sending this official species list in response to your August 1, 2014 request for information about endangered and threatened species. The list covers the California counties and/or U.S. Geological Survey 7½ minute quad or quads you requested.

Our database was developed primarily to assist Federal agencies that are consulting with us. Therefore, our lists include all of the sensitive species that have been found in a certain area *and also ones that may be affected by projects in the area*. For example, a fish may be on the list for a quad if it lives somewhere downstream from that quad. Birds are included even if they only migrate through an area. In other words, we include all of the species we want people to consider when they do something that affects the environment.

Please read Important Information About Your Species List (below). It explains how we made the list and describes your responsibilities under the Endangered Species Act.

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be October 30, 2014.

Please contact us if your project may affect endangered or threatened species or if you have any questions about the attached list or your responsibilities under the Endangered Species Act. A list of Endangered Species Program contacts can be found http://www.fws.gov/sacramento/es/Branch-Contacts/es_branch-contacts.htm.

Endangered Species Division

TAKE PRIDE IN AMERICA

U.S. Fish & Wildlife Service

Sacramento Fish & Wildlife Office

Federal Endangered and Threatened Species that Occur in or may be Affected by Projects in the Counties and/or U.S.G.S. 7 1/2 Minute Quads you requested

Document Number: 140801095119

Current as of: August 1, 2014

Quad Lists

Listed Species

Invertebrates

Branchinecta lynchi
vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus
valley elderberry longhorn beetle (T)

Lepidurus packardi
vernal pool tadpole shrimp (E)

Fish

Acipenser medirostris
green sturgeon (T) (NMFS)

Hypomesus transpacificus
Critical habitat, delta smelt (X)
delta smelt (T)

Oncorhynchus mykiss
Central Valley steelhead (T) (NMFS)
Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha
Central Valley spring-run chinook salmon (T) (NMFS)
winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Ambystoma californiense
California tiger salamander, central population (T)

Rana draytonii
California red-legged frog (T)

Reptiles

Thamnophis gigas
giant garter snake (T)

Mammals

Sylvilagus bachmani riparius
riparian brush rabbit (E)

Plants

Castilleja campestris ssp. succulenta
succulent (=fleshy) owl's-clover (T)

Quads Containing Listed, Proposed or Candidate Species:

TERMINOUS (479C)

LODI SOUTH (479D)

County Lists

Listed Species

Invertebrates

Branchinecta conservatio
Conservancy fairy shrimp (E)
Critical habitat, Conservancy fairy shrimp (X)
S

Branchinecta longiantenna
longhorn fairy shrimp (E)
S

Branchinecta lynchi
Critical habitat, vernal pool fairy shrimp (X)
vernal pool fairy shrimp (T)
S

Desmocerus californicus dimorphus
valley elderberry longhorn beetle (T)
S

Elaphrus viridis
delta green ground beetle (T)
S

Lepidurus packardi
Critical habitat, vernal pool tadpole shrimp (X)
vernal pool tadpole shrimp (E)
S

Fish

Acipenser medirostris
green sturgeon (T) (NMFS)
S

Hypomesus transpacificus
Critical habitat, delta smelt (X)
delta smelt (T)
S

Oncorhynchus mykiss
Central Valley steelhead (T) (NMFS)
Critical habitat, Central Valley steelhead (X) (NMFS)
S

Oncorhynchus tshawytscha
Central Valley spring-run chinook salmon (T) (NMFS)
Critical Habitat, Central Valley spring-run chinook (X) (NMFS)
Critical habitat, winter-run chinook salmon (X) (NMFS)
winter-run chinook salmon, Sacramento River (E) (NMFS)
S

Amphibians

Ambystoma californiense
California tiger salamander, central population (T)
Critical habitat, CA tiger salamander, central population (X)
S

Rana draytonii
California red-legged frog (T)
Critical habitat, California red-legged frog (X)
S

Reptiles

Masticophis lateralis euryxanthus
Alameda whipsnake [=striped racer] (T)
Critical habitat, Alameda whipsnake (X)
S

Thamnophis gigas
giant garter snake (T)
S

Birds

Rallus longirostris obsoletus
California clapper rail (E)
S

Vireo bellii pusillus
Least Bell's vireo (E)
S

Mammals

Neotoma fuscipes riparia
riparian (San Joaquin Valley) woodrat (E)
S

Sylvilagus bachmani riparius
riparian brush rabbit (E)
S

Vulpes macrotis mutica
San Joaquin kit fox (E)
S

Plants

Amsinckia grandiflora
Critical habitat, large-flowered fiddleneck (X)
large-flowered fiddleneck (E)
S

Arctostaphylos myrtifolia
Ione manzanita (T)
S

Castilleja campestris ssp. succulenta
Critical habitat, succulent (=fleshy) owl's-clover (X)
succulent (=fleshy) owl's-clover (T)
S

Cordylanthus palmatus
palmate-bracted bird's-beak (E)
S

Lasthenia conjugens
Critical habitat, Contra Costa goldfields (X)
S

Orcuttia viscida
Critical habitat, Sacramento Orcutt grass (X)
Sacramento Orcutt grass (E)
S

Tuctoria greenei
Greene's tuctoria (=Orcutt grass) (E)
S

Candidate Species

Birds

Coccyzus americanus occidentalis
Western yellow-billed cuckoo (C)
S

Key:

(E) *Endangered* - Listed as being in danger of extinction.
(T) *Threatened* - Listed as likely to become endangered within the foreseeable future.
(P) *Proposed* - Officially proposed in the Federal Register for listing as endangered or threatened.
(NMFS) Species under the Jurisdiction of the National Oceanic & Atmospheric Administration Fisheries Service. Consult with them directly about these species.
Critical Habitat - Area essential to the conservation of a species.
(PX) *Proposed Critical Habitat* - The species is already listed. Critical habitat is being proposed for it.
(C) *Candidate* - Candidate to become a proposed species.
(V) Vacated by a court order. Not currently in effect. Being reviewed by the Service.
(X) *Critical Habitat* designated for this species

Important Information About Your Species List

How We Make Species Lists

We store information about endangered and threatened species lists by U.S. Geological Survey 7½ minute quads. The United States is divided into these quads, which are about the size of San Francisco.

The animals on your species list are ones that occur within, **or may be affected by** projects within, the quads covered by the list.

- Fish and other aquatic species appear on your list if they are in the same watershed as your quad or if water use in your quad might affect them.

- Amphibians will be on the list for a quad or county if pesticides applied in that area may be carried to their habitat by air currents.
- Birds are shown regardless of whether they are resident or migratory. Relevant birds on the county list should be considered regardless of whether they appear on a quad list.

Plants

Any plants on your list are ones that have actually been observed in the area covered by the list. Plants may exist in an area without ever having been detected there. You can find out what's in the surrounding quads through the California Native Plant Society's online Inventory of Rare and Endangered Plants.

Surveying

Some of the species on your list may not be affected by your project. A trained biologist and/or botanist, familiar with the habitat requirements of the species on your list, should determine whether they or habitats suitable for them may be affected by your project. We recommend that your surveys include any proposed and candidate species on your list. See our Protocol and Recovery Permits pages.

For plant surveys, we recommend using the Guidelines for Conducting and Reporting Botanical Inventories. The results of your surveys should be published in any environmental documents prepared for your project.

Your Responsibilities Under the Endangered Species Act

All animals identified as listed above are fully protected under the Endangered Species Act of 1973, as amended. Section 9 of the Act and its implementing regulations prohibit the take of a federally listed wildlife species. Take is defined by the Act as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" any such animal.

> Take may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or shelter (50 CFR §17.3).

Take incidental to an otherwise lawful activity may be authorized by one of two procedures:

- If a Federal agency is involved with the permitting, funding, or carrying out of a project that may result in take, then that agency must engage in a formal consultation with the Service.

  During formal consultation, the Federal agency, the applicant and the Service work together to avoid or minimize the impact on listed species and their habitat. Such consultation would result in a biological opinion by the Service addressing the anticipated effect of the project on listed and proposed species. The opinion may authorize a limited level of incidental take.

- If no Federal agency is involved with the project, and federally listed species may be taken as part of the project, then you, the applicant, should apply for an incidental take permit. The Service may issue such a permit if you submit a satisfactory conservation plan for the species that would be affected by your project.

  Should your survey determine that federally listed or proposed species occur in the area and are likely to be affected by the project, we recommend that you work with this office and the California Department of Fish and Game to develop a plan that minimizes the project's direct and indirect impacts to listed species and compensates for project-related loss of habitat. You should include the plan in any environmental documents you file.

Critical Habitat

When a species is listed as endangered or threatened, areas of habitat considered essential to its conservation may be designated as critical habitat. These areas may require special

management considerations or protection. They provide needed space for growth and normal behavior; food, water, air, light, other nutritional or physiological requirements; cover or shelter; and sites for breeding, reproduction, rearing of offspring, germination or seed dispersal.

Although critical habitat may be designated on private or State lands, activities on these lands are not restricted unless there is Federal involvement in the activities or direct harm to listed wildlife.

If any species has proposed or designated critical habitat within a quad, there will be a separate line for this on the species list. Boundary descriptions of the critical habitat may be found in the Federal Register. The information is also reprinted in the Code of Federal Regulations (50 CFR 17.95). See our Map Room page.

Candidate Species

We recommend that you address impacts to candidate species. We put plants and animals on our candidate list when we have enough scientific information to eventually propose them for listing as threatened or endangered. By considering these species early in your planning process you may be able to avoid the problems that could develop if one of these candidates was listed before the end of your project.

Species of Concern

The Sacramento Fish & Wildlife Office no longer maintains a list of species of concern. However, various other agencies and organizations maintain lists of at-risk species. These lists provide essential information for land management planning and conservation efforts. More info

Wetlands

If your project will impact wetlands, riparian habitat, or other jurisdictional waters as defined by section 404 of the Clean Water Act and/or section 10 of the Rivers and Harbors Act, you will need to obtain a permit from the U.S. Army Corps of Engineers. Impacts to wetland habitats require site specific mitigation and monitoring. For questions regarding wetlands, please contact Mark Littlefield of this office at (916) 414-6520.

Updates

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be October 30, 2014.

CALIFORNIA DEPARTMENT OF FISH and WILDLIFE **RareFind**

Query Summary:
Quad IS (Terminous (3812114) OR Isleton (3812125) OR Thornton (3812124) OR Lodi North (3812123) OR Bouldin Island (3812115) OR Lodi South (3812113) OR Woodward Island (3712185) OR Holt (3712184) OR Stockton West (3712183))

Print Close

CNDDB Element Query Results

Scientific Name	Common Name	Taxonomic Group	Element Code	Total Occs	Returned Occs	Federal Status	State Status	Global Rank	State Rank	CA Rare Plant Rank	Other Status	Habitats
Agelaius tricolor	tricolored blackbird	Birds	ABPBXB0020	429	3	None	None	G2G3	S2	null	ABC_WLBCC-Watch List of Birds of Conservation Concern | BLM_S-Sensitive | CDFW_SSC-Species of Special Concern | IUCN_EN-Endangered | USFWS_BCC-Birds of Conservation Concern	Freshwater marsh | Marsh & swamp | Swamp | Wetland
Ambystoma californiense	California tiger salamander	Amphibians	AAAAA01180	1094	2	Threatened	Threatened	G2G3	S2S3	null	CDFW_SSC-Species of Special Concern | IUCN_VU-Vulnerable	Cismontane woodland | Meadow & seep | Riparian woodland | Valley & foothill grassland | Vernal pool | Wetland
Anthicus sacramento	Sacramento anthicid beetle	Insects	IICOL49010	13	1	None	None	G1	S1	null	IUCN_EN-Endangered	Interior dunes
Ardea herodias	great blue heron	Birds	ABNGA04010	132	2	None	None	G5	S4	null	CDF_S-Sensitive | IUCN_LC-Least Concern	Brackish marsh | Estuary | Freshwater marsh | Marsh & swamp | Riparian forest | Wetland
Astragalus tener var. tener	alkali milk-vetch	Dicots	PDFAB0F8R1	65	2	None	None	G2T2	S2	1B.2	null	Alkali playa | Valley & foothill grassland | Vernal pool | Wetland
Athene cunicularia	burrowing owl	Birds	ABNSB10010	1850	18	None	None	G4	S3	null	BLM_S-Sensitive | CDFW_SSC-Species of Special Concern | IUCN_LC-Least Concern | USFWS_BCC-Birds of Conservation Concern	Coastal prairie | Coastal scrub | Great Basin grassland | Great Basin scrub | Mojavean desert scrub | Sonoran desert scrub | Valley & foothill grassland
Atriplex cordulata var. cordulata	heartscale	Dicots	PDCHE040B0	68	1	None	None	G3T2	S2	1B.2	BLM_S-Sensitive	Chenopod scrub | Meadow & seep | Valley & foothill grassland

Atriplex joaquinana	San Joaquin spearscale	Dicots	PDCHE041F3	109	6	None	None	G2	S2	1B.2	BLM_S-Sensitive	Alkali playa | Chenopod scrub | Meadow & seep | Valley & foothill grassland
Blepharizonia plumosa	big tarplant	Dicots	PDAST1C011	48	1	None	None	G2	S2	1B.1	null	Valley & foothill grassland
Branchinecta lynchi	vernal pool fairy shrimp	Crustaceans	ICBRA03030	611	1	Threatened	None	G3	S2S3	null	IUCN_VU-Vulnerable	Valley & foothill grassland | Vernal pool | Wetland
Branchinecta mesovallensis	midvalley fairy shrimp	Crustaceans	ICBRA03150	101	2	None	None	G2	S2	null	null	Vernal pool | Wetland
Brasenia schreberi	watershield	Dicots	PDCAB01010	33	2	None	None	G5	S2	2B.3	null	Marsh & swamp | Wetland
Buteo swainsoni	Swainson's hawk	Birds	ABNKC19070	2394	187	None	Threatened	G5	S2	null	ABC_WLBCC-Watch List of Birds of Conservation Concern | BLM_S-Sensitive | IUCN_LC-Least Concern | USFS_S-Sensitive | USFWS_BCC-Birds of Conservation Concern	Great Basin grassland | Riparian forest | Riparian woodland | Valley & foothill grassland
California macrophylla	round-leaved filaree	Dicots	PDGER01070	155	1	None	None	G2	S2	1B.1	BLM_S-Sensitive	Cismontane woodland | Valley & foothill grassland
Carex comosa	bristly sedge	Monocots	PMCYP032Y0	29	2	None	None	G5	S2	2B.1	null	Freshwater marsh | Marsh & swamp | Wetland
Chloropyron palmatum	palmate-bracted salty bird's-beak	Dicots	PDSCR0J0J0	26	1	Endangered	Endangered	G1	S1	1B.1	null	Chenopod scrub | Meadow & seep | Valley & foothill grassland | Wetland
Cicuta maculata var. bolanderi	Bolander's water-hemlock	Dicots	PDAPI0M051	17	1	None	None	G5T3T4	S2	2B.1	null	Marsh & swamp | Salt marsh | Wetland
Coastal and Valley Freshwater Marsh	Coastal and Valley Freshwater Marsh	Marsh	CTT52410CA	60	11	None	None	G3	S2.1	null	null	Marsh & swamp | Wetland
Desmocerus californicus dimorphus	valley elderberry longhorn beetle	Insects	IICOL48011	201	2	Threatened	None	G3T2	S2	null	null	Riparian scrub
Elanus leucurus	white-tailed kite	Birds	ABNKC06010	158	2	None	None	G5	S3	null	BLM_S-Sensitive | CDFW_FP-Fully Protected | IUCN_LC-Least Concern	Cismontane woodland | Marsh & swamp | Riparian woodland | Valley & foothill grassland | Wetland
Emys marmorata	western pond turtle	Reptiles	ARAAD02030	1136	36	None	None	G3G4	S3	null	BLM_S-Sensitive | CDFW_SSC-Species of Special Concern | IUCN_VU-	Aquatic | Artificial flowing waters | Klamath/North coast flowing waters | Klamath/North coast standing waters | Marsh & swamp | Sacramento/San Joaquin flowing

											Vulnerable | USFS_S-Sensitive	waters | Sacramento/San Joaquin standing waters | South coast flowing waters | South coast standing waters | Wetland
Eryngium racemosum	Delta button-celery	Dicots	PDAPI0Z0S0	26	1	None	Endangered	G1Q	S1	1B.1	null	Riparian scrub | Wetland
Eschscholzia rhombipetala	diamond-petaled California poppy	Dicots	PDPAP0A0D0	10	1	None	None	G1	S1	1B.1	BLM_S-Sensitive	Valley & foothill grassland
Great Valley Valley Oak Riparian Forest	Great Valley Valley Oak Riparian Forest	Riparian	CTT61430CA	33	1	None	None	G1	S1.1	null	null	Riparian forest
Hibiscus lasiocarpos var. occidentalis	woolly rose-mallow	Dicots	PDMAL0H0R3	173	80	None	None	G5T2	S2	1B.2	null	Freshwater marsh | Marsh & swamp | Wetland
Hypomesus transpacificus	Delta smelt	Fish	AFCHB01040	27	16	Threatened	Endangered	G1	S1	null	AFS_TH-Threatened | IUCN_EN-Endangered	Aquatic | Estuary
Juglans hindsii	Northern California black walnut	Dicots	PDJUG02040	5	1	None	None	G1	S1	1B.1	null	Riparian forest | Riparian woodland
Lasiurus blossevillii	western red bat	Mammals	AMACC05060	119	2	None	None	G5	S3?	null	CDFW_SSC-Species of Special Concern | IUCN_LC-Least Concern | USFS_S-Sensitive | WBWG_H-High Priority	Cismontane woodland | Lower montane coniferous forest | Riparian forest | Riparian woodland
Laterallus jamaicensis coturniculus	California black rail	Birds	ABNME03041	241	15	None	Threatened	G4T1	S1	null	ABC_WLBCC-Watch List of Birds of Conservation Concern | BLM_S-Sensitive | CDFW_FP-Fully Protected | IUCN_NT-Near Threatened | USFWS_BCC-Birds of Conservation Concern	Brackish marsh | Freshwater marsh | Marsh & swamp | Salt marsh | Wetland
Lathyrus jepsonii var. jepsonii	Delta tule pea	Dicots	PDFAB250D2	131	24	None	None	G5T2	S2.2	1B.2	null	Freshwater marsh | Marsh & swamp | Wetland
Legenere limosa	legenere	Dicots	PDCAM0C010	78	1	None	None	G2	S2.2	1B.1	BLM_S-Sensitive	Vernal pool | Wetland
Lepidurus packardi	vernal pool tadpole shrimp	Crustaceans	ICBRA10010	274	1	Endangered	None	G3	S2S3	null	IUCN_EN-Endangered	Valley & foothill grassland | Vernal pool | Wetland
Lilaeopsis masonii	Mason's lilaeopsis	Dicots	PDAPI19030	197	71	None	Rare	G2	S2	1B.1	null	Freshwater marsh | Marsh & swamp | Riparian scrub | Wetland
Limosella												Brackish marsh | Freshwater marsh | Marsh &

australis	Delta mudwort	Dicots	PDSCR10050	59	30	None	None	G4G5	S2	2B.1	null	swamp | Riparian scrub | Wetland
Melospiza melodia	song sparrow ("Modesto" population)	Birds	ABPBXA3010	92	47	None	None	G5	S3?	null	CDFW_SSC-Species of Special Concern	null
Oncorhynchus mykiss irideus	steelhead - Central Valley DPS	Fish	AFCHA0209K	31	3	Threatened	None	G5T2	S2	null	AFS_TH-Threatened	Aquatic | Sacramento/San Joaquin flowing waters
Pogonichthys macrolepidotus	Sacramento splittail	Fish	AFCJB34020	15	1	None	None	G2	S2	null	AFS_VU-Vulnerable | CDFW_SSC-Species of Special Concern | IUCN_EN-Endangered	Aquatic | Estuary | Freshwater marsh | Sacramento/San Joaquin flowing waters
Potamogeton zosteriformis	eel-grass pondweed	Monocots	PMPOT03160	9	1	None	None	G5	S2.2?	2B.2	null	Marsh & swamp | Wetland
Rana boylii	foothill yellow-legged frog	Amphibians	AAABH01050	805	1	None	None	G3	S2S3	null	BLM_S-Sensitive | CDFW_SSC-Species of Special Concern | IUCN_NT-Near Threatened | USFS_S-Sensitive	Aquatic | Chaparral | Cismontane woodland | Coastal scrub | Klamath/North coast flowing waters | Lower montane coniferous forest | Meadow & seep | Riparian forest | Riparian woodland | Sacramento/San Joaquin flowing waters
Sagittaria sanfordii	Sanford's arrowhead	Monocots	PMALI040Q0	93	8	None	None	G3	S3	1B.2	BLM_S-Sensitive	Marsh & swamp | Wetland
Scutellaria galericulata	marsh skullcap	Dicots	PDLAM1U0J0	31	3	None	None	G5	S2	2B.2	null	Lower montane coniferous forest | Marsh & swamp | Meadow & seep | Wetland
Scutellaria lateriflora	side-flowering skullcap	Dicots	PDLAM1U0Q0	13	8	None	None	G5	S1	2B.2	null	Marsh & swamp | Meadow & seep | Wetland
Spirinchus thaleichthys	longfin smelt	Fish	AFCHB03010	45	11	Candidate	Threatened	G5	S1	null	CDFW_SSC-Species of Special Concern	Aquatic | Estuary
Sylvilagus bachmani riparius	riparian brush rabbit	Mammals	AMAEB01021	16	1	Endangered	Endangered	G5T1	S1	null	null	Riparian forest
Symphyotrichum lentum	Suisun Marsh aster	Dicots	PDASTE8470	173	54	None	None	G2	S2	1B.2	null	Brackish marsh | Freshwater marsh | Marsh & swamp | Wetland
Thamnophis gigas	giant garter snake	Reptiles	ARADB36150	271	6	Threatened	Threatened	G2	S2	null	IUCN_VU-Vulnerable	Marsh & swamp | Riparian scrub | Wetland
Trifolium hydrophilum	saline clover	Dicots	PDFAB400R5	49	1	None	None	G2	S2	1B.2	null	Marsh & swamp | Valley & foothill grassland | Vernal pool | Wetland
Tropidocarpum capparideum	caper-fruited tropidocarpum	Dicots	PDBRA2R010	18	2	None	None	G1	S1	1B.1	USFS_S-Sensitive	Valley & foothill grassland
Valley Oak Woodland	Valley Oak Woodland	Woodland	CTT71130CA	91	1	None	None	G3	S2.1	null	null	Cismontane woodland
											ABC_WLBCC-	

Vireo bellii pusillus	least Bell's vireo	Birds	ABPBW01114	436	1	Endangered	Endangered	G5T2	S2	null	Watch List of Birds of Conservation Concern | IUCN_NT-Near Threatened	Riparian forest | Riparian scrub | Riparian woodland

Plant List

12 matches found. *Click on scientific name for details*

Search Criteria

Rare Plant Rank is one of [1B, 2A, 2B], Found in San Joaquin County, Elevation is above 0 or below 0 meters, Community is one of [Bogs and fens, Meadows and seeps, Marshes and swamps, Valley and foothill grassland]

Scientific Name	Common Name	Family	Lifeform	Rare Plant Rank	State Rank	Global Rank
Atriplex cordulata var. cordulata	heartscale	Chenopodiaceae	annual herb	1B.2	S2	G3T2
Carex comosa	bristly sedge	Cyperaceae	perennial rhizomatous herb	2B.1	S2	G5
Eschscholzia rhombipetala	diamond-petaled California poppy	Papaveraceae	annual herb	1B.1	S1	G1
Hibiscus lasiocarpos var. occidentalis	woolly rose-mallow	Malvaceae	perennial rhizomatous herb	1B.2	S2	G5T2
Lathyrus jepsonii var. jepsonii	Delta tule pea	Fabaceae	perennial herb	1B.2	S2.2	G5T2
Lilaeopsis masonii	Mason's lilaeopsis	Apiaceae	perennial rhizomatous herb	1B.1	S2	G2
Limosella australis	Delta mudwort	Scrophulariaceae	perennial stoloniferous herb	2B.1	S2	G4G5
Sagittaria sanfordii	Sanford's arrowhead	Alismataceae	perennial rhizomatous herb	1B.2	S3	G3
Scutellaria galericulata	marsh skullcap	Lamiaceae	perennial rhizomatous herb	2B.2	S2	G5
Scutellaria lateriflora	side-flowering skullcap	Lamiaceae	perennial rhizomatous herb	2B.2	S1	G5
Symphyotrichum lentum	Suisun Marsh aster	Asteraceae	perennial rhizomatous herb	1B.2	S2	G2
Trifolium hydrophilum	saline clover	Fabaceae	annual herb	1B.2	S2	G2

Suggested Citation

CNPS, Rare Plant Program. 2014. Inventory of Rare and Endangered Plants (online edition, v8-02). California Native Plant Society, Sacramento, CA. Website http://www.rareplants.cnps.org [accessed 28 May 2014].

APPENDIX B

Photographs

PG&E King Island Compressed Air Energy Storage Project
Biological Reconnaissance

Photographs Taken April 17 and 18, 2014



Photograph 1. Annual grassland habitat near the northernmost point of the study area looking east towards Interstate 5.



Photograph 2. Irrigation canal containing fresh emergent wetland vegetation. Photograph taken southeast of the water treatment facility, looking east.



Photograph 3. Walnut orchard west of the access road to the King Island Well Pad looking west.



Photograph 4. Bishop Cut looking east from the west bank of Bishop Cut at the location where the study area crosses. Irrigation siphon is shown in the foreground.



Photograph 5. Ruderal vegetative community southeast of the water treatment facility looking northwest.



Photograph 6. Urban vegetative community east of the water treatment facility looking north.



Photograph 7. Valley foothill riparian vegetation community containing riparian wetlands. Photograph taken near the southwest corner of the Lodi properties looking east towards the water treatment facility (visible in the background).



Photograph 8. Vegetated ditch. This feature runs east-west and is located on the Rio Blanco Tract south of the Bishop Cut crossing. The photograph is oriented to the east.



Photograph 9. Non-vegetated ditch feature located east of the water treatment facility and east of Interstate 5. The photograph is oriented to the east.



Photograph 10. Vegetated ditch feature that rounds the northwest corner of the Rio Blanco Tract and drains vineyards. The photograph was taken from the northwest corner of the Rio Blanco Tract looking east.

APPENDIX C

Wildlife Species Observed during Reconnaissance Survey

Table 1. Wildlife species observed during reconnaissance survey conducted on April 17 and 18, 2014.

Birds	
American crow	*Corvus brachyrhynchos*
American kestrel	Falco sparverius
American robin	Turdus migratorius
Barn owl	Tyto alba
Barn swallow	Hirundo rustica
Black phoebe	Sayornis nigricans
Brewers blackbird	Euphagus cyanocephalus
Brown-headed cowbird	Molothrus ater
Bushtit	Psaltriparus minimus
Cliff Swallow	Petrochelidon pyrrhonota
Eurasian collared-dove	Streptopelia decaocto
European starling	Sturnus vulgaris
Great blue heron	Ardea herodias
Great egret	Ardea alba
Green heron	Butorides virescens
House finch	Carpodacus mexicanus
House sparrow	Passer domesticus
Killdeer	Charadrius vociferus
Mourning dove	Zenaida macroura
Northern Harrier	Circus cyaneus
Northern mockingbird	Mimus polyglottos
Red-tailed hawk	Buteo jamaicensis
Red-winged blackbird	Agelaius phoeniceus

Rock Pigeon	Columba livia
Swainson's hawk	Buteo swainsoni
Turkey vulture	Cathartes aura
Western kingbird	Tyrannus verticalis
Western scrub-jay	Aphelocoma californica
White-tailed kite	Elanus leucurus
Wilson's warbler	Wilsonia pusilla
Mammals	
Audobon cottontail	*Sylvilagus audubonii*
Black-tailed jackrabbit	*Lepus californicus*
California ground squirrel	*Spermophilus beecheyi*
Reptiles/Amphibians	
American bullfrog	*Rana catesbeiana*
Pacific gopher snake	*Pituophis catenifer catenifer*
Red-eared slider	*Trachemys scripta elegans*
Western fence lizard	*Sceloporus occidentalis*
Western Pond Turtle	*Actinemys marmorata*

APPENDIX D

Plant Species Observed during Botany Survey

PLANT SPECIES OBSERVED AT THE
PG&E KING ISLAND COMPRESSED AIR ENERGY STORAGE PROJECT
SAN JOAQUIN COUNTY, CALIFORNIA

Field Visit Dates: April 18 and July 2, 2014
Surveyor: Paul Kirk

Scientific Name	**Common Name**	**Family Name**	**Nativity[1]**
Amaranthus sp.	Pigweed (not native)	Amaranthaceae	Naturalized
Amsinckia intermedia	common fiddleneck	Boraginaceae	Native
Avena barbata	slender wild oat	Poaceae	Naturalized
Baccharis pilularis	coyote brush	Asteraceae	Native
Brassica nigra	black mustard	Brassicaceae	Naturalized
Brassica rapa	field mustard	Brassicaceae	Naturalized
Bromus diandrus	ripgut grass	Poaceae	Naturalized
Bromus hordeaceus	soft chess	Poaceae	Naturalized
Capsella bursa-pastoris	shepard's purse	Brassicaceae	Naturalized
Carduus pycnocephalus	Italian plumeless thistle	Asteraceae	Naturalized
Carex sp. (NOT *C. comosa*)	sedge	Cyperaceae	Native
Centaurea solstitialis	yellow star-thistle	Asteraceae	Naturalized
Chenopodium album	lamb's quarters	Chenopodiaceae	Naturalized
Cirsium vulgare	bull thistle	Asteraceae	Naturalized
Conium maculatum	poison hemlock	Apiaceae	Naturalized
Convolvulus arvensis	bindweed	Convolvulaceae	Naturalized
Cynodon dactylon	Bermuda grass	Poaceae	Naturalized
Cyperus esculentus	yellow nutsedge	Cyperaceae	Native
Dipsacus fullonum	wild teasel	Dipsacaceae	Naturalized
Echinochloa crus-galli	barnyardgrass	Poaceae	Naturalized
Eichhornia crassipes	water hyacinth	Pontederiaceae	Naturalized
Epilobium ciliatum	fringed willowherb	Onagraceae	Native
Erodium botrys	storksbill	Geraniaceae	Naturalized
Festuca myuros	rattail sixweeks grass	Poaceae	Naturalized
Festuca perennis	rye grass	Poaceae	Naturalized
Ficus carica	edible fig	Moraceae	Naturalized
Gnaphalium sp.	cudweed	Asteraceae	Native
Hordeum murinum	wall barley	Poaceae	Naturalized
Juglans hindsii (Naturalized)	walnut	Juglandaceae	Naturalized
Juncus sp.	rush	Juncaceae	Native
Juncus sp.	rush	Juncaceae	Native
Lemna sp.	duckweed	Lemnaceae	Naturalized
Lepidium latifolium	perennial pepperweed	Brassicaceae	Naturalized
Ludwigia peploides	water primrose	Onagraceae	Naturalized

Scientific Name	**Common Name**	**Family Name**	**Nativity[1]**
Lythrum sp.	loosestrife	Lythraceae	Naturalized
Malva neglecta	common mallow	Malvaceae	Naturalized
Malva sylvestris	high mallow	Malvaceae	Naturalized
Medicago sativa	alfalfa	Fabaceae	Naturalized
Melilotus albus	white sweetclover	Fabaceae	Naturalized
Mimulus guttatus	yellow monkeyflower	Phrymaceae	Native
Nerium oleander	common oleander	Apocynaceae	Naturalized
Persicaria lapathifolia	willow weed	Polygonaceae	Native
Phalaris sp	canary grass	Poaceae	Naturalized
Picris echioides	bristly oxtongue	Asteraceae	Naturalized
Pinus sp	pine	Pinaceae	Naturalized
Phragmites australis	common reed	Poaceae	Native
Plantago major	common plantain	Plantaginaceae	Naturalized
Poa annua	annual blue grass	Poaceae	Naturalized
Polypogon sp.	beard grass	Poaceae	Naturalized
Ranunculus sp.	buttercup	Ranunculaceae	Naturalized
Rubus armeniacus	Himalayan blackberry	Rosaceae	Naturalized
Rumex crispus	curly dock	Polygonaceae	Naturalized
Salix exigua	sandbar willow	Salicaceae	Native
Salix gooddingii	Goodding's black willow	Salicaceae	Native
Salix lasiolepis	arroyo willow	Salicaceae	Native
Phragmites australis	common reed	Poaceae	Native
Schoenoplectus acutus	common tule	Cyperaceae	Native
Senecio vulgaris	common groundsel	Asteraceae	Naturalized
Setaria pumila	yellow foxtail	Poaceae	Naturalized
Silybum marianum	milk thistle	Asteraceae	Naturalized
Sonchus asper ssp. *asper*	prickly sow thistle	Asteraceae	Naturalized
Sorghum halepense	Johnson grass	Poaceae	Naturalized
Tribulus sp.	punctureVine	Zygophyllaceae	Naturalized
Trifolium sp.	clover	Fabaceae	Naturalized
Typha latifolia	broad-leaved cattail	Typhaceae	Native
Urtica dioica	stinging nettle	Urticaceae	Native
Verbena sp.	Vervain (Not native)	Verbenaceae	Naturalized
Xanthium strumarium	cocklebur	Asteraceae	Native

[1]Nativity designation per *The Jepson Manual, 2nd edition* (Baldwin et al. 2012)

Appendix 5.2B
Qualifications of Field Study Personnel

BRANDON AMRHEIN

Senior Scientist-Wildlife/Wetlands

EDUCATION

- B.A., in Environmental Studies with a minor in Biological Sciences, California State University Sacramento, 2003

PROFESSIONAL CERTIFICATIONS AND PERMITS

- USFWS Recovery Permit: Authorized to conduct surveys for California tiger salamander (larval lifestage)
- Wetland Delineation Certificate, Wetland Training Institute, Inc.
- ISA Certified Arborist No. WE-8326A, International Society of Arborists

ADDITIONAL TRAINING:

- Rare Pond Species Survey Techniques Workshop
- California tiger salamander larval study volunteer, Sonoma County
- Biology and Management of the California Red-Legged Frog Workshop
- Clean Water Act Section 404 Nationwide and Other Specialized Permits
- CEQA Basics Workshop – Association of Environmental Professionals

SYNOPSIS: Mr. Amrhein has over seven years of biological experience conducting environmental and biological services for development, energy, and municipal planning projects. He specializes in environmental construction monitoring, worker environmental awareness training, and special status species investigations/surveys. Mr. Amrhein has extensive experience with and knowledge of many special status species including; giant garter snake, Swainson's hawk, California red-legged frog, California tiger salamander, Western burrowing owl, Western pond turtle, Valley elderberry long-horn beetle, and San Joaquin kit fox. Mr. Amrhein also has experience writing environmental documents, operating a GPS unit to collect field information, and conducting other field surveys such as biological assessments, tree surveys, and wetland delineations. Mr. Amrhein uses his experience to address site-specific natural resources and to find ways to avoid potential impacts so sensitive resources.

RELEVANT EXPERIENCE

Palermo Reconductoring Project — Butte, Yuba, and Sutter Counties, California. Wetland Biologist and Biological Monitor. Conducted wetland delineations and prepared reports for the 42-mile-long electric transmission line project located between the Palermo Substation near Oroville and the East Nicolaus Substation south of Marysville. A total of 76.43 acres of wetlands and other waters of the U.S. were identified and mapped. Coordinated field efforts, ensured implementation of safety training and protocols, and recorded GPS data for map production. Monitored giant garter snake during construction phase. Presented Environmental Awareness Training, conducted giant garter snake pre-construction surveys, supervised installation of protective fencing and signage, and prepared compliance summary reports for submittal to regulatory agencies. Client: ICF on behalf of PG&E

Swainson's Hawk Easement Monitoring — Elk Grove, California. Biologist and biological monitor. Created proceedures for monitoring Swainson's hawk easements established in Elk Grove. The easement sites required annual monitoring of farming and agricultural activities to determine if property owners were using approved methods/practices that were set up to promote continued use by Swainson's hawks. Vegetation types, farming practices, and hawk nest locations and behaviour were monitored and photo-documented. Client: City of Elk Grove

B.F. Sisk Dam Seismic Retrofit Corrective Action Project — Merced County, California. Wildlife Biologist. Conducted extensive habitat surveys for San Joaquin Kit fox, Western Burrowing Owl, and California red-legged frog within a several hundred acre project area. This project would retrofit the Sisk Dam at San Luis Reservoir to alleviate seismic safety concerns as well as provide an increase in the overall storage capacity of the lake. Surveys were conducted over a span of several months and any burrow discovered was GPS'd and cataloged for use in the habitat analysis report. Client: U.S. Bureau of Reclamation.

Route 46 Corridor Improvement Project-Whitley Phase 2A — San Luis Obispo County, California. Wildlife Biologist and Biological Monitor. Provided environmental awareness training and biological monitoring to AT&T work crews and their subs. This project is a highway road widening project in San Luis Obispo County which requires the realignment/relocation of AT&T utility lines prior to road work. Duties included preconstruction surveys and monitoring for species including: San Joaquin kit fox, American badger, and western burrowing owls. Client: Shaw Environmental & Infrastructure, Inc. on behalf of AT&T

Sacramento River Bank Protection Project — Sacramento, California. Biologist/Analyst. Conducted tree, elderberry, invasive plant, special-status plant, and instream woody material surveys at 25 stream bank erosion sites along the Sacramento River, Feather River, American River, Cache Creek, Deer Creek, and Sutter Bypass. Mapping and habitat studies were also completed to assess the sites for suitability for special-status species. Client: U.S. Army Corps of Engineers.

PG&E Compressed Air Energy Storage Sites Project – San Joaquin County, California. Biologist/Biological Monitor. Conducted site assessment for special-status species and wetlands for Lodi ECF location. Conducted protocol-level Swainson's hawk surveys. Conducted biological monitoring of construction crews working in sensitive upland giant garter snake habitat. Provided mandatory environmental awareness training to all crew members on-site. Monitored small mammal burrows for snake activity and monitored for nesting birds, including Swainson's hawk, whenever work crews were present. Client: PG&E.

County Road 67 Bridge Replacement Project - Walker Creek, Glenn County, California. Biologist, wetland delineator, and environmental analyst. Tasks completed include a biological resource assessment, habitat assessment, wetland delineation, and a Natural Environment Study report. Client: Glenn County Planning & Public Works Agency.

PG&E Pipeline Pathways Program—North Region and Central Valley, California. Project Biologist. Conducted or completed environmental constraints analyses, San Joaquin Valley HCP (SJVHCP) pre-activity surveys, SJVHCP CDFW Master Stream Alteration Agreement Verification Request Forms, preconstruction nesting bird surveys, worker environmental training, and monitoring. Work was conducted in Glenn, Yolo, Stanislaus, San Joaquin, Fresno, and Amador counties. Client: CardnoENTRIX on behalf of Pacific Gas and Electric Company (PG&E).

PAUL KIRK

Senior Engineer/Scientist

EDUCATION: M.S., Botany, California State University, Chico, 2004
B.A., Biology, California State University, Chico, 1984

PROFESSIONAL CERTIFICATIONS

- DFG Authorization to Collect Voucher Specimens of State Listed Plants [Permit # 2081(a)-09-19-V] – DFG
- Certified Ecologist – Ecological Society of America
- Certified Arborist No. WE-8151A – International Society of Arborists

ADDITIONAL TRAINING

- Basic Wetland Delineation (5-day course) – Wetland Training Institute, 2011
- Introduction to the 2nd Edition of A Manual of California Vegetation (3-day field course) – California Native Plant Society, 2009
- CEQA Basics Workshop – Association of Environmental Professionals, Fall 2007
- Introduction to CEQA/NEPA for Botanists – Friends of the Biological Sciences Herbarium, CSU, Chico, 2002

SYNOPSIS: Mr. Kirk has 8 years of experience as a biologist in northern California that includes conducting botanical inventories and vegetation mapping; conducting habitat assessments, targeted surveys, and pre-construction surveys for special-status animal species; conducting wetland delineations and assessments; preparation of CEQA/NEPA documentation including development of mitigation measures to avoid or minimize adverse environmental effects; assisting with regulatory compliance including acquisition of required agency permits/approvals; preparation and presentation of environmental awareness training programs; monitoring construction activities for compliance with required mitigation measures; and preparation of required compliance documentation.

Mr. Kirk has significant experience in designing and implementing biological monitoring programs, including 1) facilitiating Section 7 consultation to assess potential effects on federally listed species and recommend conservation measures for incorporation into Biological Opinions; 2) preparing environmental awareness training materials and coordinating with agency staff (e.g., USFWS) for approval; 3) presenting environmental training to construction personnel, and instructing other qualified staff on procedures to present/document environmental training; 4) monitoring construction activities for compliance with required conservation measures; and 5) preparing required environmental compliance reporting documentation.

RELEVANT EXPERIENCE

Iron Canyon Fish Ladder Project — Yuba County, California. Plant Ecologist. Conducted a delineation of waters of the United States along a portion of Big Chico Creek with near vertical canyon walls. The upland rim of the 2-acre proposed project site is 170 feet above the creek. Client: CSU Chico Research Foundation.

Verbena Fields Restoration Project — Butte County, California. Plant Ecologist. Conducted a delineation of waters of the United States along Lindo Channel and prepared the delineation report for the proposed stream and riparian restoration at 17-acre site owned by the City of Chico. Client: Streaminders and the City of Chico.

Palermo Reconductoring Project—ICF International on behalf of Pacific Gas and Electric Company. Biologist and Biological Monitor. Participated in field delineation and report preparation for an approximately 42-mile-long PG&E electric transmission line located between the Palermo Substation near Oroville, California, and the East Nicolaus and Rio Oso substations south of Marysville, California. Over 75 acres of potential waters of the United States were identified and mapped within the study area. Responsibilities included field delineation and preparation and review of data forms; coordinating field efforts with multiple staff; implementing appropriate safety protocols (e.g., for railroads); and maintaining field production rates (miles/day) to meet ambitious completion schedule. Currently working as a monitoring biologist for the construction phase of the project. Responsibilities include presenting USFWS-approved Environmental Awareness Training, conducting pre-construction surveys, supervising the installation of protective fencing and signage, and preparing compliance summary reports for submittal to regulatory agencies.

Yuba-Bear Hydroelectric Project (FERC Project #2266)/Drum-Spaulding Project (FERC Project # 2310)/Rollins Transmission Line Project (FERC Project #2784) Relicensing—HDR/DTA on behalf of Nevada Irrigation District and Pacific Gas and Electric Company. Botany Team Coordinator. Assembled and co-led the team of six NSR botanists who conducted special-status plant and noxious weed floristic surveys along canals, reservoirs, and other hydroelectric facilities extending from the foothills to the crest of the northern Sierra Nevada. The NSR botany team worked closely with the prime contractor to adhere to all safety and survey protocols, including daily tailboard meetings. NSR botanists reviewed and delivered all survey documentation (species lists, occurrence forms, photographs, and GIS data) to the prime contractor on a weekly basis.

Orland Pit Wetlands Mitigation Project —Knife River Construction**.** Biological Monitor. Served as lead monitoring biologist for wetlands mitigation project that involved restoration/expansion of 3.48 acres of freshwater marsh. Developed and presented USFWS-approved Environmental Awareness Training addressing identification, habitat requirements, and protection measures for valley elderberry longhorn beetle, California red-legged frog and giant garter snake. Responsible for conducting pre-construction surveys, supervising the installation of protective fencing and signage; monitoring the installation of road crossings, vegetation removal, excavation and grading, and other construction activities; monitoring the status and performance of required conservation measures and other best management practices; supervising post-construction erosion control and re-vegetation efforts; and preparing compliance summary reports for submittal to regulatory agencies.

Sacramento River Bank Protection Project—U.S. Army Corps of Engineers, Sacramento District. Biologist. Assisted with biological field investigations and preparation of CEQA/NEPA documentation for 23,897 linear feet of levee repair at 25 critical erosion sites. Field investigations included focused botanical surveys, habitat assessments and surveys for state- and federally listed animal species (e.g., valley elderberry longhorn beetle, anadromous fish, California red-legged frog, giant garter snake, Swainson's hawk, bank swallow); inventories of instream woody material, native trees, rare plants, and elderberry shrubs; mapping of vegetation communities and wildlife habitat types; and collection of field data to model effects on habitat for fish species. Participated in stakeholder outreach efforts and project planning to integrate levee repair design with protection and on-site mitigation of resource values.

Whetstone Substation Wetlands Permitting Project—PacifiCorp. Botanist. Conducted floristic surveys and vernal pool monitoring to document presence of state- and federally listed plant species, document wetland area and hydrologic conditions, and develop proposed compensatory mitigation for project-related effects. Worked with third-party conservation and land management groups to assist in identifying potential off-site mitigation areas and techniques/opportunities to propagate plant materials from on-site sources for replacement planting in potential mitigation areas.

Appendix 5.2C
Biological Constraints Analysis of the King Island Piacentine Well

North State Resources, Inc.

Date:	October 12, 2012	**PG&E Order #:**	8105484
To:	Land and Environmental Management—Catalina Reyes, Biologist		
From:	North State Resources, Inc.— John W. Hunt, Biologist		
Project:	PG&E Compressed Air Energy Storage Sites–Proposed Investigative Geologic Core Sampling at the King Island Piacentine Well.		
Subject:	Final Biological Constraints Analysis of the King Island Piacentine Well, San Joaquin County, California		

Introduction and Summary

Mr. John W. Hunt, NSR Biologist, conducted a biological constraints analysis for the proposed Geologic Core Sampling Phase of the Pacific Gas and Electric Company (PG&E) Compressed Air Energy Storage Project (project) at the proposed King Island Piacentine natural gas well pad expansion area and associated access roads (project area). The survey area consists of all areas within 20 feet of proposed access roads and all areas within 250 feet of the existing well pad and the proposed well pad expansion area (Figure 1, Appendix A). The objective of the project is to expand and utilize the existing footprint of the Piacentine natural gas well site to stage geological core sampling equipment. The geological core sampling will be used to determine the suitability of the project vicinity for compressed air storage within depleted subterranean natural gas reservoirs.

A field reconnaissance was conducted on August 20, 2012 with Ms. Catalina Reyes, PG&E Biologist. The project area includes all proposed access roads, existing well pad and staging area, and well pad expansion area identified by PG&E technical staff during the field review on August 20, 2012 (Figure 2, Appendix A).

Giant garter snake, listed as threatened under the federal Endangered Species Act (ESA) and the California Endangered Species Act (CESA); Swainson's hawk, listed as threatened under CESA; loggerhead shrike, designated as California species of special concern (SC); and white-tailed kite, a state fully protected (FP) species, have the potential to be adversely affected or impacted by the project This document provides Avoidance and Minimization Measures (AMMs) that will avoid effects on these species.

The irrigation ditches within the project area appear to meet wetland criteria and are considered to qualify as potential waters of the United States. The existing access roads, the existing well pad, and the proposed well pad expansion area do not appear to meet wetland criteria and are not considered to qualify as potential waters of the United States. All determinations concerning waters of the United States should be considered preliminary and tentative unless verified in writing by the U.S. Army Corps of Engineers.

The proposed project will receive federal funding from the U.S. Department of Energy (USDOE). As such, the USDOE is required under section 7 of the federal Endangered Species Act to determine whether the proposed project may affect federally listed and proposed species or proposed or designated critical habitat. If the USDOE determines that the project may affect federally listed species or critical habitat, consultation with the U.S. Fish and Wildlife Service and/or National Marine Fisheries Services is required.

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Project Description

The objective of the project is to collect approximate 10-inch diameter geological core samples from the subsurface natural gas formation at depth approximately 4,000-5,000 feet. Cores will be used to determine the suitability of the subsurface formation for compressed air storage. Compressed air energy storage involves utilizing appropriate geological formations (e.g., depleted natural gas reservoirs) to store surplus energy in the form of compressed air during periods of low electric demand. This stored energy can then be utilized during periods of higher electric demand, improving the efficiency of energy distribution through the power grid.

The project area is located approximately 5 miles northwest of the city of Stockton in northwestern San Joaquin County, California. It is situated immediately north of West 8 Mile Road between White Slough and Bishop Cut, and can be accessed from Interstate 5 via West 8 Mile Road at approximately 38.082284°, -121.421892° (Figure 2, Appendix A). For project construction, the preferred site access (preferred access) is from the southwest along an unnamed dirt road. The dirt road is graded and well-maintained, and is surfaced with gravel. The alternative site access (alternative access) is from the southeast along the King Island Road.

Given that existing access roads are available, no road construction is necessary for project construction. Improvements to the existing access roads from the ranch yard to approximately 900 feet north will be limited to light graveling of the unnamed dirt road if determined to be necessary (e.g., work to occur during the wet season) with the assumption no additional grading will be required. If grading is required, it will be limited to the existing road and will not extend beyond the compacted surface. All vehicle traffic will be on the existing access roads and all staging will be contained within the southeast portion of the existing well pad. Water trucks will be used as necessary to reduce dust during site access and other construction activities. Approximately 28 truck trips will be required to import well pad material to the site. An additional five truck trips will be required to remove drill cuttings and associated material from the site. If well pad expansion area is restored to pre-project conditions, an additional 28 truck trips will be required to remove temporary well pad expansion materials, which will total 61 truck trips. Best Management Practices (BMPs) and AMMs will be implemented to avoid impacts on potential waters of the United States.

The well pad expansion area will occupy an approximately 0.18-acre area (80 x 100 feet) that abuts the existing Piacentine well pad and access road. Approximately 5–6 rows of walnut trees (approximately 4 inches diameter at breast height) and intercropped safflower will be cleared in order to accommodate the well pad expansion. After clearing the vegetation, approximately 1 foot of crushed rock will be placed within the cleared area and compacted with a roller. If necessary, woven geotextile fabric will be placed as an underlayment for the overlying gravel fill. Final pad dimensions will be 220 (east-west) by 140 feet (north-south).

After the well pad expansion area has been established (i.e., cleared of vegetation, compacted and surfaced with gravel), well drilling equipment will be moved onto the expansion area. The primary equipment includes the drill rig, mud and water tanks and pumps, shaker tanks, electric generators, diesel fuel tanks, and drill pipe racks. Geologic sampling will consist of drilling a 10 inch diameter well to a depth of approximately 4,000-5,000 feet and extracting a geological core sample not greater than 4 inches in diameter. All sections of the core sample will be removed offsite for analysis and storage. All peripheral material (e.g., cuttings and drilling mud) removed during the coring process will be immediately placed in proper storage receptacles and removed offsite for disposal at an authorized facility. The drilling crew, plus engineers, temporary workers and site visitors, will consist of an average of approximately 12 workers per shift, with three shifts per day. A maximum of 20 workers may be

present during various operations. In addition to worker vehicles, service and delivery vehicles will access the site during the drilling phase including equipment trucks for all aspects of the effort. All drilling activities will be completed in compliance with the County Gas and Oil Well Improvement Plan approval.

Once the core sample is obtained and the remaining hole is plugged and abandoned per California Division of Oil Gas and Geothermal Resources (DOGGR) and Environmental Protection Agency (EPA) standards, the drilling equipment will be dismantled and demobilized from the site. Construction equipment similar to that used during well pad development will be used to remove the pad materials and return the site to near pre-project conditions. This includes spreading of any surface vegetation or roots stockpiled during site preparation. All removed material will be disposed of at suitable landfills or recycled consistent with county grading or other permit requirements. However, the property owner may elect to retain the pad for farm equipment staging and storage.

Well pad construction and improvements to access roads will occur over a two-week period commencing as early as October 2012. Drilling activities will occur virtually continuously for up to approximately six weeks. If elected to remove the well pad, restoration of the site will take up to two weeks.

Habitat and Affected Environment

The project area is situated in a landscape that currently supports active agricultural operations, an existing natural gas well site, access roads, a farmhouse, and appurtenant facilities/equipment (e.g., farm equipment, staging area, and barn). The project area is located within the "Delta Islands". The Delta Islands are areas of former marshlands of the Sacramento–San Joaquin Delta that were historically reclaimed for agricultural use by the construction of levees/dikes and draining to enable farming.

Habitats within the project area (Figure 3-1 through 3-4 and Figure 4, Appendix A) include flood irrigated row crops (e.g., corn, asparagus, onions, safflower) and walnut orchards intercropped with safflower. Some of the cornfields adjacent to the access roads in the project area were being flood irrigated during the August 20, 2012 field reconnaissance. The proposed well pad expansion area is entirely within a young walnut orchard intercropped with safflower and is disked on an annual rotation. With the exception of asparagus crops in the westernmost portion of the project area, all agricultural habitats within the project area are disked and cropped on an annual rotation. All fields are actively farmed and regularly disked, harvested and/or disturbed to the edge of the existing access road.

A series irrigation ditches parallel the entire length of the preferred access route to its junction with the graveled Piacentine well access road approximately 550 feet west of the Piacentine well. The irrigation ditches and their appear to be subject to regular vegetation management using both mechanical and chemical techniques. Habitat within the channel is predominantly open water. In addition to the open water habitat, intermittent patches of floating aquatic and emergent vegetation including water primrose (*Ludwigia* sp.), cattails (*Typha* sp.), smartweed (*Persicaria* sp.), mosquito fern (*Azolla* sp.) and water hyacinth (*Eichhornia crassipes*) are present within the channel. Ruderal herbaceous species occurring along the banks and adjacent road shoulders include common mallow (*Malva neglecta*), poison hemlock (*Conium maculatum*), Johnson grass (*Sorghum halepense*), redroot pigweed (*Amaranthus retroflexus*) and common knotweed (*Polygonum aviculare*).

Methods

The determination of the potential for the project area to support habitat for special-status species, waters of the United States, and other sensitive biological resources was established through desktop review and a field reconnaissance. The desktop review was completed using a series of database searches and a

review of pertinent resources (Appendix B). Special-status species[1] listed in the U.S. Fish and Wildlife (USFWS) species list for San Joaquin County and species reported in the CNDDB to occur within a 5-mile radius of the project area were considered in the evaluation (e.g., listed shrimp, valley elderberry longhorn beetle, giant garter snake) (Appendix B). Additionally, special-status species not included in the USFWS species list or CNDDB records were considered due to their known geographic range and/or the presence of potential habitat (e.g., white-tailed kite, loggerhead shrike, ringtail). Special-status species shown in the USFWS and CNDDB queries (Appendix B) that are not included in Table 1 lack habitat within the project area or the project area is not within the range of the species. These species are not analyzed further in this document.

Following completion of the field reconnaissance, an assessment of local, state, and federal permitting requirements was conducted to determine if the proposed project requires permits or authorizations from the local government or state and federal regulatory agencies. No local, state, or federal permits addressing biological resources are anticipated to be required.

Special-Status Species and Potential Impacts

The project area contains potentially suitable habitat for eleven special-status plant species including: watershield (*Brasenia schreberi*), bristly sedge (*Carex comosa*), woolly rose-mallow (*Hibiscus lasiocarpus* var. *occidentalis*), Delta tule pea (*Lathyrus jepsonii* var. *jepsonii*), Mason's lilaeopsis (*Lilaeopsis masonii*), Delta mudwort (*Limosella subulata*), eel-grass pondweed (*Potamogeton zosteriformis*), Sanford's arrowhead (*Sagittaria sanfordii*), marsh skullcap (*Scutellaria galericulata*), side-flowering skullcap (*Scutellaria lateriflora*), and Suisun marsh aster (*Symphyotrichum lentum*). The potentially suitable habitat for these species is located within the irrigation ditches that are present within the project area. The proposed project will not result in disturbance to the irrigation ditches. Therefore, the proposed project will not result in impacts on special-status plant species.

Special-status animal species that were determined to have the potential to occur in or near the project area, and that could be adversely affected by the proposed project, include giant garter snake (*Thamnophis gigas*), Swainson's hawk (*Buteo swainsoni*), white-tailed kite (*Elanus leucurus*), and loggerhead shrike (*Lanius ludovicianus*) (Table 1).

Within the project vicinity the perennial irrigation ditches and the nearby slough, Bishop Cut and associated uplands, provide potential suitable habitat for giant garter snake (GGS). The perennial irrigation ditches are located immediately adjacent to the preferred access road and the Bishop Cut is located adjacent to the alternate access road, King island Road (Figure 3-1 through 3-4). The CNDDB contains reported GGS occurrences from marsh habitat within Coldani Marsh less than 0.5 mile from the project. If GGS are present within the project area during the inactive season (i.e., October 1 to May 1), when work is anticipated to occur, adverse impacts (e.g., injury or death) on GGS could result from vehicular traffic or ground disturbance associated with project activities.

Although, vegetation is actively managed along ditches, emergent vegetation persists and may provide suitable habitat for GGS. Because these aquatic habitats (ditches) appear to be subject to regular vegetation management using both mechanical and chemical technique, these aquatic habitats offer poor to marginal habitat to GGS. Additionally, no fish or amphibians which serve as prey items were observed in these ditches during the August 20, 2012 field survey.

[1] Special-status species: Listed, candidate, or proposed for listing as threatened or endangered under the Endangered Species Act, or California Endangered Species Act, California Native Plant Protection Act, California Species of Special Concern, and California Fully Protected Species. Special-status plants include California rare plant rank (RPR) 1A, 1B and 2.

Burrows and other underground refuge are important to GGS during summer and winter to escape unfavorable winter cold temperatures or excessive summer heat. The GGS recovery plan states that wintering habitat can be up to 250 meters (820 feet) from the edge of marsh habitat (Miller, Hornaday et al. 1999). An irrigation ditch with perennial flow is located approximately 400 feet west of the potential well pad expansion area could provide dispersal habitat for juvenile GGS and the uplands in the project area may provide wintering habitat. Typically, the USFWS defines upland habitat as all areas occurring within 200 feet of aquatic habitat (White 1997). Because the proposed well pad expansion area is greater than 200 feet from potential GGS aquatic habitat, the risk of encountering GGS out of its burrow is greatly reduced. The highest potential of adverse impacts on GGS is most likely to occur from project activities along the access roads since they are located within 200 feet of aquatic habitat and provide potential habitat for winter burrows. If burrows are located under the access roads project activities can result in the collapse of burrows and snakes can become entombed.

Despite the presence of vegetated irrigation ditches that may support dispersal of GGS, these provide marginal to poor habitat. Based on landscape habitat use analysis of studies conducted by Wylie et al (Wylie, Graham et al. 1995; Wylie, Casazza et al. 1997; Wylie, Casazza et al. 2002; Wylie, Casazza et al. 2002) provided in the Solano Multispecies Habitat Conservation Plan (Solano HCP), low quality ditch habitat associated with rice fields provided an artificial marsh habitat that provides the essential components (e.g., appropriate cover, high food availability, and upland refuge) to support GGS. Alternatively, studies conducted in high quality marsh habitat surrounded by fallow fields did not locate GGS or found them at very low densities. Based on these results, areas supporting marginal to poor habitat or small, isolated patches of good habitat are presumed to not support GGS due to lack of surrounding aquatic habitat (Solano County Water Agency 2009). In the case of the project area, the surrounding aquatic habitat is of marginal to poor quality and thus, it is unlikely that GGS would use these for dispersal.

The upland habitat that the project area provides (i.e. upland habitat along access routes and within well pad expansion area) is also poor to marginal habitat for GGS. As part of existing agricultural activities, potential upland habitat for GGS within and immediately around proposed project area are extensively disked, tilled and planted with row crops to the edge of the existing well pad and likely precludes occupation of burrowing mammals that would provide refugia for GGS. Additionally, no burrows or other refugia were observed around the existing well pad, in the pad expansion area, or along the Piacentine well access roads (alternative or primary), and no ground squirrel activity was observed during the field reconnaissance on August 20, 2012 in these areas. Based on the observation of low quality habitat (i.e. distance from moderate to poor quality dispersal habitat provided by the primary irrigation ditches (greater than 200 feet), documented lack of use in non-rice agricultural lands, the lack of upland habitat including burrows or other refugia, and the lack of ground squirrel activity near the well pad expansion area, the primary irrigation ditches and the associated farmed upland provide low quality habitat and the likelihood for GGS to occur within the pad expansion area is very low.

To minimize potential adverse effects on GGS along the access roads, a survey for burrows shall be conducted 24 hours prior to any modifications to access roads (i.e., grading or addition of gravels). If burrows are observed during the inactive period, they shall be flagged and grading or addition of gravel along the shoulder shall avoid all burrows. In addition, all vehicles will travel in the road center and speed limit of 10 mph will be maintained which will also minimize potential impact on this species.

Table 1. Special-Status Species with Potential to Occur in the Project Area, Impacts Analysis, and Avoidance and Minimization Measures

Common Name Scientific Name	Listing Status[1] (Fed/State)	Habitat Requirements	Potential for Significant Impact	Avoidance and Minimization Measures
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	T/—	Elderberry shrubs associated with riparian forests which occur along rivers and streams.	None. No elderberry shrubs were observed within the project area.	None required
Delta smelt *Hypomesus transpacificus* **Critical habitat**	T/T	Estuarine systems in the Sacramento-San Joaquin Delta.	None. The irrigation ditches and Bishop Cut occurring within the project area and along the access roads provide potential habitat for this species and are connected to higher quality habitat (marshes and sloughs) occurring outside of the project area. However, all potential habitat for this species occurs outside of planned activity areas (i.e., access roads, existing well pads, and well pad expansions areas) and no impacts or modifications to potential habitat are expected.	None required
Sacramento splittail Pogonichthys macrolepidotus	—/SC	Shallow, dead-end sloughs with submerged vegetation.	None. The irrigation ditches and Bishop Cut occurring within the project area and along the access roads provide potential habitat for this species and are connected to higher quality habitat (marshes and sloughs) occurring outside of the project area. However, all potential habitat for this species occurs outside of planned activity areas (i.e., access roads, existing well pads, and well pad expansions areas) and no impacts or modifications to potential habitat are expected.	None required
Longfin smelt Spirinchus thaleichthys	—/SC	Sloughs of Suisun Bay and Delta.	None. The irrigation ditches and Bishop Cut occurring within the project area and along the access roads provide potential habitat for this species and are connected to higher quality habitat (marshes and sloughs) occurring outside of the project area. However, all potential habitat for this species occurs outside of planned activity areas (i.e., access roads, existing well pads, and well pad expansions areas) and no impacts or modifications to potential habitat are expected.	None required

Table 1. Special-Status Species with Potential to Occur in the Project Area, Impacts Analysis, and Avoidance and Minimization Measures

Common Name Scientific Name	Listing Status[1] (Fed/State)	Habitat Requirements	Potential for Significant Impact	Avoidance and Minimization Measures
California red-legged frog *Rana draytonii*	T/SC	Require aquatic habitat for breeding, also uses a variety of other habitat types including riparian and upland areas. Adults prefer dense, shrubby or emergent vegetation associated with deep-water pools with fringes of cattails and dense stands of overhanging vegetation. This species also breeds in ephemeral ponds that support little or no vegetation.	None . This species is outside the current known range (CWHR) and there are no occurrences within 5 miles of the project area. Additionally, the San Joaquin County Multispecies Habitat Conservation and Open Space Plan (SJMHCP) concludes that CRLF is extirpated from the valley floor (San Joaquin County 2000). This species is not expected to occur in the project area.	None required.
Giant garter snake *Thamnophis gigas*	T/T	Freshwater marshes and low gradient streams with emergent vegetation. Adapted to drainage canals and irrigation ditches with mud substrate.	Low. The irrigation ditches and associated uplands within the project area provide potential habitat. A known extant population of GGS occurs within the Coldani Marsh-White Slough area approximately 0.5 mile to the northeast of the project area. The location of this population is hydrologically connected to irrigation ditches within the project area. Ground disturbance activities that disrupt burrows within the project area could adversely affect this species.	Pre construction surveys Biological monitor Water quality BMPs

Table 1. Special-Status Species with Potential to Occur in the Project Area, Impacts Analysis, and Avoidance and Minimization Measures

Common Name Scientific Name	Listing Status[1] (Fed/State)	Habitat Requirements	Potential for Significant Impact	Avoidance and Minimization Measures
Western pond turtle *Emys marmorata*	--/SC	Slow water aquatic habitat with available basking sites. Hatchlings require shallow water with dense submergent or short emergent vegetation. Requires an upland oviposition site in the vicinity of the aquatic site.	None. Although ditches in the project area are perennial, and contain fresh emergent vegetation, the banks are steep and do not contain available basking sites. Ditches are actively maintained and likely preclude the occupation of pond turtles. Additionally, upland breeding sites are unavailable in the cropland habitat around the well expansion site and access roads. Due to lack of basking habitat and upland oviposition sites, the potential for pond turtles to occur in the project area is unlikely.	None required.
California black rail *Laterallus jamaicensis coturniculus*	—/T, FP	Coastal and inland marsh habitat.	None. The irrigation ditches occurring within the project area provide poor to no potential habitat for this species and are connected to higher quality habitat (marshes and sloughs) occurring outside of the project area. However, potential habitat for this species occurs outside of planned activity areas (i.e., access roads, existing well pads, and well pad expansions areas) and no impacts or modifications to potential habitat are expected.	None required
Swainson's hawk *Buteo swainsoni*	--/T	Breeds in stands with few trees in juniper-sage flats, riparian areas, and oak savannah; forages in adjacent livestock pasture, grassland or grain fields.	Moderate. Larger trees and stands of trees occurring within 0.5 mile of the project area provide potential nesting habitat for Swainson's hawk. There are sixteen recorded CNDDB occurrences of nesting Swainson's hawk within 5 miles of the project area with the nearest approximately 2 miles west of the project area. Noise generated by project activities could disrupt nesting behavior and nest success if Swainson's hawks are nesting within 0.5 mile of the project area.	If work is expected to occur during nesting season (March 1 to July 31), Swainson' hawk nesting surveys will be performed following CDFG protocol developed by the Swainson's Hawk Technical Advisory Committee.

Table 1. Special-Status Species with Potential to Occur in the Project Area, Impacts Analysis, and Avoidance and Minimization Measures

Common Name Scientific Name	Listing Status[1] (Fed/State)	Habitat Requirements	Potential for Significant Impact	Avoidance and Minimization Measures
White-tailed kite *Elanus leucurus*	—/FP	Nests in tall shrubs and trees, forages in grasslands, agricultural fields and marshes.	Low. Isolated trees and shrubs near proposed access roads and existing farm facilities provide potential nesting habitat for this species.	Nesting bird surveys required within the breeding season (February 15-August 31).
Loggerhead shrike *Lanius ludovicianus*	—/SC	Nests in tall shrubs and dense trees, forages in grasslands, marshes, and ruderal habitats.	Low. Isolated trees and shrubs near proposed access roads and existing farm facilities provide potential nesting habitat for this species.	Nesting bird surveys required within the breeding season (February 15-August 31).

[1]Status Codes: : Federal and State Codes: T = Threatened; SC = Species of Special Concern (State), FP = Fully Protected (State)

However, if construction occurs during the GGS active period, the likelihood of encountering a snake along or within access roads bordering GGS aquatic habitat greatly increases. Due to the aquatic habitat along the unnamed dirt road and King Island Road (Figure 2), if construction activities, occurs during the active period, a biological monitor will drive in front of heavy construction vehicles (i.e. dump trucks, drill rigs, etc.) on all dirt roads during entry/exit of project site. The biologist will lead vehicles at a maximum speed of 10 mph, watch for signs of snakes, and stop and investigate the road if there are any concerns. The preferred access road will be likely used; however, if the alternate route along King Island Road is used, all AMMs developed for dirt roads will be implemented.

Because of the proximity of a known population 0.5 miles northeast of the project and the availability of moderate to high quality marsh aquatic habitat in larger canals 900 feet north of the proposed well pad expansion area, AMM's are provided in this document to avoid potential impacts on GGS.

Potential nesting habitat (e.g., trees, power poles/towers) for Swainson's hawk occurs within the project area and within 0.5 mile of the project area. Noise generated by expanding the pad, exploration drilling, site restoration, and other construction activities could adversely affect this species if active nests are located within 0.5 mile. Project implementation is expected to commence as early as October 2012 and extend for a total of four to six weeks, which is outside of the nesting season for these species. If project implementation is confined to this period, the proposed project will not result in adverse effects on this species. However, if work will occur during the nesting season (i.e., March 1–July 31), protocol -level surveys for Swainson's hawk will be required. If active nests are detected within 0.5 mile of project activities, construction activity will stop immediately and will not resume until PG&E Biologist or Land Planner contacts USFWS and California Department of Fish and Game (CDFG) Biologists to discuss possible AMM's, which could include avoidance buffers, reconsidering access routes, and additional surveys.

Walnut orchards within the proposed area of expansion do not provide foraging habitat for Swainson's hawks and removal of approximately 0.18 acre of this crop to expand the well pad would not affect available foraging habitat for Swainson's hawks.

Nesting habitat for loggerhead shrike and white-tailed kite occur in the trees and shrubs adjacent to the project area. As with the Swainson's hawk, construction activities could have adverse impacts on nesting success for these species depending on the timing of the work. Disturbance to vegetation and removal of existing crops (i.e., walnut orchards and safflower) for well pad expansion should be conducted outside of the nesting season (i.e., between August 31-February 15) in order to avoid potential effects on nesting birds. If work is to occur during the nesting season for these species (February 15–August 31), nesting bird surveys will occur 72 hours prior to the start of construction to determine if birds are nesting in the area. If nesting birds are found PG&E will halt work and consult with CDFG and USFWS to establish AMM's to protect nest (i.e. establish buffers).

Waters of the United States and Potential Impacts

An assessment for potential waters of the United States was conducted during the August 20, 2012 field reconnaissance. The irrigation ditches adjacent to roadways within the project area were observed to support a prevalence of hydrophytic vegetation, and some reaches of the irrigation ditches contained flowing or ponded water. Water is generally pumped in or out of White Slough depending on need to irrigate farmland or to pump out water to keep the area from flooding. The irrigation ditches within the project area drain into or are adjacent (separated by a berm) to White Slough, which qualifies as waters of the United States. Given that the irrigation ditches support hydrophytic vegetation, are subject to extended inundation and/or saturation, and are tributary to waters of the United States, the features are considered as potential waters of the United States. The Bishop Cut is a navigable water and is subject to

USACE jurisdiction. The project will not result in any physical disturbance of irrigation ditches or Bishop Cut within the project area; thus, the proposed project would not result in direct impacts on the irrigation ditches. AMMs have been incorporated into the proposed project to avoid the potential for indirect impacts.

Although the USFWS National Wetlands Inventory identifies the entire project area as farmed wetlands, the existing access roads, the existing well pad, and the proposed well pad expansion area do not appear to currently meet wetland criteria. The existing access roads and the existing well pad consist of compacted surfaces that are graded and unvegetated; and do not exhibit evidence of long-duration ponding or saturation, or exhibit other indications of wetland hydrology. The proposed well pad expansion area currently supports a leveled and routinely disked agricultural field that is planted with a young walnut orchard intercropped with safflower. Field inspection of this area did not identify the presence of hydrophytic vegetation or evidence of soil inundation/saturation unrelated to routine irrigation. Based on observation of the water level in ponded portions of the irrigation ditch, the surface of the agricultural field appeared to be several feet above the water table. Given the lack of hydrophytic vegetation and an absence of indications of a current wetland hydrology, the existing access roads, the existing well pad, and the proposed well pad expansion area are not considered to qualify as potential waters of the United States.

It is important to note that the field assessment did not involve a formal delineation using U.S. Army Corps of Engineers (USACE) methodology and no detailed investigations for wetland hydrology were conducted. The entire project area was historically Sacramento–San Joaquin Delta marshland prior to dikes/draining and conversion to agricultural production. Areas of agricultural production that were formerly wetlands may still qualify as jurisdictional wetlands if hydrological characteristics remain to the extent that hydrophytic vegetation would return if the agricultural activities ceased. The determinations provided in this document concerning wetland hydrology are based on a single visual assessment conducted on August 20, 2012. Definitive documentation of the status of wetland hydrology generally cannot be provided by a single visual assessment during the dry season. Therefore, all determinations provided in this document concerning waters of the United States should be considered preliminary and tentative unless verified in writing by the USACE.

Other Sensitive Biological Resources

Migratory birds and raptors (i.e., birds of prey) protected under the federal Migratory Bird Treaty Act and the California Department of Fish and Game Code may nest on open ground, vegetation, or structures within the project area. Construction activities could have adverse impacts on nesting success for birds nesting near the construction site. If disturbance to vegetation and removal of existing crops (i.e., walnut orchards and safflower) for well pad expansion is conducted outside of the nesting season, then no impacts to nesting birds are expected to result from well pad expansion activities. If work is to occur during the nesting season for these species (February 15–August 31), nesting bird surveys will be occur 72 hours prior to the start of construction required to determine if birds are nesting in the area. If nesting birds are found PG&E will halt work and consult with CDFG and USFWS to establish AMM's to protect nest (i.e. establish buffers).

Avoidance and Minimization Measures (22 total):

1. Prior to working on-site, all workers shall be provided with Environmental Awareness Training by a qualified biologist approved by USFWS and CDFG. The training shall address the identification and general ecology of GGS, Swainson's hawk, nesting birds and other special-status species that have potential to occur in the project area, and the AMMS to be implemented in order to avoid impacts on these resources. Areas to be avoided shall also be addressed in the

training. Please contact project biologist, Catalina Reyes (925-808-8811) two weeks prior to construction to schedule the training.

2. Prior to construction, all work areas (e.g., vehicle access, parking, staging) needed to complete the project shall be identified in coordination with the on-site biologist. Due to the presence of sensitive resources, some work areas may need to be adjusted. All work areas shall be limited to the minimum area necessary to complete work.

3. If practicable, ground disturbing activity (e.g. vegetation removal, compaction, and placement of gravel fill) at all the well pad site shall be conducted during the active season for giant garter snake (GGS) (i.e., between May 1 and October 1). If ground-disturbing activity cannot be conducted during the GGS active season, preconstruction surveys for potential GGS wintering sites (i.e., burrows and soils crevices) shall be conducted within two weeks by a qualified biologist approved by USFWS and CDFG to determine the if potential GGS habitat is present within proposed areas of ground disturbing activity (e.g., the well pad expansion site, road work, application of gravel) and again within 24 hours prior to ground disturbing activity which includes any modification to access roads.

4. All burrows or potential refuge habitat shall be flagged and avoided. If work is suspended for a period of five days or greater, than the project area must be resurveyed. If it is determined that potential GGS wintering habitat (e.g., burrows and crevices) is present within areas planned for ground disturbance, ground-disturbing activities shall be postponed until the GGS active season (i.e., between May 1 and October 1). If GGS is encountered at any time during the project, work will stop immediately and the USFWS and CDFG will be contacted before work proceeds.

5. A biological monitor shall be on site during all phases of construction to direct access and construction work around irrigation ditches and other sensitive habitats capable of supporting GGS. If any GGS are observed within the project area during work activities, work shall cease and the on-site project manager shall immediately contact the project biologist, Catalina Reyes (925-808-8811) prior to resuming work. The biological monitor has the authority to stop construction to resolve any biological concerns.

6. Access to well pads shall be confined to existing roads, road shoulders, and other compacted areas. Travel along roads shall be restricted to the centerline. If placement of gravel or grading on access roads is necessary, the placement shall be limited to the existing road surface. No gravel shall be placed on ditch banks or other areas that may support burrows that could be used by GGS. No grading shall occur along segments of existing roads that may support burrows that could be used by GGS.

7. The irrigation ditches and Bishop Cut will be designated as environmentally sensitive areas and physical disturbance to ditches will be avoided during construction.

8. If deemed necessary, an exclusionary fence shall be erected to protect potentially sensitive habitat adjacent to the existing well pad. To ensure that GGS does not become trapped or entangled, no wattles with plastic monofilament netting are permitted. Burlap or coconut wattles are appropriate substitutes.

9. A qualified biologist approved by USFWS and CDFG shall perform a general pre-construction survey within 72 hours of the start of project construction.

10. Provide escape ramps at a 45 degree angle or less for any excavations that are greater than one foot that are left open overnight. For smaller holes, cover so that no gaps occur and inspect each morning for wildlife. Inspect prior to filling any trenches or holes. If special-status wildlife becomes entrapped, work shall stop and the PG&E project biologist, Catalina Reyes, shall be notified immediately to determine next steps.

11. All construction personnel shall visually check for snakes and other wildlife under vehicles and equipment prior to moving them.

12. Construction equipment will be maintained to prevent leaks of fuels, lubricants or other pollutants into aquatic habitats.

13. Whenever possible, refueling and maintenance of vehicles shall occur offsite. In cases when this is not possible, refueling and maintenance of vehicles and equipment will be conducted over drip pans and at least 100 feet from any waterway.

14. Open ends of pipes, conduits or other materials stored onsite will be covered to exclude wildlife and will be inspected prior to use.

15. Vehicular speed within the project area shall be limited to 10 miles per hour in order avoid impacts on wildlife that may be located on or near roadways. If construction activities, including addition of gravel, occurs during the active period, a biological monitor will drive in front of heavy construction vehicles (i.e. dump trucks, drill rigs, etc.) on all dirt roads during entry/exit of project site. Biologist will lead vehicles at a minimum speed of 10 mph, watch for signs of snakes, and stop and investigate the road if there are any concerns.

16. Watering of roads during dry season work shall be performed as necessary (approximately 3–4 times a day) in order to reduce potential dust resulting from project associated traffic.

17. All potential nesting substrate (e.g., shrubs and trees) that requires removal to construct the project should be removed before the onset of the nesting season (i.e., prior to February 15), if feasible. This will help preclude nesting and substantially decrease the likelihood of direct impacts on nesting birds. If this is not feasible then a nesting bird survey of potential nesting substrate will be performed 72 hours prior to its removal.

18. Surveys for nesting raptors and migratory birds (including Swainson's hawk) shall be required if project construction is to occur during the nesting season (February 15–August 31; March 1-July 31 for Swainson's hawk). Surveys shall be conducted by a qualified biologist approved by USFWS and CDFG.

    Surveys for Swainson's hawk shall follow the California Department of Fish and Game protocol developed by the Swainson's Hawk Technical Advisory Committee (see Appendix C).

    Surveys for other nesting birds, surveys will consist of performing an initial survey after February 15, 2013 or within a month of the start of project date if project is to begin later in the nesting bird season. A second nesting bird survey shall be performed within 72 hours of the start of construction. The surveys shall be repeated if work is suspended for five days or more. Please contact project biologist, Catalina Reyes (925-808-8811) two weeks prior to construction schedule surveys.

19. Caution shall be used when handling and/or storing chemicals (fuel, hydraulic fluid, etc.). As part of standard PG&E Best Management Practices (BMPs), crews shall have appropriate materials on site to provide secondary containment and prevent and manage spills. If groundwater is encountered, contact PG&E Environmental Specialist Bryon Nicholson (415-990-0139).

20. Crews shall implement all standard PG&E BMPs outlined in the Good Housekeeping Activity Specific Erosion and Sediment Control Plan (January 2011) as needed.

21. If the scope of work or project location changes, contact project biologist Catalina Reyes (925-808-8811) prior to commencing work. The project biologist or Land Planner (Ernie Ralston, 515-973-3215) will contact the USFWS Bay-Delta Fish & Wildlife Office ESA/Regulatory Division and the Dept. of Fish & Game-Bay Delta Region upon notice of any such changes.

22. Remove construction related trash from the site daily and upon work completion and return site to near pre-construction contours and conditions upon project completion.

Attachment 1. Desktop Review Results

Source	Results
County	San Joaquin
USGS Quadrangle	Terminous, California (Unsectioned Wetlands of the Empire Tract)
Aerial Photographs – Google Earth 2012 & Bing Aerial Imagery 2012	Row crop region on Delta Island. Preferred Access Road: runs north for approximately 1.0 mile, turning east for approximately 1.2 miles, then turns north to parallel secondary access road for 0.6 mile to entrance of Piacentine Well site (along west bank of unnamed irrigation ditch). Total of 2.7 miles along east and south bank of large (approximately 40 foot wide) irrigation ditch to entrance of Piacentine Well site. Irrigation ditch supports patches of emergent vegetion. Alternate Access Road: approximately 1.85 miles long. Runs north along west bank of Bishop Cut (large Delta channel) for approximately 1.0 mile, then jogs west between vineyard and (maybe) orchards for approximately 0.3 mile, then turns north for 0.6 mile, joining proposed primary access road along east bank of unnamed irrigation ditch. Piacentine Well: Approximately 0.12 mile of raised gravel access road going to well pad. Well pad access and associated well pad access road entirely within orchard.
Land Ownership California Protected Areas Database (CPAD)	None. Private Ownership.
USFWS official list	Attached.
Federally Designated Critical Habitat (within 5-mile radius)	Within Delta Smelt Critical Habitat.
CNDDB-5-mile radius	Attached.
CNDDB owl viewer	Not within range of Spotted Owl.
CNPS-9 quad search	Attached.
PG&E Raptor Concentration Zones (RCZ)	Within RCZ.
National Audubon Society Important Bird Areas (IBA)	Within Sacramento-San Joaquin IBA.
U.S. Department of Agriculture (USDA) Web Soil Survey	Project area within organic muck over alluvium: Kingile muck, Kingile-Ryde complex, and Ryde-Peltier complex.
USFWS National Wetlands Inventory	Entire project area included within farmed wetlands (Pf) in USFWS NWI.
PG&E San Joaquin HCP or other HCPs, NCCPs	Within PG&E San Joaquin HCP and San Joaquin County Multispecies HCP.
Known Swainson's Hawk, golden or bald eagle nest sites	CNDDB Swainson's hawk nesting record within 5 miles of project area. Nearest CNDDB occurrence is 0.4 mile south of the project area. No golden or bald eagle occurrences within 5 miles.
PG&E VELB Conservation Program Range	Within PG&E VELB Conservation Program Range.
CWHR (California Wildlife Habitat Relations) species.	Potential giant garter snake habitat is found in association with the irrigation ditches and associated uplands within the project area. Potential nesting habitat for Swainson's hawk occurs in several areas within 0.5 mile of the project area.

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Wylie, G. D., T. Graham, et al. 1995. National biological service giant garter snake study progress report for the 1995 field season. Unpublished report. Dixon, CA, USGS Biological Resources Division, Dixon Research Station.



Photograph 1. View north along irrigation ditch and preferred access road from junction of preferred access with West 8 Mile Road. Photograph shows (from left to right) existing corn crops, graded levees road (with no burrows or crevices in surface), unnamed ditch (with bankside vegetation and patches of floating aquatic vegetation), another levee road, and asparagus crops.



Photograph 2. View north toward preferred access road crossing of existing ditch structures showing ruderal vegetation along edge of road bed and well-graded road bed with no burrows or crevices.



Photograph 3. View west along ditch and east–west portion of preferred access road. Photograph shows (from left to right) harvested and disked row crops (safflower), preferred access road (with no burrows or crevices in surface), unnamed ditch (with ruderal bankside vegetation, floating aquatic vegetation and patches of emergent vegetation), another levee road, and flood-irrigated corn crops.



Photograph 4. View west along irrigation ditch and east–west portion of preferred access road. Photograph shows (from left to right) harvested and disked row crops (safflower), preferred access road (with no burrows or crevices in surface), unnamed ditch (with ruderal bankside vegetation.



Photograph 5. View north along unnamed irrigation ditch and preferred access road from farm facilities. Photograph shows (from left to right) unnamed graded levee road, unnamed ditch (with patches of ruderal vegetation and dense patches of emergent vegetation), preferred access road (with no burrows or crevices in surface), young walnut orchard intercropped with safflower.



Photograph 6. View west along graveled access road to King Island Piacentine well pad. Well pad is shown on left and will be expanded into the adjacent cropland. No burrows or crevices were observed in the road surface (young walnut orchard intercropped with safflower shown in background).



Photograph 7. View northeast of existing King Island Piacentine Well pad, natural gas facilities and staged agricultural supplies. No burrows or crevices were observed in the existing well pad (young walnut orchard intercropped with safflower shown in background).



Photograph 8. View east of existing King Island Piacentine well and staged agricultural supplies. No burrows or crevices were observed in the existing well pad (young walnut orchard intercropped with safflower shown in background).



Photograph 9. View north toward proposed King Island Piacentine well pad expansion area showing young walnut orchard intercropped with safflower characteristic of proposed expansion area (staged agricultural equipment on existing Piacentine well pad in foreground).



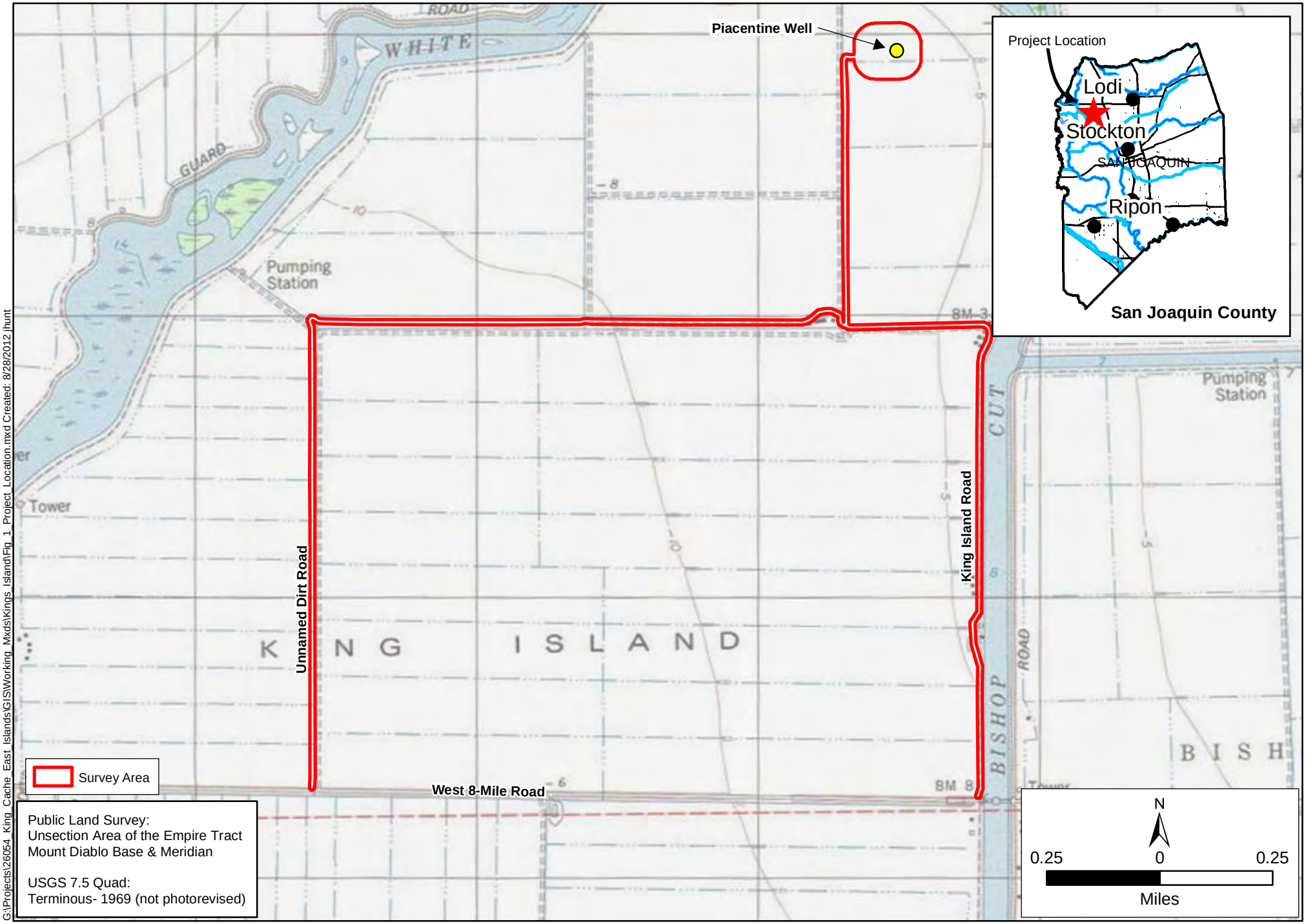
Photograph 10. View of existing agricultural facility staging area at junction of preferred and alternate access roads.



Photograph 11. View of south along King Island Road. Photograph shows (from left to right) the open water of Bishop Cut, rip-rapped banks and ruderal vegetation, King Island Road with fringing ruderal vegetation, and mature walnut orchards.

APPENDIX A

Figures

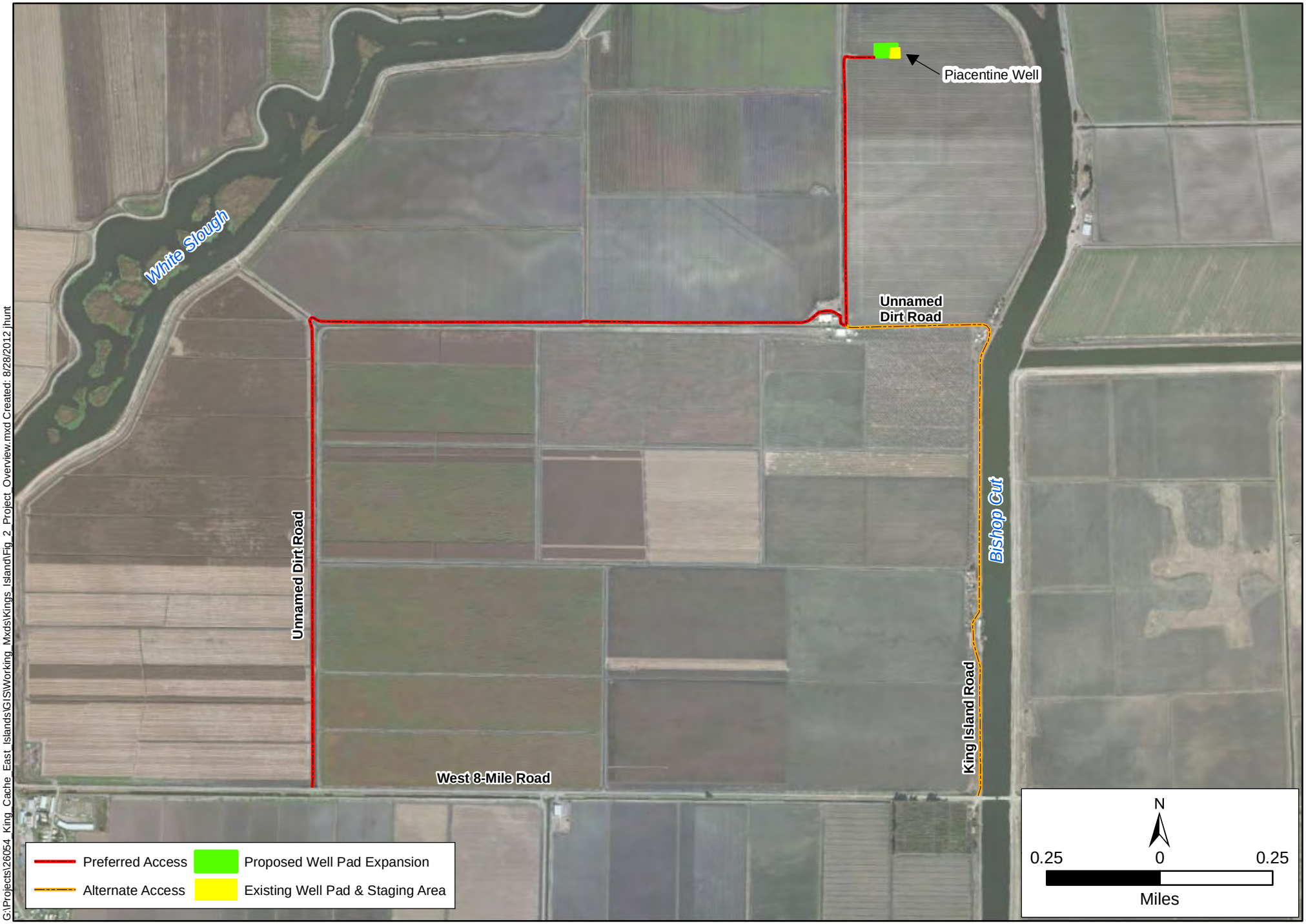


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North State Resources, Inc.

King Island, San Joaquin County, California

Figure 1. Project Location and Vicinity Map

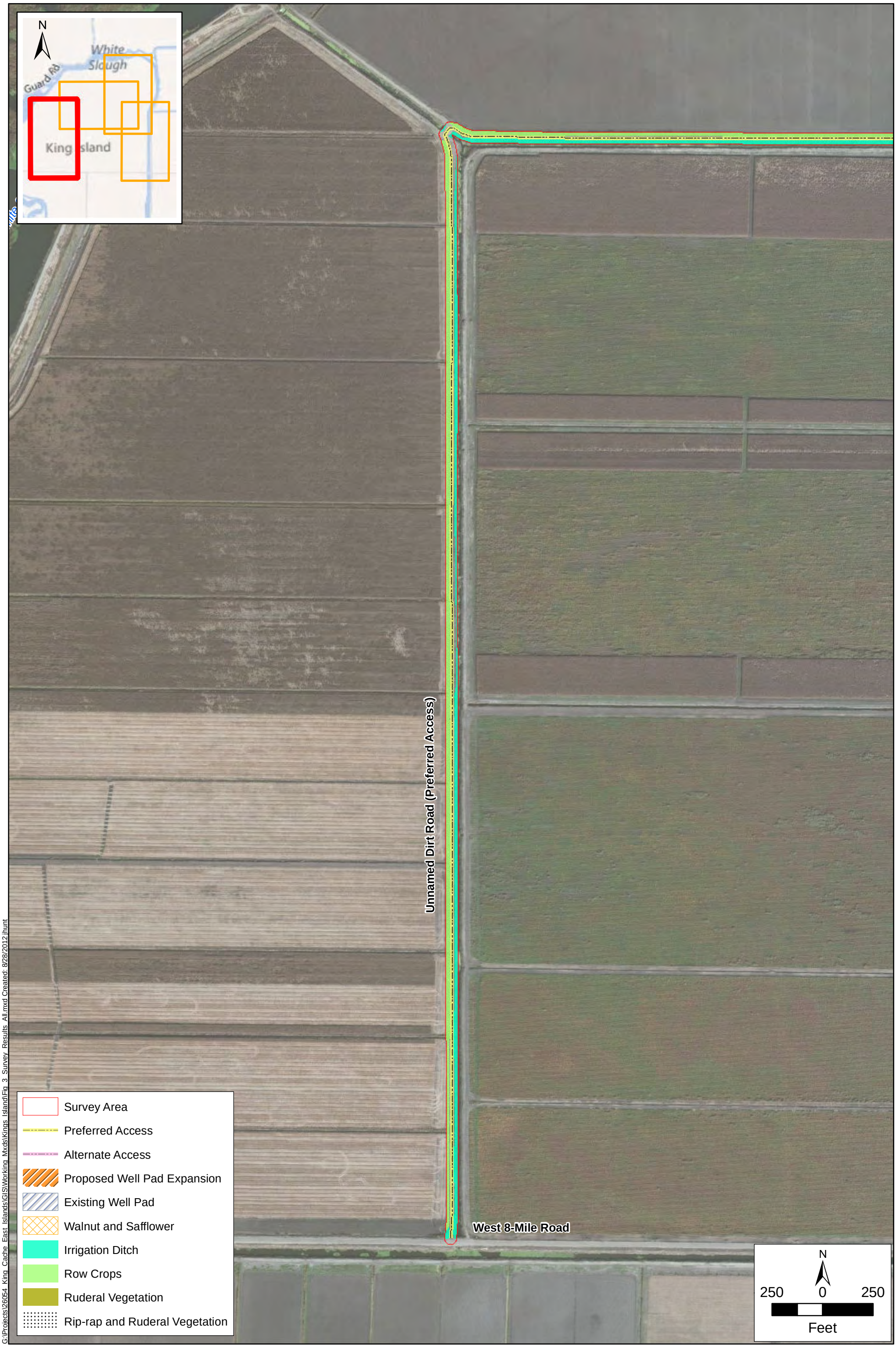


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North State Resources, Inc.

King Island, San Joaquin County, California

Figure 2. Project Area



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North State Resources, Inc.

King Island, San Joaquin County, California

Figure 3-1. Survey Results

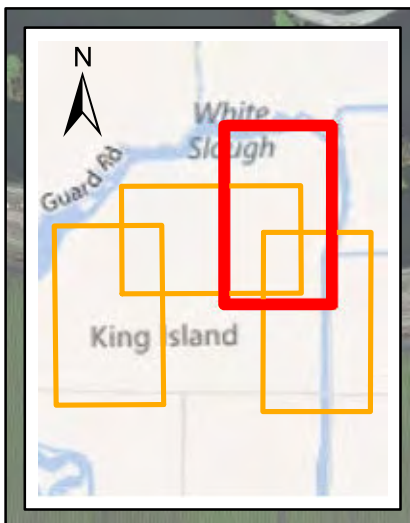


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North State Resources, Inc.

King Island, San Joaquin County, California

Figure 3-2. Survey Results



Piacentine Well

eferred Access)

Unnamed Dirt Road
(Alternate Access)

Survey Area
Preferred Access
Alternate Access
Proposed Well Pad Expansion
Existing Well Pad
Walnut and Safflower
Irrigation Ditch
Row Crops
Ruderal Vegetation
Rip-rap and Ruderal Vegetation

N
250 0 250
Feet

ess)

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North State Resources, Inc.

King Island, San Joaquin County, California

Figure 3-3. Survey Results



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King Island, San Joaquin County, California

North State Resources, Inc.

Figure 3-4. Survey Results



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King Island, San Joaquin County, California

North State Resources, Inc.

Figure 4. Survey Results - Well Pad Expansion Area

APPENDIX B

USFWS, CNDDB, and CNPS Queries

U.S. Fish & Wildlife Service

Sacramento Fish & Wildlife Office

Federal Endangered and Threatened Species that Occur in or may be Affected by Projects in the Counties and/or U.S.G.S. 7 1/2 Minute Quads you requested

Document Number: 120816041228

Database Last Updated: September 18, 2011

Quad Lists

Listed Species

Invertebrates

Branchinecta lynchi
vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus
valley elderberry longhorn beetle (T)

Lepidurus packardi
vernal pool tadpole shrimp (E)

Fish

Acipenser medirostris
green sturgeon (T) (NMFS)

Hypomesus transpacificus
Critical habitat, delta smelt (X)
delta smelt (T)

Oncorhynchus mykiss
Central Valley steelhead (T) (NMFS)
Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha
Central Valley spring-run chinook salmon (T) (NMFS)
winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Ambystoma californiense
California tiger salamander, central population (T)

Rana draytonii
California red-legged frog (T)

Reptiles

Thamnophis gigas
giant garter snake (T)

Mammals

Sylvilagus bachmani riparius
riparian brush rabbit (E)

Quads Containing Listed, Proposed or Candidate Species:

TERMINOUS (479C)

County Lists

San Joaquin County

Listed Species

Invertebrates

Branchinecta conservatio
Conservancy fairy shrimp (E)
Critical habitat, Conservancy fairy shrimp (X)

Branchinecta longiantenna
longhorn fairy shrimp (E)

Branchinecta lynchi
Critical habitat, vernal pool fairy shrimp (X)
vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus
valley elderberry longhorn beetle (T)

Elaphrus viridis
delta green ground beetle (T)

Lepidurus packardi
Critical habitat, vernal pool tadpole shrimp (X)
vernal pool tadpole shrimp (E)

Fish

Acipenser medirostris
green sturgeon (T) (NMFS)

Hypomesus transpacificus
Critical habitat, delta smelt (X)
delta smelt (T)

Oncorhynchus mykiss
Central Valley steelhead (T) (NMFS)
Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha
Central Valley spring-run chinook salmon (T) (NMFS)
Critical Habitat, Central Valley spring-run chinook (X) (NMFS)
Critical habitat, winter-run chinook salmon (X) (NMFS)
winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Ambystoma californiense
California tiger salamander, central population (T)
Critical habitat, CA tiger salamander, central population (X)

Rana draytonii
California red-legged frog (T)
Critical habitat, California red-legged frog (X)

Reptiles

Masticophis lateralis euryxanthus
Alameda whipsnake [=striped racer] (T)

Critical habitat, Alameda whipsnake (X)

Thamnophis gigas
giant garter snake (T)

Birds

Rallus longirostris obsoletus
California clapper rail (E)

Vireo bellii pusillus
Least Bell's vireo (E)

Mammals

Neotoma fuscipes riparia
riparian (San Joaquin Valley) woodrat (E)

Sylvilagus bachmani riparius
riparian brush rabbit (E)

Vulpes macrotis mutica
San Joaquin kit fox (E)

Plants

Amsinckia grandiflora
Critical habitat, large-flowered fiddleneck (X)
large-flowered fiddleneck (E)

Arctostaphylos myrtifolia
Ione manzanita (T)

Castilleja campestris ssp. succulenta
Critical habitat, succulent (=fleshy) owl's-clover (X)
succulent (=fleshy) owl's-clover (T)

Cordylanthus palmatus
palmate-bracted bird's-beak (E)

Lasthenia conjugens
Critical habitat, Contra Costa goldfields (X)

Orcuttia viscida
Critical habitat, Sacramento Orcutt grass (X)
Sacramento Orcutt grass (E)

Tuctoria greenei
Greene's tuctoria (=Orcutt grass) (E)

Candidate Species

Birds

Coccyzus americanus occidentalis
Western yellow-billed cuckoo (C)

Key:

(E) *Endangered* - Listed as being in danger of extinction.
(T) *Threatened* - Listed as likely to become endangered within the foreseeable future.
(P) *Proposed* - Officially proposed in the Federal Register for listing as endangered or threatened.
(NMFS) Species under the Jurisdiction of the National Oceanic & Atmospheric Administration Fisheries Service. Consult with them directly about these species.
Critical Habitat - Area essential to the conservation of a species.
(PX) *Proposed Critical Habitat* - The species is already listed. Critical habitat is being proposed for it.
(C) *Candidate* - Candidate to become a proposed species.
(V) Vacated by a court order. Not currently in effect. Being reviewed by the Service.
(X) *Critical Habitat* designated for this species

Important Information About Your Species List

How We Make Species Lists

We store information about endangered and threatened species lists by U.S. Geological Survey 7½ minute quads. The United States is divided into these quads, which are about the size of San Francisco.

The animals on your species list are ones that occur within, **or may be affected by** projects within, the quads covered by the list.

- Fish and other aquatic species appear on your list if they are in the same watershed as your quad or if water use in your quad might affect them.
- Amphibians will be on the list for a quad or county if pesticides applied in that area may be carried to their habitat by air currents.
- Birds are shown regardless of whether they are resident or migratory. Relevant birds on the county list should be considered regardless of whether they appear on a quad list.

Plants

Any plants on your list are ones that have actually been observed in the area covered by the list. Plants may exist in an area without ever having been detected there. You can find out what's in the surrounding quads through the California Native Plant Society's online Inventory of Rare and Endangered Plants.

Surveying

Some of the species on your list may not be affected by your project. A trained biologist and/or botanist, familiar with the habitat requirements of the species on your list, should determine whether they or habitats suitable for them may be affected by your project. We recommend that your surveys include any proposed and candidate species on your list. See our Protocol and Recovery Permits pages.

For plant surveys, we recommend using the Guidelines for Conducting and Reporting Botanical Inventories. The results of your surveys should be published in any environmental documents prepared for your project.

Your Responsibilities Under the Endangered Species Act

All animals identified as listed above are fully protected under the Endangered Species Act of 1973, as amended. Section 9 of the Act and its implementing regulations prohibit the take of a federally listed wildlife species. Take is defined by the Act as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" any such animal.

Take may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or shelter (50 CFR §17.3).

Take incidental to an otherwise lawful activity may be authorized by one of two procedures:

- If a Federal agency is involved with the permitting, funding, or carrying out of a project that may result in take, then that agency must engage in a formal consultation with the Service.

  During formal consultation, the Federal agency, the applicant and the Service work together to avoid or minimize the impact on listed species and their habitat. Such consultation would result in a biological opinion by the Service addressing the anticipated effect of the project on listed and proposed species. The opinion may authorize a limited level of incidental take.

- If no Federal agency is involved with the project, and federally listed species may be taken as part of the project, then you, the applicant, should apply for an incidental take permit. The Service may issue such a permit if you submit a satisfactory conservation plan for the species that would be affected by your project.

  Should your survey determine that federally listed or proposed species occur in the area and are likely to be affected by the project, we recommend that you work with this office and the California Department of Fish and Game to develop a plan that minimizes the project's direct and indirect impacts to listed species and compensates for project-related loss of habitat. You should include the plan in any environmental documents you file.

Critical Habitat

When a species is listed as endangered or threatened, areas of habitat considered essential to its conservation may be designated as critical habitat. These areas may require special management considerations or protection. They provide needed space for growth and normal behavior; food, water, air, light, other nutritional or physiological requirements; cover or shelter; and sites for breeding, reproduction, rearing of offspring, germination or seed dispersal.

Although critical habitat may be designated on private or State lands, activities on these lands are not restricted unless there is Federal involvement in the activities or direct harm to listed wildlife.

If any species has proposed or designated critical habitat within a quad, there will be a separate line for this on the species list. Boundary descriptions of the critical habitat may be found in the Federal Register. The information is also reprinted in the Code of Federal Regulations (50 CFR 17.95). See our Map Room page.

Candidate Species

We recommend that you address impacts to candidate species. We put plants and animals on our candidate list when we have enough scientific information to eventually propose them for listing as threatened or endangered. By considering these species early in your planning process you may be able to avoid the problems that could develop if one of these candidates was listed before the end of your project.

Species of Concern

The Sacramento Fish & Wildlife Office no longer maintains a list of species of concern. However, various other agencies and organizations maintain lists of at-risk species. These lists provide essential information for land management planning and conservation efforts. More info

Wetlands

If your project will impact wetlands, riparian habitat, or other jurisdictional waters as defined by section 404 of the Clean Water Act and/or section 10 of the Rivers and Harbors Act, you will need to obtain a permit from the U.S. Army Corps of Engineers. Impacts to wetland habitats require site specific mitigation and monitoring. For questions regarding wetlands, please contact Mark Littlefield of this office at (916) 414-6520.

Updates

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be November 14, 2012.

Count of ELMCODE CNAME	SNAME	FEDLIST	CALLIST	RPLANTRANK	SRANK	Total
burrowing owl	Athene cunicularia	None	None	(blank)	S2	1
California black rail	Laterallus jamaicensis coturniculus	None	Threatened	(blank)	S1	6
Coastal and Valley Freshwater Marsh	Coastal and Valley Freshwater Marsh	None	None	(blank)	S2.1	7
Delta mudwort	Limosella subulata	None	None	2.1	S2.1	8
Delta smelt	Hypomesus transpacificus	Threatened	Endangered	(blank)	S1	3
Delta tule pea	Lathyrus jepsonii var. jepsonii	None	None	1B.2	S2.2	4
giant garter snake	Thamnophis gigas	Threatened	Threatened	(blank)	S2S3	5
great blue heron	Ardea herodias	None	None	(blank)	S4	1
Mason's lilaeopsis	Lilaeopsis masonii	None	Rare	1B.1	S2	18
side-flowering skullcap	Scutellaria lateriflora	None	None	2.2	S1	2
Suisun Marsh aster	Symphyotrichum lentum	None	None	1B.2	S2	25
Swainson's hawk	Buteo swainsoni	None	Threatened	(blank)	S2	25
Valley Oak Woodland	Valley Oak Woodland	None	None	(blank)	S2.1	1
vernal pool tadpole shrimp	Lepidurus packardi	Endangered	None	(blank)	S2S3	1
watershield	Brasenia schreberi	None	None	2.3	S2	1
western pond turtle	Emys marmorata	None	None	(blank)	S3	11
white-tailed kite	Elanus leucurus	None	None	(blank)	S3	1
woolly rose-mallow	Hibiscus lasiocarpos var. occidentalis	None	None	1B.2	S2.2	28
Grand Total						148

CNPS Inventory of Rare and Endangered Plants

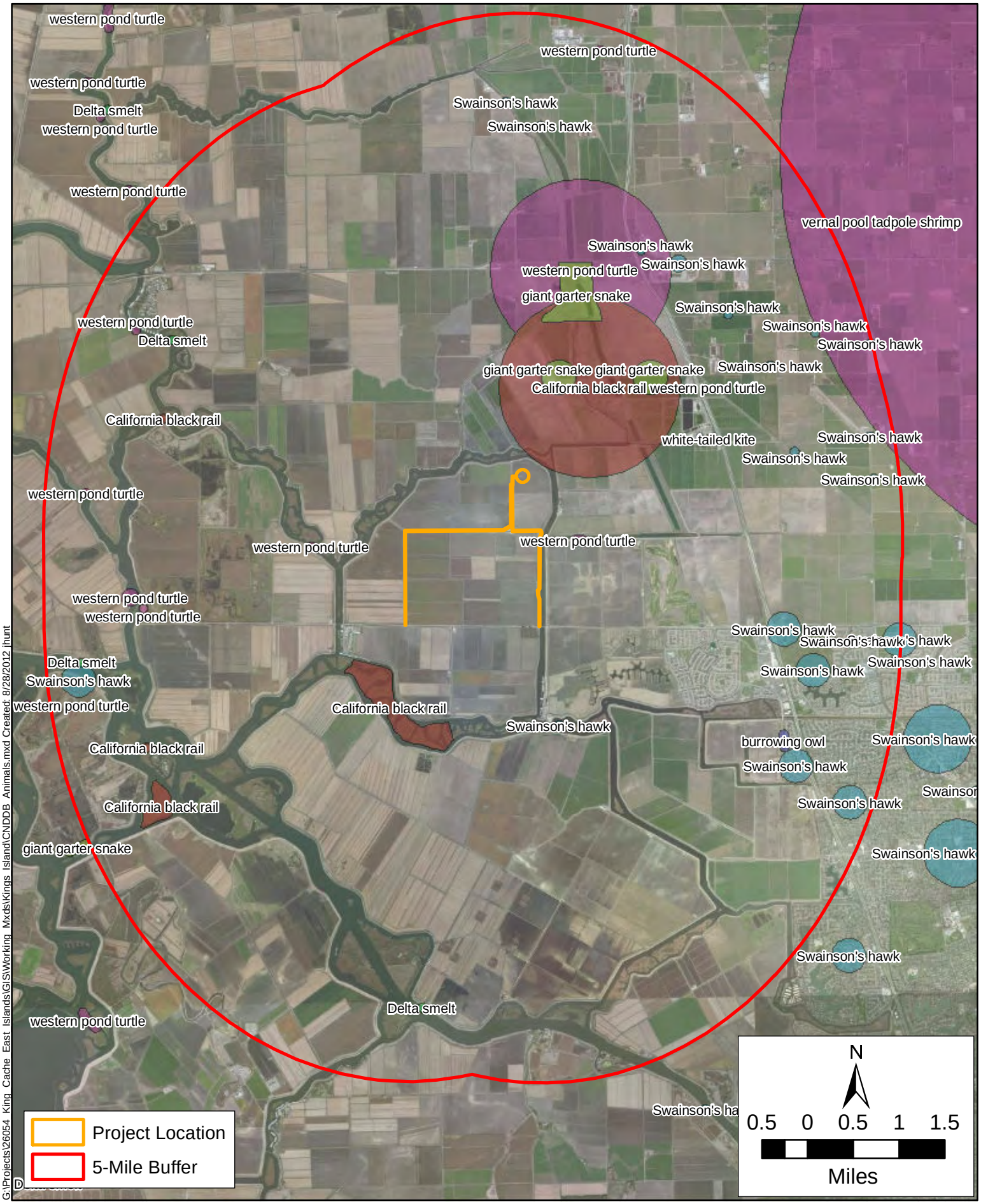
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Reformat list as: Standard List - with Plant Press controls

ECOLOGICAL REPORT

scientific	family	life form	blooming	communities	elevation	CNPS
Astragalus tener var. tener	Fabaceae	annual herb	Mar-Jun	•Playas (Plyas) •Valley and foothill grassland (VFGrs) (adobe clay) •Vernal pools (VnPls)/alkaline	1 - 60 meters	List 1B.2
Atriplex cordulata var. cordulata	Chenopodiaceae	annual herb	Apr-Oct	•Chenopod scrub (ChScr) •Meadows and seeps (Medws) •Valley and foothill grassland (VFGrs) (sandy)/saline or alkaline	0 - 560 meters	List 1B.2
Atriplex joaquinana	Chenopodiaceae	annual herb	Apr-Oct	•Chenopod scrub (ChScr) •Meadows and seeps (Medws) •Playas (Plyas) •Valley and foothill grassland (VFGrs)/alkaline	1 - 835 meters	List 1B.2
Blepharizonia plumosa	Asteraceae	annual herb	Jul-Oct	•Valley and foothill grassland (VFGrs)/Usually clay.	30 - 505 meters	List 1B.1
Brasenia schreberi	Cabombaceae	perennial rhizomatous herb aquatic	Jun-Sep	•Marshes and swamps (MshSw)/freshwater	30 - 2200 meters	List 2.3
California macrophylla	Geraniaceae	annual herb	Mar-May	•Cismontane woodland (CmWld) •Valley and foothill grassland (VFGrs)/clay	15 - 1200 meters	List 1B.1
Carex comosa	Cyperaceae	perennial rhizomatous herb	May-Sep	•Coastal prairie (CoPrr) •Marshes and swamps (MshSw) (lake margins) •Valley and foothill grassland (VFGrs)	0 - 625 meters	List 2.1
Chloropyron palmatum	Orobanchaceae	annual herb hemiparasitic	May-Oct	•Chenopod scrub (ChScr) •Valley and foothill grassland (VFGrs)/alkaline	5 - 155 meters	List 1B.1
Eryngium racemosum	Apiaceae	annual/perennial herb	Jun-Oct	•Riparian scrub (RpScr)(vernally mesic clay depressions)	3 - 30 meters	List 1B.1

Hibiscus lasiocarpos var. occidentalis	Malvaceae	perennial rhizomatous herb emergent	Jun-Sep	•Marshes and swamps (MshSw) (freshwater)	0 - 120 meters	List 1B.2
Juglans hindsii	Juglandaceae	perennial deciduous tree	Apr-May	•Riparian forest (RpFrs) •Riparian woodland (RpWld)	0 - 440 meters	List 1B.1
Lathyrus jepsonii var. jepsonii	Fabaceae	perennial herb	May-Jul(Sep), Months in parentheses are uncommon.	•Marshes and swamps (MshSw) (freshwater and brackish)	0 - 4 meters	List 1B.2
Legenere limosa	Campanulaceae	annual herb	Apr-Jun	•Vernal pools (VnPls)	1 - 880 meters	List 1B.1
Lilaeopsis masonii	Apiaceae	perennial rhizomatous herb	Apr-Nov	•Marshes and swamps (MshSw) (brackish or freshwater) •Riparian scrub (RpScr)	0 - 10 meters	List 1B.1
Limosella subulata	Scrophulariaceae	perennial stoloniferous herb	May-Aug	•Marshes and swamps (MshSw)	0 - 3 meters	List 2.1
Potamogeton zosteriformis	Potamogetonaceae	annual herb aquatic	Jun-Jul	•Marshes and swamps (MshSw) (assorted freshwater)	0 - 1860 meters	List 2.2
Sagittaria sanfordii	Alismataceae	perennial rhizomatous herb emergent	May-Oct	•Marshes and swamps (MshSw) (assorted shallow freshwater)	0 - 650 meters	List 1B.2
Scutellaria galericulata	Lamiaceae	perennial rhizomatous herb	Jun-Sep	•Lower montane coniferous forest (LCFrs) •Meadows and seeps (Medws) (mesic) •Marshes and swamps (MshSw)	0 - 2100 meters	List 2.2
Scutellaria lateriflora	Lamiaceae	perennial rhizomatous herb	Jul-Sep	•Meadows and seeps (Medws) (mesic) •Marshes and swamps (MshSw)	0 - 500 meters	List 2.2
Symphyotrichum lentum	Asteraceae	perennial rhizomatous herb	May-Nov	•Marshes and swamps (MshSw) (brackish and freshwater)	0 - 3 meters	List 1B.2
Tropidocarpum capparideum	Brassicaceae	annual herb	Mar-Apr	•Valley and foothill grassland (VFGrs) (alkaline hills)	1 - 455 meters	List 1B.1

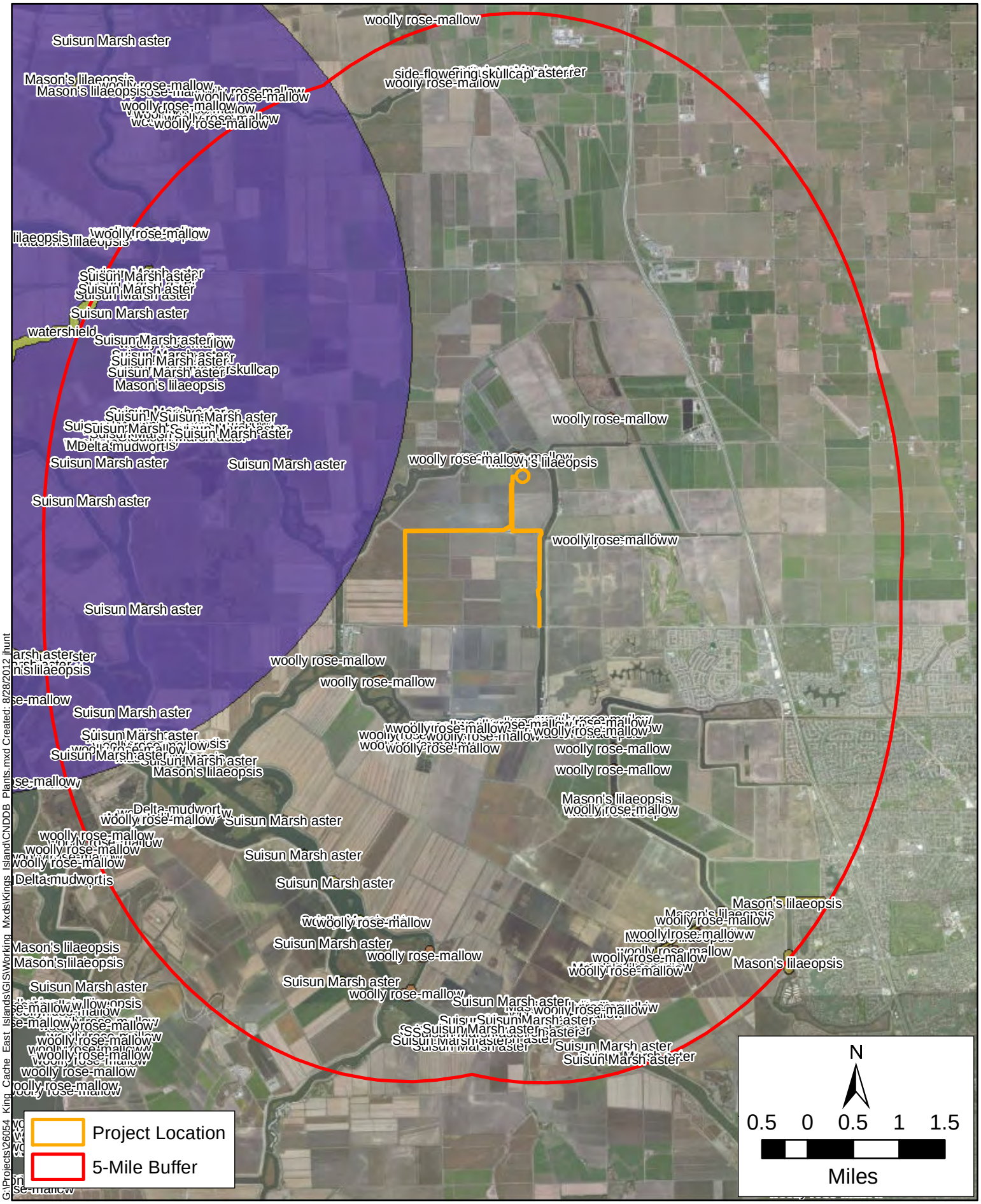


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Kings Island, San Joaquin County, California

North State Resources, Inc.

Animal CNDDB Results



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Kings Island, San Joaquin County, California

North State Resources, Inc.

Plants CNDDB Results

APPENDIX C

Swainson's Hawk Survey Protocol

RECOMMENDED TIMING AND METHODOLOGY FOR SWAINSON'S HAWK NESTING SURVEYS IN CALIFORNIA'S CENTRAL VALLEY

Swainson's Hawk Technical Advisory Committee

May 31, 2000

This set of survey recommendations was developed by the Swainson's Hawk Technical Advisory Committee (TAC) to maximize the potential for locating nesting Swainson's hawks, and thus reducing the potential for nest failures as a result of project activities/disturbances. The combination of appropriate surveys, risk analysis, and monitoring has been determined to be very effective in reducing the potential for project-induced nest failures. As with most species, when the surveyor is in the right place at the right time, Swainson's hawks may be easy to observe; but some nest sites may be very difficult to locate, and even the most experienced surveyors have missed nests, nesting pairs, mis-identified a hawk in a nest, or believed incorrectly that a nest had failed. There is no substitute for specific Swainson's hawk survey experience and acquiring the correct search image.

METHODOLOGY

Surveys should be conducted in a manner that maximizes the potential to observe the adult Swainson's hawks, as well as the nest/chicks second. To meet the California Department of Fish and Game's (CDFG) recommendations for mitigation and protection of Swainson's hawks, surveys should be conducted for a ½ mile radius around all project activities, and if active nesting is identified within the ½ mile radius, consultation is required. In general, the TAC recommends this approach as well.

Minimum Equipment

Minimum survey equipment includes a high-quality pair of binoculars and a high quality spotting scope. Surveying even the smallest project area will take hours, and poor optics often result in eye-strain and difficulty distinguishing details in vegetation and subject birds. Other equipment includes good maps, GPS units, flagging, and notebooks.

Walking vs Driving

Driving (car or boat) or "windshield surveys" are usually preferred to walking if an adequate roadway is available through or around the project site. While driving, the observer can typically approach much closer to a hawk without causing it to fly. Although it might appear that a flying bird is more visible, they often fly away from the observer using trees as screens; and it is difficult to determine from where a flying bird came. Walking surveys are useful in locating a nest after a nest territory is identified, or when driving is not an option.

Angle and Distance to the Tree

Surveying subject trees from multiple angles will greatly increase the observer's chance of detecting a nest or hawk, especially after trees are fully leafed and when surveying multiple trees

in close proximity. When surveying from an access road, survey in both directions. Maintaining a distance of 50 meters to 200 meters from subject trees is optimal for observing perched and flying hawks without greatly reducing the chance of detecting a nest/young: Once a nesting territory is identified, a closer inspection may be required to locate the nest.

Speed
Travel at a speed that allows for a thorough inspection of a potential nest site. Survey speeds should not exceed 5 miles per hour to the greatest extent possible. If the surveyor must travel faster than 5 miles per hour, stop frequently to scan subject trees.

Visual and Aural Ques
Surveys will be focused on both observations and vocalizations. Observations of nests, perched adults, displaying adults, and chicks during the nesting season are all indicators of nesting Swainson's hawks. In addition, vocalizations are extremely helpful in locating nesting territories. Vocal communication between. hawks is frequent during territorial displays; during courtship and mating; through the nesting period as mates notify each other that food is available or that a threat exists; and as older chicks and fledglings beg for food.

Distractions
Minimize distractions while surveying. Although two pairs of eyes may be better than one pair at times, conversation may limit focus. Radios should be off, not only are they distracting, they may cover a hawk's call.

Notes and Species Observed
Take thorough field notes. Detailed notes and maps of the location of observed Swainson's hawk nests are essential for filling gaps in the Natural Diversity Data Base; please report all observed nest sites. Also document the occurrence of nesting great homed owls, red-tailed hawks, red-shouldered hawks and other potentially competitive species. These species will infrequently nest within 100 yards of each other, so the presence of one species will not necessarily exclude another.

TIMING

To meet **the minimum level** of protection for the species, surveys should be completed for **at least** the two survey periods immediately prior to a project's initiation. For example, if a project is scheduled to begin on June 20, you should complete 3 surveys in Period III and 3 surveys in Period V. However, it is always recommended that surveys be completed in Periods II, III and V. **Surveys should not be conducted in Period IV.**

The survey periods are defined by the timing of migration, courtship, and nesting in a "typical" year for the majority of Swainson's hawks from San Joaquin County to Northern Yolo County. Dates should be adjusted in consideration of early and late nesting seasons, and geographic differences (northern nesters tend to nest slightly later, etc). If you are not sure, contact a TAC member or CDFG biologist.

Survey dates **Justification and search image**	**Survey time**	**Number of Surveys**
I. *January-March 20 (recommended optional)*	*All day*	*1*

Prior to Swainson's hawks returning, it may be helpful to survey the project site to determine potential nest locations. Most nests are easily observed from relatively long distances, giving the surveyor the opportunity to identify potential nest sites, as well as becoming familiar with the project area. It also gives the surveyor the opportunity to locate and map competing species nest sites such as great homed owls from February on, and red-tailed hawks from March on. After March 1, surveyors are likely to observe Swainson's hawks staging in traditional nest territories.

II. *March 20 to April 5*	*Sunrise to 1000* *1600 to sunset*	*3*

Most Central Valley Swainson's hawks return by April 1, and immediately begin occupying their traditional nest territories. For those few that do not return by April 1, there are often hawks ("floaters") that act as place-holders in traditional nest sites; they are birds that do not have mates, but temporarily attach themselves to traditional territories and/or one of the site's "owners." Floaters are usually displaced by the territories' owner(s) if the owner returns.

Most trees are leafless and are relatively transparent; it is easy to observe old nests, staging birds, and competing species. The hawks are usually in their territories during the survey hours, but typically soaring and foraging in the mid-day hours. Swainson's hawks may often be observed involved in territorial and courtship displays, and circling the nest territory. Potential nest sites identified by the observation of staging Swainson's hawks will usually be active territories during that season, although the pair may not successfully nest/reproduce that year.

III. *April 5 to April 20*	*Sunrise to 1200* *1630 to Sunset*	***3***

Although trees are much less transparent at this time, 'activity at the nest site increases significantly. Both males and females are actively nest building, visiting their selected site frequently. Territorial and courtship displays are increased, as is copulation. The birds tend to vocalize often, and nest locations are most easily identified. This period may require a great deal of "sit and watch" surveying.

IV. *April 21 to June 10*	*Monitoring known nest sites only* ***Initiating Surveys is not recommended***	

Nests are extremely difficult to locate this time of year, and even the most experienced surveyor will miss them, especially if the previous surveys have not been done. During this phase of nesting, the female Swainson's hawk is in brood position, very low in the nest, laying eggs, incubating, or protecting the newly hatched and vulnerable chicks; her head may or may not be visible. Nests are often well-hidden, built into heavily vegetated sections of trees or in clumps of mistletoe, making them all but invisible. Trees are usually not viewable from all angles, which may make nest observation impossible.

Following the male to the nest may be the only method to locate it, and the male will spend hours away from the nest foraging, soaring, and will generally avoid drawing attention to the nest site. Even if the observer is fortunate enough to see a male returning with food for the female, if the female determines it is not safe she will not call the male in, and he will not approach the nest; this may happen if the observer, or others, are too close to the nest or if other threats, such as rival hawks, are apparent to the female or male.

V. ***June 10 to JuIy 30 (post-fledging)*** ***Sunrise to 1200*** ***3***
1600 to sunset

Young are active and visible, and relatively safe without parental protection. Both adults make numerous trips to the nest and are often soaring above, or perched near or on the nest tree. The location and construction of the nest may still limit visibility of the nest, young, ‘and adults.

DETERMINING A PROJECT'S POTENTIAL
FOR IMPACTING SWAINSON'S HAWKS

LEVEL OF RISK	REPRODUCTIVE SUCCESS (Individuals)	LONGTERM SURVIVABILITY (Population)	NORMAL SITE CHARACTERISTICS (Daily Average)	NEST MONI-TORING
HIGH	Direct physical contact with the nest tree while the birds are on eggs or protecting young. (Helicopters in close proximity)	Loss of available foraging area.	Little human-created noise, little human use: nest is well away from dwellings, equipment yards, human access areas, etc. *Do not include general cultivation practices in evaluation.*	**MORE**
		Loss of nest trees.		
	Loss of nest tree after nest building is begun prior to laying eggs.	Loss of potential nest trees.		
	Personnel within 50 yards of nest tree (out of vehicles) for extended periods while birds are on eggs or protecting young that are < 10 days old.	Cumulative: Multi-year, multi-site projects with substantial noise/personnel disturbance.		
	Initiating construction activities (machinery and personnel) within 200 yards of the nest after eggs are laid and before young are > 10 days old.	Cumulative: Single-season projects with substantial noise/personnel disturbance that is greater than or significantly different from the daily norm.		
	Heavy machinery only working within 50 yards of nest.		Substantial human-created noise and occurrence: nest is near roadways, well-used waterways, active airstrips, areas that have high human use. *Do not include general cultivation practices in evaluation.*	
	Initiating construction activities within 200 yards of nest before nest building begins or after young > 10 days old.	Cumulative: Single-season projects with activities that "blend" well with site's "normal' activities.		
LOW	All project activities (personnel and machinery) greater than 200 yards from nest.			**LESS**

Appendix 5.2D
CAES Compression Testing Biological Constraints Analysis

North State Resources, Inc.

Technical Memorandum

Date:	July 25, 2013	**PG&E Order #:**	8105484
To:	Pacific Gas and Electric Company		
From:	North State Resources, Inc.		
Project:	PG&E Compressed Air Energy Storage Compression Testing Project		
Subject:	Draft Biological Constraints Analysis, San Joaquin County, California		

Introduction and Summary

North State Resources, Inc. (NSR) conducted a biological constraints analysis for the proposed Compression Testing Phase of the Pacific Gas and Electric Company (PG&E) Compressed Air Energy Storage Project (project) at the King Island Temporary Site Facilities (TSF) project area (project area).

The project consists of development of a TSF to conduct compression testing and evaluate the feasibility of development of a Compressed Air Energy Storage (CAES) project. Development of the TSF would include limited maintenance on existing access roads. The U.S. Department of Energy (DOE) is co-funding the TSF project and is serving as the National Environmental Policy Act (NEPA) lead agency.

Development of a distribution line is required to provide power to the TSF. Development of the distribution line would involve re-conductoring existing lines and construction of new lines. The DOE is the NEPA lead agency for development of the electric distribution line, which is being authorized separately from the TSF as an interim action.

The objective of the compression testing phase is to confirm the geologic suitability of the site and provide more detailed information for project engineering.

The biological constraints analysis included both a desktop review of biological resources and a field review of the project area. The purpose of the biological constraints analysis is to:

1) Characterize the habitats and vegetation communities present;
2) Evaluate the potential for the occurrence of special-status plant and animal species;
3) Determine the presence or absence of waters of the United States;
4) Determine the presence or absence of other sensitive biological resources (e.g., riparian habitats, nesting raptors)
5) Determine potential impacts on biological resources resulting from site ingress/egress, TSF pad development, localized excavations, pole installation, and temporary stockpiling of excavated material;
6) Recommend practicable avoidance and minimization measures (AMMs) that may be considered by PG&E to minimize and avoid potential impacts; and
7) Evaluate whether the proposed activities, in combination with the recommended AMMs, would avoid adverse effects on sensitive biological resources.

Giant garter snake, listed as threatened under the federal Endangered Species Act (ESA) and the California Endangered Species Act (CESA); Swainson's hawk, listed as threatened under CESA; northern harrier, burrowing owl, and loggerhead shrike, designated as California species of special concern; and white-tailed kite, a state fully protected species, have at least some potential to be present in or near the project area. Without the implementation of AMMs, there is a potential for the project to result in adverse effects on these species. With the implementation of the recommended AMMs, the project is not expected to result in adverse effects on these species.

The irrigation ditches within the project area appear to meet wetland criteria and may be considered potential waters of the United States. One wetland area along Eight Mile Road would not likely qualify as waters of the United States. Bishop Cut is a navigable water and qualifies as a waters of the United States. All determinations concerning waters of the United States should be considered preliminary and tentative unless verified in writing by the U.S. Army Corps of Engineers (USACE).

Because the project would receive federal funding from the DOE, the DOE is required under section 7 of the federal Endangered Species Act to determine whether the project may affect federally listed or designated critical habitat. If the DOE determines that the project may affect federally listed species or designated critical habitat, consultation with the U.S. Fish and Wildlife Service and/or National Marine Fisheries Services is required.

Project Description

Project Purpose

The objective of the proposed project is to study the feasibility of using an underground porous rock formation (depleted natural gas field) for a CAES project. CAES technology involves two major processes: (a) air compression for storage and (b) air release for electricity generation. During the air compression and storage process, electric motor-driven compressors inject air into a sealed and porous underground geological formation for storage under high pressure. During the air release phase, the high-pressure air is released from the underground reservoir, heated using natural gas (if necessary), and expanded through sequential turbines ("expanders"), which drive an electrical generator. The stored energy can be used during periods of higher electric demand, improving the efficiency of energy distribution through the power grid. This proposed project's goal is to conduct pressure testing of the formation. This would consist of injecting air to build a subsurface bubble within the reservoir sands of the depleted King Island Gas Field, and then conducting a series of pressure tests to further confirm the geologic suitability of the formation and provide more detailed information for project engineering.

PG&E proposes to construct a TSF, and perform drilling and compression tests to determine if a geological formation has the potential as a storage reservoir for future use as a CAES facility. An action that is interrelated to the construction of the TSF, drilling, and compression testing is the development of an electric distribution line that would provide power to the TSF. Development of the distribution line would involve re-conductoring existing lines and construction of new lines.

This site for the compression tests is located at the King Island Piacentine Well Pad Site (King Island) located in San Joaquin County, California. The proposed TSF is located approximately 1.8

miles northwest of the City of Stockton's northern boundary at Eight Mile Road in northwestern San Joaquin County, California. The TSF site would be situated on King Island between White Slough and Bishop Cut, and can be accessed from Interstate 5 via West Eight Mile Road and King Island Road (Figures 1 and 2a, Appendix A).

Project activities will include the construction and operation of the King Island TSF and access road maintenance. The electric distribution line will be upgraded by a combination of re-conductoring and new construction to provide power to operate the compression testing.

King Island Temporary Site Facilities

Project construction actions for developing the King Island TSF include construction of the TSF pad, well drilling, and compression and cycling testing. All staging, well drilling, compression, and cycling testing would occur on the TSF pad. Other associated project activities include access road maintenance (if deemed necessary) and development of the distribution line to power the activities at the TSF site. The expected timeline for construction activities is as follows:

- The development of the distribution line is expected to occur between August 2013 through March 2014;
- The access road maintenance, if needed, is expected to occur during the TSF pad construction time period of January 2014 through March 2014; and

TSF pad construction, well drilling, and compression testing would occur from February 2014 through August 2014.

TSF Pad Construction and Well Drilling

A pad to support the project and its operations (TSF pad) would be constructed to approximately 650 feet by 165 feet, or 2.5 acres in size, of which 0.7 acre was previously created for the geological core drilling task associated with this project. The TSF pad would be constructed as shown on the site plan (Figure 2b, Appendix A). Access road maintenance, pad construction, and drilling of the wells to complete the TSF pad at King Island is expected to take approximately 3 months.

The existing 0.7-acre pad would be expanded by additional clearing, grubbing, scarifying, and compacting into an area that is currently planted with sapling-stage walnut trees, requiring the removal of approximately 90 small trees. Geotextile material would be placed over the compacted work area, then up to 18 inches of sub-base material and Class II aggregate base would be placed and compacted. The work area would be crowned and sloped so that stormwater sheet-flows off the pad. PG&E would constrain all construction activities to the pad and a 20-foot buffer area

During the construction of the TSF pad, eight workers, five trucks and trucks to haul material, road grader/maintainer, dozer (D-5 or equal), sheep's foot compactor, roller compactor, water truck, and similar construction equipment would be used. Approximately 28 truck trips would be required to import material to the TSF pad.

Once the TSF pad is constructed, a drilling rig and associated equipment would be mobilized to the project. The primary drilling equipment includes the drill rig, mud and water tanks and pumps, shaker tanks, electric generators, diesel fuel tanks, and drill pipe racks. Two wells would be drilled into the formation– one well for injection and withdrawal of air (IW well), and the second well for monitoring

field pressures and responses to the injection and withdrawal process. The construction contractor would place all waste, cuttings, and drilling mud associated with well drilling in proper storage receptacles for offsite disposal at an authorized disposal facility. An additional five truck trips would be required to remove drill cuttings and associated material from the site. Drilling crew, engineers, temporary workers and site visitors would number an average of approximately 12 workers/people per shift, with three shifts per day. To accommodate continuous work shifts, night-time lighting would be used. Up to a maximum of 20 workers may be present at one time during various operations. In addition to worker vehicles, service, equipment, and material delivery vehicles would access the site during the drilling phase, generating an estimated 40 trips per day. Total duration of this task is approximately six weeks.

Water for pad construction and well drilling would be trucked to the project area from off-site municipal water supply sources. All drilling activities would be completed in compliance with the U.S. Environmental Protection Agency (EPA) Underground Injection Control (UIC) permit. Construction wastewater would be hauled offsite and disposed of in a permitted, commercial injection well in Rio Vista. Once the two wells are drilled and the drilling equipment demobilized from the work area, the compression and cycling equipment would be installed.

Once the two wells are drilled and the drilling equipment demobilized from the work area, the compression and cycling equipment would be installed.

Development of the facility includes installation of compression equipment, closed-loop cooling system, portable office trailer, tank for drilling mud, and lighting.

Compression and Cycling Testing
The construction and installation phase would be followed by four to five months of compression and withdrawal cycling that simulates the operation of a CAES facility. The testing would involve, initially, creating the compressed air reservoir or "bubble" by pumping the compressed air into the geological formation. Creation of bubble can take up to two months.

After the bubble is created, a series of pressure tests would be conducted and data would be collected from the IW well, the observation well and possibly from additional existing nearby gas wells to assess the reservoir response. The testing protocols are still being developed and would include a series of sequential injection, pressure buildup, pressure fall off, and possibly flow tests. The final compression testing plan would be developed to collect data that allows assessment of the reservoirs characteristics to support refinement of the computer reservoir model constructed for the project.

Other than the IW wells, the primary equipment used during the compression test would include the following:

- High-pressure compressor train capable of injecting the compressed air at flow rates up to 17 million standard cubic feet per day and compressor outlet pressures up to a maximum of 2,700 pounds per square inch,

- After-cooler to cool the compressed air to a temperature no higher than approximately 140 degrees Fahrenheit before injection,
- If necessary for safety purposes, the air supply stream may include oxygen-depleted air generated using a portable membrane filtration system or similar equipment,
- Appurtenant equipment including a temporary electrical supply, a step-down transformer, a power distribution system, a compressor cooling system, high-pressure piping, and control circuitry,
- Equipment to support withdrawal testing including high-pressure piping, a choke valve, a propane or electric line heater, a phase separator, one or more produced water storage tanks, and an air discharge vent, and
- Monitoring and measurement equipment including:
    - Wellhead pressure and temperature sensors at the wells;
    - A sensor array along the discharge piping to measure flow, pressure, temperature, combustible gas concentrations, oxygen concentrations and relative humidity; and
    - A sensor array along the injection piping to measure flow, pressure, temperature, oxygen concentrations, and relative humidity.

During this approximate 4- to 5-month period of compression and cycling testing, approximately 12 workers would be on site per day, staffing three eight-hour shifts. Night-time lighting would be required to accommodate a 24-hour work schedule. Workers, service vehicles and site visitors are expected to generate approximately15 trips per day.

Following completion of the compression testing, all of the drilling, compression, and other equipment would be removed from the site. If the compression testing has indicated the formation demonstrates appropriate characteristics for a CAES project, the pad along with established wells would be left in place for use in development of the CAES facility. If the testing demonstrates otherwise, the wells would be plugged and abandoned per California Department of Conservation Division of Oil, Gas, and Geothermal Resources (DOGGR) regulations and the requirements of the UIC permit issued by the EPA for the project. If the project does not move forward, the well pad and associated wells would be transferred to the subsurface rights owner as a condition of its agreement with PG&E. The pad material may be retained or removed from the site at the discretion of the subsurface rights owner. If the TSF pad is removed, equipment, workers and trips would be similar to the TSF pad construction as described above, but duration would be shortened to approximately 4 weeks.

Access Road Maintenance

Given that existing access roads are available, no road construction is necessary for project construction. Maintenance to the existing access roads would be limited to light graveling of the unnamed dirt road if determined to be necessary during the TSF pad construction and compression testing (this work would occur between January and March 2014) with the assumption that no additional grading would be required. If grading is required, it would be limited to leveling and/or smoothing the existing road and would not extend beyond the compacted surface. All vehicle traffic would be on the existing access roads

and all staging would be contained within the southeast portion of the existing well pad. Water trucks would be used as necessary to reduce dust during site access and other construction activities.

Electric Distribution Line

PG&E would develop an electrical distribution line to provide power to the equipment needed for compression testing. The distribution line would involve a combination of the use of existing overhead lines with no improvements, re-conductoring of existing overhead and underground lines to upgrade them to higher voltage and load capacity, and construction of new overhead lines (Figure 2a, Appendix A). The distribution line would be designed to or retrofitted within avian protection specifications to protect raptors and migratory birds from electrocution. Construction and improvements to the distribution line would occur between August 2013 and March 2014.

The distribution line serving the project would begin at the PG&E Eight Mile Road Substation and would be approximately 4.25 miles in length from the substation to the TSF pad (Figure 2a, Appendix A). A new 300-foot long underground line would be installed from the substation to an existing overhead line. Continuing west, the first 0.3-mile of this existing overhead line is adequate for project electric load and minimal modifications are required, but the remaining 0.6-mile segment will require re-conductoring and the installation of a pad-mounted transformer in the public road right of way. The route would then continue west to King Island Road along a 1.3-mile segment that would require entirely new construction, and would cross Bishop Cut (a navigation channel) on existing tall lattice steel structures required for vessel passage. The height of the existing structures will be extended as required for vessel passage. Pole replacement would be required on the east side of the levee to accommodate height extension and re-conductoring of the existing structures. After crossing Bishop Cut, the route would extend north along King Island Road, turning west and then north again on unnamed farm roads to the TSF. The first 1.4 miles of this portion of the route would involve re-conductoring and pole replacement, and the remaining 0.6-mile segment to the TSF pad would require new construction.

Distribution line construction would occur along existing public and private roads, and would not require construction of access routes or roads. Except for the water crossing at Bishop Cut, conductor support would consist of wooden poles with a span length of approximately 300-feet.. Construction would occur within a 50-foot wide work area, centered on the line.

The crossing of Bishop Cut would involve extension of the existing lattice steel structures to provide the necessary navigation clearance for the conductors over Bishop Cut. PG&E proposes to use a helicopter to complete the mast extension and re-conductoring of the span over Bishop Cut. Since the existing distribution lines must be removed from the top of the lattice steel structures before the tops can be extended, these lines will be relocated to temporary wood poles installed around the perimeter of the lattice steel structure work areas. A service line to a nursery on the southwest side of Eight Mile Road and the crossing currently connected to the top of the mast will require temporary poles as well. Once the top extension is complete the distribution line will be relocated to the top of the lattice steel structures and the temporary wood poles removed. Construction details such as staging areas, work areas at the pole sites, pull and tension sites, areas where special construction methods may need to be employed, and areas where vegetation removal may occur, etc., would be provided to the Contractor as the information becomes available. The Bishop Cut lattice steel structure extension would require a 100 x 100 foot work area on each side of the levee approximately 300 feet from the base of the mast in the cultivated field.

Electric distribution line construction would include up to two line crews (eight to ten workers total) over a period of approximately 12 weeks. Equipment would include line trucks with augers, bucket trucks, puller rig, conductor reel trailers and crew trucks.

Habitat and Affected Environment

The project area is situated in a landscape that currently supports active agricultural operations, an existing natural gas well site, access roads, several agricultural residences, and appurtenant facilities/equipment (e.g., farm equipment, staging area, and barn). It also includes a 0.7-acre well pad previously developed for the core-drilling phase of the project. The project area is located within the "Delta Islands," which are areas of former marshlands of the Sacramento–San Joaquin Delta that were historically reclaimed for agricultural use by the construction of levees/dikes and draining.

The area surrounding the TSF is generally level and ranges in elevation from approximately 5 to 10 feet below sea level. Water levels in White Slough and Bishop Cut are slightly above sea level and are separated from King Island by a series of levees topped by paved and unpaved roads. The area surrounding the TSF is crossed by a series of dirt and gravel ranch roads that provide access to the various ranch fields and to the test site. Several agricultural residences are located approximately 0.5 to 0.75 mile south of the test site along the south side of an east-west-trending gravel road.

Most of the project area occurs in agricultural fields and road shoulders that are frequently disturbed and nearly all native vegetation has been removed. The distribution line (existing and proposed new line) borders a golf course and a residential neighborhood in the eastern portion of the project area along the shoulder of Eight Mile Road.

Vegetation communities within the project area, include annual grassland, cropland/orchard, fresh emergent wetland, riverine, and ruderal (Figure 3a–3i, Appendix A). Vegetation communities are classified based on descriptions provided in *A Guide to Wildlife Habitats of California* (Mayer and Laudenslayer 1988).

Areas along the golf course on Eight Mile Road support annual grassland. The golf course was historically farmed up to Eight Mile Road prior to 1998 (Google Earth Imagery, August 17, 1998). Since the golf course installation, non-native annual grasses have re-colonized the area. Herbaceous cover is dense and is dominated by wild oat (*Avena fatua*), Johnson grass (*Sorghum halepense*), perennial ryegrass (*Festuca perenne*), fiddleneck (*Amsinckia menziesii*), wild radish (*Raphanus raphanistrum*), ripgut brome (*Bromus diandrus*), and milk thistle (*Silybum marianum*).

Cropland/orchard (e.g., corn, asparagus, onions, safflower, walnut orchard) is the dominant vegetation community within the proposed TSF pad and along the distribution line, with exception of few areas along Eight Mile Road that are dominated by annual grassland. The TSF pad is entirely within a young walnut orchard and the open areas between the rows are disked and or mowed on an annual basis. Most crops along the distribution line are annual row crops. All fields are actively farmed and annually disked, harvested and/or disturbed up to the edge of existing roads.

Fresh emergent wetlands are present in irrigation ditches with sufficient hydration throughout the project area and in ponds located on the golf course in the eastern portion of the project area. Irrigation ditches are located parallel to the gravel access road to the TSF pad, and are located perpendicular and parallel to Eight Mile Road. The irrigation ditches appear to be subject to regular vegetation management using

both mechanical and chemical techniques. Irrigation ditches adjacent to the TSF pad and gravel access road, and those perpendicular to Eight Mile Road are perennially inundated and support fresh emergent vegetation. Irrigation ditches on either side of Bishop Cut, and those at the western portion of the project area near the PG&E Eight Mile Substation are intermittently inundated during the irrigation season and are generally devoid of vegetation. Perennially inundated irrigation ditches and ponds support patches of fresh emergent vegetation including water primrose (*Ludwigia* sp.), cattails (*Typha* sp.), smartweed (*Persicaria* sp.), mosquito fern (*Azolla* sp.), and water hyacinth (*Eichhornia crassipes*).

Bishop Cut provides riverine habitat for aquatic species at the Eight Mile Road Bridge crossing. The Bishop Cut is an artificial navigation and irrigation channel connecting White Slough to the north and Disappointment Slough to the south. Within the project area, the levee banks are rip-rapped with large rock and the channel is generally devoid of vegetation. The section of the Bishop Cut levee road that will be used for project access is paved.

Areas that are often disturbed (e.g., mowed, disked) were classified as ruderal. Ruderal areas are located along the levee banks of Bishop Cut and adjacent road shoulders. Dominant plant species include common mallow (*Malva neglecta*), poison hemlock (*Conium maculatum*), mustard (*Brassica* sp.), milk thistle, Johnson grass, redroot pigweed (*Amaranthus retroflexus*), and common knotweed (*Polygonum aviculare*).

No seasonal wetlands, vernal pools, elderberry shrubs (*Sambucus nigra*), riparian wetlands or other sensitive natural community (e.g., California Natural Diversity Database (CNDDB) ranked rare natural communities) are present in the project area. Fresh emergent wetlands only occur in the ditches and golf course ponds (outside of the project area). Farmed agricultural lands do not provide habitat for special-status plant species. Vernal pools, mesic areas, alkaline or serpentine soils, chenopod scrub, and riparian forest or scrub habitats that would support special-status plant species are not present within the project area.

Methods

The status of habitat for special-status species, waters of the United States, and other sensitive biological resources within the project area was determined through desktop analysis and field reconnaissance. The following areas were evaluated during the desktop analysis and field reconnaissance and are referred to as the project area: (1) a 200-foot buffer around the TSF pad; (2) a 20-foot buffer around all gravel access roads; (3) a 50-foot-wide corridor along the approximate 4.25-mile electrical distribution alignment, and (4) within the work areas identified on either side of Bishops Cut (Figure 3a-3i, Appendix A). A discussion of the methodology for the desktop analysis and field reconnaissance is provided below.

Desktop Analysis

Multiple information sources were reviewed to evaluate biological resources within the project area. The following is a list of the principal resources:

- The *Terminous, California* USGS 7.5-minute topographic quadrangle;
- Color aerial photographs of the project area and vicinity;
- The U.S. Fish and Wildlife Service (USFWS) official list of endangered and threatened species that may occur, or be affected by projects, in the *Terminous, California*, 7.5-minute quadrangle (Appendix B);

- The California Department of Fish and Wildlife (CDFW) California Natural Diversity Database (CNDDB) (California Department of Fish and Wildlife 2013a) plant and animal records within 5 miles of the project area (Appendix B);
- The California Native Plant Society (CNPS) online Inventory of Rare and Endangered Plants (California Native Plant Society 2010) records for the *Terminous, California* and eight adjacent quadrangles (Appendix B);
- GIS shapefiles of designated critical habitat from the USFWS Critical Habitat Portal website;
- U.S. Department of Agriculture (USDA) Web Soil Survey;
- USFWS National Wetlands Inventory;
- CDFW publications including State and Federally Listed Endangered, Threatened and Rare Plants of California (California Department of Fish and Wildlife 2013a); Special Vascular Plants, Bryophytes, and Lichens (California Department of Fish and Wildlife 2013b); State and Federally Listed and Threatened Animals of California (California Department of Fish and Wildlife 2013c); and Special Animals List (California Department of Fish and Wildlife 2011); and
- Pertinent biological literature including the following: *The Jepson Manual: Vascular Plants of California* (Baldwin et al. 2012), *Amphibian and Reptile Species of Special Concern* (Jennings and Hayes 1994), and *Bird Species of Special Concern in California* (Shuford and Gardali 2008).

These resources were used to create a list of regionally occurring special-status species that may occur near the project area. Species listed in the U.S. Fish and Wildlife (USFWS) species list for San Joaquin County and special-status species identified in the CNDDB records were considered in the evaluation (e.g., listed shrimp, valley elderberry longhorn beetle, giant garter snake) (Appendix B). Additionally, special-status species not included in the USFWS species list or CNDDB records were considered due to their known geographic range and/or the presence of potential habitat (e.g., white-tailed kite and loggerhead shrike).

For the purpose of this evaluation, special-status plant species include plants that are (1) listed as threatened or endangered under the California Endangered Species Act (CESA) or the federal Endangered Species Act (ESA), (2) proposed for federal listing as threatened or endangered, (3) state or federal candidate species, (4) designated as rare by the CDFW, and (5) California Rare Plant Rank (RPR) 1A, 1B, or 2 species. Special-status animal species include species that are (1) listed as threatened or endangered under the CESA or ESA, (2) proposed for federal listing as threatened or endangered, (3) state or federal candidate species, and (4) identified by the CDFW as species of special concern or fully protected species.

Determination of wetlands was based on the approach outlined in the Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory 1987) and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0) (U.S. Army Corps of Engineers 2008). Additionally, the assessment for potential "other waters" was based on the presence of an ordinary high water mark as defined in USACE regulations (33 CFR 328.3 and 33 CFR 328.4).

Field Reconnaissance

A field reconnaissance was conducted on August 20, 2012 by NSR Biologist John Hunt, and PG&E Biologist Catalina Reyes, on April 3, 2013 by NSR Biologist Brandon Amrhein, and on July 17 by NSR

Biologist Patrick Martin. The biological field review consisted of pedestrian surveys to view all areas to the extent necessary to document the existing conditions. Mr. Eric Hansen, Consulting Biologist, reviewed the TSF pad and access road to assess potential giant garter snake aquatic and upland habitat.

Special-Status Species

Table 1 (Appendix C) lists special-status species that have potential to occur within the project area based on habitat documented during the field surveys. Species for which habitat does not exist within the project area were not included in Table 1 and are not discussed further in this document.

Special-Status Plant Species

Irrigation ditches and the area along Bishop Cut within the project area provide potential habitat for 12 special-status plant species. Habitat for seven RPR 1B species potentially occurs in the project area including, slough thistle (*Cirsium crassicaule*), woolly rose-mallow (*Hibiscus lasiocarpus* var. *occidentalis*), Delta tule pea (*Lathyrus jepsonii* var. *jepsonii*), Mason's lilaeopsis (*Lilaeopsis masonii*), Sanford's arrowhead (*Sagittaria sanfordii*), and Suisun marsh aster (*Symphyotrichum lentum*). Habitat for five RPR 2 species potentially occur and include watershield (*Brasenia schreberi*), bristly sedge (*Carex comosa*), Delta mudwort (*Limosella subulata*), eel-grass pondweed (*Potamogeton zosteriformis*), marsh skullcap (*Scutellaria galericulata*), and side-flowering skullcap (*Scutellaria lateriflora*). These species are generally found in marshes and swamp habitat, which the perennially inundated irrigation ditches and Bishop Cut may provide.

Suitable habitat for these species is located within the irrigation ditches and along Bishop Cut. The project would not result in disturbance to the irrigation ditches or Bishop Cut. Therefore, the project would not adversely affect special-status plant species.

Special-Status Animal Species

Seven special-status animal species were determined to have the potential to occur in or near the project area, and could be affected by the proposed project (Table 1, Appendix C). These species include:

- giant garter snake (*Thamnophis gigas*), federal and state threatened;
- western pond turtle (*Emys marmorata*), California species of special concern;
- Swainson's hawk (*Buteo swainsoni*), state threatened;
- white-tailed kite (*Elanus leucurus*), California fully protected species;
- northern harrier (*Circus cyaneus*), California species of special concern;
- western burrowing owl (*Athene cunicularia*), California species of special concern; and
- loggerhead shrike (*Lanius ludovicianus*), California species of special concern.

Giant Garter Snake

Perennial irrigation ditches throughout the project area and the golf course ponds north of the eastern portion of the project area potentially provides low quality aquatic habitat for the giant garter snake (GGS). The uplands within 200 feet of these areas potentially provides low quality upland habitat. Most of the dirt access road to the TSF pad borders a perennially inundated irrigation ditch (Figures 3a – 3i, Appendix A). The distribution line bisects three perennially inundated irrigation ditches and runs parallel to ponds located approximately 45 to 165 feet north of the eastern portion of the project area on the golf course.

The CNDDB contains reported GGS occurrences from marsh habitat within Coldani Marsh approximately 1.7 north of the TSF pad. Documentation of GGS within Coldani Marsh also includes surveys conducted by Eric Hansen during 2009–2010 (Hansen 2011). Although GGS are known to occur in Coldani Marsh, the densities of GGS populations in the Delta region is known to be very low and survey efforts since the mid-1980s suggest that much of the Delta is unoccupied or supports few GGS (Hansen 2013). For example, surveys conducted approximately 2 miles south of Coldani Marsh, which is 1.5 miles north of the eastern portion of the distribution line, did not detect GGS (Hansen 2011).

Essential habitat components required for GGS include (1) adequate water during the snake's primary active period; (2) suitable prey base; (3) abundant emergent, herbaceous wetland vegetation, such as cattails (*Typha* spp.) and bulrushes (*Scirpus* spp.) for escape cover and foraging habitat; (4) upland habitat for basking, cover, and retreat sites; and (5) higher elevation uplands for cover and refuge from flood waters (Miller et al. 1999).

Although vegetation is actively managed along ditches, emergent vegetation persists and these ditches may provide aquatic habitat for GGS when inundated. Because the ditches appear to be subject to regular vegetation management using both mechanical and chemical techniques and the water level fluctuates with respect to different periods of the irrigation cycle, the suitability of the ditches in providing cover and retreat habitat for GGS is limited and the habitat is considered low quality. Prey items such as mosquito fish (*Gambusia affinis*), bullfrogs (*Lithobates catesbeianus*), and Sierran treefrogs (*Psuedacris sierra*) are present within the perennially inundated ditches along the dirt access road and Eight Mile Road.

Based on studies conducted by Wylie et al. (Wylie et al. 1995; Wylie et al. 1997; Wylie et al. 2002a; Wylie et al. 2002b), the Solano Multispecies Habitat Conservation Plan (Solano HCP) analyzed landscape habitat use and found that low quality ditch habitat associated with rice fields include an artificial marsh habitat that provides the essential components (e.g., appropriate cover, high food availability, upland refuge) to support GGS. In addition, studies conducted in high quality marsh habitat surrounded by fallow fields did not locate GGS or found them at very low densities. Based on these results, areas supporting marginal to poor habitat or small, isolated patches of good habitat are presumed to not support GGS due to lack of surrounding aquatic habitat (Solano County Water Agency 2009). The project area lacks marshes or other expansive aquatic habitat (e.g., rice fields) and the potential GGS aquatic habitat that is present (e.g., irrigation ditches) is of marginal to poor quality. Therefore, it is unlikely that GGS would utilize the irrigation ditches in the project area.

Burrows and other underground refugia are important to GGS during winter and summer to escape unfavorable winter cold temperatures or excessive summer heat. The GGS Recovery Plan states that wintering habitat can be up to 250 meters (820 feet) from the edge of marsh habitat (Miller et al. 1999). Typically, the USFWS defines upland habitat as all areas occurring within 200 feet of aquatic habitat (White 1997).

The upland habitat in the agricultural portions of the project area is poor to marginal habitat for GGS. As part of existing agricultural activities, the agricultural uplands are extensively disked, tilled and periodically may be planted with row crops between the walnut orchard rows. These activities largely preclude the development/persistence of burrows created by small mammals that are used as refugia by GGS. Additionally, GGS require open space for basking and predator avoidance, and tend to avoid areas with extensive canopy cover because of excessive shade and lack of basking sites (Miller et al. 1999).

Canopy cover provided by the young walnut orchard that occupies the TSF pad limits available open habitat, which reduces suitability of upland habitat.

The ponds on the golf course north of the distribution line (Figure 3h, Appendix A) support fresh emergent wetlands and provide the essential habitat components for GGS, with the ponds providing potential aquatic habitat and the ruderal areas around the golf course providing potential upland habitat. The golf course ponds are in proximity to a series of irrigation canals, irrigation ditches, and fresh emergent wetland habitat that connects to the Coldani Marsh population of GGS located approximately 3.5 miles north of the distribution line near the golf course ponds. However, the potential for GGS to occur in the golf course ponds is considered to be low for the following reasons: 1) few burrows are present in the ruderal areas of the golf course; 2) the golf course is not surrounding by marshes or other expansive aquatic habitat; 3) surveys for GGS conducted in 2009–2010 in aquatic habitat 2 miles south of Coldani Marsh (e.g., in the aquatic corridor between the golf course and Coldani Marsh) had negative results (Hansen 2011); and 4) the densities of GGS populations in the Delta region is known to be very low (Hansen 2013).

The proximity of the distribution line to the golf course ponds ranges from approximately 65 to 145 feet. A large berm (approximately 20 feet wide and 15 feet tall) separates the golf course from the distribution line and Eight Mile Road is located immediately south of the distribution line. The areas south of Eight Mile Road near the golf course consist of residential developments and upland agricultural fields. GGS are not anticipated to occur within the distribution alignment near the golf course for the following reasons: 1) GGS are not likely to occur in the golf course ponds; 2) a large berm separates the golf course from the distribution alignment; 3) the distribution alignment is limited to the road side of the berm; and 4) no suitable habitat is present within or south of distribution alignment and, thus, there is no reason for GGS to move through the area.

In summary, given the nature of potential aquatic and upland habitats for GGS in the project area (e.g., low-quality and isolated from higher quality habitats) and the characteristics of GGS populations in the Delta region (e.g., very low densities, most potential habitat is unoccupied), GGS are unlikely to occur in the project area and very unlikely to occur in areas where the project activity would result in ground disturbance. The majority of ground disturbance and other activities associated with the project would be at the TSF pad. As part of project planning and environmental review for the well pad that was previously developed at the TSF pad for the core drilling phase, PG&E contracted with Eric C. Hansen (Consulting Environmental Biologist) to evaluate the potential for GGS to occur within the project area. Based on a review of the habitat characteristics, previous survey results in nearby areas of the Delta, and other factors, Mr. Hansen determined that there was minimal to no likelihood that GGS occur within the area of the proposed TSF pad. The report prepared by Mr. Hansen also included a summary of Delta-wide GGS survey efforts. A copy of Mr. Hansen's report is provided as Appendix D.

Project Effects

Project effects on GGS vary based on the GGS activity period (e.g., inactive or active) in which the work is conducted. Construction and operation of all activities associated with this phase of the project are anticipated to commence in August 2013 and continue through October 2014. Development of the distribution line is anticipated to start August 2013 and be completed by March 2014. Construction of the TSF pad and any road maintenance is anticipated to occur January through March 2014, with commissioning and operations to occur April through August 2014, and decommissioning activities to occur in September and October 2014.

The TSF pad construction and decommissioning would be conducted during the GGS inactive period (October 2–April 30). TSF operations would be conducted during the GGS active period (May 1–October 1). The development of the distribution line would be conducted during both the GGS active and inactive period. The following sections describe effects based on the phase of construction and the GGS activity season.

Construction, Drilling, and Decommissioning

Construction of the TSF pad, road maintenance and decommissioning of the project are expected to occur during the GGS inactive period. If GGS are present within the project area, GGS could be affected by road grading, ground disturbance, use of hazardous materials (e.g., fuel, oils), noise disturbance, lighting disturbance, and other activities associated with project construction and decommissioning.

Based on the project schedule, ground disturbance for the TSF pad and road maintenance activities would occur from January through March, and the decommissioning period would occur from September through October, 2014. The periods for construction and decommissioning roughly correspond with the GGS inactive period. During the inactive period, GGS are anticipated to be within burrows or other refugia within 200 feet of aquatic habitat (White 1997). The highest potential for effects on GGS during construction and decommissioning is from activities along the access roads where they border irrigation ditches (e.g., heavy traffic, road grading). Although suitable winter refugia (e.g., burrows) is generally lacking in the project area, GGS could be directly affected if burrows occupied by GGS were disturbed (e.g., effects resulting from crushing or collapsing burrows). Potential direct effects resulting from disturbance to burrows would be avoided with implementation of AMMs.

It is anticipated that construction and decommissioning activities would result in sound levels of approximately 81 to 90 decibels (dB) at the TSF pad based on the equipment that would be used and drilling of two wells (U.S. Fish and Wildlife Service 2006). Sources of construction noise would include medium-sized to large construction equipment, drill rigs, pneumatic tools, and medium-sized to large diesel engines. The level of noise generated from construction and decommissioning would be similar to existing farming activities (e.g., noise from farming equipment like diesel engines, generators, pumps, and power tools), but the noise would be more stationary and longer in duration at specific locations (e.g., drilling at TSF pad). Effects on GGS from construction noise are not expected and are not considered to be adverse because these activities would occur during the inactive period when GGS are in winter refugia.

Well drilling during the construction phase would occur over a 24-hour period, which would require night-time lighting. As with noise disturbance, GGS would be in winter refugia and disturbance from night-time lighting is not expected and would not result in adverse effects.

Construction and decommissioning would not involve ground-disturbance in potential aquatic habitats for GGS. However, construction and decommissioning would involve the use of fuels, oils, and other hazardous materials. GGS could be affected if hazardous materials were released into aquatic habitats occupied by GGS. Potential direct effects resulting from hazardous materials would be avoided with implementation of AMMs.

Development of Distribution Line and Project Operation

Development of the distribution line is expected to occur during the GGS inactive and active period and the project operation period (compression and cycle testing) is expected to occur during the GGS active

period. The greatest potential for GGS to be affected by distribution line development would be from vehicle access and pole replacement activities. The greatest potential for GGS to be affected during project operation activities would be from light traffic leaving and entering the TSF pad, and from noise and light generated at the TSF pad.

During development of the distribution line, line trucks and other vehicles would be accessing the distribution line to install poles or re-conductor overhead lines. Effects could result from direct contact with vehicles, collapse of refugia in which snakes may take cover, or GGS avoidance of foraging habitat (e.g., irrigation ditches, ponds). Potential direct effects resulting from vehicle traffic or excavation would be avoided or minimized with implementation of AMMs.

Project personnel and service vehicle traffic are expected to decrease during the operation phase of the project (approximately April–August), which is within the active period for GGS (active period is May 1–October 1). Snakes are expected to be within, and immediately adjacent to, aquatic habitats during the active period. GGS foraging in the irrigation ditches and GGS basking on or near roadway surfaces (e.g., near the irrigation ditches) could be disturbed by vehicle traffic. Traffic entering and leaving the TSF pad could results in direct effects on GGS. Effects could result from direct contact with vehicles or avoidance of available foraging habitat in the irrigation ditches due to the increased level of disturbance. Potential direct effects resulting from vehicle traffic would be avoided or minimized with implementation of AMMs.

Operations at the TSF pad would generate noise by compression testing over a five-month period from April through August 2014. Noise generation would be concentrated at the TSF pad. There would be two testing phases, each expected to last 3 weeks. Injection and withdrawal would be alternated on repeating daily schedules for 4 to 5 days, followed by a short period to inject air and stabilize the reservoir. Daily withdrawal would be conducted from 5 to 10 hours depending on the rates being tested. The air release vent would be installed with a silencer and air withdrawal would not result in sudden high noise levels, but would ramp-up over a 10-minute period. With a silencer on air release vent, the compression testing would generate noise reaching 65 to 90 A-weighted sound pressure levels (dBA) adjacent to the TSF pad, attenuating to less than 60 dBA approximately 0.25 mile from the TSF pad (Figures 4a and 4b, Appendix A).

Although the noise levels that would be generated at the TSF pad are similar to ambient conditions (e.g., noise from farming equipment like diesel engines, generators, pumps, and power tools), the noise would be stationary and longer in duration. Given the stationary nature of the noise and the duration of the noise, GGS in close proximity to the TSF pad could be affected. Although snakes do not have external ears or an ear drum, they do have an inner ear that is connected to their jawbone. Snakes “hear” by sensing vibrations traveling through the ground (and possibly the air), which cause vibrations in the jawbone that are relayed to the brain via the inner ear. Effects on GGS from noise could result from avoidance of aquatic or upland habitats if noise vibrations interfere with foraging activities or are otherwise uncomfortable for the snake. Given the low potential for snakes to be present near the TSF pad, the attenuation of noise with increasing distance from the TSF pad, and the ability of snakes to move away from the area, noise effects from operations are not considered to be adverse.

Operation of the project would require night-time lighting at the TSF pad seven days a week for the duration of the project. The lighting would be focused on the TSF pad and would be shielded to minimize the illumination of areas outside the TSF pad. However, the segment of irrigation ditch

immediately west of the TSF pad and along the access road could be illuminated. If GGS utilize this segment of irrigation ditch, effects could result from avoidance of the area, changes in behavior, or reduced availability of prey. Given the low potential for snakes to be present near the TSF pad, the small area of potential habitat that would be affected, and the ability of snakes to move away from the area, effects from night-time lighting are not considered to be adverse.

Western Pond Turtle

The golf course ponds north of the distribution line in the eastern portion of the project area and associated uplands provide suitable habitat for western pond turtle (Figure 3h, Appendix A). Upland nesting habitat is also present adjacent to the golf course. Western pond turtles are documented to occur in the irrigation canal approximately 1.3 miles northwest of the portion of the distribution line along the southern boundary of the golf course (California Department of Fish and Wildlife 2013d). Because of the presence of habitat and occurrences within proximity of the golf course, this species has a moderate potential to occur in the project area.

Although ditches in the project area are perennial, and contain some fresh emergent vegetation, the banks are steep and do not contain available basking sites. Ditches are actively maintained which likely precludes occupation by pond turtles. Additionally, upland breeding sites are unavailable in the cropland habitat within the project area. Due to lack of basking habitat and upland breeding sites, pond turtles are not expected to occur in the agricultural portions of the project area near the TSF pad.

Project Effects

The project could have adverse effects on western pond turtle if an individual or a nest were crushed during the construction or operation phase of the project. The peak of construction activity would occur in the winter between January and March. Western pond turtles generally hibernate under water during colder periods (i.e., winter months) (Zeiner et al. 1988) and would not likely be encountered during construction activities. Pond turtles move overland during the spring and early summer and have been documented to move over 325 feet (Jennings and Hayes 1994). Installation of the distribution line would occur in the road shoulders, which is too compacted to provide nesting substrate for western pond turtles. It is expected that only adults could be encountered along roads during project implementation.

Because the duration of the project is approximately 10 months and turtles are generally restricted to aquatic habitats, long-term effects are not expected. Implementation of AMMs provided below would minimize the potential for adverse effects on western pond turtle. These measures include a preconstruction survey and stop work measures if a turtle is encountered.

Swainson's Hawk

Suitable nesting habitat (e.g., trees, power poles/towers) for Swainson's hawk occurs within 0.5 mile of the project area. Suitable nesting habitat within 0.25 mile of the project area is limited to one eucalyptus tree (*Eucalyptus* sp.), which is located approximately 700 feet north of the TSF pad, and trees located along King Island Road, north and south of Eight Mile Road west of Bishops Cut. Foraging habitat is abundant in the agricultural lands near the project area. However, walnut orchards currently within the proposed TSF pad do not provide foraging habitat (California Department of Fish and Game 1994). CNDDB records include one Swainson's hawk occurrence approximately 0.2 mile southeast of the PG&E Eight Mile Road Substation, one 2001 Swainson's hawk nest approximately 1 mile south of Eight Mile Road at Bishops Cut along Disappointment Slough, and Swainson's hawks nested in 2009 approximately 1 mile northeast of the TSF pad.

Surveys following the guidance provided in *Recommended Timing and Methodology for Swainson's Hawk Nesting Surveys in California's Central Valley* (Swainson's Hawk Technical Advisory Committee 2000) were conducted by NSR during the spring of 2013 within 0.5 mile of the project area. No Swainson's hawk nests were detected within 0.5 mile of the project area (North State Resources 2013). One Swainson's hawk pair exhibited nesting behavior during April 2013 approximately 1.5 miles north of the project area (North State Resources 2013).

Given that there is a general lack of nesting habitat within 0.25 mile of the project area, and that the 2013 surveys did not detect nesting Swainson's hawks within 0.5 mile of the project area, the potential for Swainson's hawks to nest within 0.5 mile of the project area during project activities is considered to be low.

Project Effects

Noise generated during construction and operation activities could affect Swainson's hawks if active nests are located within 0.25 mile of the project area (California Department of Fish and Game 1994). As discussed above, it is anticipated that construction of the TSF pad, well drilling, and installation of the distribution line would result in a high sound level of approximately 81 to 90 dB, which is similar to the ambient sound level generated by annual crop farming occurring year-round (e.g., tilling, planting spraying, pumping, harvesting); however, drilling would be stationary and of longer duration.

Construction of the TSF pad and drilling noise would be generated continuously for 3 months and is anticipated to occur between January and March 2014. Decommissioning would occur during September and October, thus construction and decommissioning would largely occur during the non-nesting season for Swainson's hawk (non-nesting season is October 1 to February 28). Given that construction and decommissioning would occur outside the Swainson's hawk nesting period, effects on Swainson's hawks is not expected.

Development of the distribution line would occur between August 2013 and March 2014. Initiation of the distribution line improvements would occur at the end, but completed before the start of the Swainson's hawk nesting period (March 1 through September 15). Activities associated with development of the distribution line (e.g., noise and line-of-sight disturbance) could result in effects on nesting Swainson's hawks (e.g., nest abandonment). However, work would occur after the post-fledgling period (June 10-July 30) (Swainson's Hawk Technical Advisory Committee 2000) and effects on young would not be expected for they would have likely have fledged by early August.

During the operation phase (compression testing), most noise generation would be concentrated within the TSF pad. Operation sound levels would be at a similar sound level as for the construction phase of the project (approximately 65-90 dbA with a silencer). With a silencer on the air release vent, the decibel rating at 0.25-mile would be less than 60 dBA, which is a low sound level (U.S. Fish and Wildlife Service 2006). Compression testing would occur during the nesting season for Swainson's hawk (nesting season is March 1–September 15). Noise generation during drilling and compression testing are similar in sound level and duration. These sound levels are comparable to ambient sound levels; however, noise would be stationary and continuous for a longer duration than farming activities.

Because the operation phase would occur during the nesting season for Swainson's hawk, effects on Swainson's hawk from noise could result in the incidental loss of fertile eggs, nestlings, or otherwise lead to nest abandonment, which could adversely affect the species. However, noise would be of similar level

and duration between the drilling and compression testing. If Swainson's hawks begin nesting after the commencement of drilling in January 2014 near the project area and compression testing follows drilling, effects are not expected.

Given that (1) the potential for Swainson's hawk to nest within 0.25 mile of the TSF pad is very low, (2) nest sites greater than 0.25 mile from the TSF pad would be subject less than 60 dBA, which is lower than ambient conditions, and (3) noise conditions are similar between drilling and compression testing, which would commence prior to the nesting season, impacts on nesting Swainson's hawks are considered low.

Both the construction and the operation phase of the project would require night-time lighting seven days a week during the drilling activities and compression testing, respectively. Because the low potential for Swainson's hawks to nest within 0.25 mile of the project area, lighting would be consistent from the onset of the nesting season, and operations would cease in the fall/winter of 2014, adverse lighting effects on nesting Swainson's hawks, if present, are not expected.

Project activities could adversely affect Swainson's hawk if the project starts at the end of the nesting season (e.g., distribution line) or does not start prior to the nesting season (e.g., construction and operation activities). Swainson's hawk surveys would be conducted to determine presence/absence if project activities begin during any time of the nesting season. If present, determination of buffers or a limited operating period may be required. If nesting occurs within 0.5 mile while construction/drilling or operation phases (compression testing) are in progress, nesting activity should be monitored to confirm noise or line-of-sight disturbance during construction or operation activities does not disrupt nesting success. Implementation of the AMMs provided below would minimize the potential for adverse effects on Swainson's hawks.

Other Special-Status Birds

Habitat for white-tailed kite, northern harrier, western burrowing owl, and loggerhead shrike is present in the project area. Nesting habitat for loggerhead shrike and white-tailed kite is present in the trees and shrubs in the project area. Open areas near ponds at the golf course may provide nesting habitat for northern harrier. Burrows and other structures (e.g., culverts) in annual grasslands and ruderal habitats along road shoulders, open areas, and levee berms provide habitat for burrowing owl. White-tailed kite is documented by the CNDDB to nest 2 miles northeast of the project area and burrowing owl is reported to occur within 3.8 miles southeast of the project area (California Department of Fish and Wildlife 2013d). Northern harrier was observed nesting 1.5 miles north of the project area during April 2013 (North State Resources 2013). Because of the presence of habitat and known occurrences near the project area, white-tailed kite, and loggerhead shrike have a low potential to occur in the TSF pad, and a moderate potential to occur along the distribution line; northern harrier has a moderate potential to occur near the golf course ponds along the distribution line; and western burrowing owl has a moderate potential to occur along the distribution line.

Project Effects

As described for the Swainson's hawk, construction and operation activities could affect nesting success for other special-status birds. Ground disturbing activities and vegetation removal could directly affect birds nesting on the ground or in trees slated for removal (e.g., mortality of young in nest). Direct effects (e.g., nest abandonment due to noise disturbance) on nesting birds may result if construction activities commence after the nesting season begins.

Construction of the distribution line occurs within non-nesting and nesting habitat for the burrowing owl. Burrowing owls occupy burrows throughout the year and effects on burrowing owl could occur during any time of year. Although no burrowing owls were observed during the field reconnaissance on April 3 and July 17 2013, burrowing owls could move into the area prior to construction. Habitat is limited to the distribution line and effects on owls would only be anticipated during installation of the distribution line.

Noise and lighting effects resulting from construction/decommissioning (January-March; September-October) and operation activities (April-August) would be the same as those described for the Swainson's hawk. Because high sound levels and ongoing night-time lighting would be present from the onset of potential nesting activity and operations would cease in the fall/winter of 2014, no effects on birds nesting near the TSF pad are expected. However, if construction phase does not start until after the nesting season begins, effects on nesting birds could be adverse if nests are located in or near the project area.

Implementation of the AMMs provided below would reduce the potential for adverse effects on special-status birds. These measures include preconstruction surveys for burrowing owl and, if work does not commence prior to the nesting season, preconstruction surveys for other nesting special-status birds.

Waters of the United States

An assessment for potential waters of the United States was conducted during the August 20, 2012, April 3, and July 17, 2013 field reconnaissance visits. Some of the irrigation ditches within the project area were observed to support a prevalence of hydrophytic vegetation, and some reaches of the irrigation ditches contained flowing or ponded water (Photographs 1 and 2). Water is generally pumped in or out of White Slough or Bishop Cut depending on need to irrigate farmland or to keep the area from flooding. The irrigation ditches within the project area are adjacent (separated by a levee) to White Slough or Bishop Cut, which qualify as waters of the United States. Given that the irrigation ditches support hydrophytic vegetation, are subject to extended inundation and/or saturation, and are adjacent to waters of the United States, the features are considered as potential waters of the United States. The project would not result in any physical disturbance of irrigation ditches or Bishop Cut, and would not result in direct impacts on potential waters of the United States. AMMs have been incorporated into the project to avoid indirect impacts to potential waters of the United States.

A small area (3 feet by 4 feet) south of Eight Mile Road adjacent to the subdivision is hydrated with nuisance water from landscape irrigation. Cattails (*Typha* sp.) and barnyard grass (*Echinochloa crusgalli*), which are both hydrophytic plants, have colonized the area at the interface of the paved road and adjacent soil (Photograph 13). Wetland plants thrive due to continued irrigation run-off. Because of the dominance of hydrophytic vegetation, sufficient hydrology augmented by irrigation, and soil saturation, the area would likely meet the USACE definition of a wetland (per 33 CFR 328.3).

The hydrology that supports this wetland would not likely persist if irrigation ceased. The area is nearly level and water collects at the slight rise in the topography where the pavement meets a gravel road that is perpendicular to the paved shoulder. The area is rehydrated and inundated with reoccurring landscape irrigation. Based on the depth of the ponded area (less than 2 inches), it is likely, during normal precipitation events, the area dries or percolates and would not be hydrated for a sufficient duration to support a prevalence of hydrophytic vegetation, and would revert to upland vegetation. Based on USACE guidance, the feature would not qualify as waters of the United States because the area is artificially irrigated and would likely revert to upland vegetation if irrigation was to cease (U.S. Army Corps of Engineers 2011). However, because this area would be used as an access route access and staging would

be limited to the gravel road and disturbed areas, this area will be avoided and no direct impacts on this feature are expected. Implementation of BMPs and AMMs incorporated into the project would avoid indirect effects on this feature.

One roadside ditch occurs adjacent to the golf course in the eastern portion of the project area. Vegetation in the ditch is dominated by upland and facultative upland plant species including ripgut brome and poison hemlock (Photograph 14). Because the duration of inundation is insufficient to support a dominance of hydrophytic vegetation and the ditch does not exhibit evidence of hydrology that supports long-duration saturation or inundation (e.g., lacks water marks, drift lines, sediment deposits) to support wetland vegetation, the ditch does not qualify as a federal jurisdictional wetland (per 33 CFR 328.3). Additionally, the ditch does not exhibit evidence of scour or sediment deposition, which indicates that it is not subject to frequent or high-velocity flows. It also gradually loses depth, and terminates west and east of the golf course entrance, which is evidence that it is not tributary to waters of the United States or other water body features. Based on lack of wetland hydrology and hydrophytic vegetation, these ditches may collect water during storm events, but water either percolates or evaporates quickly. The ditch is not considered to qualify as waters of the United States because it: (1) is not a natural stream that has been altered; (2) was not excavated in waters of the United States; (3) does not have relatively permanent flowing or standing water; (4) does not connect two or more jurisdictional waters of the United States; and (5) does not drain natural water bodies (including wetlands) into the tributary system of a traditional navigable or interstate water (U.S. Army Corps of Engineers 2011).Although the USFWS National Wetlands Inventory identifies the entire project area as farmed wetlands, the existing access roads, the existing well pad, and the proposed TSF pad do not appear to currently meet wetland criteria. The existing access roads and the existing well pad consist of compacted surfaces that are graded and unvegetated; and do not exhibit evidence of long-duration ponding or saturation, or exhibit other indications of wetland hydrology. The proposed TSF pad expansion area currently supports a leveled and routinely disked agricultural field that is planted with a young walnut orchard. Field inspection of this area did not identify the presence of hydrophytic vegetation or evidence of soil inundation/saturation unrelated to routine irrigation. Based on observation of the water level in ponded portions of the irrigation ditch, the surface of the agricultural field is several feet above the water table. Given the lack of hydrophytic vegetation and an absence of indications of a current wetland hydrology, the existing access roads, the existing well pad, and the TSF pad are not considered to qualify as waters of the United States.

It is important to note that the field assessment did not involve a formal delineation using USACE methodology and no detailed investigations for wetland hydrology were conducted. The entire project area was historically Sacramento–San Joaquin Delta marshland prior to dikes/draining and conversion to agricultural production. Areas of agricultural production that were formerly wetlands may still qualify as jurisdictional wetlands if hydrological characteristics remain to the extent that hydrophytic vegetation would return if the agricultural activities ceased and the levees were breached. All determinations provided in this document concerning waters of the United States should be considered preliminary and tentative unless verified in writing by the USACE.

Other Sensitive Biological Resources

Migratory birds and raptors (i.e., birds of prey) protected under the federal Migratory Bird Treaty Act and California Fish and Game Code may nest on open ground, vegetation, or structures within the project area. Multiple stick nests and mud nests were observed during the field visits. Cliff swallow (*Petrochelidon pyrrhonota*) nests were observed under the Eight Mile Road Bridge over Bishop Cut.

As described for the Swainson's hawk, construction and operation activities could have adverse effects on nesting success for birds nesting near the construction site. Implementation of AMMs provided below would reduce the potential for adverse effects on nesting migratory birds and raptors. If work does not commence prior to the nesting season, preconstruction surveys for nesting birds should be conducted.

The project also occurs within a PG&E designated raptor concentration zone. Birds that perch or build nests on utility poles may become electrocuted if they come in contact with live wires. Raptors and other migratory birds utilize power poles to perch and build nests. As discussed in the project description, the distribution line would be built or retrofitted to avian protection specifications.

Wildlife corridors connect habitat that is separated by human activities. Wildlife corridors are important as they increase available habitat by providing protective passage between suitable habitat. Nursery habitat provides habitat elements necessary to raise young to maturity (e.g., caves, rookeries, wetland, rivers). Bishop Cut provides migratory, spawning, and rearing habitat for several fish species. The project would not occur within Bishop Cut and would not interfere with the movement of any native resident or migratory fish or wildlife species, with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites.

Tree removal required for the project is limited to removal of approximately 90 sapling-sized walnut trees in a portion of a walnut orchard. The walnut orchard is not considered a sensitive biological resource and the tree removal would not require authorization under, or conflict with, a tree ordinance.

The project area occurs within the San Joaquin County Multispecies Habitat Conservation and Open Space Plan (SJMSCP) planning area. The proposed project is not subject to discretionary approval by San Joaquin County, and as such would not conflict with the SJMSCP.

Recommended Avoidance and Minimization Measures:

1. Prior to working on any phase of the project, all workers will be provided with Environmental Awareness Training by a qualified biologist. The training will address the identification and general ecology of giant garter snake, Swainson's hawk, nesting birds and other special-status species that have potential to occur in the project area, and the AMMS to be implemented in order to avoid impacts on these resources. Areas to be avoided will also be addressed in the training. Please contact PG&E project biologist two weeks prior to construction to schedule the training.

2. Prior to construction of any phase of the project, all work areas (e.g., vehicle access, parking, staging) needed to complete the project will be identified in coordination with the monitoring biologist. Due to the presence of sensitive resources, some work areas may need to be adjusted. All work areas will be limited to the minimum area necessary to complete work. Laydown and staging will be limited to the road shoulder or previously developed or disturbed areas along the golf course.

3. Prior to constructing the TSF pad, high visibility fencing will be erected 20 feet beyond the proposed TSF pad to contain personnel and equipment. The Construction Contractor will inspect fencing before the start of each workday and the fencing will be maintained by the Contractor until completion of the project.

4. Because construction of the TSF pad will occur within 200 feet of aquatic habitat for giant garter snake in the irrigation ditch along the gravel access road, exclusionary fencing will be installed along the irrigation ditch on the west side of the road a minimum of 200 feet from the TSF pad in both directions to prohibit snake entry. Exclusionary fencing will be placed during the active period between (May 1 and October 1), so that the fence is erected before snakes move to upland refugia that may occur in the TSF pad. Snake exclusionary fencing will be buried at least six inches below the ground to prevent snakes from attempting to move under the fence. If burrows are present along the ditch, methods to hold the exclusionary fencing flush with the ground (e.g., sand or rock bags, pins) will be employed as appropriate to avoid damage to burrows. The fencing will not contain any holes along the ground large enough for snakes to enter the construction site. Fencing can be as high as 12 to 24 inches above ground.

5. Due to the temporary nature of pole installation along the irrigation ditches along the gravel access road and Eight Mile Road, and near the golf course ponds, exclusionary fencing is not required for the distribution line. However, a biological monitor will be present during all distribution line activities conducted within 200 feet of GGS aquatic habitat (i.e., irrigation ditches and golf course ponds). PG&E proposes to construct the section of distribution line located along the irrigation ditch near the TSF pad during the GGS active period.

6. To ensure that wildlife does not become trapped or entangled, no wattles or other materials with plastic monofilament netting are permitted. Burlap or coconut wattles are appropriate substitutes.

7. If practicable, ground disturbing activity (e.g. vegetation removal, compaction, placement of gravel fill, new pole placement) will be conducted during the active season for giant garter snake (i.e., between May 1 and October 1). If ground-disturbing activity cannot be conducted during the active season, preconstruction surveys for potential wintering sites (e.g., burrows and soils crevices) within proposed disturbance areas will be conducted by a qualified biologist approved by the USFWS and CDFW. The preconstruction survey will be conducted no more than two weeks prior to construction activities. All burrows or potential refuge habitat will be flagged and avoided. If work is suspended for a period of five days or greater, than the project area must be resurveyed for giant garter snake. If it is determined that potential giant garter snake wintering habitat (e.g., burrows and crevices) is present within areas planned for ground disturbance, ground-disturbing activities will be postponed until the giant garter snake active season (i.e., between May 1 and October 1).

8. A biological monitor approved by the USFWS and CDFW will be on site during all phases of construction to direct traffic and construction work around irrigation ditches and other sensitive habitats capable of supporting giant garter snake. Full-time monitoring will be employed during construction activities that require increase vehicle traffic and ground disturbance (i.e., TSF pad construction, distribution line development, access road maintenance, and mobilization/demobilization to escort large equipment). Part-time monitoring (1-2 days per week) will be employed during project activities limited to the well pad with limited traffic (i.e., well drilling and compression testing). The purpose of the part time monitor is to ensure that AMMs are in place and to meet the crews monitoring needs. The purpose of the part time monitor is to ensure that AMMs are in place and to meet the crews monitoring needs (e.g., access road maintenance monitoring, environmental awareness training for new crew members, mobilization/demobilization of large equipment or other unforeseeable need for a monitor). The

biological monitor will coordinate closely with construction personnel to ensure monitors are present during key construction activities.

9. If any giant garter snakes are observed within the project area during work activities, work will cease and the on-site project manager will immediately contact the PG&E project biologist subsequently the USFWS and CDFW will be contacted before work proceeds. The biological monitor has the authority to stop construction to resolve any biological concerns.

10. Access to the TSF pad and distribution line will be confined to existing roads, road shoulders, and other compacted areas. Travel along roads will be restricted to the centerline. If placement of gravel or grading on access roads is necessary, the placement will be limited to the existing road surface. No gravel will be placed on ditch banks or other areas that may support burrows that could be used by giant garter snake. No grading will occur along segments of existing roads that may support burrows that could be used by giant garter snake.

11. The irrigation ditches, golf course ponds, and Bishop Cut will be designated as environmentally sensitive areas and physical disturbance to these features will be avoided during construction.

12. A qualified biologist approved by USFWS and CDFW will perform a general pre-construction survey for special-status species and other wildlife within 72 hours of the start of project construction.

13. Portable lighting would only be used during construction when absolutely necessary for worker safety, or as necessary to accomplish critical construction equipment maintenance or time-critical continuous process tasks that extend into nighttime hours. When in operation the temporary flood lighting will be directed towards the work area to minimize illumination of areas beyond the immediate work areas, and minimize reflected glare and illumination of the nighttime sky to the maximum extent practicable. When not in immediate use the temporary floodlights will be directed downward or turned off.

14. Reduce construction night lighting on sensitive habitats. Exterior lighting within the project area adjacent to preserved habitat will be of the lowest illumination allowed for human safety, selectively placed, shielded, and directed away from sensitive habitat to the maximum extent practicable.

15. Provide escape ramps at a 45 degree angle or less for any excavations that are greater than one foot that are left open overnight. For smaller holes, cover so that no gaps occur and inspect each morning for wildlife. Inspect prior to filling any trenches or holes. If wildlife becomes entrapped, work will stop and the PG&E project biologist will be notified immediately to determine next steps.

16. Prior to moving parked vehicles or equipment, construction personnel will visually check for snakes and other wildlife.

17. Ground disturbance and vegetation removal will be limited to the minimum amount necessary to complete work.

18. If a plant or animal is found at the work site and is believed to be a protected species, work must STOP and a biological monitor must be contacted for guidance. Care will be taken not to harm the plant or animal species. No wildlife or plant species will be handled and/or removed from the site by anyone except qualified biologists.

19. Construction equipment will be maintained to prevent leaks of fuels, lubricants or other pollutants into aquatic habitats.

20. Whenever possible, refueling and maintenance of vehicles will occur offsite. In cases when this is not practicable, refueling and maintenance of vehicles and equipment will be conducted over drip pans and at least 100 feet from any waterway.

21. Open ends of pipes, conduits or other materials stored onsite will be covered to exclude wildlife and will be inspected prior to use.

22. Vehicular speed within the project area will be limited to 10 miles per hour in order avoid impacts on wildlife that may be located on or near roadways. If ground disturbing activities, addition of gravel to roads, or movement of large equipment (May 1–October 1), a biological monitor will drive in front of heavy construction vehicles (e.g., dump trucks, drill rigs) on all gravel roads during entry/exit of project site. Biologist will lead vehicles at a speed of 10 mph or less, watch for signs of snakes, and stop and investigate the road if there are any concerns.

23. Watering of roads during dry season work will be performed as necessary in order to reduce potential dust resulting from project associated traffic.

24. All potential nesting substrate (e.g., shrubs and trees) that requires removal to construct the project should be removed before the onset of the nesting season (i.e., prior to February 15), if practicable. This will help preclude nesting and substantially decrease the likelihood of direct impacts on nesting birds. If this is not feasible then a nesting bird survey of potential nesting substrate will be performed 72 hours prior to its removal.

25. Surveys for nesting birds will be required if project construction is to occur during the nesting season. Surveys will be conducted by a qualified biologist approved by USFWS and CDFW.

    Surveys for Swainson's hawk will be conducted within a 0.5-mile radius between March 1 and September 15, and follow guidance provided by the Swainson's Hawk Technical Advisory Committee (see Appendix E).

    Surveys for burrowing owl within suitable habitat will be conducted within 72 hours of the start of construction.

    Surveys for other nesting birds will consist of performing an initial survey after February 15, 2013 or within a month of the start of project date if project is to begin later in the nesting bird season. A second nesting bird survey will be performed within 72 hours of the start of construction. Surveys will be completed within a 250-foot buffer of the project area. The surveys will be repeated if work is suspended for five days or more. Please contact PG&E project biologist two weeks prior to construction schedule surveys.

26. Caution will be used when handling and/or storing chemicals (fuel, hydraulic fluid, etc.). As part of standard PG&E Best Management Practices (BMPs), crews will have appropriate materials on site to provide secondary containment and prevent and manage spills. If groundwater is encountered, contact the PG&E Environmental Specialist.

27. Crews will implement all BMPs outlined in the project's NPDES Construction Storm Water Pollution Prevention Plan.

28. If the scope of work or project location changes, contact PG&E project biologist prior to commencing work. The PG&E project biologist or Land Planner will contact the USFWS Bay-Delta Fish & Wildlife Office ESA/Regulatory Division and the Dept. of Fish & Wildlife - Bay Delta Region upon notice of any such changes.

29. Remove construction related trash from the site daily and upon work completion and return site to near pre-construction contours and conditions upon project completion.

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Representative Photographs
Photographs taken on August 20, 2012 and April 3, 2013



Photograph 1. Irrigation ditch south of TSF pad. Photograph taken August 20, 2012.



Photograph 2. Irrigation ditch near the TSF pad. Photograph taken April 3, 2013.



Photograph 3. Walnut orchard adjacent to TSF pad. Photograph taken August 20, 2012.



Photograph 4. TSF pad and access road. Photograph taken April 3, 2013.



Photograph 5. Existing core drilling pad. Photograph taken April 3, 2013.



Photograph 6. King Island Road looking south. Bishop Cut is on the left. Photograph taken August 20, 2012.



Photograph 7. Western pull location and work area at the intersection of King Island Road and Eight Mile Road. Photograph taken April 3, 2013.



Photograph 8. Irrigation ditch and drainage located at the western pull location and work area at the intersection of King Island Road and Eight Mile Road. Photograph taken April 3, 2013.



Photograph 9. Bishop Cut at Eight Mile Road Bridge. Swallow nests are present under the bridge. Photograph taken April 3, 2013.



Photograph 10. Eastern pull location and work area at the intersection of King Island Road and Eight Mile Road. Photograph taken April 3, 2013.



Photograph 11. Representative intermittent irrigation ditch. Ditch located in the eastern pull location work area. Photograph taken April 3, 2013.



Photograph 12. Ruderal area between the PG&E Eight Mile Road Substation and the golf course in the eastern portion of the project area. Photograph taken April 3, 2013.



Photograph 13. Small wetland area created by nuisance irrigation water. Wetland would not likely qualify as waters of the United States. Photograph taken July 17, 2013.



Photograph 14. Annual grassland located at the golf course entrance. Roadside ditch (beneath vegetation, red arrow) does not qualify as a waters of the United States. Photograph taken April 3, 2013.



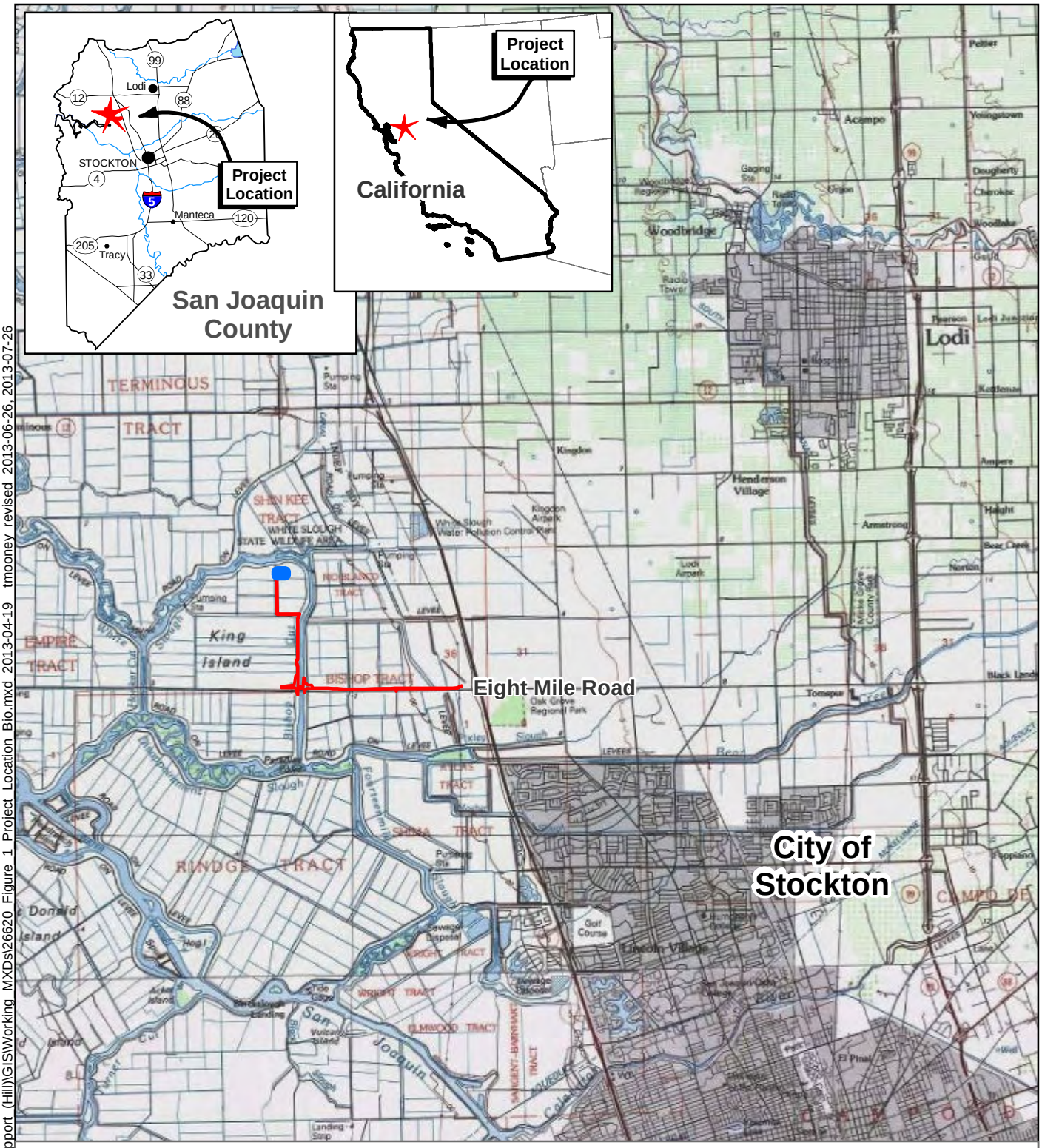
Photograph 15. Representative pond and berm on the golf course adjacent to the distribution corridor in the eastern portion of the project area. Photograph taken April 3, 2013.



Photograph 16. Representative irrigation ditch in the eastern portion of the project area along Eight Mile Road. Photograph taken April 3, 2013.

APPENDIX A

Figures



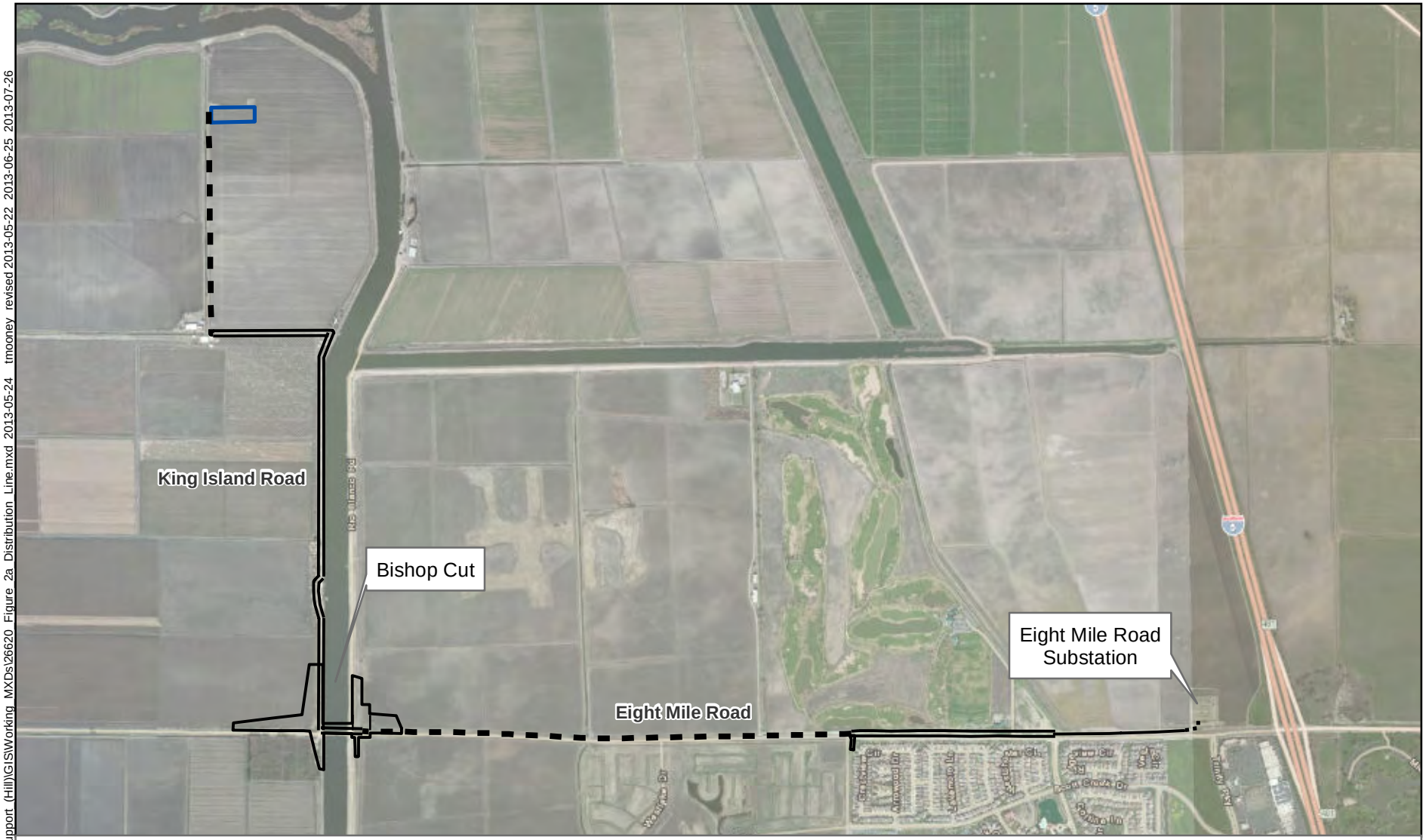
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USGS 7.5 Quad:
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PG&E CAES Project - King Island

Figure 1
Project Location

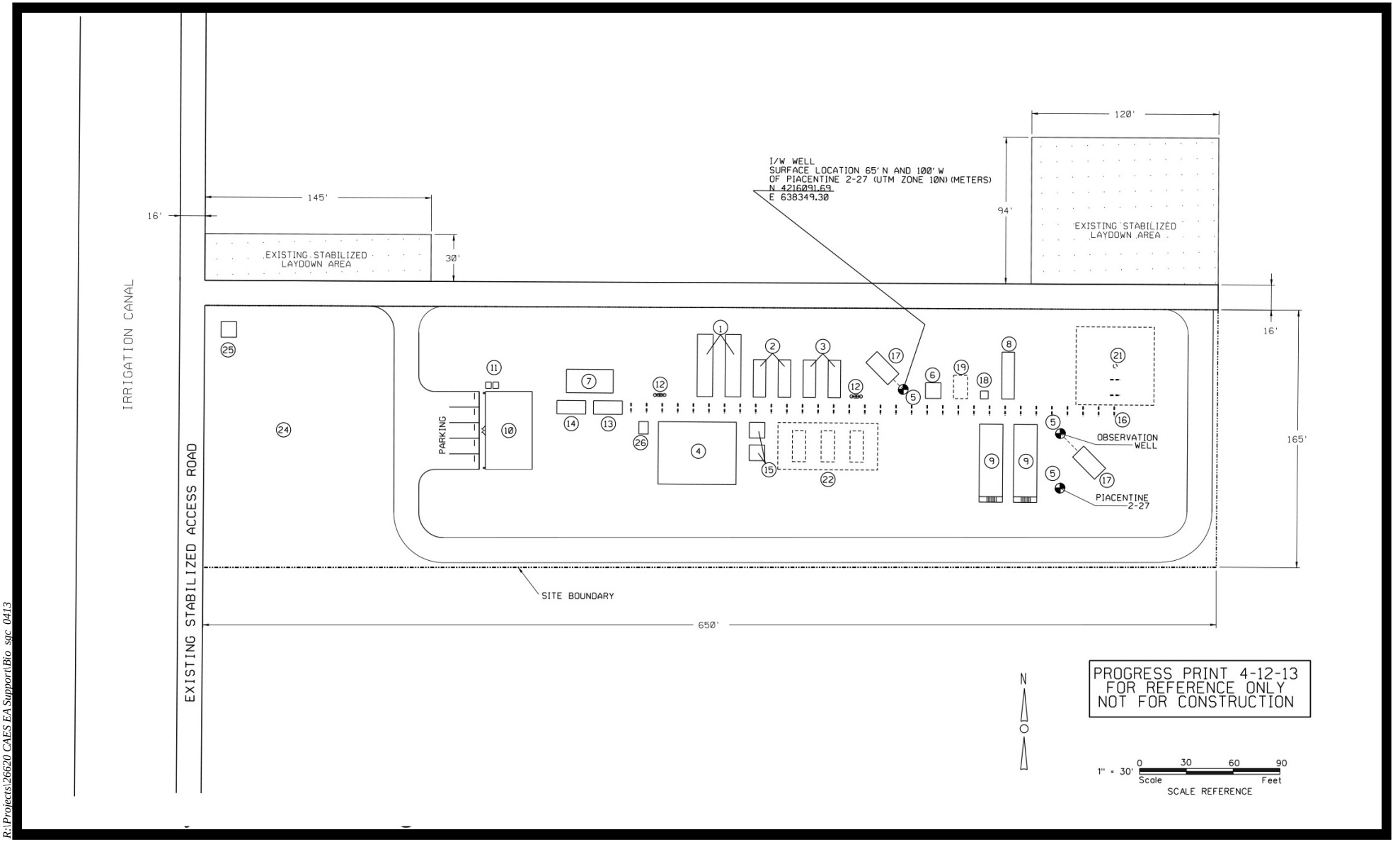


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PG&E CAES Project - King Island

Figure 2a
Distribution Line



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Figure 2b
Site Layout

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Gravel Access Road

White Slough

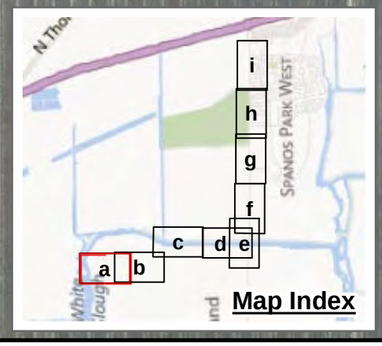
Study Area
Distribution Line
TSF Facility
Existing Well Pad
Culvert

Potential Waters of the U.S.
Irrigation Ditch
Perennial Stream

Vegetation Communities
Annual Grassland
Fresh Emergent Wetland
Orchard/Cropland
Riverine
Ruderal

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Feet

N



Map Index

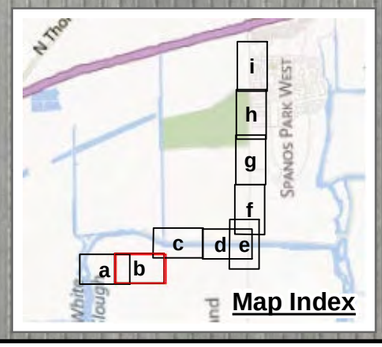
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PG&E CAES Project - King Island

Figure 3a
Survey Results
July 26, 2013

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Gravel Access Road



Study Area
Distribution Line
TSF Facility
Existing Well Pad
Culvert

Potential Waters of the U.S.
Irrigation Ditch
Perennial Stream

Vegetation Communities
Annual Grassland
Fresh Emergent Wetland
Orchard/Cropland
Riverine
Ruderal

200 0 200
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North State Resources, Inc.

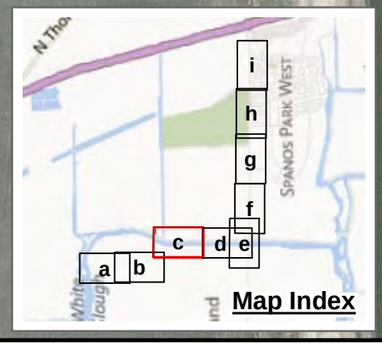
PG&E CAES Project - King Island

Figure 3b
Survey Results
July 26, 2013

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King Island Road

Bishop Cut



Study Area
Distribution Line
TSF Facility
Existing Well Pad
Culvert

Potential Waters of the U.S.
Irrigation Ditch
Perennial Stream

Vegetation Communities
Annual Grassland
Fresh Emergent Wetland
Orchard/Cropland
Riverine
Ruderal

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Feet

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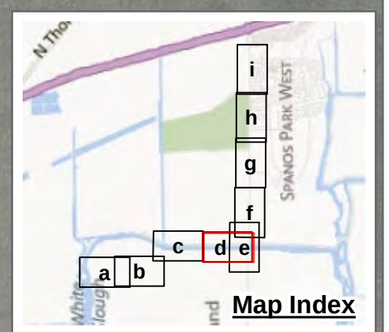
PG&E CAES Project - King Island

Figure 3c
Survey Results
July 26, 2013

King Island Road

Bishop Cut

Eight Mile Road



Study Area
Distribution Line
TSF Facility
Existing Well Pad
Culvert

Potential Waters of the U.S.
Irrigation Ditch
Perennial Stream

Vegetation Communities
Annual Grassland
Fresh Emergent Wetland
Orchard/Cropland
Riverine
Ruderal

200 0 200
Feet

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PG&E CAES Project - King Island

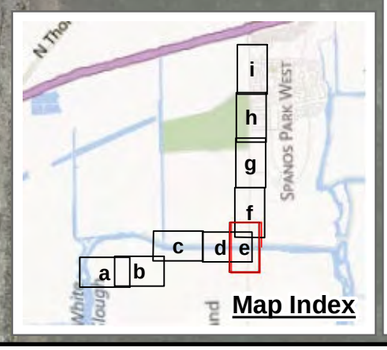
Figure 3d
Survey Results
July 26, 2013

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King Island Road

Eight Mile Road

Bishop Cut



Study Area
Distribution Line
TSF Facility
Existing Well Pad
Culvert

Potential Waters of the U.S.
Irrigation Ditch
Perennial Stream

Vegetation Communities
Annual Grassland
Fresh Emergent Wetland
Orchard/Cropland
Riverine
Ruderal

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Feet

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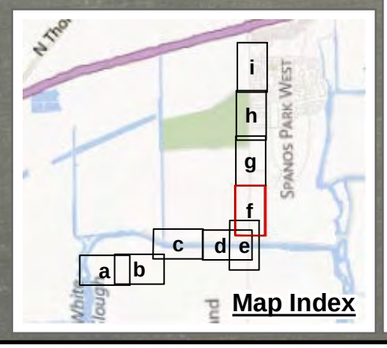
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PG&E CAES Project - King Island

Figure 3e
Survey Results
July 26, 2013

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Eight Mile Road



Study Area
Distribution Line
TSF Facility
Existing Well Pad
Culvert

Potential Waters of the U.S.
Irrigation Ditch
Perennial Stream

Vegetation Communities
Annual Grassland
Fresh Emergent Wetland
Orchard/Cropland
Riverine
Ruderal

200 0 200
Feet

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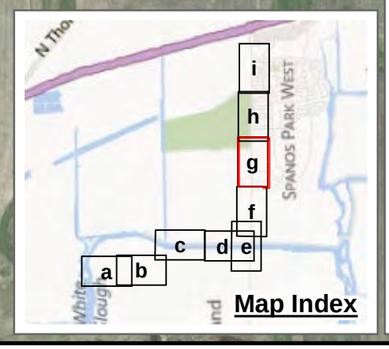
North State Resources, Inc.

PG&E CAES Project - King Island

Figure 3f
Survey Results
July 26, 2013

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Eight Mile Road



Study Area
Distribution Line
TSF Facility
Existing Well Pad
Culvert

Potential Waters of the U.S.
Irrigation Ditch
Perennial Stream

Vegetation Communities
Annual Grassland
Fresh Emergent Wetland
Orchard/Cropland
Riverine
Ruderal

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Feet

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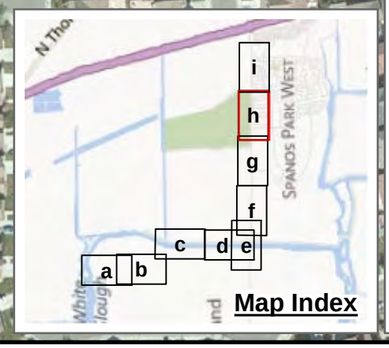
North State Resources, Inc.

PG&E CAES Project - King Island

Figure 3g
Survey Results
July 26, 2013

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Eight Mile Road



Study Area
Distribution Line
TSF Facility
Existing Well Pad
Culvert

Potential Waters of the U.S.
Irrigation Ditch
Perennial Stream

Vegetation Communities
Annual Grassland
Fresh Emergent Wetland
Orchard/Cropland
Riverine
Ruderal

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Feet
N

North State Resources, Inc.

PG&E CAES Project - King Island

Figure 3h
Survey Results
July 26, 2013

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PG&E Eight Mile Substation

Eight Mile Road

Map Index

Study Area
Distribution Line
TSF Facility
Existing Well Pad
Culvert

Potential Waters of the U.S.
Irrigation Ditch
Perennial Stream

Vegetation Communities
Annual Grassland
Fresh Emergent Wetland
Orchard/Cropland
Riverine
Ruderal

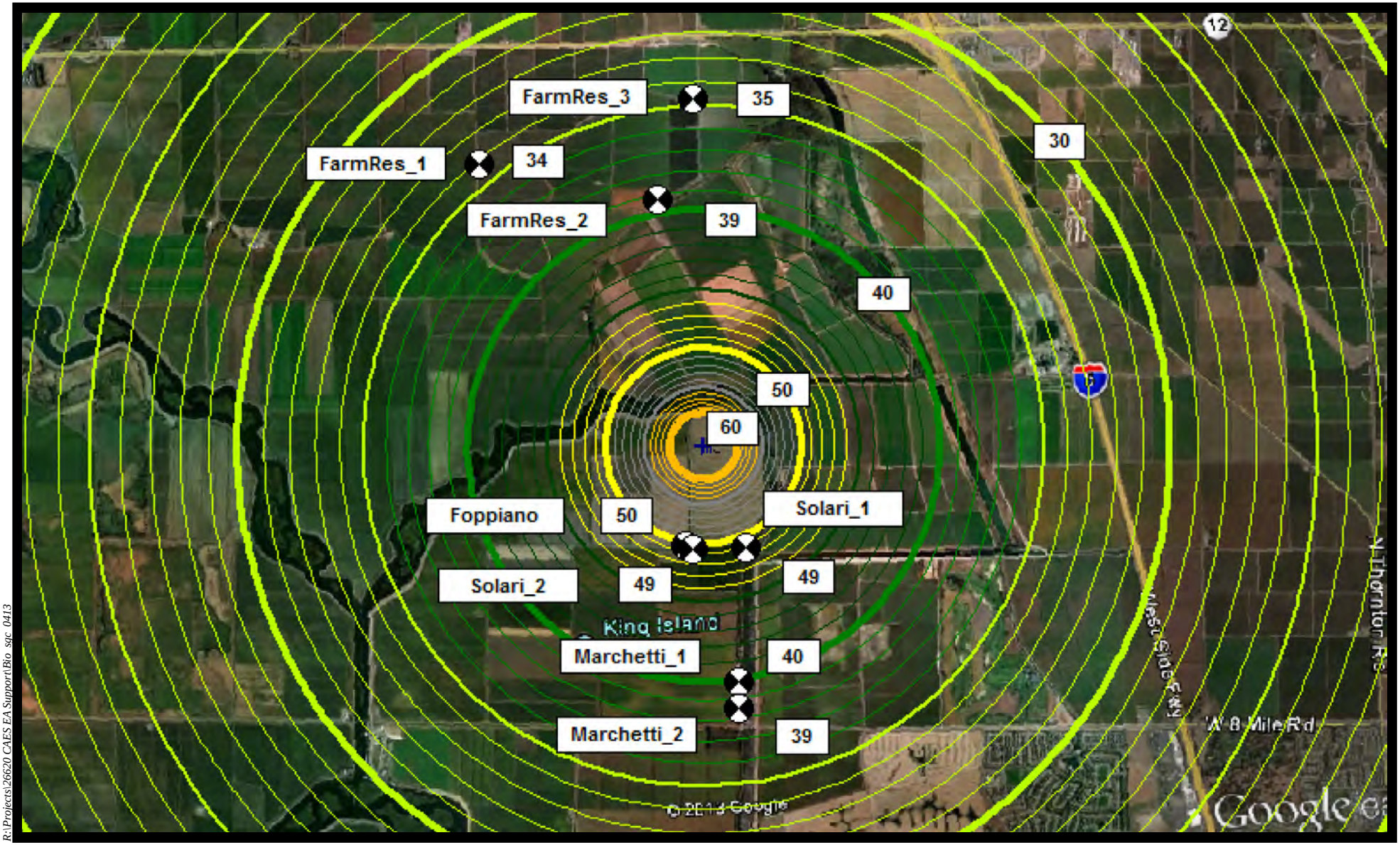
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North State Resources, Inc.

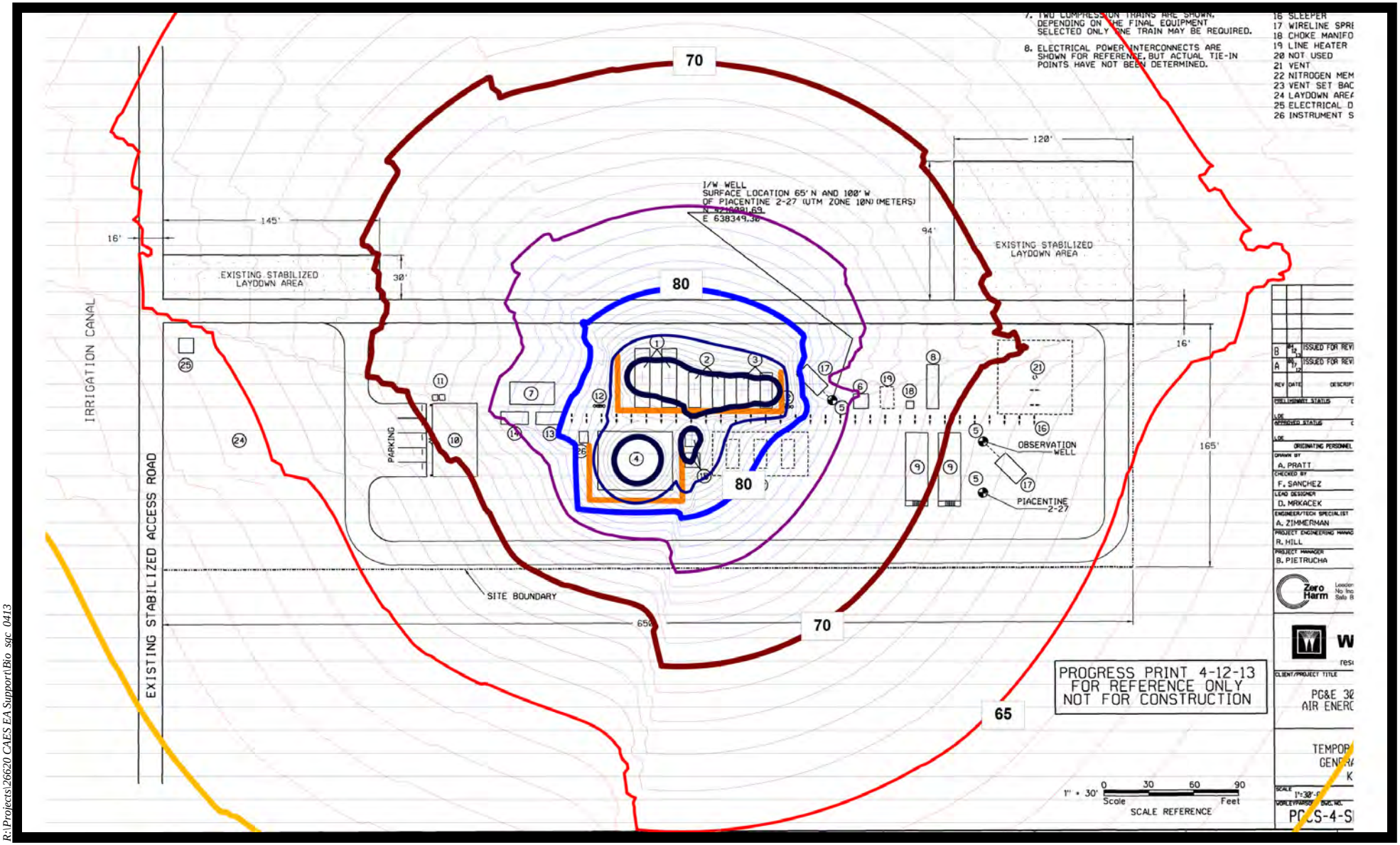
PG&E CAES Project - King Island

Figure 3i
Survey Results
July 26, 2013



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Figure 4a
Noise Contours with Mitigation



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Figure 4b
Noise Contours at TSF Pad with Mitigation

APPENDIX B

USFWS, CNDDB, and CNPS Queries

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825

April 19, 2013

Document Number: 130419063611

Heather L. Kelly
North State Resources
5000 Bechelli Lane Ste 203
Redding, ca 96002

Subject: Species List for CAES Project

Dear: Ms. Kelly

We are sending this official species list in response to your April 19, 2013 request for information about endangered and threatened species. The list covers the California counties and/or U.S. Geological Survey 7½ minute quad or quads you requested.

Our database was developed primarily to assist Federal agencies that are consulting with us. Therefore, our lists include all of the sensitive species that have been found in a certain area *and also ones that may be affected by projects in the area*. For example, a fish may be on the list for a quad if it lives somewhere downstream from that quad. Birds are included even if they only migrate through an area. In other words, we include all of the species we want people to consider when they do something that affects the environment.

Please read Important Information About Your Species List (below). It explains how we made the list and describes your responsibilities under the Endangered Species Act.

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be July 18, 2013.

Please contact us if your project may affect endangered or threatened species or if you have any questions about the attached list or your responsibilities under the Endangered Species Act. A list of Endangered Species Program contacts can be found here.

Endangered Species Division

TAKE PRIDE IN AMERICA

U.S. Fish & Wildlife Service

Sacramento Fish & Wildlife Office

Federal Endangered and Threatened Species that Occur in or may be Affected by Projects in the Counties and/or U.S.G.S. 7 1/2 Minute Quads you requested

Document Number: 130419063611

Database Last Updated: September 18, 2011

Quad Lists

Listed Species

Invertebrates

Branchinecta lynchi
vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus
valley elderberry longhorn beetle (T)

Lepidurus packardi
vernal pool tadpole shrimp (E)

Fish

Acipenser medirostris
green sturgeon (T) (NMFS)

Hypomesus transpacificus
Critical habitat, delta smelt (X)
delta smelt (T)

Oncorhynchus mykiss
Central Valley steelhead (T) (NMFS)
Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha
Central Valley spring-run chinook salmon (T) (NMFS)
winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Ambystoma californiense
California tiger salamander, central population (T)

Rana draytonii
California red-legged frog (T)

Reptiles

Thamnophis gigas
giant garter snake (T)

Mammals

Sylvilagus bachmani riparius
riparian brush rabbit (E)

Quads Containing Listed, Proposed or Candidate Species:

TERMINOUS (479C)

County Lists

No county species lists requested.

Key:

(E) *Endangered* - Listed as being in danger of extinction.

(T) *Threatened* - Listed as likely to become endangered within the foreseeable future.

(T) *Threatened* - Listed as likely to become endangered within the foreseeable future.
(P) *Proposed* - Officially proposed in the Federal Register for listing as endangered or threatened.
(NMFS) Species under the Jurisdiction of the National Oceanic & Atmospheric Administration Fisheries Service. Consult with them directly about these species.
Critical Habitat - Area essential to the conservation of a species.
(PX) *Proposed Critical Habitat* - The species is already listed. Critical habitat is being proposed for it.
(C) *Candidate* - Candidate to become a proposed species.
(V) Vacated by a court order. Not currently in effect. Being reviewed by the Service.
(X) *Critical Habitat* designated for this species

Important Information About Your Species List

How We Make Species Lists

We store information about endangered and threatened species lists by U.S. Geological Survey 7½ minute quads. The United States is divided into these quads, which are about the size of San Francisco.

The animals on your species list are ones that occur within, **or may be affected by** projects within, the quads covered by the list.

- Fish and other aquatic species appear on your list if they are in the same watershed as your quad or if water use in your quad might affect them.
- Amphibians will be on the list for a quad or county if pesticides applied in that area may be carried to their habitat by air currents.
- Birds are shown regardless of whether they are resident or migratory. Relevant birds on the county list should be considered regardless of whether they appear on a quad list.

Plants

Any plants on your list are ones that have actually been observed in the area covered by the list. Plants may exist in an area without ever having been detected there. You can find out what's in the surrounding quads through the California Native Plant Society's online Inventory of Rare and Endangered Plants.

Surveying

Some of the species on your list may not be affected by your project. A trained biologist and/or botanist, familiar with the habitat requirements of the species on your list, should determine whether they or habitats suitable for them may be affected by your project. We recommend that your surveys include any proposed and candidate species on your list. See our Protocol and Recovery Permits pages.

For plant surveys, we recommend using the Guidelines for Conducting and Reporting Botanical Inventories. The results of your surveys should be published in any environmental documents prepared for your project.

Your Responsibilities Under the Endangered Species Act

All animals identified as listed above are fully protected under the Endangered Species Act of 1973, as amended. Section 9 of the Act and its implementing regulations prohibit the take of a federally listed wildlife species. Take is defined by the Act as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" any such animal.

> Take may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or shelter (50 CFR §17.3).

Take incidental to an otherwise lawful activity may be authorized by one of two procedures:

- If a Federal agency is involved with the permitting, funding, or carrying out of a project that may result in take, then that agency must engage in a formal consultation with the Service.

  During formal consultation, the Federal agency, the applicant and the Service work together to avoid or minimize the impact on listed species and their habitat. Such consultation would result in a biological opinion by the Service addressing the anticipated effect of the project on listed and proposed species. The opinion may authorize a limited level of incidental take.

- If no Federal agency is involved with the project, and federally listed species may be taken as part of the project, then you, the applicant, should apply for an incidental take permit. The Service may issue such a permit if you submit a satisfactory conservation plan for the species that would be affected by your project.

  Should your survey determine that federally listed or proposed species occur in the area and are likely to be affected by the project, we recommend that you work with this office and the California Department of Fish and Game to develop a plan that minimizes the project's direct and indirect impacts to listed species and compensates for project-related loss of habitat. You should include the plan in any environmental documents you file.

Critical Habitat

When a species is listed as endangered or threatened, areas of habitat considered essential to its conservation may be designated as critical habitat. These areas may require special management considerations or protection. They provide needed space for growth and normal behavior; food, water, air, light, other nutritional or physiological requirements; cover or shelter; and sites for breeding, reproduction, rearing of offspring, germination or seed dispersal.

Although critical habitat may be designated on private or State lands, activities on these lands are not restricted unless there is Federal involvement in the activities or direct harm to listed wildlife.

If any species has proposed or designated critical habitat within a quad, there will be a separate line for this on the species list. Boundary descriptions of the critical habitat may be found in the Federal Register. The information is also reprinted in the Code of Federal Regulations (50 CFR 17.95). See our Map Room page.

Candidate Species

We recommend that you address impacts to candidate species. We put plants and animals on our candidate list when we have enough scientific information to eventually propose them for listing as threatened or endangered. By considering these species early in your planning process you may be able to avoid the problems that could develop if one of these candidates was listed before the end of your project.

Species of Concern

The Sacramento Fish & Wildlife Office no longer maintains a list of species of concern. However, various other agencies and organizations maintain lists of at-risk species. These lists provide essential information for land management planning and conservation efforts. More info

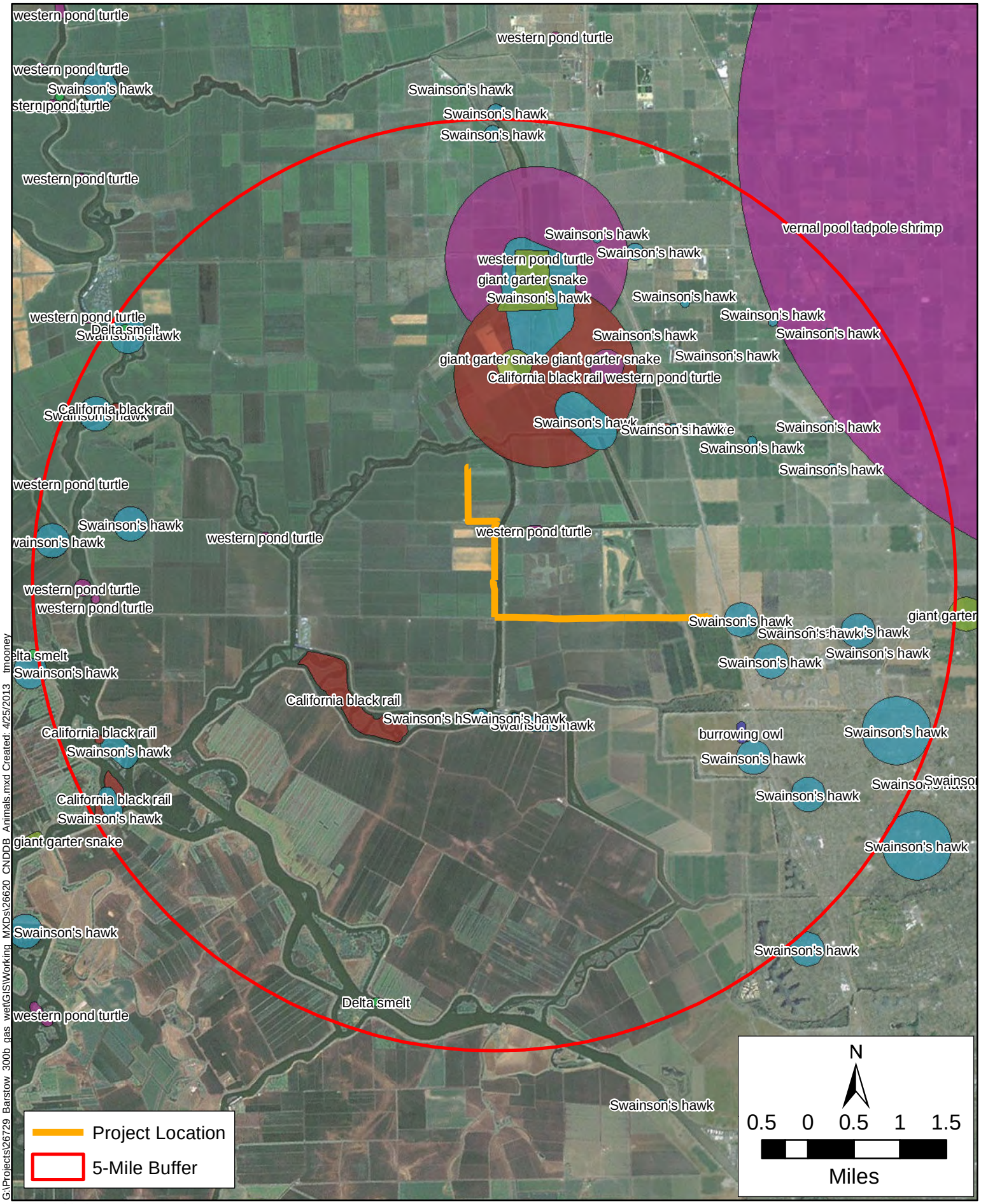
Wetlands

If your project will impact wetlands, riparian habitat, or other jurisdictional waters as defined by section 404 of the Clean Water Act and/or section 10 of the Rivers and Harbors Act, you will need to obtain a permit from the U.S. Army Corps of Engineers. Impacts to wetland

habitats require site specific mitigation and monitoring. For questions regarding wetlands, please contact Mark Littlefield of this office at (916) 414-6520.

Updates

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be July 18, 2013.

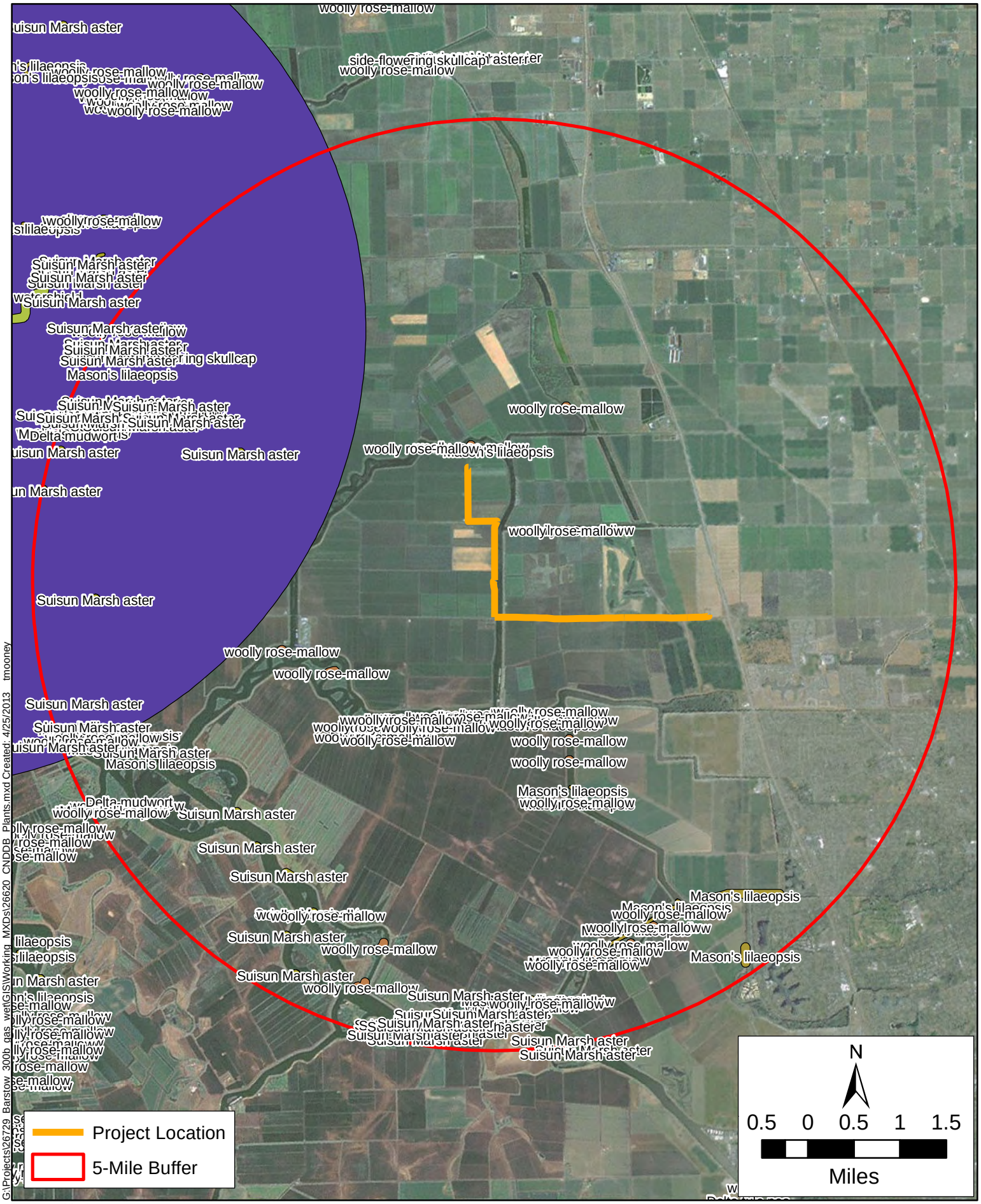


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North State Resources, Inc.

CAES PDEA - King Island

Animal CNDDB Results



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North State Resources, Inc.

CAES PDEA - King Island

Plants CNDDB Results

CNDDB 5-Mile Radius, April 23, 2013

SNAME	CNAME	FEDLIST	CALLIST	RPLANTRANK
Athene cunicularia	**burrowing owl**	None	**None**	
Buteo swainsoni	**Swainson's hawk**	None	**Threatened**	
Elanus leucurus	**white-tailed kite**	None	**None**	
Emys marmorata	**western pond turtle**	None	**None**	
Hibiscus lasiocarpos var. occidentalis	**woolly rose-mallow**	None	**None**	1B.2
Hypomesus transpacificus	**Delta smelt**	Threatened	**Endangered**	
Laterallus jamaicensis coturniculus	**California black rail**	None	**Threatened**	
Lathyrus jepsonii var. jepsonii	**Delta tule pea**	None	**None**	1B.2
Lepidurus packardi	**vernal pool tadpole shrimp**	Endangered	**None**	
Lilaeopsis masonii	**Mason's lilaeopsis**	None	**Rare**	1B.1
Limosella australis	**Delta mudwort**	None	**None**	2.1
Scutellaria lateriflora	**side-flowering skullcap**	None	**None**	2.2
Symphyotrichum lentum	**Suisun Marsh aster**	None	**None**	1B.2
Thamnophis gigas	**giant garter snake**	Threatened	**Threatened**	
Grand Total				

CNPS Inventory of Rare and Endangered Plants

Status: Plant Press Manager window with 25 items - Fri, Apr. 19, 2013 20:46 ET c

Reformat list as: Standard List - with Plant Press controls

ECOLOGICAL REPORT

scientific	family	life form	blooming	communities	elevation	CNPS
Astragalus tener var. tener	Fabaceae	annual herb	Mar-Jun	•Playas (Plyas) •Valley and foothill grassland (VFGrs) (adobe clay) •Vernal pools (VnPls)/alkaline	1 - 60 meters	List 1B.2
Atriplex cordulata var. cordulata	Chenopodiaceae	annual herb	Apr-Oct	•Chenopod scrub (ChScr) •Meadows and seeps (Medws) •Valley and foothill grassland (VFGrs) (sandy)/saline or alkaline	0 - 560 meters	List 1B.2
Atriplex joaquinana	Chenopodiaceae	annual herb	Apr-Oct	•Chenopod scrub (ChScr) •Meadows and seeps (Medws) •Playas (Plyas) •Valley and foothill grassland (VFGrs)/alkaline	1 - 835 meters	List 1B.2
Blepharizonia plumosa	Asteraceae	annual herb	Jul-Oct	•Valley and foothill grassland (VFGrs)/Usually clay.	30 - 505 meters	List 1B.1
Brasenia schreberi	Cabombaceae	perennial rhizomatous herb aquatic	Jun-Sep	•Marshes and swamps (MshSw)/freshwater	30 - 2200 meters	List 2.3
California macrophylla	Geraniaceae	annual herb	Mar-May	•Cismontane woodland (CmWld) •Valley and foothill grassland (VFGrs)/clay	15 - 1200 meters	List 1B.1
Carex comosa	Cyperaceae	perennial rhizomatous herb	May-Sep	•Coastal prairie (CoPrr) •Marshes and swamps (MshSw) (lake margins) •Valley and foothill grassland (VFGrs)	0 - 625 meters	List 2.1
Chloropyron palmatum	Orobanchaceae	annual herb hemiparasitic	May-Oct	•Chenopod scrub (ChScr) •Valley and foothill grassland (VFGrs)/alkaline	5 - 155 meters	List 1B.1
Cirsium	Asteraceae	annual/perennial	May-Aug	•Chenopod scrub (ChScr) •Marshes and	3 - 100	List

crassicaule	Asteraceae	herb	May-Aug	swamps (MshSw) (sloughs) •Riparian scrub (RpScr)	meters	1B.1
Delphinium recurvatum	Ranunculaceae	perennial herb	Mar-Jun	•Chenopod scrub (ChScr) •Cismontane woodland (CmWld) •Valley and foothill grassland (VFGrs)/alkaline	3 - 790 meters	List 1B.2
Downingia pusilla	Campanulaceae	annual herb	Mar-May	•Valley and foothill grassland (VFGrs) (mesic) •Vernal pools (VnPls)	1 - 445 meters	List 2.2
Eryngium racemosum	Apiaceae	annual/perennial herb	Jun-Oct	•Riparian scrub (RpScr)(vernally mesic clay depressions)	3 - 30 meters	List 1B.1
Eschscholzia rhombipetala	Papaveraceae	annual herb	Mar-Apr	•Valley and foothill grassland (VFGrs) (alkaline, clay)	0 - 975 meters	List 1B.1
Gratiola heterosepala	Plantaginaceae	annual herb	Apr-Aug	•Marshes and swamps (MshSw) (lake margins) •Vernal pools (VnPls)/clay	10 - 2375 meters	List 1B.2
Hibiscus lasiocarpos var. occidentalis	Malvaceae	perennial rhizomatous herb emergent	Jun-Sep	•Marshes and swamps (MshSw) (freshwater)	0 - 120 meters	List 1B.2
Lathyrus jepsonii var. jepsonii	Fabaceae	perennial herb	May-Jul(Sep), Months in parentheses are uncommon.	•Marshes and swamps (MshSw) (freshwater and brackish)	0 - 4 meters	List 1B.2
Lilaeopsis masonii	Apiaceae	perennial rhizomatous herb	Apr-Nov	•Marshes and swamps (MshSw) (brackish or freshwater) •Riparian scrub (RpScr)	0 - 10 meters	List 1B.1
Limosella australis	Scrophulariaceae	perennial stoloniferous herb	May-Aug	•Marshes and swamps (MshSw) (freshwater or brackish) •Riparian scrub (RpScr)/Usually mud banks	0 - 3 meters	List 2.1
Madia radiata	Asteraceae	annual herb	Mar-May	•Cismontane woodland (CmWld) •Valley and foothill grassland (VFGrs)	25 - 1215 meters	List 1B.1
Sagittaria sanfordii	Alismataceae	perennial rhizomatous herb emergent	May-Oct	•Marshes and swamps (MshSw) (assorted shallow freshwater)	0 - 650 meters	List 1B.2

				freshwater)		
Scutellaria galericulata	Lamiaceae	perennial rhizomatous herb	Jun-Sep	•Lower montane coniferous forest (LCFrs) •Meadows and seeps (Medws) (mesic) •Marshes and swamps (MshSw)	0 - 2100 meters	List 2.2
Scutellaria lateriflora	Lamiaceae	perennial rhizomatous herb	Jul-Sep	•Meadows and seeps (Medws) (mesic) •Marshes and swamps (MshSw)	0 - 500 meters	List 2.2
Symphyotrichum lentum	Asteraceae	perennial rhizomatous herb	May-Nov	•Marshes and swamps (MshSw) (brackish and freshwater)	0 - 3 meters	List 1B.2
Trichocoronis wrightii var. wrightii	Asteraceae	annual herb	May-Sep	•Meadows and seeps (Medws) •Marshes and swamps (MshSw) •Riparian forest (RpFrs) •Vernal pools (VnPls)/alkaline	5 - 435 meters	List 2.1
Tropidocarpum capparideum	Brassicaceae	annual herb	Mar-Apr	•Valley and foothill grassland (VFGrs) (alkaline hills)	1 - 455 meters	List 1B.1

APPENDIX C

Regional Special-Status Species Review

Table 1. Special-Status Species with Potential to Occur in the Project Area, Impacts Analysis, and Avoidance and Minimization Measures

Common Name Scientific Name	Listing Status[1] (Fed/State)	Habitat Requirements	Potential for Significant Impact	Avoidance and Minimization Measures
Delta smelt *Hypomesus transpacificus*	T/T	Estuarine systems in the Sacramento-San Joaquin Delta.	No. Bishop Cut provides spawning habitat for this species and is designated critical habitat. Because the road is paved, no additional roadwork on levee road is anticipated, and work areas used to span Bishop Cut would be 190 feet from surface water on the down-slope side opposite of Bishop Cut, effects from silting, fill or spills are not expected.	Water quality BMPs
Central Valley steelhead DPS *Oncorhynchus mykiss*	T/—	Spawns in cool, moderately fast flowing water with gravel bottom.	No. Bishop Cut provides migratory habitat for this species and is designated critical habitat. Because the road is paved, no additional roadwork on levee road is anticipated, and work areas used to span Bishop Cut would be 190 feet from surface water on the down-slope side opposite of Bishop Cut, effects from silting, fill or spills are not expected.	Water quality BMPs
Winter-run Chinook salmon ESU *Oncorhynchus tshawytscha*	E/E	Spawn and rear in main-stem Sacramento River. Require cool year-round water temperatures, since spawning occurs during the summer. Requires deep pools and riffles, and clean gravel and cobble substrate to spawn.	No. Bishop Cut provides migratory habitat for this species. Because the road is paved, no additional roadwork on levee road is anticipated, and work areas used to span Bishop Cut would be 190 feet from surface water on the down-slope side opposite of Bishop Cut, effects from silting, fill or spills are not expected.	Water quality BMPs

Table 1. Special-Status Species with Potential to Occur in the Project Area, Impacts Analysis, and Avoidance and Minimization Measures

Common Name Scientific Name	Listing Status[1] (Fed/State)	Habitat Requirements	Potential for Significant Impact	Avoidance and Minimization Measures
Central Valley spring-run Chinook salmon ESU *Oncorhynchus tshawytscha*	T/T	Cool streams that reach the ocean and that have shallow, partly shaded pools and clear-water depression pools.	No. Bishop Cut provides migratory habitat for this species. Because the road is paved, no additional roadwork on levee road is anticipated, and work areas used to span Bishop Cut would be 190 feet from surface water on the down-slope side opposite of Bishop Cut, effects from silting, fill or spills are not expected.	Water quality BMPs
Green sturgeon, southern DPS *Acipenser medirostris*	T/SC	DPS includes green sturgeon that spawn in rivers south of the Eel River and includes the Sacramento-San Joaquin Delta. Preferred spawning substrate is large cobble, but can range from clean sand to bedrock.	No. Bishop Cut provides migratory habitat for this species and is designated critical habitat. Because the road is paved, no additional roadwork on levee road is anticipated, and work areas used to span Bishop Cut would be 190 feet from surface water on the down-slope side opposite of Bishop Cut, effects from silting, fill or spills are not expected.	Water quality BMPs
Longfin smelt San Francisco Bay-Delta DPS *Spirinchus thaleichthys*	C/SC	Sloughs of Suisun Bay and Delta.	No. Bishop Cut provides spawning habitat for this species. Because the road is paved, no additional roadwork on levee road is anticipated, and work areas used to span Bishop Cut would be 190 feet from surface water on the down-slope side opposite of Bishop Cut, effects from silting, fill or spills are not expected.	Water quality BMPs

Table 1. Special-Status Species with Potential to Occur in the Project Area, Impacts Analysis, and Avoidance and Minimization Measures

Common Name Scientific Name	Listing Status[1] (Fed/State)	Habitat Requirements	Potential for Significant Impact	Avoidance and Minimization Measures
Central Valley fall/late fall-run Chinook salmon ESU *Oncorhynchus tshawytscha*	SC/SC	Spawn and rear in main-stem Sacramento River and suitable perennial tributaries. Spawn and rear in main-stem Sacramento River and suitable perennial tributaries. Requires cool water temperatures for spawning, egg-incubation and juvenile rearing. Spawn in riffles with gravel and cobble.	No. Bishop Cut provides migratory habitat for this species. Because the road is paved, no additional roadwork on levee road is anticipated, and work areas used to span Bishop Cut would be 190 feet from surface water on the down-slope side opposite of Bishop Cut, effects from silting, fill or spills are not expected.	Water quality BMPs
Sacramento splittail *Pogonichthys macrolepidotus*	—/SC	Shallow, dead-end sloughs with submerged vegetation.	No. Bishop Cut provides spawning habitat for this species. Because the road is paved, no additional roadwork on levee road is anticipated, and work areas used to span Bishop Cut would be 190 feet from surface water on the down-slope side opposite of Bishop Cut, effects from silting, fill or spills are not expected.	Water quality BMPs
River lamprey *Lampetra ayresi*	—/SC	Anadromous fish found in rivers from San Francisco Bay watershed north to Alaska. Spawn in similar habitat as salmon.	No. Bishop Cut provides migratory habitat for this species. Because the road is paved, no additional roadwork on levee road is anticipated, and work areas used to span Bishop Cut would be 190 feet from surface water on the down-slope side opposite of Bishop Cut, effects from silting, fill or spills are not expected.	Water quality BMPs

Table 1. Special-Status Species with Potential to Occur in the Project Area, Impacts Analysis, and Avoidance and Minimization Measures

Common Name Scientific Name	Listing Status[1] (Fed/State)	Habitat Requirements	Potential for Significant Impact	Avoidance and Minimization Measures
California red-legged frog *Rana draytonii*	T/SC	Require aquatic habitat for breeding, also uses a variety of other habitat types including riparian and upland areas. Adults prefer dense, shrubby or emergent vegetation associated with deep-water pools with fringes of cattails and dense stands of overhanging vegetation. This species also breeds in ephemeral ponds that support little or no vegetation.	No. The project is outside the current known range (CWHR) of this species and there are no CNDDB reports within 5 miles of the project area. Additionally, the California red-legged frog recovery plan concludes that CRLF is extirpated from the valley floor (U.S. Fish and Wildlife Service 2002). This species is not expected to occur in the project area.	None required.
Giant garter snake *Thamnophis gigas*	T/T	Freshwater marshes and low gradient streams with emergent vegetation. Adapted to drainage canals and irrigation ditches with mud substrate.	Low. Perennially inundated irrigation ditches, golf course ponds, and associated uplands within the project area provide potential habitat. An extant population occurs within the Coldani Marsh-White Slough area approximately 1.7 miles to the northeast of the TSF pad and 3.5 miles north of the distribution line along the southern portion of the golf course. This population is connected by a series of irrigation ditches and golf course ponds within the project area. Ground disturbance activities that disrupt burrows could adversely affect this species. Because giant garter snakes are absent from larger rivers, it is not anticipated that Bishop Cut would provide habitat for this species (Miller et al. 1999).	Pre-construction surveys Biological monitor Water quality BMPs Maintain speed limits less than 10 mph.

Table 1. Special-Status Species with Potential to Occur in the Project Area, Impacts Analysis, and Avoidance and Minimization Measures

Common Name Scientific Name	Listing Status[1] (Fed/State)	Habitat Requirements	Potential for Significant Impact	Avoidance and Minimization Measures
Western pond turtle *Emys marmorata*	—/SC	Slow water aquatic habitat with available basking sites. Hatchlings require shallow water with dense submergent or short emergent vegetation. Requires an upland oviposition site near the aquatic site.	Low. Perennially inundated irrigation ditches and the ponds at the golf course north of Eight Mile Road provide aquatic habitat. Pond habitat and adjacent uplands provide aquatic and upland nesting habitat. The nearest CNDDB record to suitable aquatic habitat is 1.2 miles northwest of the golf course ponds. Although ditches in the project area are perennial, and contain fresh emergent vegetation, the banks are steep and do not contain available basking sites. Ditches are actively maintained which likely precludes occupation by pond turtles. Additionally, upland breeding sites are unavailable in the cropland habitat. Due to lack of basking habitat and upland nesting sites, pond turtles are unlikely to occur in the agricultural portions of the project area.	Pre-construction surveys Avoidance measures Maintain speed limits below 10 mph
California black rail *Laterallus jamaicensis coturniculus*	—/T, FP	Coastal and inland marsh habitat.	No. Marsh habitat suitable for this species is absent from the project area and no impacts are expected.	None required
Swainson's hawk *Buteo swainsoni*	--/T	Breeds in stands with few trees in juniper-sage flats, riparian areas, and oak savannah; forages in adjacent livestock pasture, grassland or grain fields.	Low. Larger trees and stands of trees occurring within 0.5 mile of the project area provide potential nesting habitat for Swainson's hawk. There are sixteen recorded CNDDB occurrences of nesting Swainson's hawk within 5 miles of the project area with the nearest approximately 1 mile south of the project area. Surveys and monitoring associated with the CAES coring phase did not detect nesting during the 2013-nesting season (North State Resources 2013). Noise generated by project activities could disrupt nesting behavior and nest success if Swainson's hawks are nesting within 0.25 mile of the project area.	Pre-construction surveys if work is expected to occur during nesting season (March 1 to September 15)

Table 1. Special-Status Species with Potential to Occur in the Project Area, Impacts Analysis, and Avoidance and Minimization Measures

Common Name Scientific Name	Listing Status[1] (Fed/State)	Habitat Requirements	Potential for Significant Impact	Avoidance and Minimization Measures
White-tailed kite *Elanus leucurus*	—/FP	Nests in tall shrubs and trees, forages in grasslands, agricultural fields and marshes.	Low. Isolated trees and shrubs near proposed access roads and existing farm facilities provide potential nesting habitat for this species.	Pre-construction surveys if work is expected to occur during nesting season (February 15–August 31)
Northern harrier *Circus cyaneus*	—/SC	Forages in marshes, grasslands, and ruderal habitats; nests in extensive marshes and wet fields.	Low. Wet meadows and wetlands near the golf course may provide nesting habitat for northern harrier. Exposure to project activities would only be during installation of distribution lines. Potential nesting habitat is north of a bermed area, which would reduce effects on nesting birds, if present.	Pre-construction surveys if work is expected to occur during nesting season (February 15–August 31)
Western burrowing owl *Athene cunicularia*	—/SC	Grasslands and ruderal habitats.	Low. Annual grassland and ruderal habitat present along the distribution line provide habitat for this species. Ground squirrel burrows observed along the distribution line route. Grassland may grow too high to support burrowing owl foraging habits. No owls observed during the field reconnaissance; however, they could move into the area prior to construction.	Pre-construction surveys
Loggerhead shrike *Lanius ludovicianus*	—/SC	Nests in tall shrubs and dense trees, forages in grasslands, marshes, and ruderal habitats.	Low. Isolated trees and shrubs near proposed access roads and existing farm facilities provide potential nesting habitat for this species.	Pre-construction surveys if work is expected to occur during nesting season (February 15–August 31)

[1]Status Codes: : Federal and State Codes: Endangered; T = Threatened; C=Candidate; SC = Species of Concern (federal), Species of Special Concern (State), FP = Fully Protected (State)

APPENDIX D

Giant Garter Snake Impacts Review for the Pacific Gas and Electric Company (PG&E) Compressed Air Energy Storage Project-King Island Piacentine Well Pad Expansion and Core Drilling Project-January 2013

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To: Catalina Reyes
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3401 Crow Canyon Road, Rm 150E
San Ramon, CA 94583

Re: Giant Garter Snake Impacts Review for the Pacific Gas and Electric Company (PG&E) Compressed Air Energy Storage Project— King Island Piacentine Well Pad Expansion and Core Well Drilling Project

Date: 23 January, 2013

Dear Ms. Reyes:

This letter/memorandum provides a brief review of environmental documents prepared by North State Resources, Inc. (NSR) in support of the Pacific Gas and Electric Company (PG&E) Compressed Air Energy Storage Project—King Island Piacentine Well Pad Expansion and Core Well Drilling Project. The King Island project area is located approximately 5 miles northwest of the city of Stockton in San Joaquin County at approximately Latitude 38.082284° , Longitude -121.421892. The project will require the expansion of the existing well pads and improvements of existing roads to access the project area.

Conducted in light of potential impacts to the giant garter snake (*Thamnophis gigas*, GGS), this review is based on the following documents:

1. Pacific Gas and Electric. 2012. *Pacific Gas and Electric Company Compressed Air Energy Storage Project— King Island Piacentine Well Pad Expansion and Core Well Drilling: Assessment of Effects on Federally Listed Species*. Prepared by North State Resources, Inc. Prepared for U.S. Department of Energy National Energy Technology Laboratory. October 12, 2012.

2. Pacific Gas and Electric. 2013. *Giant Garter Snake Burrow Baseline Surveys Results Summary—East Island and King Island Project Areas*. Technical Memorandum from Patrick Martin, North State Resources, Inc. to Catalina Reyes, Pacific Gas and Electric Company. January 9, 2013.

The purpose of this review is to provide a quality assurance assessment of the findings in the two PG&E documents prepared by NSR and an independent review and summary of potential risks to GGS. A site visit was also conducted for this purpose at the proposed King Island well pad site on 17 January, 2013. This memorandum includes a summary of the conclusions presented by NSR, a discussion of the site's suitability and impact potential for GGS, and provides broader context by providing a summary of Delta-wide GGS survey efforts to illustrate negative results that are not available in the California Natural Diversity Database (Appendix 1). Photographs illustrating the site's general character are provided in a separate photo appendix (Appendix 2).

The results of this review confirm what I feel is a thorough and accurate assessment by NSR, whose findings suggest that: 1) potential habitat on the project site is largely unsuitable due the canopy cover provided by the young walnut orchard comprising the entirety of the site; 2) overwintering opportunities are diminished or eliminated by annual intercropping of safflower between the walnut rows; and 3) that the distance and poor quality of aquatic habitat likely precludes access by GGS to the few burrows that could function as winter refugia.

As part of a thorough assessment, NSR has appropriately identified all features with even the most remote potential to support GGS. Based on the results of my site visit, my experience in the region, and my experience with the species as a whole, I concur that GGS are not likely to occur for the reasons stated above. Most noteworthy are the canopy cover, the annual intercropping of safflower, and the fact that the site falls more than 450 feet from the nearest potential aquatic habitat, all of which are factors that are generally incompatible with the life history of GGS. Only the very poor-quality drainage canal provides a potential source for GGS; however, even in the unlikely event that GGS should occupy the canal, there would no foreseeable incentive for them to move such a substantial distance over inhospitable terrain to overwinter, and very little chance of finding the few small burrows identified by NSR even if they did so.

Finally, I would emphasize that the density of GGS in the Delta is known to be extremely low, and that this further reduces the likelihood of GGS occurring in the sub-optimal landscape surrounding the project site. Historically, GGS occurred in both the south and north Delta regions (Hansen and Brode 1980; Hansen 1988; CNDDB 2012). However, the extent to which these historically occupied areas represent viable breeding populations is unclear, given agricultural conversion of much of the Delta. Nonetheless, survey efforts since the mid-1980s suggest that much of the Delta is unoccupied or supports few GGS.

To assess the likelihood of GGS occurring in the project vicinity, NSR's assessment necessarily relies heavily upon records reported in the California Natural Diversity Database (CNDDB). However, this approach tends to result in

very conservative assessments because: 1) the CNDDB does not provide negative survey results; and 2) because the gray literature/technical reports summarizing negative survey results are generally unavailable to the public. In order to supplement the material provided by NSR and to place the known GGS distribution within the Delta in better perspective, I am including a summary of Delta-wide GGS survey efforts illustrating negative survey results that are not available in the CNDDB. This summary, which details the historical and current survey work and occurrence information available in the Delta proper, is included as Appendix 1.

In closing, I believe that NSR has conducted a thorough and reasonable assessment of site conditions and has presented an appropriately conservative evaluation of potential impacts. I agree with NSR's conclusion that GGS are unlikely to occur on site due to the incompatibility of the existing aquatic habitat, land cover, and agricultural practices with GGS life history. I would emphasize that the low-quality aquatic habitat lies well beyond 200 feet boundary from linear bank margins that the USFWS generally considers as suitable upland for GGS when assessing a project's disturbance area (USFWS 1997, 2004). I would also emphasize the lack of positive survey data within this portion of the Delta when evaluating the likelihood that GGS might occur. In my professional opinion, this combination of factors eliminates virtually all likelihood that GGS occur on the project site. Finally, I agree with NSR that impacts to potential refugia occurring along access roads within 200 feet of aquatic habitat can be avoided and are not likely to be adversely impacted by project activities.

If you have questions regarding this review or any of the subsequent comments, please do not hesitate to contact me. I will gladly expand on any of these topics upon request.

Sincerely,



Eric C. Hansen
Consulting Environmental Biologist

Appendices:

1. Summary of Delta GGS Sampling Efforts
2. Photographs of relevant features
3. References

APPENDIX 1. SUMMARY OF DELTA GGS SAMPLING EFFORTS

Overview

Historically, giant garter snakes occurred in both the south and north Delta regions (Hansen and Brode, 1980; Hansen 1988; CNDDB 2012). Individuals have been observed in the north Delta region east of the Sacramento River at North Stone Lake, Beach Lake, and near Locke (CNDDB 2012). The species also was recorded on Sherman Island near the Antioch Bridge north of the City of Oakley (CNDDB 2012). Other documented occurrences are distributed around the periphery of the north and east Delta. The extent to which these historically occupied areas represent viable breeding populations is unclear, given agricultural conversion of much of the Delta. Nonetheless, survey efforts since the mid-1980s suggest that much of the Delta is unoccupied or supports few giant garter snakes.

Despite negative survey findings, Hansen (1988) reported that although the major permanent waterways of the Delta are apparently unsuitable for the giant garter snake, small backwater sloughs and toe drains support suitable habitat for, and thus could potentially support, small numbers of giant garter snakes.

The following describes the historical and current survey work and occurrence information in the Delta proper.

South Delta

During 1987 and 1988, live trapping and visual surveys were conducted at various locations in the California Department of Water Resources (DWR) South Delta Water Management Project area, including Trapper Slough, Salmon Slough, and along the irrigation canal at SR 4 near the Clifton Court Forebay expansion area. No giant garter snakes were observed during either year, although virtually all islands and channels contained some suitable habitat (ECOS 1990).

In 1994, surveys were conducted to determine the status of the giant garter snake in DWR's Interim South Delta Project area. The purpose of this study was to focus on particular areas containing the most suitable habitat and to conduct live trapping as well as additional ground surveys. Ground surveys for giant garter snakes were undertaken during previous work in the south Delta region in 1987, 1988, and 1993. Although no giant garter snakes were observed during any of these surveys, suitable habitat for the snake was present in some of the more remote sloughs and waterways in the project area (e.g., Tom Paine Slough, Salmon Slough, and Paradise Cut). Based on the presence of apparently suitable habitat, the potential for isolated populations of the giant garter snake was not ruled out (Miriam Green Associates 1995).

There are only two isolated records of giant garter snakes on the south side of the San Joaquin River in the northern aspect of the species' range. Although the historical and current distribution of giant garter snake in the Delta is poorly

understood, the south bank of the San Joaquin River lies within the apparent gap between the northern and southern populations (CNDDB 2012). The isolated records on Sherman Island represents the northern population's known southern extent in the Plan Area. The known southern terminus of the northern population outside of the Plan Area occurs north and east of the San Joaquin River in Duck Creek (CNDDB 2012). The nearest locality record to the south lies approximately 50 air miles distant in Merced County; no giant garter snakes are documented in Stanislaus County between the documented extremes of the Sacramento Valley and San Joaquin Valley populations.

North Delta

Surveys were also conducted to determine the status of giant garter snakes in DWR's Interim North Delta Program area (Miriam Green Associates 1996). The species was observed at scattered locations in the program area during 1994 surveys, but was not encountered in the major waterways of the North Delta. The species was observed in marsh and canal habitats along the Upland Canal from the confluence of Sycamore Slough and the Upland Canal south to the vicinity of White Slough on the Terminous and Shin Kee Tracts. Giant garter snakes also occur in the Upland Canal and the Coldani Marsh, north and east of Shin Kee Tract, respectively (Miriam Green Associates 1996).

Coldani Marsh/White Slough and Eastern Delta Fringe

Between 1974 and 1978, 13 rectangular borrow pits were excavated from 1 to 5 miles west of I-5 to provide fill for freeway construction (California Department of Water Resources 1995). The pits are fed by groundwater and periodic runoff from precipitation, irrigation, and high canal flows, creating a series of ponds characterized by vegetated sloping or vertical banks and open water with adjacent uplands and high ground. White Slough Wildlife Area encompasses ponds 7 through 13 along a roughly 14-mile (22.5-kilometer) stretch between Thornton and Stockton.

The White Slough Wildlife Area supports one of 13 extant giant garter snake populations recognized by USFWS (Coldani Marsh/White Slough population) (USFWS 1999). First identified on site in 1974 (CNDDB 2012), giant garter snakes were observed at the White Slough Wildlife Area from 1976 until the mid-1990s (Hansen and Brode 1980; Hansen 1988, 1996). Among sites supporting two giant garter snake populations recognized in San Joaquin County, the White Slough location is perhaps the only locality still supporting a viable snake population.

Most giant garter snake observations at White Slough Wildlife Area are concentrated at Pond 9, but surveys conducted by George Hansen in 1994 yielded additional sightings at Pond 7, Pond 11, and a site between Ponds 6 and 7

(California Department of Water Resources 1995; CNDDB 2012). Although channels and drainages including Telephone Cut, Sycamore Slough, Hog Slough, and Beaver Slough were surveyed, observations were made only at the ponds (M. Green, pers. comm.). Each of the ponds where snakes were observed are characterized by slow-moving water with mud banks and bottoms, vegetation cover, and access to high ground (California Department of Water Resources 1995).

In 2009 and 2010, under a grant provided by the Central Valley Project (CVP) Habitat Restoration Program, Hansen conducted rigorous trap and visual encounter sampling at Ponds 7–13 of the White Slough Wildlife Area to determine the current status and distribution of giant garter snake. Giant garter snakes were only confirmed within the emergent wetlands west of Pond 9 along the Upland Canal (Coldani Marsh), east of Guard Road and south of SR 12 (CNDDB 2012; Hansen 2011). In total, 27 snakes representing a normal age/size and gender distribution were captured. Surveys conducted in and near Lost Slough in 1996, 2004 and 2009 failed to detect giant garter snakes east of I-5 (Hansen 2004;Patterson, pers. comm.; Wylie pers. comm.

Antioch/Oakley and West Delta

Recent, intensive trapping surveys conducted within Contra Costa County independently by Eric Hansen and by Swaim Biological have failed to detect giant garter snakes. Likewise, Swaim Biological intensively trapped in regions northeast of Oakley in 2003 and 2005, including Marsh Creek, Big Break, and Contra Costa Canal, without success (Swaim Biological 2004; 2005a, b,c,d,e,f; 2006). With few exceptions, these surveys spanned 3 to 5 months of the species' active period. Swaim Biological also rigorously investigated bullfrog stomach contents to see if undetected giant garter snakes had been consumed; none was detected. While all of these surveys produced captures of common snake species, giant garter snakes were not detected, and, in all cases, it was determined that self-sustaining populations were unlikely to occur. Each report cited marginal habitat value as probable explanations for the species' absence. While the final disposition of Swaim Biological results and recommendations are unknown, USFWS concurred with Eric Hansen's findings that the species was unlikely to occur within the areas sampled.

Central Delta

In support of DWR's Delta Wetlands Project, Eric Hansen intensively trapped for giant garter snakes on Webb Tract and on Bacon Island in 2003 and 2004 without success (Patterson and Hansen, 2004; Patterson 2005.

All Delta

APPENDIX 1. SUMMARY OF DELTA GGS SAMPLING EFFORTS

In 2009, as part of the Delta Habitat Conservation and Conveyance Program, DWR biologists deployed 62, 50-trap traplines at White Slough Wildlife Area and throughout the Delta proper, resulting in approximately 42,700 accrued trap-days. Trap distribution ranged from the vicinity of Elk Grove to the north, I-5 to the east, Sherman Island to the west, and the vicinity of Clifton Court Forebay to the south. GGS were not detected during these surveys (Patterson pers. comm).

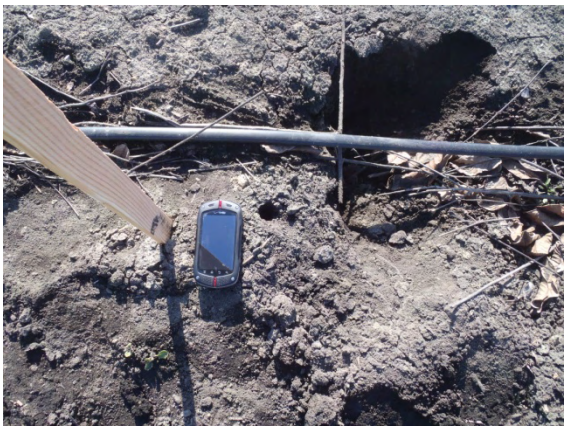
APPENDIX 2. PHOTOGRAPHS OF RELEVANT FEATURES



1. Margin in the transition zone between the existing well pad and proposed expansion



2. Example of inter-row vegetation



3. Example of the small string of burrows falling along only one row of the walnut orchard



4. Denuded ditch situated approximately 450 feet west of the project site

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Patterson, Laura. Department of Water Resources, Division of Environmental Sciences. Sacramento, CA

Wylie, G.D. Research Biologist. Dixon Field Station; U.S. Geological Survey Western Ecological Research Center, 6924 Tremont Road; Dixon, CA 95620

APPENDIX E

Swainson's Hawk Survey Guidance

RECOMMENDED TIMING AND METHODOLOGY FOR SWAINSON'S HAWK NESTING SURVEYS IN CALIFORNIA'S CENTRAL VALLEY

Swainson's Hawk Technical Advisory Committee

May 31, 2000

This set of survey recommendations was developed by the Swainson's Hawk Technical Advisory Committee (TAC) to maximize the potential for locating nesting Swainson's hawks, and thus reducing the potential for nest failures as a result of project activities/disturbances. The combination of appropriate surveys, risk analysis, and monitoring has been determined to be very effective in reducing the potential for project-induced nest failures. As with most species, when the surveyor is in the right place at the right time, Swainson's hawks may be easy to observe; but some nest sites may be very difficult to locate, and even the most experienced surveyors have missed nests, nesting pairs, mis-identified a hawk in a nest, or believed incorrectly that a nest had failed. There is no substitute for specific Swainson's hawk survey experience and acquiring the correct search image.

METHODOLOGY

Surveys should be conducted in a manner that maximizes the potential to observe the adult Swainson's hawks, as well as the nest/chicks second. To meet the California Department of Fish and Game's (CDFG) recommendations for mitigation and protection of Swainson's hawks, surveys should be conducted for a ½ mile radius around all project activities, and if active nesting is identified within the ½ mile radius, consultation is required. In general, the TAC recommends this approach as well.

Minimum Equipment

Minimum survey equipment includes a high-quality pair of binoculars and a high quality spotting scope. Surveying even the smallest project area will take hours, and poor optics often result in eye-strain and difficulty distinguishing details in vegetation and subject birds. Other equipment includes good maps, GPS units, flagging, and notebooks.

Walking vs Driving

Driving (car or boat) or "windshield surveys" are usually preferred to walking if an adequate roadway is available through or around the project site. While driving, the observer can typically approach much closer to a hawk without causing it to fly. Although it might appear that a flying bird is more visible, they often fly away from the observer using trees as screens; and it is difficult to determine from where a flying bird came. Walking surveys are useful in locating a nest after a nest territory is identified, or when driving is not an option.

Angle and Distance to the Tree

Surveying subject trees from multiple angles will greatly increase the observer's chance of detecting a nest or hawk, especially after trees are fully leafed and when surveying multiple trees

in close proximity. When surveying from an access road, survey in both directions. Maintaining a distance of 50 meters to 200 meters from subject trees is optimal for observing perched and flying hawks without greatly reducing the chance of detecting a nest/young: Once a nesting territory is identified, a closer inspection may be required to locate the nest.

Speed
Travel at a speed that allows for a thorough inspection of a potential nest site. Survey speeds should not exceed 5 miles per hour to the greatest extent possible. If the surveyor must travel faster than 5 miles per hour, stop frequently to scan subject trees.

Visual and Aural Ques
Surveys will be focused on both observations and vocalizations. Observations of nests, perched adults, displaying adults, and chicks during the nesting season are all indicators of nesting Swainson's hawks. In addition, vocalizations are extremely helpful in locating nesting territories. Vocal communication between. hawks is frequent during territorial displays; during courtship and mating; through the nesting period as mates notify each other that food is available or that a threat exists; and as older chicks and fledglings beg for food.

Distractions
Minimize distractions while surveying. Although two pairs of eyes may be better than one pair at times, conversation may limit focus. Radios should be off, not only are they distracting, they may cover a hawk's call.

Notes and Species Observed
Take thorough field notes. Detailed notes and maps of the location of observed Swainson's hawk nests are essential for filling gaps in the Natural Diversity Data Base; please report all observed nest sites. Also document the occurrence of nesting great homed owls, red-tailed hawks, red-shouldered hawks and other potentially competitive species. These species will infrequently nest within 100 yards of each other, so the presence of one species will not necessarily exclude another.

TIMING

To meet **the minimum level** of protection for the species, surveys should be completed for **at least** the two survey periods immediately prior to a project's initiation. For example, if a project is scheduled to begin on June 20, you should complete 3 surveys in Period III and 3 surveys in Period V. However, it is always recommended that surveys be completed in Periods II, III and V. **Surveys should not be conducted in Period IV.**

The survey periods are defined by the timing of migration, courtship, and nesting in a "typical" year for the majority of Swainson's hawks from San Joaquin County to Northern Yolo County. Dates should be adjusted in consideration of early and late nesting seasons, and geographic differences (northern nesters tend to nest slightly later, etc). If you are not sure, contact a TAC member or CDFG biologist.

Survey dates **Justification and search image**	**Survey time**	**Number of Surveys**
I. *January-March 20 (recommended optional)*	*All day*	*1*

Prior to Swainson's hawks returning, it may be helpful to survey the project site to determine potential nest locations. Most nests are easily observed from relatively long distances, giving the surveyor the opportunity to identify potential nest sites, as well as becoming familiar with the project area. It also gives the surveyor the opportunity to locate and map competing species nest sites such as great homed owls from February on, and red-tailed hawks from March on. After March 1, surveyors are likely to observe Swainson's hawks staging in traditional nest territories.

II. *March 20 to April 5*	*Sunrise to 1000* *1600 to sunset*	*3*

Most Central Valley Swainson's hawks return by April 1, and immediately begin occupying their traditional nest territories. For those few that do not return by April 1, there are often hawks ("floaters") that act as place-holders in traditional nest sites; they are birds that do not have mates, but temporarily attach themselves to traditional territories and/or one of the site's "owners." Floaters are usually displaced by the territories' owner(s) if the owner returns.

Most trees are leafless and are relatively transparent; it is easy to observe old nests, staging birds, and competing species. The hawks are usually in their territories during the survey hours, but typically soaring and foraging in the mid-day hours. Swainson's hawks may often be observed involved in territorial and courtship displays, and circling the nest territory. Potential nest sites identified by the observation of staging Swainson's hawks will usually be active territories during that season, although the pair may not successfully nest/reproduce that year.

III. *April 5 to April 20*	*Sunrise to 1200* *1630 to Sunset*	***3***

Although trees are much less transparent at this time, 'activity at the nest site increases significantly. Both males and females are actively nest building, visiting their selected site frequently. Territorial and courtship displays are increased, as is copulation. The birds tend to vocalize often, and nest locations are most easily identified. This period may require a great deal of "sit and watch" surveying.

IV. *April 21 to June 10*	*Monitoring known nest sites only* ***Initiating Surveys is not recommended***	

Nests are extremely difficult to locate this time of year, and even the most experienced surveyor will miss them, especially if the previous surveys have not been done. During this phase of nesting, the female Swainson's hawk is in brood position, very low in the nest, laying eggs, incubating, or protecting the newly hatched and vulnerable chicks; her head may or may not be visible. Nests are often well-hidden, built into heavily vegetated sections of trees or in clumps of mistletoe, making them all but invisible. Trees are usually not viewable from all angles, which may make nest observation impossible.

Following the male to the nest may be the only method to locate it, and the male will spend hours away from the nest foraging, soaring, and will generally avoid drawing attention to the nest site. Even if the observer is fortunate enough to see a male returning with food for the female, if the female determines it is not safe she will not call the male in, and he will not approach the nest; this may happen if the observer, or others, are too close to the nest or if other threats, such as rival hawks, are apparent to the female or male.

V. ***June 10 to JuIy 30 (post-fledging)*** ***Sunrise to 1200*** ***3***
1600 to sunset

Young are active and visible, and relatively safe without parental protection. Both adults make numerous trips to the nest and are often soaring above, or perched near or on the nest tree. The location and construction of the nest may still limit visibility of the nest, young, ‘and adults.

DETERMINING A PROJECT'S POTENTIAL
FOR IMPACTING SWAINSON'S HAWKS

LEVEL OF RISK	REPRODUCTIVE SUCCESS (Individuals)	LONGTERM SURVIVABILITY (Population)	NORMAL SITE CHARACTERISTICS (Daily Average)	NEST MONI-TORING
HIGH	Direct physical contact with the nest tree while the birds are on eggs or protecting young. (Helicopters in close proximity)	Loss of available foraging area.	Little human-created noise, little human use: nest is well away from dwellings, equipment yards, human access areas, etc. *Do not include general cultivation practices in evaluation.*	**MORE**
		Loss of nest trees.		
	Loss of nest tree after nest building is begun prior to laying eggs.	Loss of potential nest trees.		
	Personnel within 50 yards of nest tree (out of vehicles) for extended periods while birds are on eggs or protecting young that are < 10 days old.	Cumulative: Multi-year, multi-site projects with substantial noise/personnel disturbance.		
	Initiating construction activities (machinery and personnel) within 200 yards of the nest after eggs are laid and before young are > 10 days old.	Cumulative: Single-season projects with substantial noise/personnel disturbance that is greater than or significantly different from the daily norm.		
	Heavy machinery only working within 50 yards of nest.		Substantial human-created noise and occurrence: nest is near roadways, well-used waterways, active airstrips, areas that have high human use. *Do not include general cultivation practices in evaluation.*	
	Initiating construction activities within 200 yards of nest before nest building begins or after young > 10 days old.	Cumulative: Single-season projects with activities that "blend" well with site's "normal' activities.		
LOW	All project activities (personnel and machinery) greater than 200 yards from nest.			**LESS**

Appendix 5.3A
Cultural Resources Technical Report (Confidential)

Confidential document available by request to qualified personnel.

Appendix 5.3B
CHRIS Literature Search Results (Confidential)

Confidential document available by request to qualified personnel.

Appendix 5.3C
Qualifications of Field Study Personnel

BRIAN V. LUDWIG, PHD

Senior Archaeologist

EDUCATION:

- Ph.D., Anthropology, Rutgers University, 1999
- M.A., Anthropology, Rutgers University, 1992
- B.A., Anthropology, Montclair State College, 1985

PROFESSIONAL AFFILIATIONS:

- Society for Historical Archaeology
- Society for California Archaeology
- Eastern States Archaeological Federation

CERTIFICATIONS:

- Register of Professional Archaeologists

AWARDS AND HONORS:

- AEP Outstanding Public Involvement/Education Program, March 2009 – Stewardship of the Lower Putah Creek Watershed

SYNOPSIS: Dr. Ludwig has been associated with the cultural resources management and academic fields for more than 30 years. He possesses a broad range of expertise in the implementation and management of technical investigations for numerous public and private concerns. These studies were conducted in accordance with national, state, and local preservation guidelines, including CEQA, NEPA, Section 106 of NHPA, NAGPRA, and the Washington State Environmental Protection Act, among others. Dr. Ludwig has managed and participated in a diverse range of cultural resource studies, from large-scale historic-era excavations in downtown Manhattan to surveys of FERC-licensed hydroelectric facilities in the Sierra Nevada of California, as well as the guidance of cultural landscape studies in California and Nevada.

Dr. Ludwig has developed an extensive set of skills, including expertise in experimentally based lithic analyses, burial and cemetery excavation techniques, and historic military contexts. Documentation efforts have included historic-era and prehistoric analyses, project resource inventory reports, National Register evaluations, cultural resources management plans, Caltrans Historic Property Survey Reports and Archaeological Survey Reports, and the full range of CEQA and NEPA environmental compliance documents. Although Dr. Ludwig has most recently worked primarily in California and elsewhere in the western United States, his experience also includes project management and research efforts throughout the northeastern U.S., Puerto Rico, Guam, East Africa, and Iraq.

RELEVANT EXPERIENCE:

PG&E MAOP Validation Digs Cultural Resources Support On-Call – Pacific Gas and Electric Company. Dr. Ludwig, serving as Project Manager, is performing cultural resources investigations for PG&E's Maximum Allowable Operating Pressure (MAOP) verification digs on pre-1970 pipes. Tasks for which he is responsible include performing desktop cultural constraints reviews, performing field reviews in areas with known cultural resources or a high sensitivity for cultural resources, and preparing memoranda with recommendations for the dig sites.

PG&E Sonoma Substation Cultural Resources Investigations, Sonoma, CA – Pacific Gas and Electric Company. As Principal Investigator, Dr. Ludwig conducted a literature search, map research, and a cultural resources sensitivity analysis of the Sonoma Substation site in the City of Sonoma, Sonoma County, California. The project proposed to replace various substation elements in an area sensitive for cultural resources due to the nearby presence of numerous perennial waterways. Although analyses determine the area to be only moderately sensitive for exhibiting traces of prehistoric and/or historic-era activities, mitigation measures were recommended for reducing effects on encountered resources to less-than-significant levels.

PG&E Whisman Substation Cultural Resources Investigations, Santa Clara, CA – Pacific Gas and electric Company. As Principal Investigator, Dr. Ludwig provided guidance and review for a cultural resources sensitivity analysis and archaeological survey for the Whisman Substation site in the City of Mountain View, Santa Clara County, California. The project proposed to construct various substation elements in an area potentially sensitive for cultural resources. The project analysis determined the specific project site was not necessarily sensitive for exhibiting traces of prehistoric or early historic-era activities although avoidance and mitigation measures for unanticipated discoveries were developed.

PG&E Sonoma Transmission Line Proponent's Environmental Assessment , Sonoma, CA – Pacific Gas and Electric Company. Dr. Ludwig, serving as Senior Archaeologist, conducted a routing study for a new 115 kV transmission line in Sonoma County. Staff examined environmental impacts of potential routes to determine the environmentally preferred location for the transmission line. He worked collaboratively with PG&E engineers, transmission planners, and the Technical Environmental Services group. Dr. Ludwig also prepared the Proponent's Environmental Assessment of the transmission system upgrade for submittal to the California Public Utilities Commission.

PG&E Stanislaus River Hydroelectric Relicensing, Stanislaus National Forest, CA – Pacific Gas and Electric Company and Tri-Dam Project. Dr. Ludwig, serving as project manager/senior archaeologist, conducted archaeological field surveys within FERC boundaries for Tulloch, Beardsley/Donnells, Spring Gap-Stanislaus, and Donnells-Curtis hydroelectric and transmission line projects. Lead author of technical report. Work was completed in anticipation of FERC relicensing of hydroelectric facilities. Numerous prehistoric and historic sites were noted within the four survey areas.

PG&E Pit 1 Hydroelectric Relicensing Project, Shasta County, CA – Pacific Gas and Electric Company. Dr. Ludwig, serving as project manager/senior archaeologist, managed the inventory of a 7-mile stretch of the Pit River Canyon and several hundred acres near Pit 1 Forebay. Prehistoric and historic-era resources documented include Native American sites, 19th and 20th century artifact scatters, and an early ranch complex.

PG&E North Baja Natural Gas Pipeline, Riverside and Imperial Counties, CA – Pacific Gas and Electric National Energy Corporation. Dr. Ludwig served as lithic analyst and conducted extensive attribute-based and refitting studies on the prehistoric lithic assemblages recovered from surface and subsurface contexts in the Imperial Valley, near Blythe. Attribute and refitting analyses revealed detailed information related to prehistoric patterns of material acquisition, utilization, and curation. Assemblages varied greatly in size and composition, ranging from sparse scatters to more dense concentrations of flaking debris, cores, percussors, and refined pieces. Project was an 87-mile segment of a natural gas pipeline running from Ehrenburg, Arizona, to Caliente, California, through Riverside and Imperial Counties in California.

Appendix 5.3D
Cultural Resources Map (Confidential)

Confidential document available by request to qualified personnel.

Appendix 5.3E
Cultural Resources Survey for the PG&E CAES Project, King Island (Confidential)

Confidential document available by request to qualified personnel.

Appendix 5.3F
Cultural Resources Inventory and Evaluation Report, Compressed Air Energy Storage Compression Testing Project (Confidential)

Confidential document available by request to qualified personnel.

Appendix 5.3G
Subsurface Identification Efforts for the CAES Compression Testing Project (Confidential)

Confidential document available by request to qualified personnel.

Appendix 5.5A
Offsite Consequences Analysis Modeling Protocol

APPENDIX 5.5A

Modeling Protocol: Offsite Consequence Analysis for Ammonia

An off-site consequence analysis (OCA) for ammonia would be conducted for the proposed PG&E King Island CAES Project (KICP) after the Application for Certification is accepted for processing by the California Energy Commission. The KICP would be required by the Clean Air Act to install Best Available Control Technology to control emissions of criteria air pollutants produced by the turbo-expander equipment. Oxides of nitrogen (NOx) emissions would be reduced through the use of selective catalytic reduction (SCR). The SCR control system utilizes ammonia as the reduction reagent in the presence of a catalyst. The KICP SCR system would use aqueous ammonia, 19 percent NH_3 by weight, stored in one 0,000 gallon tank. Ammonia is a hazardous material and has an Emergency Response Planning Guideline level 2 (ERPG-2) toxic endpoint (Te) value of 150 ppm (*RMP Offsite Consequence Analysis Guidance,* EPA, April 1999). The Te value is based on a one-hour exposure or averaging time.

Aqueous ammonia is a liquid, which has a boiling point of approximately 124°F (324 K). When spilled, aqueous ammonia will evaporate, releasing ammonia vapors to the surrounding atmosphere.

The OCA would be based on the final design configuration of the KICP ammonia storage tank and secondary containment structure. In addition to the type of ammonia stored on-site, the OCA would consider tank size, surface area of the containment structure, location of the storage area relative to potential off-site receptors, local climatology, and the type of release. Pursuant to the CalARP regulations and federal Risk Management Plan regulations, the OCA would be performed for the worst-case release scenario, which involves the failure and complete discharge of the storage tank, as well as an alternative release scenario, such as the complete discharge of the ammonia delivery vehicle during tank filling operations.

Ammonia emissions from these two potential release scenarios would be calculated following methods provided in *RMP Offsite Consequence Analysis Guidance*, EPA, April 1999. The default meteorological data necessary for emission and dispersion calculations would be supplemented by daily temperature data as required by CCR Title 19, Section 2750.2. The CAES project is located west of Interstate 5, approximately 5 miles southwest of the westernmost portion of Lodi and approximately 3 miles north of the northernmost portions of Stockton. The maximum temperature recorded in the area in the past 3 years would be used for emission and dispersion calculations.

OCA dispersion modeling would be conducted as part of the CEC license proceeding to predict the potential extent of off-site ammonia concentrations above the specified EPA Te of 150 ppm and the CEC level of significance of 75 ppm, considered by CEC staff to be the ammonia concentration that results in no serious adverse effects on the public for a one-time exposure (*Preliminary Staff Assessment-Otay Mesa Generating Project*, 99-AFC-5, May 2000). Potential off-site ammonia concentrations would be calculated using the SLAB numerical dispersion modeling program. A complete description of the SLAB model is available in *User's Manual for SLAB: An Atmospheric Dispersion Model for Denser-Than-Air-Releases*, D. E. Ermak, Lawrence Livermore National Laboratory, June 1990. The SLAB user manual contains a substance database which includes chemical-specific data for ammonia. This data would be used in all modeling runs without exception or modification.

Results from the OCA would be tabulated showing the distance from the source release point to the downwind concentrations of 150 ppm and 75 ppm for both release scenarios. The potential area of ammonia concentrations above these values and resulting from the worst case release scenario would be shown in a figure drawn to scale, which shows the ammonia storage location, the proposed CAES, and any nearby off-site sensitive receptors.

Appendix 5.6A
State Lands Commission Letter

CALIFORNIA STATE LANDS COMMISSION
100 Howe Avenue, Suite 100-South
Sacramento, CA 95825-8202

JENNIFER LUCCHESI, *Executive Officer*
(916) 574-1800 FAX (916) 574-1810
California Relay Service From TDD Phone **1-800-735-2922**
from Voice Phone **1-800-735-2929**

Contact Phone **(916) 574-0909**
Contact FAX: **(916) 574-1925**

April 14, 2014

File Ref: SD 2014-04-03.1

Ernie Ralston, Principal Planner
Pacific Gas and Electric
246 Market Street, N10A
San Francisco, CA 94105

SUBJECT: Three proposed pipeline crossings under the bed of White Slough and Bishop Cut adjacent to Assessor's Parcel Numbers 071-080-22 and 05-090-01 and 035-120-06, near Lodi, San Joaquin County

Dear Ernie Ralston:

This letter concerns the above-referenced inquiry and whether the California State Lands Commission (CSLC) asserts a sovereign title interest in White Slough and Bishop Cut, adjacent to Assessor's Parcel Numbers 071-080-22 and 05-090-01 and 035-120-06, near Lodi, San Joaquin County.

The CSLC has jurisdiction and management authority over all ungranted tidelands, submerged lands, and the beds of navigable lakes and waterways. The CSLC also has certain residual and review authority for tidelands and submerged lands legislatively granted in trust to local jurisdictions (PRC §6301 and §6306). All tidelands and submerged lands, granted or ungranted, as well as navigable lakes and waterways, are subject to the protections of the Common Law Public Trust.

As general background, the State of California acquired sovereign ownership of all tidelands and submerged lands and beds of navigable lakes and waterways upon its admission to the United States in 1850. The State holds these lands for the benefit of all people of the State for statewide Public Trust purposes, which include but are not limited to waterborne commerce, navigation, fisheries, water-related recreation, habitat preservation, and open space. On tidal waterways, the State's sovereign fee ownership extends landward to the mean high tide line, except for areas of fill or artificial accretion or where the boundary has been fixed by agreement or a court. On navigable non-tidal waterways, including lakes, the State holds fee ownership of the bed of the waterway landward to the ordinary low water mark and a Public Trust easement landward to the ordinary high water mark, except where the boundary has been fixed by agreement or a court. Such boundaries may not be readily apparent from present day site inspections.

CSLC staff understands that the Pacific Gas and Electric Company (PG&E) is considering three potential pipeline crossing sites under the bed of White Slough and Bishop Cut, San Joaquin County.

Based upon the information provided and a review of our records, Bishop Cut, at the proposed crossing adjacent to APN 055-120-06, and White Slough, at the proposed crossing adjacent to APN 055-090-01, are not State sovereign lands under the jurisdiction of the CSLC. *However, White Slough, at the proposed crossing adjacent to APN 071-080-22, is State sovereign land under the jurisdiction of the CSLC.* Therefore, a lease from the CSLC is required for any proposed pipeline crossing at White Slough adjacent to, or near, APN 071-080-22.

If PG&E plans to proceed with the project at this location, we advise you to submit an application to our office as soon as practicable. For more information concerning CSLC leasing procedures, contact Jonathan Sampson, Public Land Management Specialist, at jonathan.sampson@slc.ca.gov or (916) 574-0909.

Please also be advised that White Slough and Bishop Cut, at the subject locations, may be subject to a public navigational easement. This easement provides that members of the public have the right to navigate and exercise the incidences of navigation in a lawful manner on State waters that are capable of being physically navigated by oar or motor-propelled small craft. Such uses may include, but not be limited to, boating, rafting, sailing, rowing, fishing, fowling, bathing, skiing, and other water-related public uses. The proposed project must not restrict or impede the easement right of the public.

This conclusion is without prejudice to any future assertion of State ownership or public rights, should circumstances change, or should additional information come to our attention.

This letter is not intended, nor should it be construed as, a waiver or limitation of any right, title, or interest of the State of California in any lands under its jurisdiction.

If you have any questions, please contact Jonathan Sampson at (916) 574-0909 or by e-mail at jonathan.sampson@slc.ca.gov

Sincerely,

Ninette Lee
Public Land Manager I

THIS MAP FOR ASSESSMENT USE ONLY

055-09

PT. BEARS N. 89° 35' W. 7837 FT. FROM N.E. COR. OF SEC. 25 T. 3N. R. 5 E.

22 | 23 (8)

DREDGER CUT — APPROX.

N. 89° 35' W. 5268

27 | 26

△ (1)

322.05 AC.

KING

ISLAND

SLOUGH

RIO BLANCO TRACT

CANAL

N. 89° 38' E. 5562

CANAL (12)

WHITE SLOUGH

Bk. 71

△ (2)

388.0 AC.

27 | 26

TELEPHONE — APPROX. CUT

34 | 35

NORTHERLY BOUNDARY OF REC. DIST. NO. 2042

26 | 25

APPROX.

35 | 36

(31) (31) (28)

SAN JOAQUIN COUNTY CALIFORNIA ASSESSOR

POR. OF SEC. 26-27 T. 3N. R. 5E.

SCALE 1"=600'

SAN JOAQUIN COUNTY ASSESSOR'S MAPS

△ - WILLIAMSON ACT PARCELS

THIS MAP IS FOR ASSESSMENT USE ONLY

055-12

THORNTON ROAD

INTERSTATE — 5

ROUTE — 5

PERIPHERAL

CANAL

CANAL

CANAL

TELEPHONE CUT

NORTH

SAN JOAQUIN COUNTY CALIFORNIA ASSESSOR

1" = 600'

23 | 24 | 19

26 | 25 | 24 | 25

13 | 8 | 19

09 | 12 | 13 | 11

35 | 36 | 36 | 31

6 — 75.19 ACS. — STATE OF CALIFORNIA

13.60 ACS.

11 — 235.73 ACS.–NET — CITY OF LODI

12.64 ACS. — CITY OF LODI

3 — 158.57 ACS. — CITY OF LODI

13.55 ACS.

12 — 207.04 ACS.–NET

13 — 108.16 ACS.

14 — 23.91 ACS.

11

S. 89° 20' E. 4073.90' N. 89° 35' W. 8251.00'

222.65' 300.00' 2891.81' 2290.85' 2840.00'±

S. 22° 22' E. S. 22° 22' E.

S. 15° 29' E. 364.22' S. 17° 38' E. 349.98' S. 11° 34' E. 302.04' 2000.00' 2227.02' S. 13° 21' E. S. 13° 21' E.

2653.00'±

S. 21° 45' E.

604.83' 300.00' 222.60' 1092.40' S. 89° 38' E. 1092.49' S. 89° 22' E. 2539.38' 2539.58' 26.80' S. 13°40'E. 89.02' S. 89° 22' E. 2492.02'

2885.05' 2878.69' N. 22° 22' W. S. 22° 22' E.

870.67' S. 13° 02' E. 810.99' N. 13° 40' W. 1872.14' N. 13° 21' W. 1362.34' S. 13° 21' E.

2109.30' S. 0° 12' W.

561.38' S. 89° 24' E. 1977.54' 544.82'

650.96' 222.54' N. 89° 23' W. 3163.27' N. 89° 24' W. 1845.93'

△ —Williamson Act Parcels

HIGHEST A.P.N. USED			
YEAR	PAR. #	PAR. #	PAR. #
94–95	10		
95–96	11		
07–08	12		
09–10	14		

A – R. S. Bk. 32 Pg. 087
B – R. S. Bk. 32 Pg. 175
C – R. S. Bk. 36 Pg. 029

PT. BEARS 1780 FT. EAST OF S.W. COR. OF S.E. 1/4 OF SEC. 26 T.3N. R.5E.

NOTE: Assessor's Parcel Numbers Shown in Circles.
Assessor's Block Numbers Shown in Ellipses.

SEC. 25 & POR. SEC. 26., T.3N. R. 5E. M.D.B. & M.

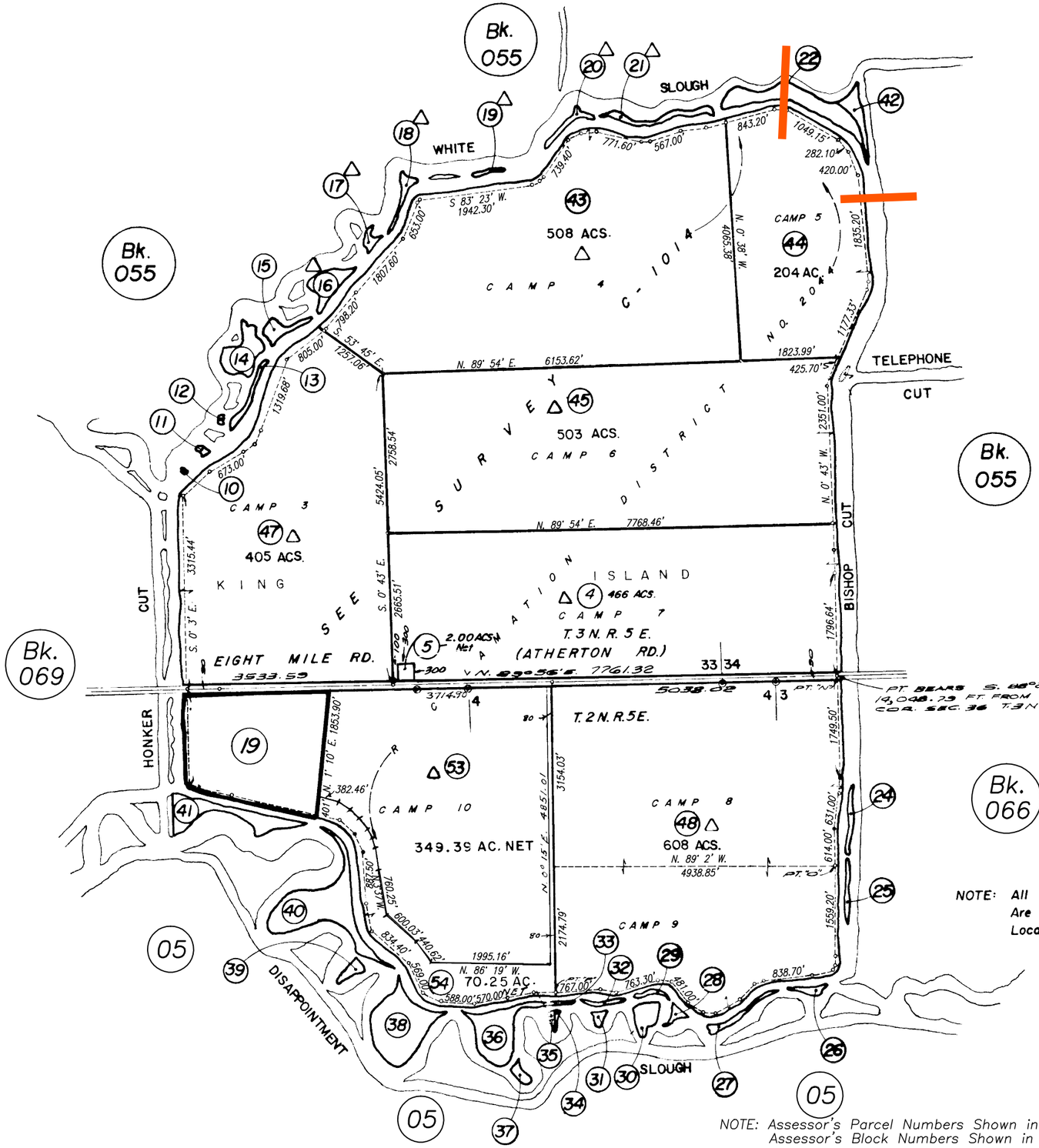
Assessor's Map Bk.055 Pg
County of San Joaquin, Cc

KING ISLAND

THIS MAP IS FOR ASSESSMENT USE ONLY

071–08

1" = 2000'



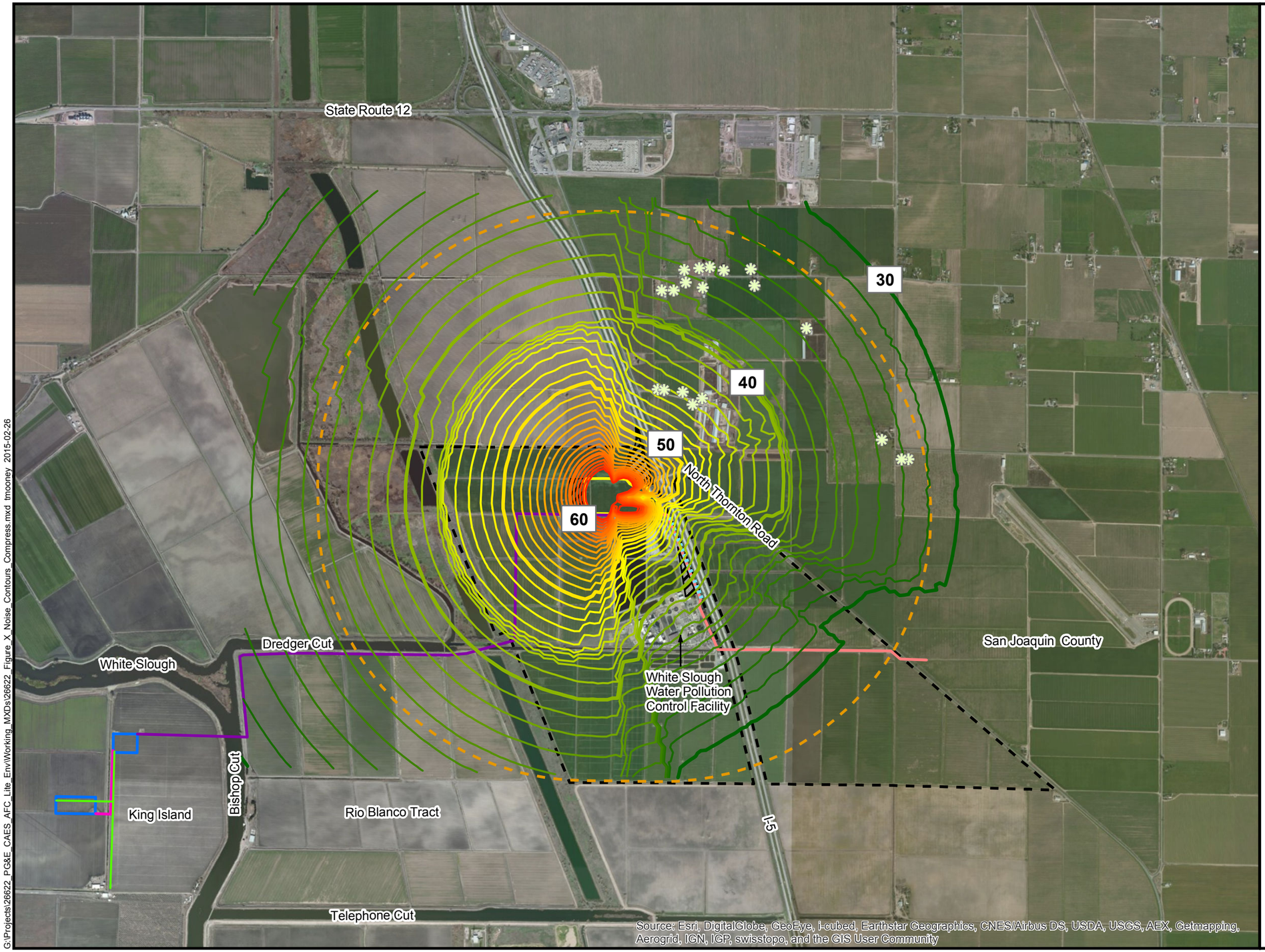
Berm No.		Acres
10	–	0.2 △
11	–	0.5 △
12	–	0.4 △
13	–	2.2 △
14	–	9.1 △
15	–	2.5 △
16	–	6.3
17	–	1.6
18	–	2.1
19	–	0.4
20	–	2.8
21	–	3.4
22	–	8.1
24	–	1.7 △
25	–	0.6 △
26	–	1.1 △
27	–	2.0 △
28	–	0.9 △
29	–	0.4 △
30	–	3.1 △
31	–	1.0 △
32	–	0.6 △
33	–	0.3 △
34	–	0.4 △
35	–	0.6
36	–	13.9
37	–	1.5
38	–	21.3
39	–	1.6
40	–	22.6
41	–	14.2
42	–	2.6 △

△ – Willamson Act Parcels

HIGHEST A.P.N. USED			
YEAR	PAR. #	PAR. #	PAR. #
78–79	54		

Assessor's Map Bk.071 Pg.08
County of San Joaquin, Calif.

Appendix 5.7
Noise Contour Maps



Residence
Air Pipeline
Air Collection Pipeline
Gas Pipeline
ECF Generator Tie-Line
12kV Service Line
Water Supply Pipeline
Energy Conversion Facility (ECF)
Well Pad
Staging
1 Mile Buffer
City of Lodi

DB

30	42	54
31	43	55
32	44	56
33	45	57
34	46	58
35	47	59
36	48	60
37	49	61
38	50	62
39	51	63
40	52	64
41	53	65

This map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

N

0 2,000 4,000

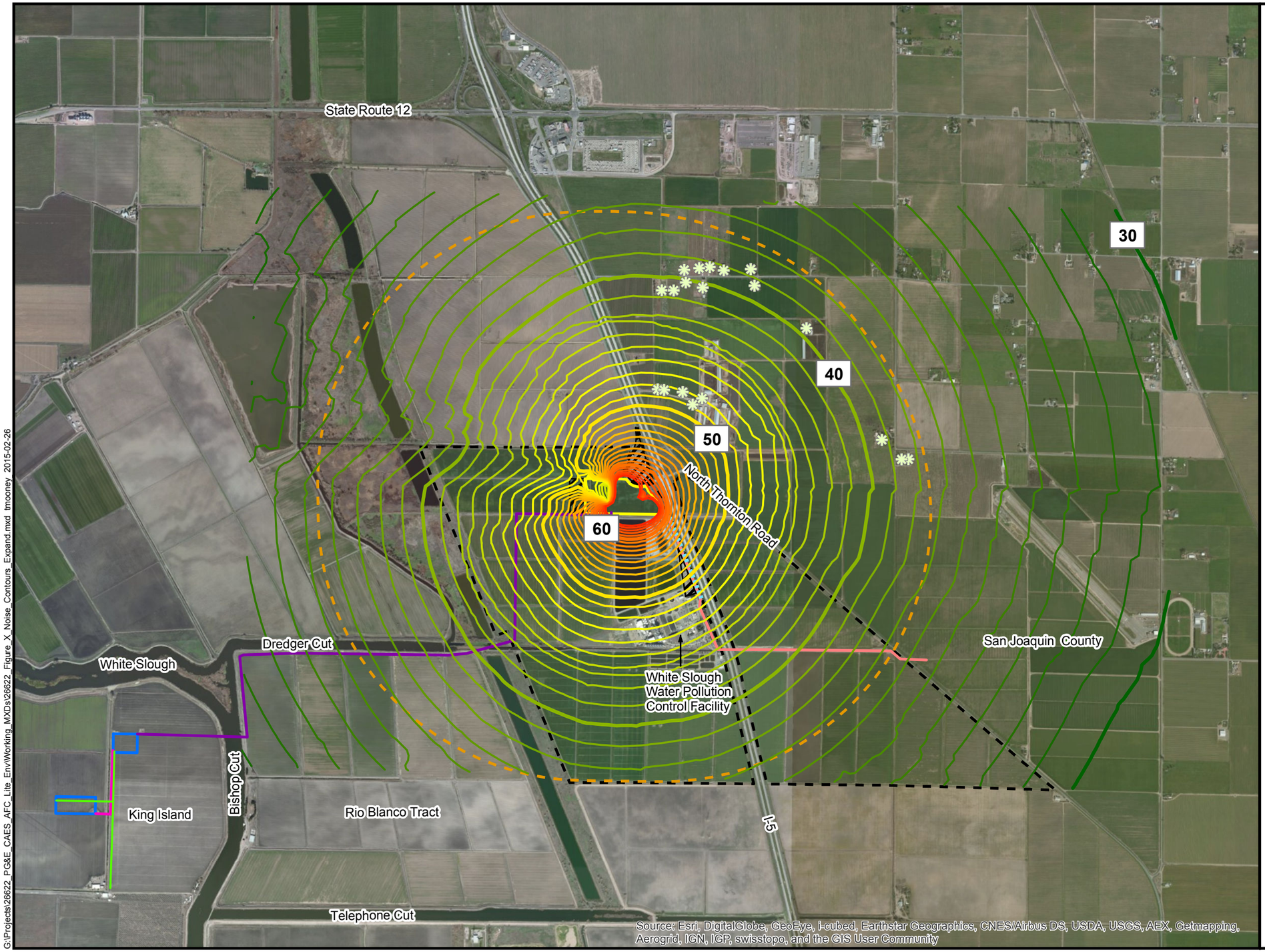
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North State Resources, Inc.

PG&E King Island Compressed Air Energy Storage Project

Noise Contours
Compression Phase



Residence
Air Pipeline
Air Collection Pipeline
Gas Pipeline
ECF Generator Tie-Line
12kV Service Line
Water Supply Pipeline
Energy Conversion Facility (ECF)
Well Pad
Staging
1 Mile Buffer
City of Lodi

DB

30	42	54
31	43	55
32	44	56
33	45	57
34	46	58
35	47	59
36	48	60
37	49	61
38	50	62
39	51	63
40	52	64
41	53	65

This map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

N

0 2,000 4,000

Feet

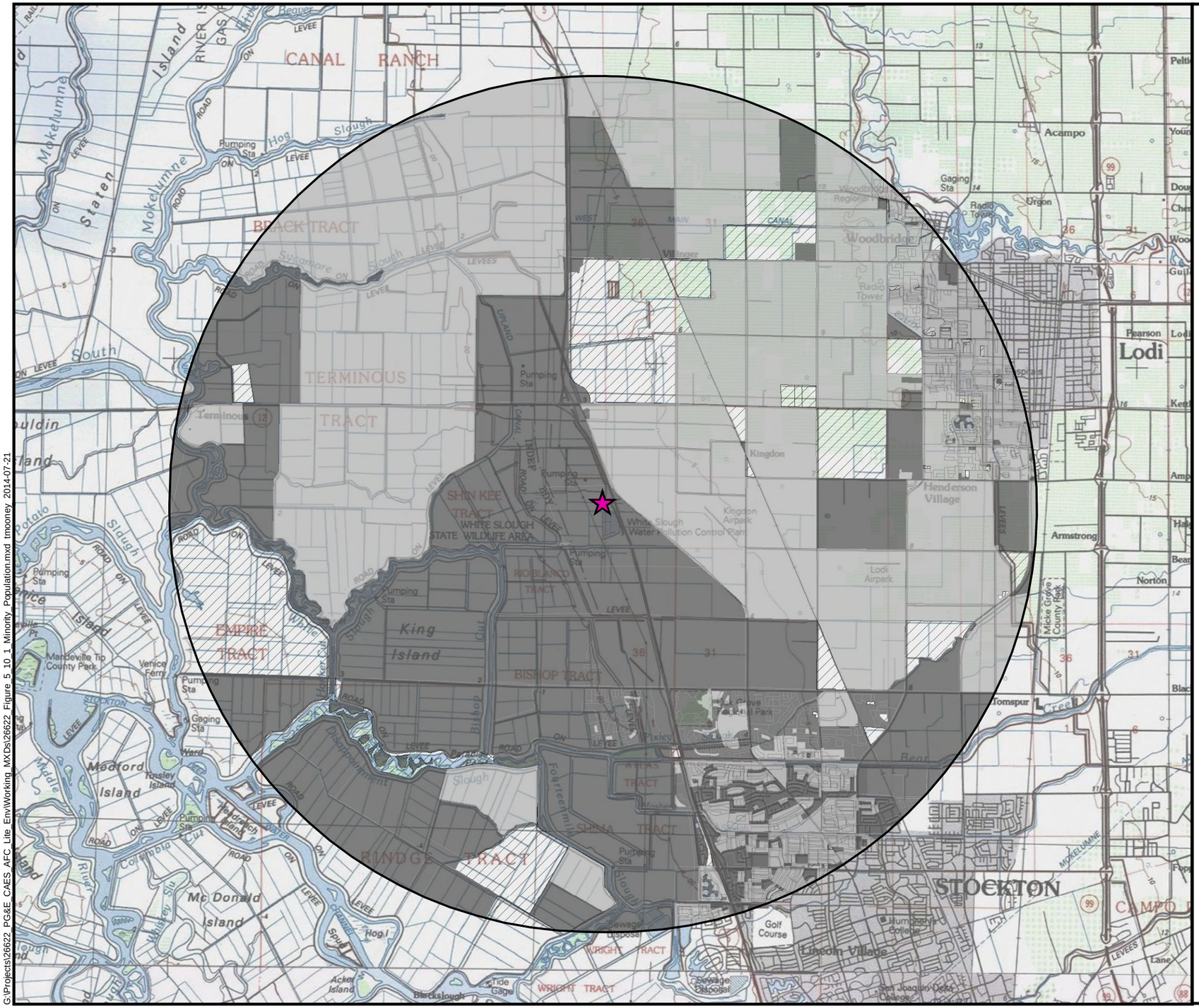
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North State Resources, Inc.

PG&E King Island Compressed Air Energy Storage Project

Noise Contours
Expansion Phase

Appendix 5.10A
Environmental Justice Analysis



PROJECT LOCATION

SIX MILE BUFFER

PERCENTAGE OF MINORITY POPULATION

NO MINORITY

0 - 50 PERCENT MINORITY

50 - 100 PERCENT MINORITY

Notes:
1. Source: American Fact Finder, U.S. Census Bureau, 2010 Census, Summary File 1, 100 - Percent Data.

N

0 8,000 16,000

Feet

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North State Resources, Inc.

PG&E King Island Compressed Air Energy Storage Project

Figure 5.10-1
Minority Population Distribution By Census Blocks Within Six Miles of Site

Appendix 5.14A
Phase I Final Site Assessment, I-5 and Thornton Road, Lodi, San Joaquin County

Environmental Resources Management

1277 Treat Boulevard
Suite 500
Walnut Creek, CA 94597
(925) 946-0455
(925) 946-9968 (fax)
www.erm.com

24 February 2014

Ms. Anne P. Conner
Sr. Remediation Project Manager
Pacific Gas and Electric Company
3401 Crow Canyon Road
San Ramon, CA 94583

Subject: Phase I Environmental Site Assessment
I-5 Frontage Road and North Thornton Road
Lodi, San Joaquin County, California

Dear Ms. Conner:

ERM-West, Inc. (ERM) is pleased to present the final Phase I Environmental Site Assessment (ESA) report for the approximately 25-acre Lodi Property located southwest of the I-5 Frontage Road and North Thornton Road intersection in Lodi, San Joaquin County, California. The Phase I ESA was conducted in conformance with ERM's proposal dated 20 December 2013.

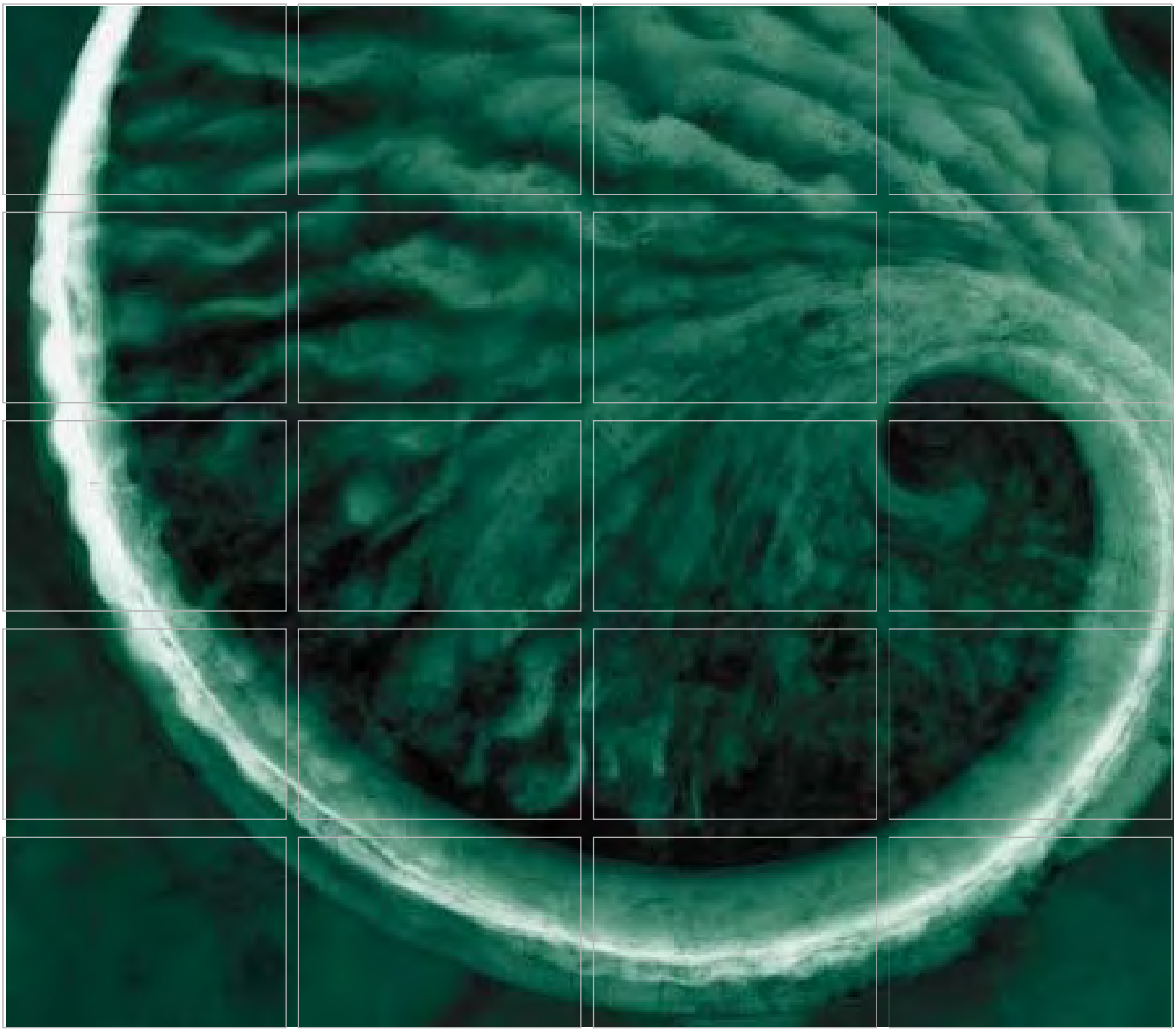
If you have any questions, or require additional information, please do not hesitate contact me at (925) 482-3204. ERM appreciates the opportunity to provide environmental services to PG&E.

Best Regards,

Bailey Blosser

Bailey Blosser
Project Manager

BWB/lhm/0231727.01.****
Enclosures



Phase I Environmental Site Assessment

City of Lodi Property
I-5 Frontage Road and North Thornton Road
Lodi, San Joaquin County, California

February 2014

Prepared for:
Pacific Gas and Electric Company

www.erm.com

ERM

The world's leading sustainability consultancy

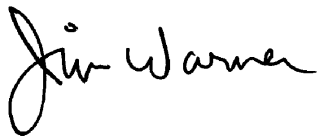
Pacific Gas and Electric Company

Phase I Environmental Site Assessment

City of Lodi Property
I-5 Frontage Road and North Thornton Road
Lodi, San Joaquin County, California

February 2014

Project No. 0231727



Jim Warner, P.G.
Principal-in-Charge



Arun Chemburkar, P.E.
Technical Director



Bailey Blosser
Project Manager

Environmental Resources Management
1277 Treat Boulevard, Suite 500
Walnut Creek, California 94597
T: 925-946-0455
F: 925-946-9968

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ERM-West, Inc. (ERM) conducted a Phase I Environmental Site Assessment (ESA) of the property located southwest of the I-5 Frontage Road and North Thornton Road intersection in Lodi, San Joaquin County, California (the "site" or "subject property"). The subject property consists of approximately 25 acres of agricultural land which is located within the larger approximately 225 acre parcel identified as San Joaquin County Assessor's Office Assessor's Parcel Number (APN) 055-150-29. The Phase I ESA was conducted in accordance with the scope and limitations of American Society for Testing and Materials (ASTM) Standard E 1527-13, *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process,* and the standards for conducting all appropriate inquiries set forth by the United States Environmental Protection Agency at Title 40 of the Code of Federal Regulations Part 312. This Phase I ESA was performed on behalf of Pacific Gas and Electric Company (PG&E) to assess potential environmental liabilities associated with surface and/or subsurface impacts from past and current operations at the subject property.

A site visit was conducted on 29 January 2014 by Ms. Lindsay Capitanich of ERM. Mr. Benjamin Jordan, Right of Way Contractor of PG&E, provided information regarding current and historical use of the subject property and accompanied ERM during the site visit.

The 25 acre agricultural site occupies the eastern portion of the larger 225 acre parcel. With the exception of a concrete canal located along the northern and eastern property boundaries and a wooden fence located along the southern property boundary, there are no other structures or improvements located within the site. The site and parcel is owned by the City of Lodi.

According to information provided by site personnel, the subject property has historically been used as unimproved/agricultural land since at least 1894. The City of Lodi purchased the parcel in 1964 from owners who previously farmed the land.

The subject property is situated in an agricultural area in Lodi, California. Adjacent properties and surrounding areas include a wastewater treatment facility and agricultural land to the south of the site, agricultural land and the I-5 Frontage Road to the north of the site, North Cord Road followed by I-5 to the east of the site, and agricultural land with 230 kilovolt power transmission lines to the west of the site. The site is accessible from the east off of North Cord Road.

Recognized Environmental Conditions

A *recognized environmental condition* (REC), as defined in ASTM E 1527-13, is "the presence or likely presence of any hazardous substances or petroleum products in, on, or at a property: (1) due to release to the environment; (2) under conditions indicative of a release to the environment; or (3) under conditions that pose a material threat of a future release to the environment."

Based on the data obtained during the site visit, the environmental database review, and an interview with personnel familiar with the subject property and its history, this assessment has revealed no evidence of RECs in connection with the subject property.

Controlled Recognized Environmental Conditions

A *controlled recognized environmental condition* (CREC), as defined in ASTM E 1527-13, is "a recognized environmental condition resulting from a past release of hazardous substances or petroleum products that has been addressed to the satisfaction of the applicable regulatory authority (for example, as evidenced by the issuance of a no further action letter or equivalent, or meeting risk-based criteria established by regulatory authority), with hazardous substances or petroleum products allowed to remain in place subject to the implementation of required controls (for example, property use restrictions, activity and use limitations, institutional controls, or engineering controls)."

Based on the data obtained during the site visit, the environmental database review, and an interview with personnel familiar with the subject property and its history, this assessment has revealed no evidence of CRECs in connection with the subject property.

Historical Recognized Environmental Conditions

This assessment has revealed no evidence of historical RECs in connection with the subject property.

De Minimis or Other Potential Issues

The following *de minimis* condition was identified at the subject property:

- The subject property has been used historically been used as unimproved/agricultural land since at least 1894. Historical agricultural operations typically would have included the use of agricultural chemicals (e.g., pesticides, herbicides, fertilizers); although no specific information regarding agricultural chemical use was obtained. Given the nature of

current land use and the lack of regulatory scrutiny to date, the potential presence of any residual agricultural chemicals in soil or groundwater at the site represents a *de minimis* condition.

1.0 INTRODUCTION AND BACKGROUND

This section describes the purpose of the Phase I Environmental Site Assessment (ESA), the auditors, the scope of work, and any limiting or special conditions encountered during the assessment.

1.1 PURPOSE AND AUDITORS

ERM-West, Inc. (ERM) conducted a Phase I ESA of the approximately 25 acre property located at the intersection of I-5 Frontage Road and North Thornton Road in Lodi, San Joaquin County, California (the "site" or "subject property"). The subject property consists of approximately 25 acres of land within the larger approximately 225 acre parcel identified as San Joaquin County Assessor's Office Assessor's Parcel Number (APN) 055-150-29.

A site visit was conducted on 29 January 2014 by Ms. Lindsay Capitanich of ERM. Mr. Benjamin Jordan, Right of Way Contractor of PG&E, provided information regarding current and historical use of the subject property and accompanied ERM during the site visit.

1.2 SCOPE OF WORK

This ESA was conducted in conformance with ERM's proposal dated 20 December 2013 and with the requirements of American Society for Testing and Materials (ASTM) Standard E 1527-13, *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process,* and the standards for conducting all appropriate inquiries set forth by the United States Environmental Protection Agency (USEPA) at Title 40 of the Code of Federal Regulations (CFR) Part 312.

The ESA was conducted to evaluate and identify conditions indicative of releases and threatened releases of hazardous substances and petroleum products on, at, in, or to the subject property. ERM's Phase I ESA sought to gather information regarding: (1) current and past property users and occupancies; (2) current and past users of hazardous substances and petroleum products; (3) waste management and disposal activities that could have caused a release or threatened release of hazardous substances; (4) current and past corrective actions and response activities to address past and ongoing releases of hazardous substances at the subject property; (5) engineering controls at the subject property; (6) institutional controls at the subject property; and (7) properties adjoining or located near the subject property that have environmental

conditions that could have resulted in conditions indicative of releases or threatened releases of hazardous substances to the subject property.

ERM's Phase I ESA included the following tasks:

- An on-site inspection of the subject property to evaluate current conditions and identify areas of potential concern.
- A review of property history through an interview with subject property personnel and aerial photographs, city directories, and historical mapping.
- Observation, and interviews with knowledgeable personnel where possible, of adjacent properties and the local area to evaluate the potential for adverse environmental impact to the subject property.
- Interviews/research of local city/county, tribal, state, and federal records, including contracting of Environmental Data Resources, Inc. (EDR) to identify sites of concern as required in the regulatory records review section of the ASTM standards for a Phase I ESA, where available.
- A request for information pertaining to the subject property was sent to the San Joaquin County Assessor's Office, the City of Lodi Building and Planning Department, the City of Lodi Fire Department, and the San Joaquin County Environmental Health Department. ERM also searched the California State Water Resources Control Board (SWRCB) GeoTracker Database, the California Department of Toxic Substances Control (DTSC) Envirostor and Hazardous Waste Tracking System (HWTS) Databases, the USEPA Envirofacts, Enforcement and Compliance History Online (ECHO), Resource Conservation and Recovery Act Information System (RCRIS), and Superfund Information Systems (CERCLIS) Databases for information pertaining to the subject property.

Photographs of the subject property and surrounding areas were taken to document current conditions and are included in Appendix A. Copies of aerial photographs, topographic maps, and Sanborn Fire Insurance Maps "unmapped property" certification, as well as reports for the city directory search, chain-of-title search, and environmental lien search are presented in Appendix B. The EDR database search report is included in Appendix C. A copy of the User Questionnaire is included in Appendix D.

1.3 LIMITING AND SPECIAL CONDITIONS

Limiting conditions and assumptions for the Phase I ESA are discussed below.

1.3.1 Limiting Conditions during the Site Visit

The weather during the site visit was cloudy and the temperature approximately 56°F. No limiting conditions were encountered during the site visit.

1.3.2 Significant Assumptions

No significant assumptions were made in preparation of this Phase I ESA.

2.0 SITE SETTING

This section describes the general subject property location and identifies surrounding properties. It also summarizes site topography and hydrology, and the local geology and hydrogeology.

2.1 LOCATION

The subject property consists of approximately 25 acres of land located southwest of the intersection of I-5 Frontage Road and North Thornton Road in Lodi, San Joaquin County, California. The site includes the approximately 25 acre agricultural property within the larger approximately 225 acre parcel identified with San Joaquin County Assessor's Office APN 055-150-29. The general location of the subject property and physiographic features of the surrounding area are shown on Figure 1, developed from the United States Geological Survey (USGS) 7.5-minute quadrangle for Terminous, California, dated 1993.

2.2 NEIGHBORING PROPERTIES

The subject property is located in an agricultural use area in Lodi, California. The abutting properties and nearby land use include:

- **North:** The subject property is bordered to the north by agricultural land, and the I-5 Frontage Road;
- **South:** The subject property is bordered to the south by White Slough Water Pollution Control Facility (WSWPCF) and agricultural land;
- **East:** The subject property is bordered to the east by North Cord Road followed by I-5; and
- **West:** The subject property is bordered to the west by agricultural land with 230 kilovolt power transmission lines running northwest to southeast.

Based on ERM's observation, the closest residential property is located approximately 1 mile east of the subject property. No visual evidence of environmental concern was observed on immediately surrounding properties.

2.3 TOPOGRAPHY AND HYDROLOGY

The subject property is located in a generally flat area within the San Joaquin Valley and is situated at an average elevation of 7 feet above mean sea level. Based on site visit observations and topographic map review, the subject property is generally flat with a gently sloping topographic gradient towards the south-southwest. Based on site visit observations, storm water that falls within the agricultural areas at the site either infiltrates into the ground or is captured on site and contained within the concrete irrigation canals. The closest surface water body to the subject property is an irrigation water retention pond located adjacent to the south of the site.

According to the EDR report, there are federal wetland areas identified adjacent to the south of the subject property within the vicinity of the irrigation water retention pond. Federal wetland areas were also identified to the east of the site. The subject property is located within the 100-year flood zone.

2.4 GEOLOGY AND HYDROGEOLOGY

Geologic and hydrogeologic information was obtained from the EDR report. According to the EDR report, bedrock beneath the site is typically of the Cenozoic Era and within the Quaternary Series. Soils beneath the site are listed as "Devries." Devries soils are characterized by somewhat poorly drained sandy loam with slow infiltration rates.

The California Department of Water Resources (DWR) Bulletin 118 provides an overview of the San Joaquin Valley Groundwater Basin and the Eastern San Joaquin Subbasin. In summary, sediments are primarily of Pliocene to Recent fine sands, clays, and gravels that were primarily deposited by the San Joaquin Delta. The average annual precipitation ranges from 11 to 25 inches. According to information provided GeoTracker, depth to groundwater beneath the subject property is expected to be approximately 15 feet below ground surface (bgs).

While ERM has not confirmed groundwater flow direction at the subject property, based on surface topography, it is expected groundwater flow beneath the subject property is generally to the southwest. It is important to note that the groundwater flow direction can be influenced locally and regionally by the presence of local wetland features, surface topography, recharge and discharge areas, horizontal and vertical inconsistencies in the types and location of subsurface soils, and proximity to water pumping wells.

3.0 SITE AND OPERATIONS INFORMATION

This section provides a general site description and history of operational use, including any utilities provided to the subject property, current and former operations, chemical use and storage, and hazardous and non-hazardous waste management. It also presents an assessment of water, wastewater, and storm water conditions; air emissions; and evidence of polychlorinated biphenyls (PCBs), on-site impacts, asbestos, and lead-based paint at the site.

3.1 GENERAL SITE DESCRIPTION

The subject property consists of approximately 25 acres of land located southwest of the intersection of I-5 Frontage Road and North Thornton Road in Lodi, San Joaquin County, California. The site includes the approximately 25 acre agricultural property within the larger approximately 225 acre parcel identified with San Joaquin County Assessor's Office APN 055-150-29.

The 25 acre agricultural site occupies the eastern portion of the parcel and includes agricultural operations. With the exception of a concrete irrigation canal located along the northern and eastern site boundary and fence located along the southern property boundary, there are no other structures or improvements located within the site. According to information provided by site personnel, the majority of the subject property has historically been used as unimproved/agricultural land since at least 1894.

The subject property is situated in an agricultural area in Lodi, California. Adjacent properties and surrounding areas include a wastewater treatment facility and agricultural land to the south of the site, agricultural land and the I-5 Frontage Road to the north of the site, North Cord Road followed by I-5 to the east of the site, and agricultural land with 230 kilovolt power transmission lines to the west of the site. The site is accessible from the east off of North Cord Road.

A layout of the subject property is provided in Figure 2.

3.2 UTILITIES

According to information provided by site personnel and observations made during ERM's site visit, the site is not improved with utility services or connections. A 230 kilovolt power transmission line is located adjacent to the west of the site and runs northwest to southeast.

3.3 PROCESSES AND MATERIAL USE

This subsection summarizes information concerning operations at the subject property.

3.3.1 Current Operations

The subject property currently consists of an agricultural land improved with a concrete irrigation canal located along the northern and eastern site boundary and a fence in disrepair located along the southern property boundary. No other structures or improvements are located within the site. According to information provided by site personnel, the majority of the subject property has historically been used as unimproved/agricultural land since at least 1894.

The site is provided water for irrigation from treated wastewater from WSWPCF located adjacent to the south of the site. Water from WSWPCF is diverted to the subject property via distribution piping. ERM observed culverts, and a concrete canal located along the eastern and northern property boundary. ERM observed no surficial staining within the agricultural portion of the site and no other visual evidence of environmental concern was observed at the subject property during the site visit.

3.3.2 Discontinued Operations

According to information provided by site personnel, the subject property has historically been used as unimproved/agricultural land since at least 1894. No evidence of former structures was observed at the subject property during ERM's site visit.

3.4 CHEMICAL USE AND STORAGE

According to information provided by the site contact and observations made during ERM's site visit, no chemical use or storage was observed at the subject property. ERM did not observe evidence of chemical staining at the subject property.

No information regarding historical use of pesticides and/or herbicides was provided by the site contact. No records of past chemical use at the subject property were identified during this assessment.

3.4.1 Underground Storage Tanks

No evidence of current or former underground storage tanks (USTs) at the subject property was observed during the site visit. The site contact was unaware of any current or former USTs at the subject property. No USTs were reported for the subject property in the EDR report.

3.4.2 Aboveground Storage Tanks

No evidence of aboveground storage tanks (ASTs) at the subject property was observed during the site visit. The site contact was not aware of any current or former ASTs at the subject property. A review of historical aerial photographs for the subject property did not show features resembling ASTs at the subject property.

3.5 HAZARDOUS AND NON-HAZARDOUS WASTE MANAGEMENT

This subsection describes information concerning the use of hazardous and non-hazardous waste at the subject property.

3.5.1 Hazardous Waste

No hazardous wastes are currently being generated on site, and ERM did not observe evidence of hazardous waste generation or storage during the site visit. ERM observed the surface soil and vegetation to be in generally good condition with no apparent staining or dried or distressed vegetation.

No universal waste generation or storage was observed at the subject property during the site visit.

3.5.2 Non-Hazardous Waste

Current operations do not generate non-hazardous wastes at the subject property. ERM did not observe evidence of non-hazardous waste generation or storage during the site visit.

3.6 WATER, WASTEWATER, AND STORM WATER

This subsection presents information concerning water, wastewater, and storm water at the subject property.

3.6.1 Water

According to site visit observations and information provided by site personnel, the site obtains water for irrigation purposes from treated wastewater from WSWPCF located adjacent to the south of the site. Water from WSWPCF is diverted to the subject property via distribution piping. The EDR report did not list any water supply wells on the subject property, and no evidence of water wells was observed during the site visit.

The site is not provided water for drinking or sanitary use.

3.6.2 Wastewater

According to site personnel, the subject property does not generate process wastewater at the site; therefore, no process wastewater is discharged from on-site operations.

No sanitary wastewater is currently generated and no restroom facilities were observed during the site visit. According to the site contact, there are no current or former septic systems, leach fields, drywells, or underground injection control wells at the site. ERM did not observe evidence of septic tanks or septic systems at the subject property during the site visit.

3.6.3 Storm Water

Based on site visit observations, storm water that falls within the agricultural areas at the site either infiltrates into the ground or is captured on site in concrete irrigation canals located to the east and north of the site.

3.7 AIR EMISSIONS

As the subject property is currently agricultural land, no air emissions that require permitting were observed during the site visit. No current air permits were identified for the site within the EDR report or during regulatory review.

3.8 POLYCHLORINATED BIPHENYLS

ERM inspected the subject property for types of equipment that have been historically associated with the use of PCBs as a dielectric fluid coolant and stabilizer. Some examples of the types of equipment that potentially contain PCBs or PCB-contaminated oil include electrical equipment such as transformers

(pad-mounted or pole-mounted), capacitors, and high-voltage, liquid-filled switches.

At the time of the site visit, no PCB-type equipment was observed on the subject property. Adjacent to the west of the site are 230 kilovolt power transmission lines. ERM observed the transmission lines to be in generally good condition with no apparent staining on the concrete pads or ground surface surrounding the equipment.

3.9 VISUAL INDICATIONS OF ON-SITE IMPACTS

No visual indications of on-site impacts were observed during the site visit. ERM observed no surficial staining throughout the subject property and no evidence of dried or distressed vegetation was observed during the site visit.

3.10 ASBESTOS-CONTAINING MATERIALS

Asbestos was banned in most friable building materials (spray-applied surfacing materials and thermal system insulation) in 1978, but the Occupational Safety and Health Administration deems spray-applied surfacing materials, thermal system insulation materials, and vinyl flooring materials as "presumed asbestos-containing materials" if they are present in pre-1980 buildings (Title 8 of the California Code of Regulations Section 5208).

With the exception of concrete irrigation canals and fencing, no other permanent structures were observed during the site visit. Based on the building materials observed, it is unlikely that asbestos-containing materials are present at the subject property. Historical sources did not indicate the presence of other structures at the subject property.

3.11 LEAD-BASED PAINT

Lead-based paint was used widely throughout the interiors and exteriors of buildings prior to 1978, primarily due to its strength and overall durability. With the exception of concrete irrigation canals and fencing, no other permanent structures were observed during the site visit. Based on the building materials observed, it is unlikely that lead-based paint is present at the subject property.

4.0 ASSESSMENT OF PAST LAND USE AND OPERATIONS

This section addresses past land use and operations at the subject property and the surrounding area, based on an interview with a representative of the property owner and review of historical records and photographs.

4.1 GENERAL INFORMATION

According to site personnel and a review of historical photographs and records, the subject property has been used as unimproved/agricultural land since at least 1894. The City of Lodi purchased the property in 1964 to build the treatment plant. Previous owners reportedly farmed the land for corn and alfalfa. The subject property is currently owned and operated by the City of Lodi. Adjacent and surrounding land use has historically been primarily agricultural since 1894.

4.2 PREVIOUS ENVIRONMENTAL REPORTS

ERM was not provided with previous environmental reports for the subject property. No previous environmental reports for the subject property were identified during our search of public records.

4.3 EVALUATION OF HISTORICAL INFORMATION SOURCES

To determine past uses of the subject property and surrounding properties, ERM reviewed historical sources of information as outlined below. Sanborn Fire Insurance Maps were requested from EDR; however, EDR had no coverage for the subject property and surrounding area. A copy of the EDR "unmapped property" certification is presented in Appendix B. Copies of the aerial photographs, topographic maps, city directories, chain-of-title report, and environmental liens search that were provided by EDR are also included in Appendix B.

Table 1 *Summary of Historical Records Reviewed*

	Name/Years Reviewed	
Source of Information	**Subject Property**	**Adjacent Properties**
Interview with current occupant and/or owner	Mr. Benjamin Jordan, Right of Way Contractor with PG&E and Mr. F. Wally Sandelin, Public Works Director with the City of Lodi.	Mr. Benjamin Jordan, Right of Way Contractor with PG&E and Mr. F. Wally Sandelin, Public Works Director with the City of Lodi.
Interview(s) with past owners/occupants, (if appropriate)	Contact information not readily available	Not applicable
Interview(s) with owner/occupants of neighboring and nearby properties (in cases of abandoned subject property)	Not applicable	Not applicable
Environmental Liens and Activity and Use Limitations	None reported	Not provided
Chain-of-Title Report	1940 to present	Not applicable
Aerial Photographs	1957, 1963, 1974, 1984, 1993, 1998, 2005, 2006, 2009, 2010, and 2012	1957, 1963, 1974, 1984, 1993, 1998, 2005, 2006, 2009, 2010, and 2012
Sanborn Fire Insurance Map	No coverage	No coverage
Topographic Maps	1894, 1910, 1939, 1947, 1952, 1968, 1978, 1993, and 1997	1894, 1910, 1939, 1947, 1952, 1968, 1978, 1993, and 1997
City Directories	Not available	2013, 2008, 2003, and 1999

4.3.1 Subject Property

According to review of the topographic maps and aerial photographs, the subject property is depicted as unimproved/agricultural land from 1894 to present. According to information provided in the chain-of-title report, no deeds vesting title in the subject property were found from 1940 to present. According to the site contact, the City of Lodi purchased the property from a farmer in 1964. The roads adjacent to the subject property are first depicted in the 1974 aerial photograph and 1978 topographic map. According to review of the aerial photographs, the subject property appears relatively unchanged since in the 1984 aerial photograph. The subject property was not identified in the city directory search report provided by EDR.

4.3.2 Adjacent Properties and Surrounding Area

According to review of the topographic maps and aerial photographs, the adjacent properties and surrounding area is primarily depicted as unimproved/agricultural land from 1894 to present. WSWPCF is first depicted in the 1974 aerial photograph and 1978 topographic map. The power transmission lines are first depicted in the 1957 aerial photograph and the 1952 topographic map. The roads adjacent to the subject property are first depicted in the 1974 aerial photograph and 1978 topographic map, and I-5 is first depicted in the 1984 aerial photograph and the 1978 topographic map.

Based on review of the 1978 topographic map and the 1974 aerial photograph, adjacent properties and surrounding areas remain relatively unchanged.

4.3.3 Non-Regulatory Interviews

Information obtained from site personnel is discussed in the applicable sections throughout this report.

5.0 DATABASE AND GOVERNMENT RECORDS REVIEW

This section summarizes ERM's review of environmental databases as well as government records, and discusses data gaps identified during the assessment.

5.1 GOVERNMENT RECORDS REVIEW/INTERVIEWS

ERM reviewed the GeoTracker database maintained by the SWRCB, the Envirostor and HWTS databases maintained by the DTSC, and the Envirofacts, ECHO, CERCLIS, and RCRIS databases maintained by the USEPA. These databases provide available data where extensive investigation and/or cleanup actions are planned or have been completed at permitted facilities and cleanup sites. The subject property was not identified in the searches of these databases.

The site was not identified on any of the databases searched by EDR.

ERM submitted requests for public records to the following agencies to obtain environmental information pertaining to the subject property and its vicinity:

- San Joaquin County Assessor's Office;
- City of Lodi Building and Planning Department;
- San Joaquin County Environmental Health Department; and
- City of Lodi Fire Department.

None of the agencies had records on file for the subject property. The subject property is not located on tribal lands or within tribal jurisdiction.

5.2 ENVIRONMENTAL DATABASE SEARCH

ERM contracted EDR to conduct a database search for agency records. The database report, presented in Appendix C, defines and summarizes the ASTM-required databases reviewed in the EDR report and notes if any sites (including the subject property) were identified within the ASTM-specified radii for each database. The locations of the sites identified in the EDR report were evaluated to determine which sites were located within the ASTM-specified search distance from the subject property boundary. Only those sites within the ASTM-specified distances are discussed below.

It should be noted that the computerized geocoding technology used in the database search is based on available census data and is only accurate to ±300

feet. The EDR report provides a list of unmapped sites for which inadequate location information was provided. ERM has reviewed the list of "unmapped" sites to determine if these sites are within the study radius.

Based on maps of the area, the required database search radius for a given database, and the site reconnaissance, it appears that none of the unmapped sites are within the designated search distances for each database.

Sites identified within the study radii, if present, are evaluated to determine whether they are likely to have adversely impacted the subject property. The criteria used to evaluate the potential for adverse impact to the subject property include:

- Distance from the subject property;
- Expected depth and direction of groundwater and surface water flow;
- Expected storm water flow direction; and
- The presence/absence of documented contaminant releases at the identified sites that have not been remedied to the satisfaction of regulators.

The identification of a site as potentially upgradient or downgradient is based on the expected direction of groundwater flow to the southwest as discussed in Section 2.4.

5.2.1 Subject Property

The subject property was not identified in any of the databases searched by EDR. ERM also searched the GeoTracker database maintained by the SWRCB, the Envirostor and HWTS databases maintained by the DTSC, and the Envirofacts, ECHO, CERCLIS, and RCRIS databases maintained by the USEPA. The subject property was not identified in any of the online databases searched.

5.2.2 Surrounding Properties

When evaluating the potential adverse impacts of off-site properties, the properties are not considered to have adversely impacted the subject property because: (1) the case has been closed to the satisfaction of regulators, (2) sites are located down gradient of the subject property relative to the expected groundwater flow direction to the southwest, or (3) sites are not located within a distance to the subject property that is likely to have an adverse impact.

The following properties were identified within the search radius of the subject property:

- The WSWPCF (EPA ID S106920509) is located adjacent to the south of the subject property was identified in the National Pollutant Discharge Elimination System (NPDES), Cortese, Enforcement action listing (ENF), and the emissions inventory data (EMI) databases searched by EDR. The WSWPCF received notice of violations (NOVs) for effluent limitation violations from 2000 to 2007, and not complying with the monitoring and reporting program requirements in 2010, and for violating the limitations of the waste discharge requirements from 2011 to 2013. According to Mr. Sandelin from the City of Lodi, the violations were due to ammonia concentrations slightly higher than allowed, and turbidity violations. These were in effluent stream that was ultimately discharged to the Delta.
- Lodi Energy Center (EPA ID S110042436), located approximately 0.25 miles south of the site, was identified in the NPDES, voluntary cleanup program (VCP), and Envirostor databases searched by EDR. A Phase I ESA was performed at the facility in 2008, which identified potential environmental concerns. A Phase II ESA was subsequently performed identifying elevated concentrations of polycyclic aromatic hydrocarbons (PAHs) and organochlorine pesticides in the surface and subsurface soils. On further review, the elevated concentrations were misreported due to incorrect units. No further action was issued by the DTSC in 2009.
- San Joaquin Air (EPA ID S103442230), located approximately 0.5 miles northeast of the site, was identified in the waste management unit database (WMUDS/SWAT). San Joaquin Air is an agricultural facility that treats and/or disposes of the wastes associated with confined and concentrated animal feeding, confined animal holding, aquaculture, and/or the confined and concentrated aquatic animal production facility. San Joaquin Air is in the WMUDS database for washwater waste such as photo reuse wastewater or vegetable washwater. No violations were reported.

6.0 DATA GAPS

The following table summarizes the data gaps identified during the development of this ESA. The significance of the data gaps with respect to the conclusions of this assessment is presented in the table below. The data gaps are not deemed to be a significant constraint on identifying conditions indicative of releases or threatened releases to the subject property; therefore, the significance of the data gaps is rated low.

Table 2 Data Gap Summary

Data Gap	Sources Consulted to Address Data Gap	Significance[1]
ERM did not interview previous subject property owners because contact information for the owners was not readily available.	Interview with a representative of the current property owner who is familiar with the subject property history, and review of historical maps and photographs.	Low
The User Questionnaire was not completed by a representative.	Interview with a representative of the current property owner who is familiar with the subject property history, and review of historical maps and photographs.	Low

1 Significance of data gaps to identify conditions indicative of releases or threatened releases to the subject property is rated from low to high. Low significance indicates that additional information to fill the data gaps is likely to have no impact on the conclusions reached in this report. A medium rating indicates that additional information may prove valuable, but may not significantly alter the conclusions of this report. High significance indicates that it is the consultant's opinion that additional investigation (either from reports or field sampling) is required to address the data gap.

7.0 USER-PROVIDED INFORMATION

ERM contacted PG&E (the "Client" or "User") and Mr. F. Wally Sandelin (the "Owner") to determine the status of potential environmental concerns at the subject property. The following information on the subject property was requested:

- An evaluation of the presence of Environmental Cleanup Liens for the subject property;
- Activity and Use Limitations such as engineering controls (e.g., slurry walls, caps) and land use restrictions or institutional controls (e.g., deed restrictions, covenants) that may be in place for the subject property;
- Specialized Knowledge that includes personal knowledge or experience related to the subject property or nearby properties based on professional experience or knowledge of the subject property;
- Fair Market Value to evaluate whether a purchase price is significantly below Fair Market Value;
- Obvious Indicators that involve past or present spills, stains, releases, or cleanups on or near the subject property; and
- Common Knowledge about specific chemicals, possible contamination, or past use of the subject property and surrounding area.

The *Owner/Key Site Manager Questionnaire for Phase One Additional Inquiries* (Owner Questionnaire) was completed by Mr. F. Wally Sandelin. The *User Questionnaire for Phase One Additional Inquiries* (User Questionnaire) was not completed by Mr. Benjamin Jordan with PG&E. This has been identified as a data gap in Section 6.0. Responses to the Owner Questionnaire are addressed in the following sections. A copy of the Owner Questionnaire is presented in Appendix D.

7.1 TITLE RECORDS

At the request of PG&E, ERM ordered a 60-year chain-of-title report for the subject property from EDR. The subject property occupies approximately 25 acres in the eastern portion of the larger 225 acre parcel of land identified as Kern County Assessor's Office APN 055-150-29. Based the chain-of-title report, the City of Lodi is the current owner, and no other deeds vesting title in the subject property were found from 1940 to present.

A copy of the chain-of-title report for the subject property is included in Appendix B.

7.2 ENVIRONMENTAL LIENS OR ACTIVITY AND USE LIMITATIONS

At the request of PG&E, ERM contracted with EDR to conduct a search for environmental liens against the subject property. No environmental liens or activity and use limitations were identified for the subject property. The EDR environmental liens search report is included in Appendix B.

7.3 SPECIALIZED KNOWLEDGE

The Owner does not have specialized knowledge regarding former and current activities associated with the subject property.

7.4 COMMONLY KNOWN OR REASONABLY ASCERTAINABLE INFORMATION

The User has access to commonly known and reasonably ascertainable information associated with the subject property. The User provided this information to ERM prior to the site visit. Information from the User is presented throughout this report in the relevant sections.

7.5 VALUATION REDUCTION FOR ENVIRONMENTAL ISSUES

No evaluation of the purchase price to fair market value has been conducted.

7.6 OWNER AND OCCUPANT INFORMATION

The following information regarding the subject property has been identified:

Entity	Name
Subject property owner	City of Lodi.
Current subject property occupant	White Slough Water Pollution Control Facility

7.7 REASON FOR PERFORMING PHASE I

This Phase I ESA was performed on behalf of PG&E to assess potential environmental liabilities associated with surface and/or subsurface impacts from past and current operations at the subject property.

8.0 CONCLUSIONS

ERM conducted a Phase I ESA at the subject property. Our conclusions and opinions are based on a scope of work that followed the requirements set forth in ASTM Standard E 1527-13 and 40 CFR 312. A summary of ERM's conclusions and opinions is presented below.

Recognized Environmental Conditions

ERM has performed a Phase I ESA in conformance with the scope and limitations of ASTM Practice E 1527-13 of the City of Lodi Property located southwest of the I-5 Frontage Road and North Thornton Road intersection in Lodi, San Joaquin County, California. Any exceptions to, or deletions from, this practice are described in Section 1.3 of this report.

Based on the data obtained during the site visit, the environmental database review, and an interview with personnel familiar with the subject property and its history, this assessment has revealed no evidence of RECs in connection with the subject property.

Controlled Recognized Environmental Conditions

Based on the data obtained during the site visit, the environmental database review, and an interview with personnel familiar with the subject property and its history, this assessment has revealed no evidence of CRECs in connection with the subject property.

Historical Recognized Environmental Conditions

This assessment has revealed no evidence of historical RECs in connection with the subject property.

De Minimis or Other Potential Issues

The following *de minimis* condition was identified at the subject property:

- The subject property has been used historically been used as unimproved/agricultural land since at least 1894. Historical agricultural operations typically would have included the use of agricultural chemicals (e.g., pesticides, herbicides, fertilizers); although no specific information regarding agricultural chemical use was obtained. Given the nature of current land use and the lack of regulatory scrutiny to date, the potential

presence of any residual agricultural chemicals in soil or groundwater at the site represents a *de minimis* condition.

9.0 REFERENCES

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10.0 QUALIFICATIONS OF ENVIRONMENTAL PROFESSIONALS CONDUCTING THIS ASSESSMENT

This ESA was conducted by Ms. Lindsay Capitanich of ERM. Ms. Bailey Blosser, Mr. Arun Chemburkar and Mr. Jim Warner of ERM reviewed the contents of this report. The professional qualifications for Ms. Capitanich, Ms. Blosser, Mr. Chemburkar, and Mr. Warner are included in Appendix E.

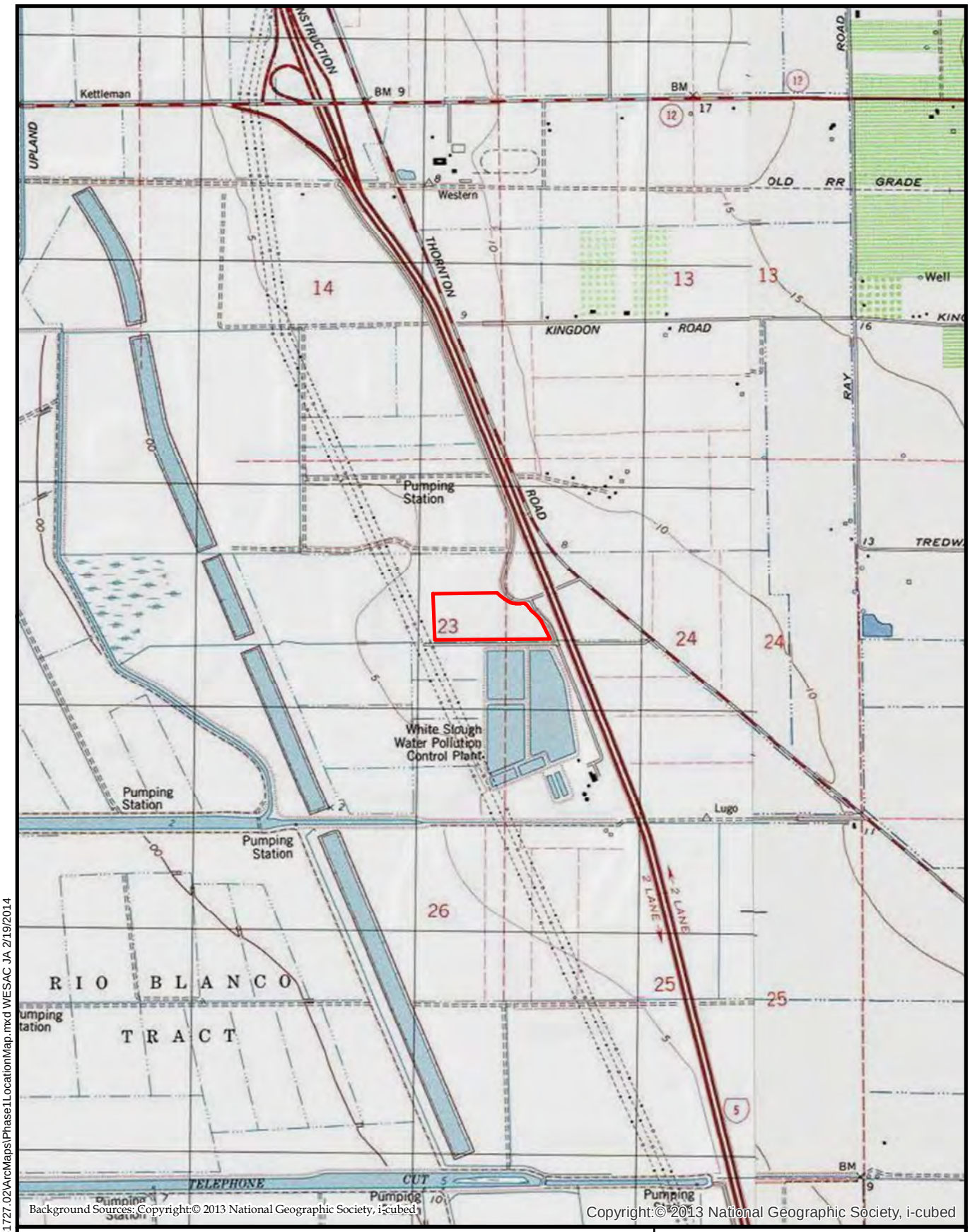
The signatures for Ms. Blosser, Mr. Chemburkar, and Mr. Warner are affixed onto the cover of this report. Mr. Chemburkar and Mr. Warner are the designated Environmental Professionals for this project and prepared the following declaration:

- We declare that, to the best of our professional knowledge and belief, we meet the definition of Environmental Professional as defined in 40 CFR 312.10.
- We have the specific qualifications based on education, training, and experience to assess a property of the nature, history, and setting of the subject property. We have developed and performed the all appropriate inquiries in conformance with the standards and practices set forth in 40 CFR 312.

11.0 LIMITATIONS

The innocent landowner, contiguous owner, and prospective purchaser defenses to liability under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) require that a person acquiring property conduct an all appropriate inquiry with respect to the subject property. ERM has conducted this environmental assessment in accordance with the standards for conducting an all appropriate inquiry set forth at 40 CFR 312. Those standards require the application of scientific principles and professional judgment to certain facts with resultant subjective interpretations and exercise of discretion. Professional judgments expressed herein are based on the facts currently available within the limits of the existing data, and data gaps identified herein, scope of work, budget, and schedule. Those standards also require that the client undertake certain additional inquiries. In addition, the liability defenses under CERCLA require, among several other things, that the client stop any continuing releases after the acquisition, prevent any future threatened releases and prevent or limit human, environmental or natural resource exposure to any hazardous substance released at the subject property. Therefore, except as provided above, ERM makes no warranties, express or implied, including, without limitation, warranties as to merchantability or fitness for a particular purpose, including any warranty that this Phase I assessment will in fact qualify the client for the innocent landowner, contiguous property owner or prospective purchaser defense to liability under CERCLA. ERM's assessment is limited strictly to identifying recognized environmental conditions associated with the subject property. Results of this assessment are based upon the visual site inspection of readily accessible areas of the subject property conducted by ERM personnel, information from interviews with knowledgeable persons regarding the site, information reviewed regarding historical uses, information provided by contacted regulatory agencies, and review of publicly available and practically reviewable information identifying current and historical uses of the property and surrounding properties. All conclusions and recommendations regarding the subject property represent the professional opinions of the ERM personnel involved with the project, and the results of this report should not be considered a legal interpretation of existing environmental regulations. ERM assumes no responsibility or liability for errors in the public data utilized, statements from sources outside of ERM, or developments resulting from situations outside the scope of this project.

Figures



Legend

Site Boundary

N

0 24000

Scale in Inches

0 2000

Scale in Feet

1: 24000 USGS Quadrangle Name: Terminous

ERM

Figure 1
Lodi Phase 1 ESA
North Thornton Road
Lodi, California 95242

PREPARED BY: JA (ERM)

Job No.: 0231727.02
File: Phase1LocationMap.mxd

F:\GIS\Projects\Lodi\P0231727.02\ArcMaps\Phase1LocationMap.mxd WESAC JA 2/19/2014



Legend

Site Boundary

N

0 300 600

Scale in Feet

ERM

Figure 2
Lodi Phase 1 ESA
North Thornton Road
Lodi, California 95242

PREPARED BY:
JA (ERM)

Job No.: 0231727.02
File: Phase1SiteDetail.mxd

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Appendix A
Site Photographs



Photograph: *1*	*View of site looking northwest.*

Pacific Gas and Electric Company	ERM	*City Of Lodi Property* *I-5 Frontage Road and North Thornton Road* *Lodi, San Joaquin County, California*



Photograph: *2*	*View of site including concrete irrigation canal on eastern boundary, looking north.*

Pacific Gas and Electric Company	ERM	*City Of Lodi Property* *I-5 Frontage Road and North Thornton Road* *Lodi, San Joaquin County, California*



Photograph: *3*	*View of the concrete irrigation canal on northern boundary of site, looking west.*

Pacific Gas and Electric Company	ERM	*City Of Lodi Property* *I-5 Frontage Road and North Thornton Road* *Lodi, San Joaquin County, California*



Photograph: *4*	*View of site including adjacent property to the south, looking south.*

Pacific Gas and Electric Company	ERM	*City Of Lodi Property* *I-5 Frontage Road and North Thornton Road* *Lodi, San Joaquin County, California*



Photograph: *5*	*View of the power transmission lines, looking southeast.*

Pacific Gas and Electric Company	ERM	*City Of Lodi Property* *I-5 Frontage Road and North Thornton Road* *Lodi, San Joaquin County, California*



Photograph: *6*	*View of site fencing on southern boundary, looking east.*

Pacific Gas and Electric Company	ERM	*City Of Lodi Property* *I-5 Frontage Road and North Thornton Road* *Lodi, San Joaquin County, California*



Photograph: 7	*Site fence in disrepair*

Pacific Gas and Electric Company	ERM	*City Of Lodi Property* *I-5 Frontage Road and North Thornton Road* *Lodi, San Joaquin County, California*



Photograph: 8	*View of the site looking northeast.*

Pacific Gas and Electric Company	ERM	*City Of Lodi Property* *I-5 Frontage Road and North Thornton Road* *Lodi, San Joaquin County, California*



Photograph: *9*	*View of site looking north.*

Pacific Gas and Electric Company	ERM	*City Of Lodi Property* *I-5 Frontage Road and North Thornton Road* *Lodi, San Joaquin County, California*



Photograph: *10*	*View of southern boundary of site, looking west*

Pacific Gas and Electric Company	ERM	*City Of Lodi Property* *I-5 Frontage Road and North Thornton Road* *Lodi, San Joaquin County, California*



Photograph: *11*	*View of White Slough Water Pollution Control Facility, looking south.*

Pacific Gas and Electric Company	ERM	*City Of Lodi Property* *I-5 Frontage Road and North Thornton Road* *Lodi, San Joaquin County, California*



Photograph: *12*	*View of North Cord Road and I-5, looking east.*

Pacific Gas and Electric Company	ERM	*City Of Lodi Property* *I-5 Frontage Road and North Thornton Road* *Lodi, San Joaquin County, California*

Appendix B
Aerial Photographs, Topographic Maps, EDR "Unmapped Property" Certification for Sanborn Fire Insurance Maps, City Directory Report, Chain-of-Title Report, and Environmental Lien Search Report

Lodi Phase I ESA
12755 N Thornton Rd
Lodi, CA 95242

Inquiry Number: 3827360.8
January 14, 2014

The EDR Aerial Photo Decade Package

EDR® Environmental Data Resources Inc

440 Wheelers Farms Road
Milford, CT 06461
800.352.0050
www.edrnet.com

EDR Aerial Photo Decade Package

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Date EDR Searched Historical Sources:

Aerial Photography January 14, 2014

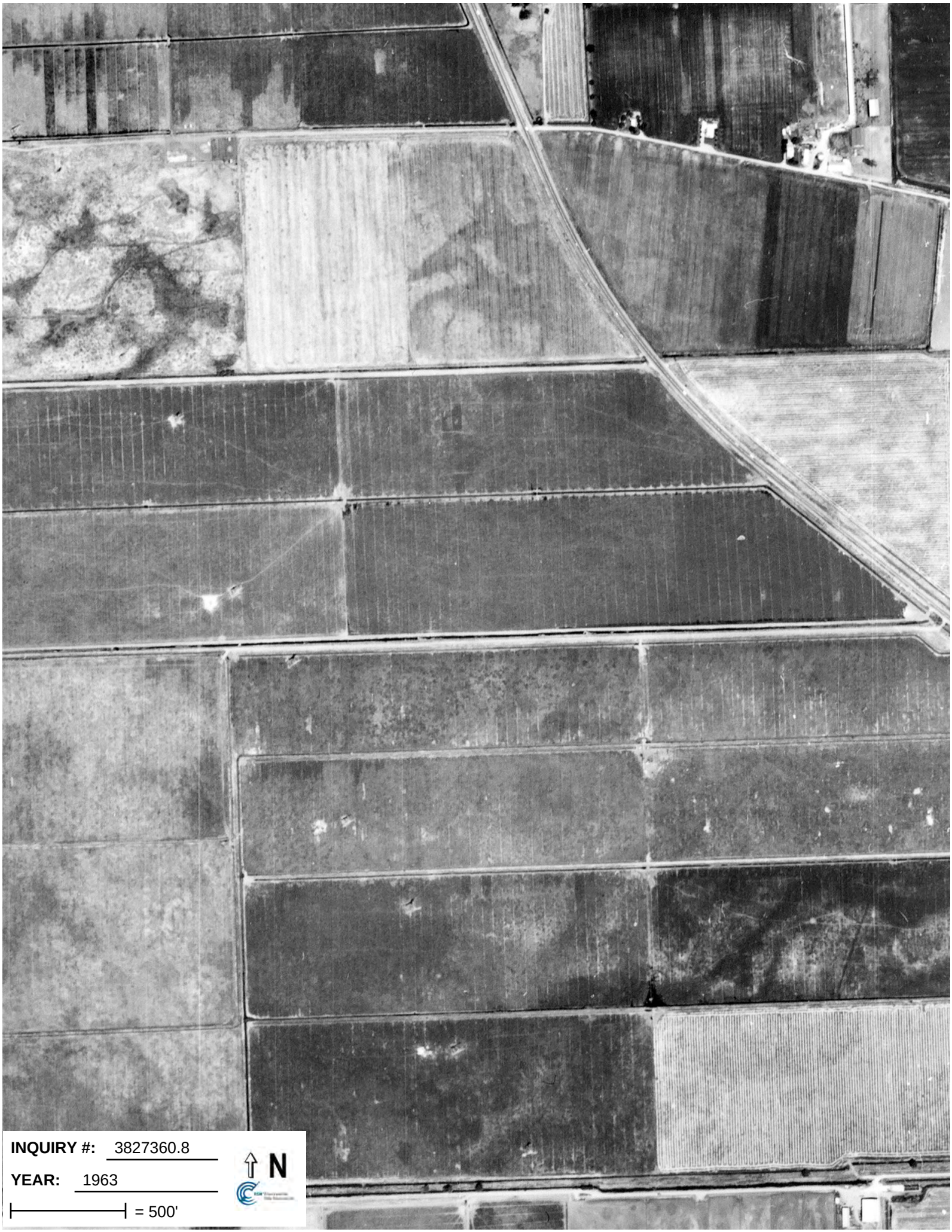
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12755 N Thornton Rd

Lodi, CA 95242

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1963	Aerial Photograph. Scale: 1"=500'	Flight Year: 1963	Mark Hurd
1974	Aerial Photograph. Scale: 1"=500'	Flight Year: 1974	USGS
1984	Aerial Photograph. Scale: 1"=500'	Flight Year: 1984	USGS
1993	Aerial Photograph. Scale: 1"=500'	Flight Year: 1993	USGS
1998	Aerial Photograph. Scale: 1"=500'	/DOQQ - acquisition dates: 1998	EDR
2005	Aerial Photograph. Scale: 1"=500'	Flight Year: 2005	EDR
2006	Aerial Photograph. Scale: 1"=500'	Flight Year: 2006	EDR
2009	Aerial Photograph. Scale: 1"=500'	Flight Year: 2009	EDR
2010	Aerial Photograph. Scale: 1"=500'	Flight Year: 2010	EDR
2012	Aerial Photograph. Scale: 1"=500'	Flight Year: 2012	EDR


INQUIRY #: 3827360.8
YEAR: 1957
= 500'
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INQUIRY #: 3827360.8
YEAR: 1963
= 500'
N


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= 500'
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INQUIRY #: 3827360.8
YEAR: 2012
= 500'
N

Lodi Phase I ESA
12755 N Thornton Rd
Lodi, CA 95242

Inquiry Number: 3827360.4
January 10, 2014

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EDR Historical Topographic Map Report

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with any questions or comments.

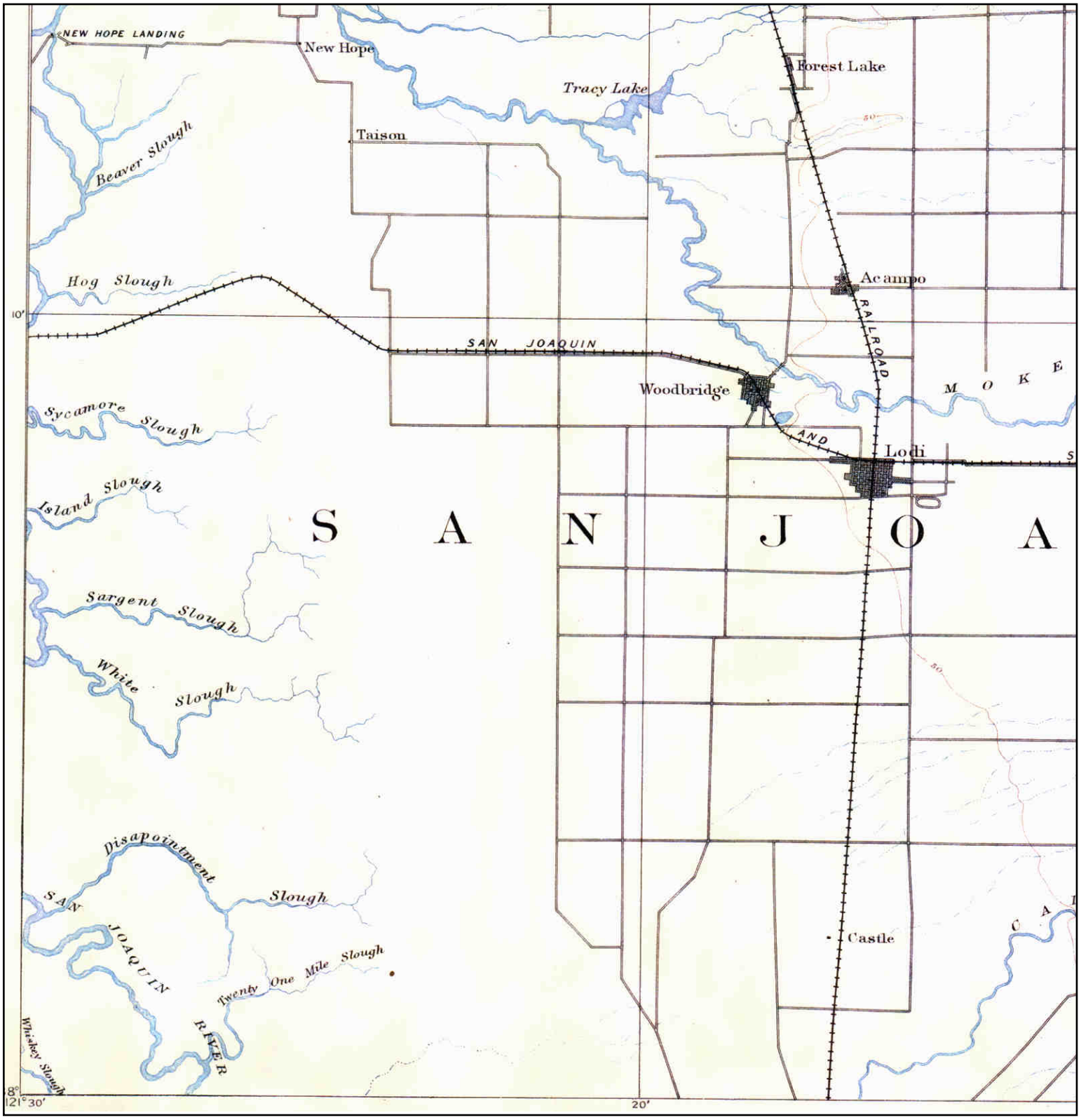
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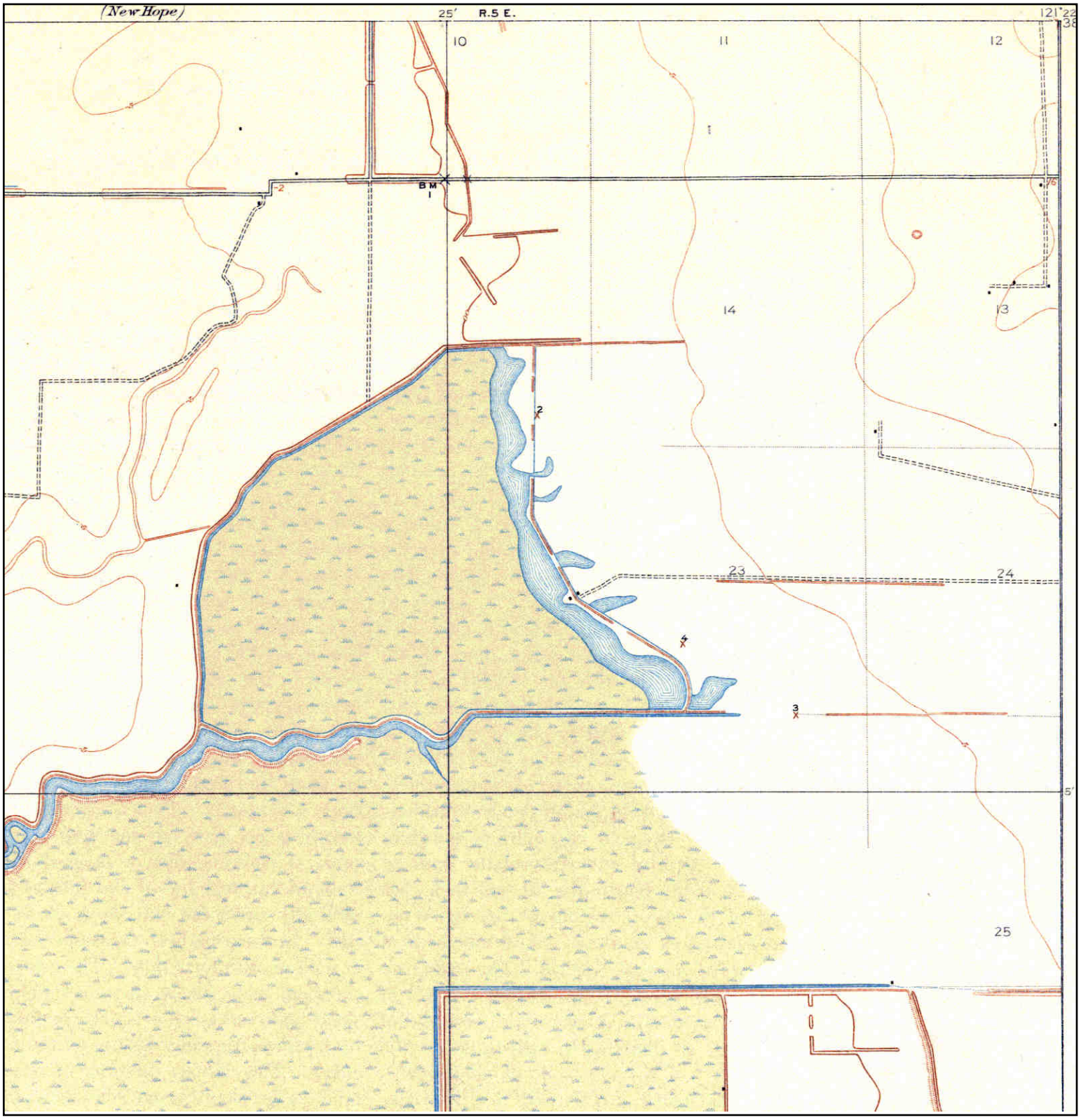
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Historical Topographic Map



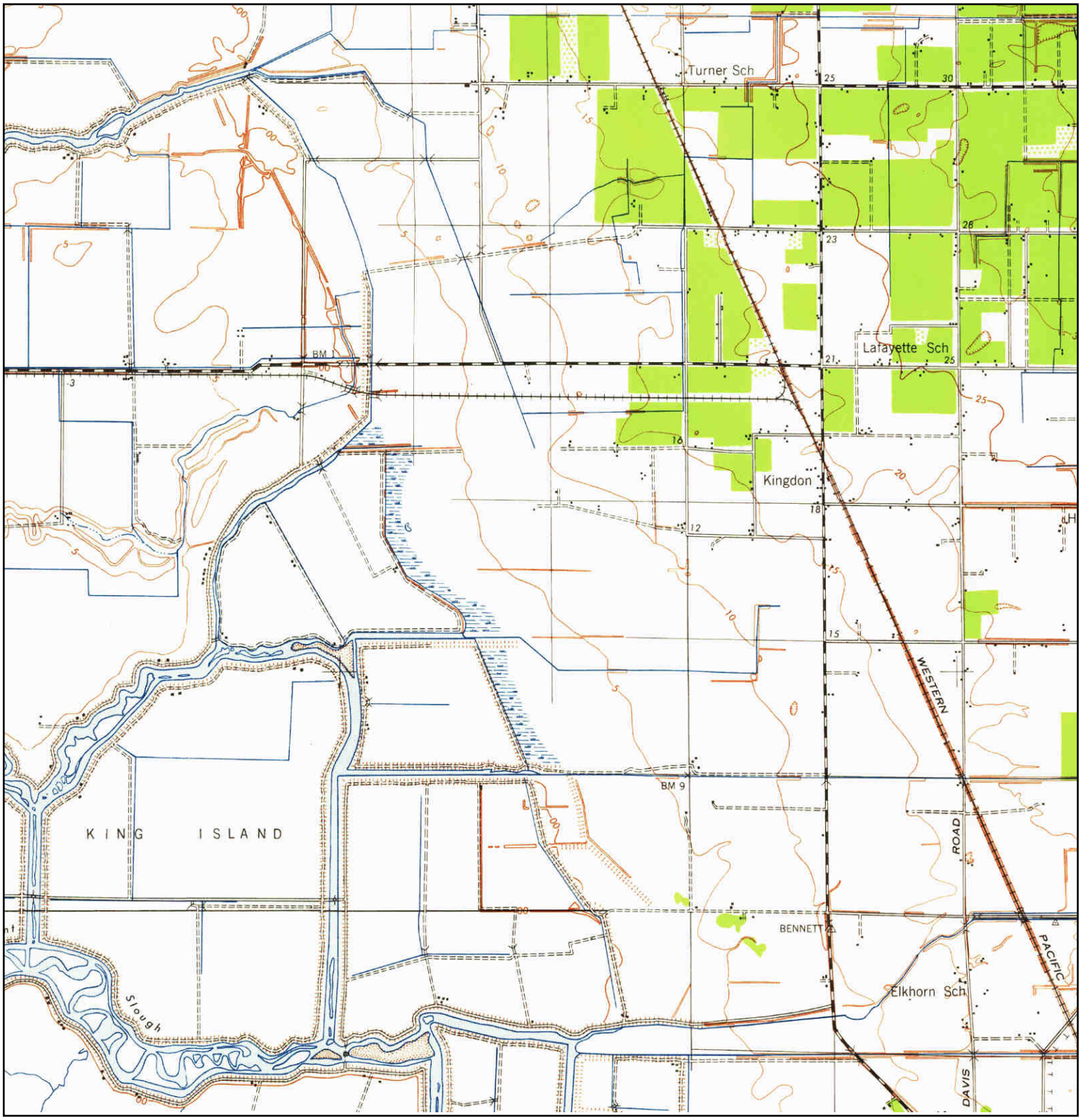
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Historical Topographic Map



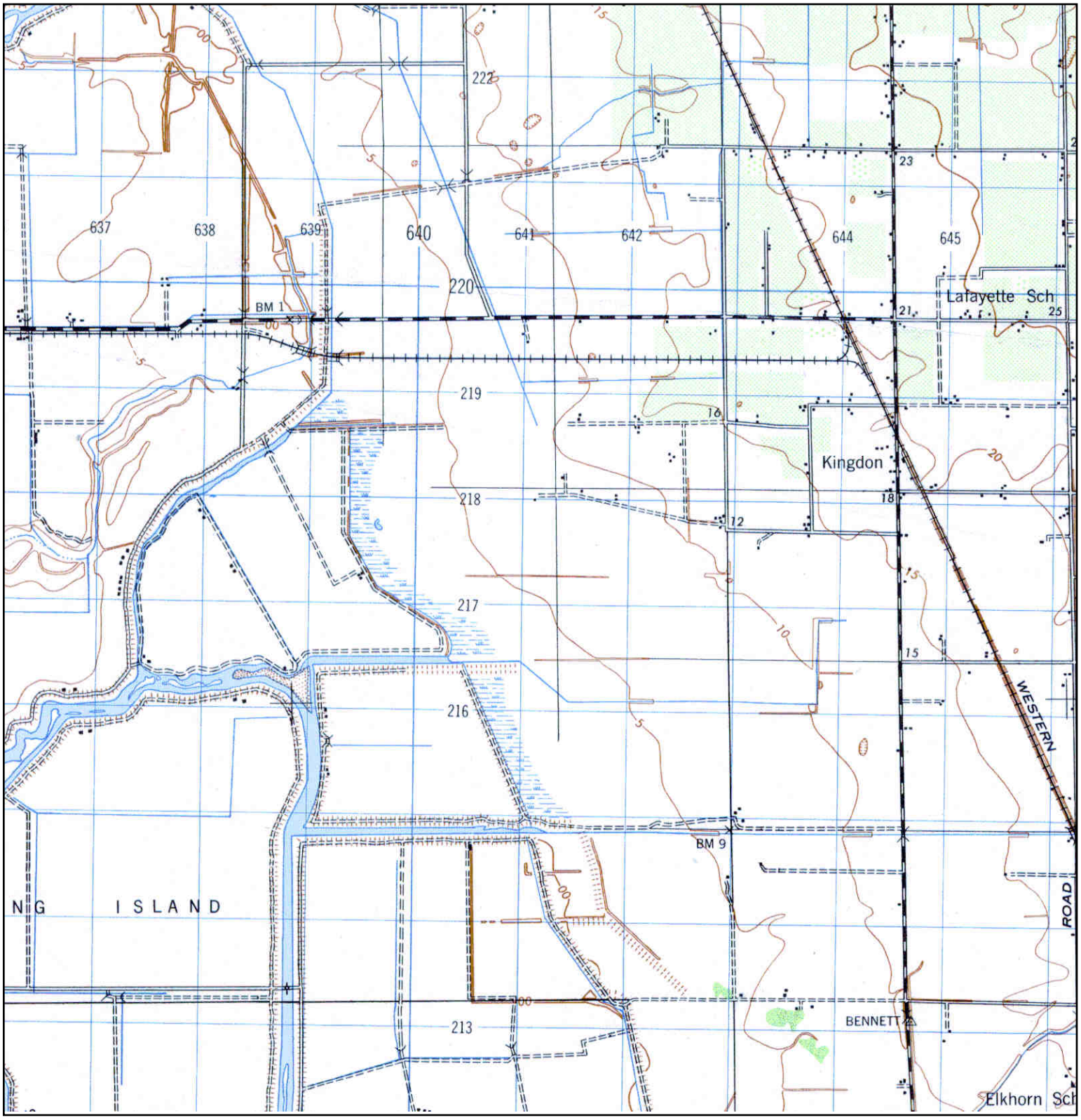
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Historical Topographic Map



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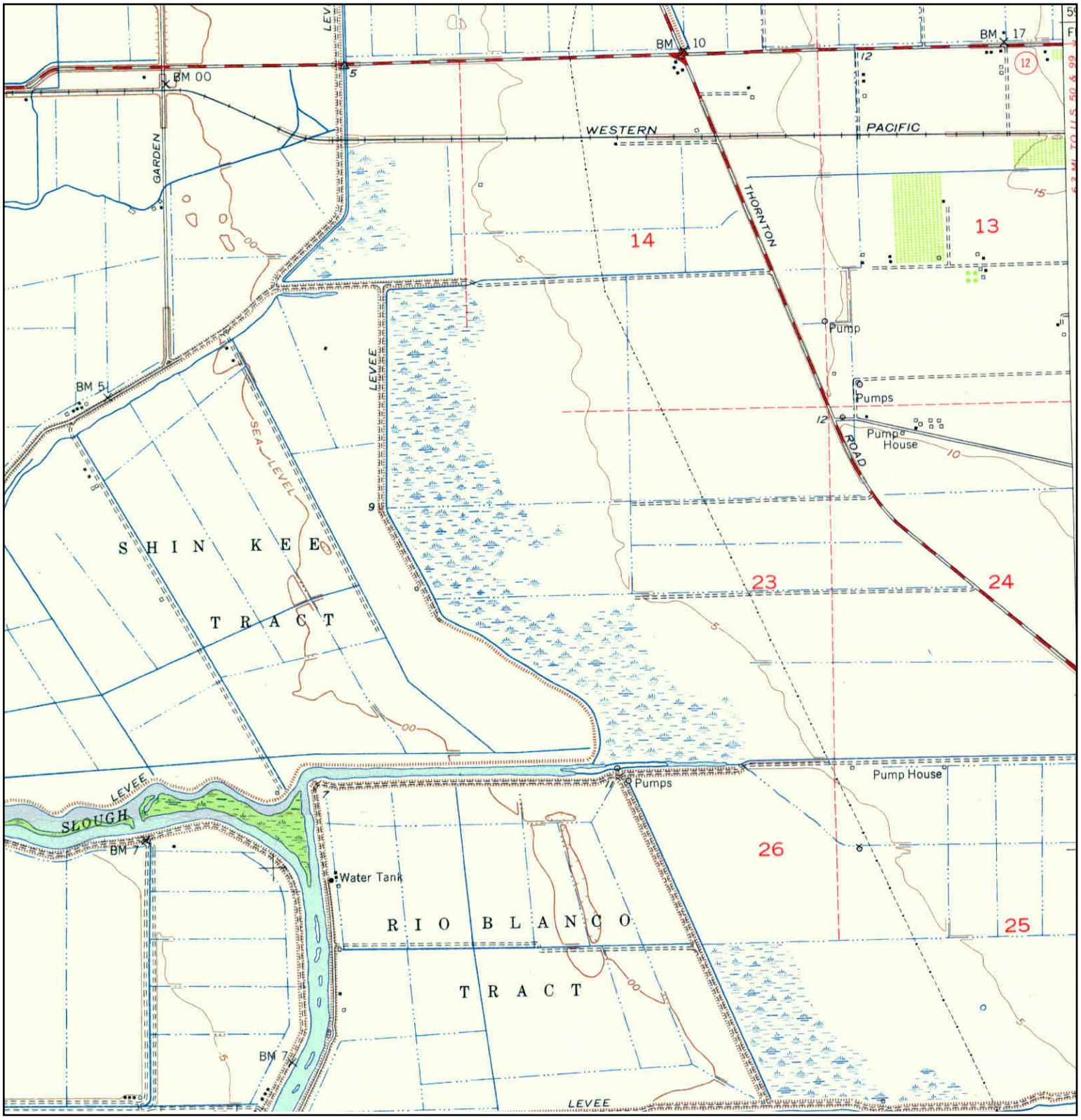
Historical Topographic Map



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	MAP YEAR:	1947	ADDRESS:	12755 N Thornton Rd
				Lodi, CA 95242
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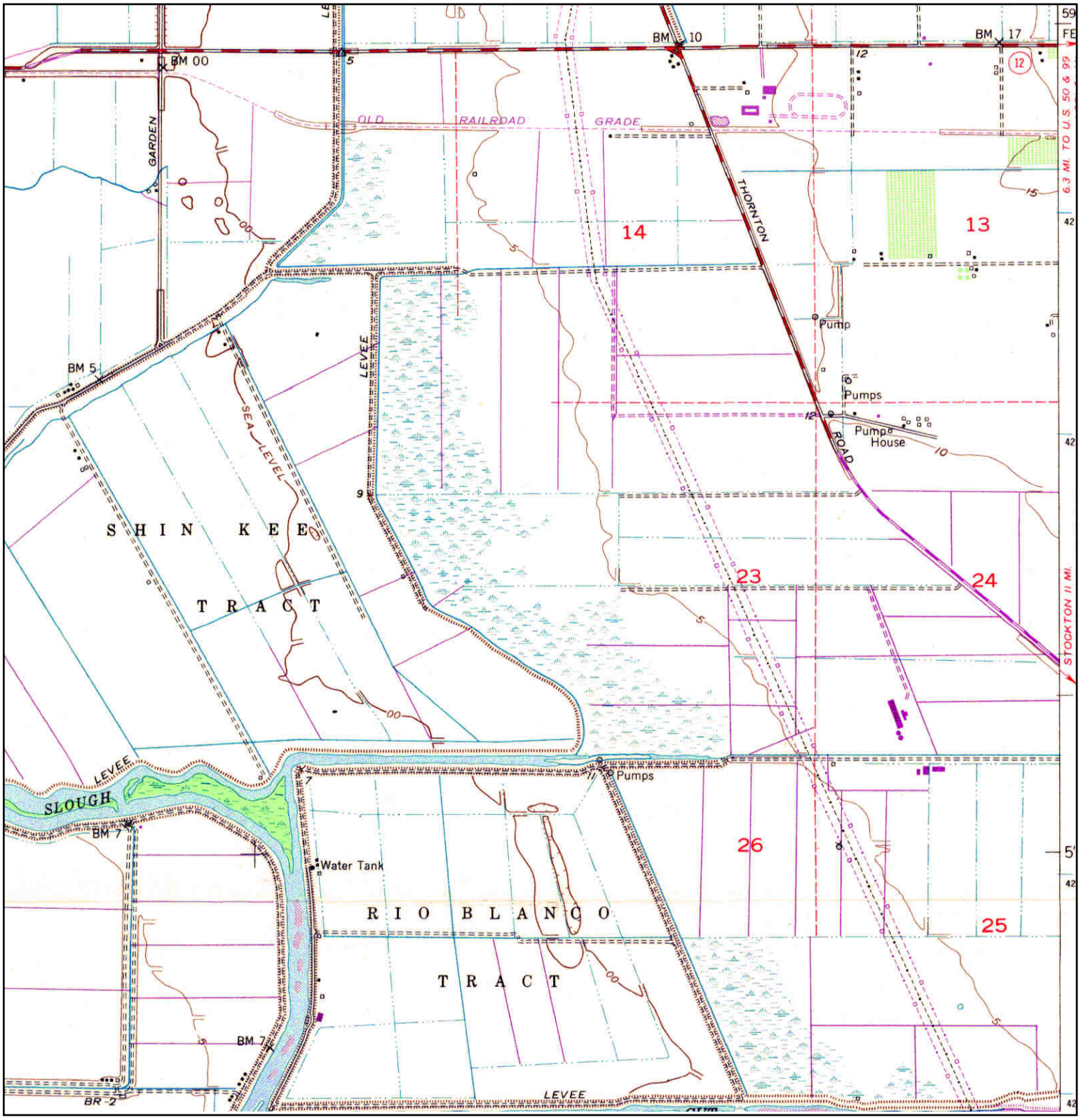
CLIENT:	ERM - West, Inc.
CONTACT:	Bailey Blosser
INQUIRY#:	3827360.4
RESEARCH DATE:	01/10/2014

Historical Topographic Map



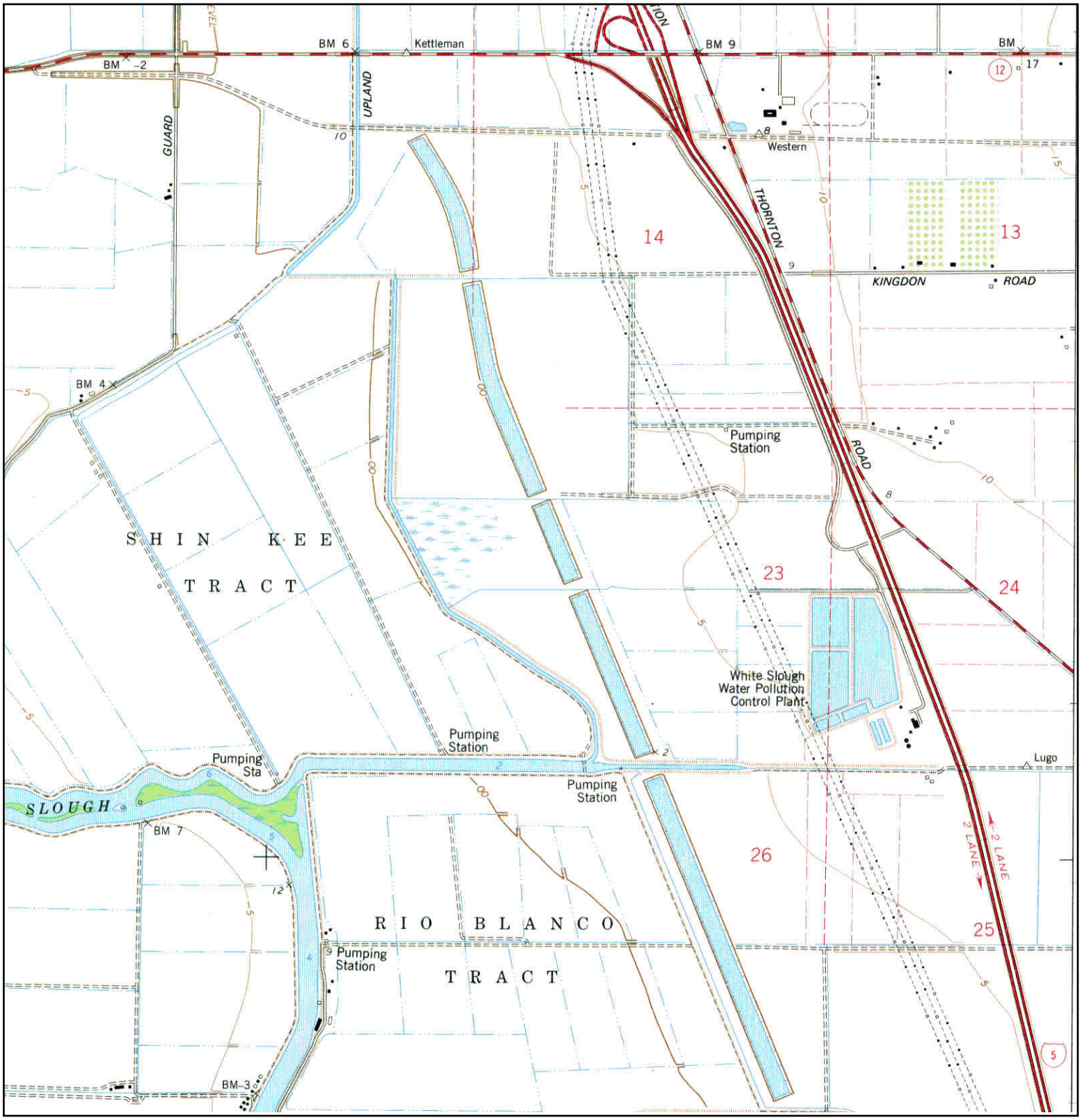
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Historical Topographic Map



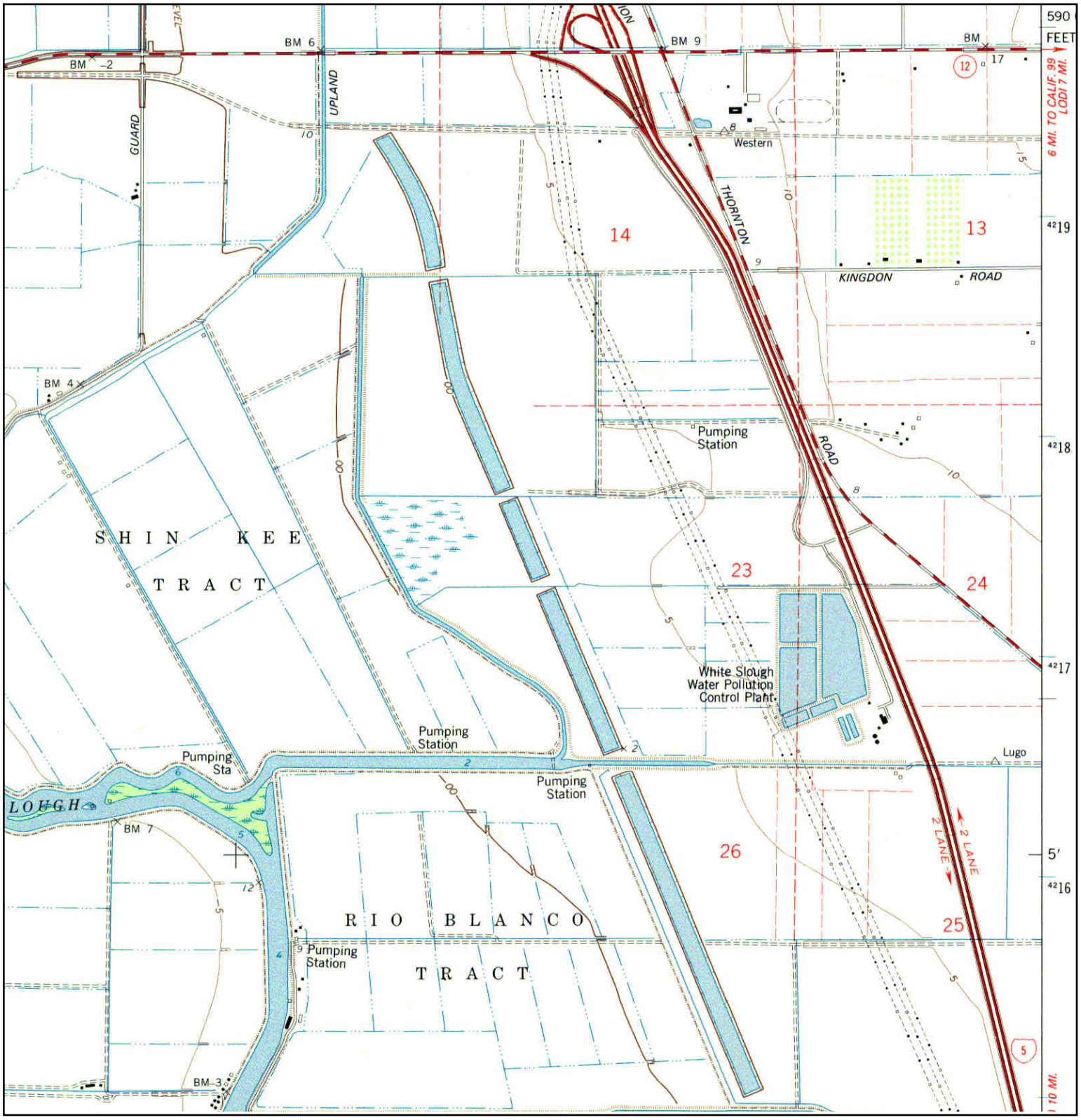
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Historical Topographic Map



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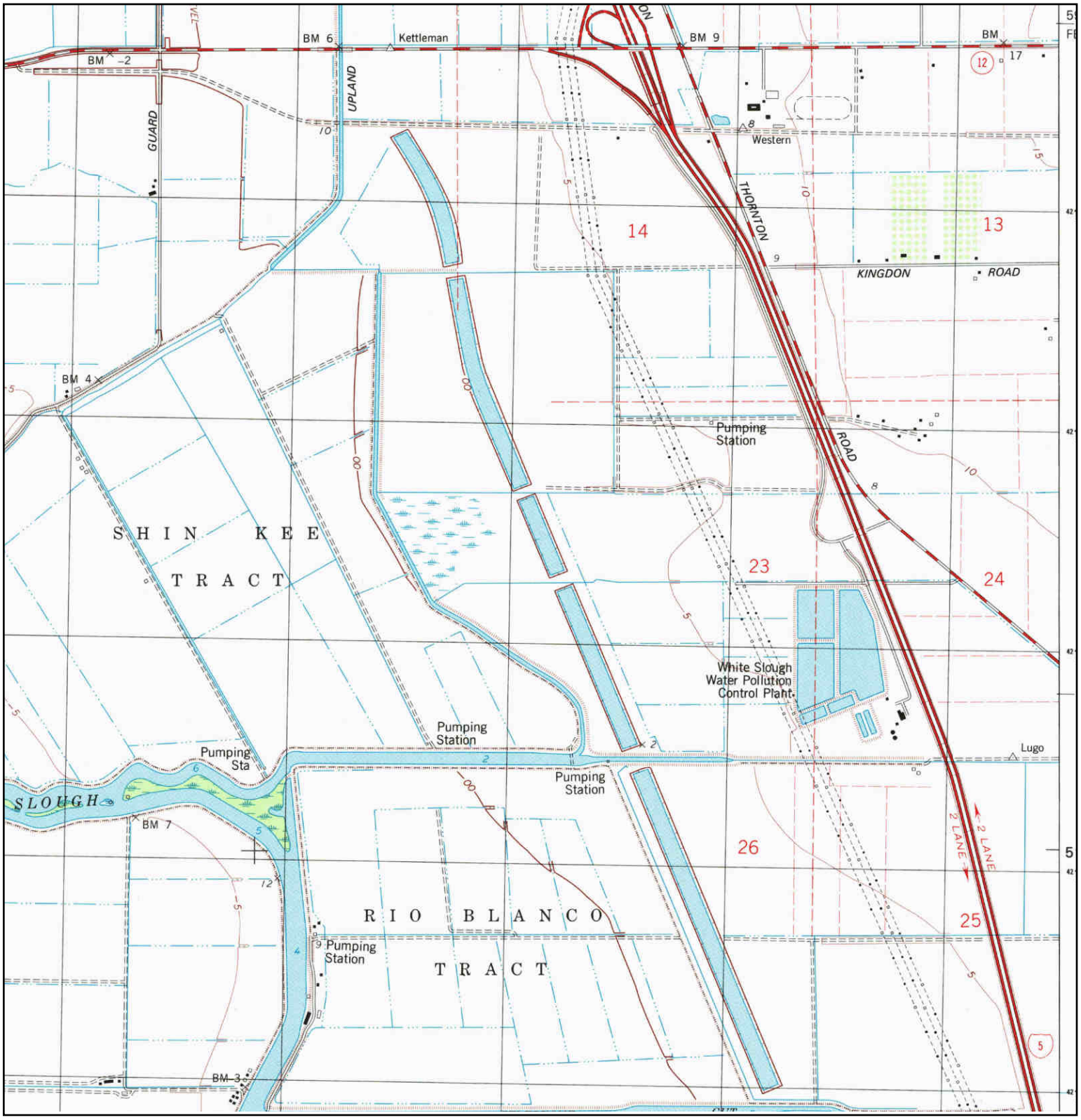
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	REVISED FROM :	1978		Lodi, CA 95242
	SERIES:	7.5	LAT/LONG:	38.0953 / -121.3895
	SCALE:	1:24000		

CLIENT:	ERM - West, Inc.
CONTACT:	Bailey Blosser
INQUIRY#:	3827360.4
RESEARCH DATE:	01/10/2014

Historical Topographic Map



N	TARGET QUAD NAME: TERMINOUS MAP YEAR: 1997 SERIES: 7.5 SCALE: 1:24000	SITE NAME: Lodi Phase I ESA ADDRESS: 12755 N Thornton Rd Lodi, CA 95242 LAT/LONG: 38.0953 / -121.3895	CLIENT: ERM - West, Inc. CONTACT: Bailey Blosser INQUIRY#: 3827360.4 RESEARCH DATE: 01/10/2014

Lodi Phase I ESA
12755 N Thornton Rd
Lodi, CA 95242

Inquiry Number: 3827360.3
January 10, 2014

Certified Sanborn® Map Report

EDR® Environmental Data Resources Inc

440 Wheelers Farms Road
Milford, CT 06461
800.352.0050
www.edrnet.com

Certified Sanborn® Map Report

1/10/14

Site Name:
Lodi Phase I ESA
12755 N Thornton Rd
Lodi, CA 95242

Client Name:
ERM - West, Inc.
1277 Treat Blvd
Walnut Creek, CA 94597

EDR Inquiry # 3827360.3

Contact: Bailey Blosser

EDR® Environmental Data Resources Inc

The complete Sanborn Library collection has been searched by EDR, and fire insurance maps covering the target property location provided by ERM - West, Inc. were identified for the years listed below. The certified Sanborn Library search results in this report can be authenticated by visiting www.edrnet.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by Sanborn Library LLC, the copyright holder for the collection.

Certified Sanborn Results:

Site Name: Lodi Phase I ESA
Address: 12755 N Thornton Rd
City, State, Zip: Lodi, CA 95242
Cross Street:
P.O. # 0231727
Project: Lodi Phase I ESA
Certification # E793-4C72-8ECD

UNMAPPED PROPERTY

This report certifies that the complete holdings of the Sanborn Library, LLC collection have been searched based on client supplied target property information, and fire insurance maps covering the target property were not found.

Sanborn® Library search results
Certification # E793-4C72-8ECD

The Sanborn Library includes more than 1.2 million Sanborn fire insurance maps, which track historical property usage in approximately 12,000 American cities and towns. Collections searched:

- ✓ Library of Congress
- ✓ University Publications of America
- ✓ EDR Private Collection

The Sanborn Library LLC Since 1866™

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Lodi Phase I ESA
12755 N Thornton Rd
Lodi, CA 95242

Inquiry Number: 3827360.5
January 13, 2014

The EDR-City Directory Image Report

Environmental Data Resources Inc

440 Wheelers Farms Road
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City Directory Images

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EXECUTIVE SUMMARY

DESCRIPTION

Environmental Data Resources, Inc.'s (EDR) City Directory Report is a screening tool designed to assist environmental professionals in evaluating potential liability on a target property resulting from past activities. EDR's City Directory Report includes a search of available city directory data at 5 year intervals.

RESEARCH SUMMARY

The following research sources were consulted in the preparation of this report. A check mark indicates where information was identified in the source and provided in this report.

Year	Target Street	Cross Street	Source
2013	☑	☐	Cole Information Services
2008	☑	☐	Cole Information Services
2003	☑	☐	Cole Information Services
1999	☑	☐	Cole Information Services
1993	☐	☐	Polk's City Directory
1988	☐	☐	Polk's City Directory
1983	☐	☐	Polk's City Directory
1978	☐	☐	Polk's City Directory
1973	☐	☐	Polk's City Directory
1968	☐	☐	Polk's City Directory
1963	☐	☐	Polk's City Directory
1959	☐	☐	Polk's City Directory

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FINDINGS

TARGET PROPERTY STREET

12755 N Thornton Rd
Lodi, CA 95242

Year	*CD Image*	*Source*	
N THORNTON RD			
2013	pg A1	Cole Information Services	
2008	pg A2	Cole Information Services	
2003	pg A3	Cole Information Services	
1999	pg A4	Cole Information Services	
1993	-	Polk's City Directory	Street not listed in Source
1988	-	Polk's City Directory	Street not listed in Source
1983	-	Polk's City Directory	Street not listed in Source
1978	-	Polk's City Directory	Street not listed in Source
1973	-	Polk's City Directory	Street not listed in Source
1968	-	Polk's City Directory	Street not listed in Source
1963	-	Polk's City Directory	Street not listed in Source
1959	-	Polk's City Directory	Street not listed in Source

FINDINGS

CROSS STREETS

No Cross Streets Identified

City Directory Images

Target Street	Cross Street	Source
✓	-	Cole Information Services

N THORNTON RD 2013

11685	CASTELANELLI BROTHERS
12745	ART INC
	NORTHERN CALIFORNIA POWER AGENCY
	SIEMENS ENERGY INC
	STIG
12751	CITY OF LODI
13436	JACK HAMM
	LIMA RANCH
13438	TE LIMA
13440	JOSE MACIAS
13448	OCCUPANT UNKNOWN
13452	VERONICA GARCIA
14659	ROCKYS RESTAURANT
14749	3 BS TRUCK & AUTO PLAZA
	BAPH3 INC

Target Street	Cross Street	Source
✓	-	Cole Information Services

N THORNTON RD 2008

11685	OCCUPANT UNKNOWN
11751	OCCUPANT UNKNOWN
11789	JIM RUSSELL
13436	JACK HAMM
	LIMA RANCH
13438	HELEN LIMA
	JACK HAMM
	LIMA HAMM FARMS
13440	JOSE MACIAS
13448	SERGIO AGUILAR
13450	CLARION POODLES
	KATHERINE KENNEDY
13452	GERMAN DIAZ
14749	3BS TRUCK & AUTO PLAZA

Target Street	Cross Street	Source
✓	-	Cole Information Services

N THORNTON RD 2003

11685	OCCUPANT UNKNOWN
11789	COSTA & COSTA FARMS INC
	JIM RUSSELL
12751	LODI CITY OF PUBLIC WORKS DEPT
13436	HELEN M LIMA
	LIMA RANCH
	ROBERT CARLISLE
13438	PATRICIA HAMM
13448	OCCUPANT UNKNOWN
13450	ANN KENNEDY
13452	GERMAN DIAZ
14659	OCCUPANT UNKNOWN
	ROCKYS RESTAURANT
14749	OCCUPANT UNKNOWN

Target Street	Cross Street	Source
✓	-	Cole Information Services

N THORNTON RD 1999

11685	OCCUPANT UNKNOWN
11789	JIM RUSSELL
	OCCUPANT UNKNOWN
12751	LODI CITY OF PUBLIC WORKS DEPARTMENT
	NORTHERN CALIFORNIA POWER AGENCY
13436	LIMA RANCH
13438	TE LIMA
13440	OCCUPANT UNKNOWN
13448	SERGIO AGUILAR
13452	GERMAN DIAZ
14659	ROCKYS RESTAURANT
14749	3 BS TRUCK & AUTO PLAZA
	NANDS GENERAL TIRE REPAIR SHOP

Lodi Phase I ESA
12755 N Thornton Rd
Lodi, CA 95242

Inquiry Number: 3827360.10S
January 23, 2014

The EDR Chain of Title Report

EDR Environmental Data Resources Inc

440 Wheelers Farms Road
Milford, CT 06461
800.352.0050
www.edrnet.com

EDR Chain of Title

The EDR Chain of Title Report tracks a line of successive owners from the present back to 1940 of a particular parcel of property, linked together by recorded transactions which pass title. Available nationwide, this report provides a summary of a property's ownership history and is a valuable source for determining the prior uses of a property

A network of professional abstractors following established procedures, uses client supplied address Information to locate:

- Historical Chain of Title research
- Leases and Miscellaneous

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EDR Chain of Title

TARGET PROPERTY INFORMATION

ADDRESS

Lodi Phase I ESA
12755 N Thornton Rd
Lodi, CA 95242

Research Source

Source 1:	San Joaquin County Assessor
Source 2:	San Joaquin County Recorder
Examiner's Note:	Public records of San Joaquin County, California were searched from January 1, 1940 to January 22, 2014, and no other deeds vesting title in the subject property were found of record during the period searched.

PROPERTY DESCRIPTION

Current Owner:	City of Lodi
Legal Description:	All that certain piece or parcel of land containing 225.35 acres, more or less, being a portion of Section 23, Township 3 North, Range 5 East, Mount Diablo Base and Meridian, situate and lying in the County of San Joaquin, State of California.
Property Identifiers:	055-150-29

HISTORICAL CHAIN OF TITLE

See Exhibit "A"

LEASES AND MISCELLANEOUS

See Exhibit "B" - Not Requested

EDR Chain of Title

Chain of Title

Exhibit "A"

EDR Chain of Title

HISTORICAL CHAIN OF TITLE

PARCEL NO. 1

Chain 1

According to the San Joaquin County Assessor, the current owner of the subject property is the City of Lodi. Records were searched at the San Joaquin County Recorder's Office. No conveyance was found of record transferring fee title ownership into the City of Lodi for the subject property.

EDR Chain of Title

LEASES and MISCELLANEOUS

Exhibit "B"

EDR Chain of Title

LEASES and MISCELLANEOUS

1. Type of Instrument:
First Party:
Second Party:
Recorded:
Book:
Page:
Document No.:

2. Type of Instrument:
First Party:
Second Party:
Recorded:
Book:
Page:
Document No.:

Lodi Phase I ESA
12755 N Thornton Rd
Lodi, CA 95242

Inquiry Number: 3827360.11S
January 23, 2014

The EDR Environmental LienSearch™ Report



440 Wheelers Farms Road
Milford, CT 06461
800.352.0050
www.edrnet.com

EDR Environmental LienSearch™ Report

The EDR Environmental LienSearch Report provides results from a search of available current land title records for environmental cleanup liens and other activity and use limitations, such as engineering controls and institutional controls.

A network of professional, trained researchers, following established procedures, uses client supplied address information to:

- search for parcel information and/or legal description;
- search for ownership information;
- research official land title documents recorded at jurisdictional agencies such as recorders' offices, registries of deeds, county clerks' offices, etc.;
- access a copy of the deed;
- search for environmental encumbering instrument(s) associated with the deed;
- provide a copy of any environmental encumbrance(s) based upon a review of key words in the instrument(s) (title, parties involved, and description); and
- provide a copy of the deed or cite documents reviewed.

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EDR Environmental LienSearch™ Report

TARGET PROPERTY INFORMATION

ADDRESS

Lodi Phase I ESA
12755 N Thornton Rd
Lodi, CA 95242

RESEARCH SOURCE

Source 1: San Joaquin County, California Assessor

Source 2: San Joaquin County, California Recorder

PROPERTY INFORMATION

Deed 1:

According to the San Joaquin County Assessor, the current owner of the subject property is the City of Lodi. Records were searched at the San Joaquin County Recorder's Office. No conveyance was found of record transferring fee title ownership into the City of Lodi for the subject property.

Legal Description: All that certain piece or parcel of land containing 225.35 acres, more or less, being a portion of Section 23, Township 3 North, Range 5 East, Mount Diablo Base and Meridian, situate and lying in the County of San Joaquin, State of California.

Legal Current Owner: City of Lodi

Property Identifiers: 055-150-29

ENVIRONMENTAL LIEN

Environmental Lien: Found ☐ Not Found ☒

If found:

1st Party:

2nd Party:

Dated:

Recorded:

Book:

Page:

Docket:

Volume:

Instrument:

Comments:

Miscellaneous:

EDR Environmental LienSearch™ Report

OTHER ACTIVITY AND USE LIMITATIONS (AULs)

Other AUL's: Found ☐ Not Found ☒

If found:

1st Party:

2nd Party:

Dated:
Recorded:
Book:
Page:
Docket:
Volume:
Instrument:
Comments:
Miscellaneous:

Appendix C
EDR Database Search Results

Lodi Phase I ESA
12755 N Thornton Rd
Lodi, CA 95242

Inquiry Number: 3827360.2s
January 10, 2014

The EDR Radius Map™ Report with GeoCheck®

EDR® Environmental Data Resources Inc

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EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-13) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

12755 N THORNTON RD
LODI, CA 95242

COORDINATES

Latitude (North):	38.0953000 - 38° 5' 43.08''
Longitude (West):	121.3895000 - 121° 23' 22.20''
Universal Tranverse Mercator:	Zone 10
UTM X (Meters):	641222.4
UTM Y (Meters):	4217407.5
Elevation:	7 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:	38121-A4 TERMINOUS, CA
Most Recent Revision:	1993
East Map:	38121-A3 LODI SOUTH, CA
Most Recent Revision:	1976

AERIAL PHOTOGRAPHY IN THIS REPORT

Photo Year:	2012
Source:	USDA

TARGET PROPERTY SEARCH RESULTS

The target property was not listed in any of the databases searched by EDR.

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the search radius around the target property for the following databases:

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL---------- National Priority List

EXECUTIVE SUMMARY

Proposed NPL ---------- Proposed National Priority List Sites
NPL LIENS ---------- Federal Superfund Liens

Federal Delisted NPL site list

Delisted NPL ---------- National Priority List Deletions

Federal CERCLIS list

CERCLIS ---------- Comprehensive Environmental Response, Compensation, and Liability Information System
FEDERAL FACILITY ---------- Federal Facility Site Information listing

Federal CERCLIS NFRAP site List

CERC-NFRAP ---------- CERCLIS No Further Remedial Action Planned

Federal RCRA CORRACTS facilities list

CORRACTS ---------- Corrective Action Report

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF ---------- RCRA - Treatment, Storage and Disposal

Federal RCRA generators list

RCRA-LQG ---------- RCRA - Large Quantity Generators
RCRA-SQG ---------- RCRA - Small Quantity Generators
RCRA-CESQG ---------- RCRA - Conditionally Exempt Small Quantity Generator

Federal institutional controls / engineering controls registries

US ENG CONTROLS ---------- Engineering Controls Sites List
US INST CONTROL ---------- Sites with Institutional Controls
LUCIS ---------- Land Use Control Information System

Federal ERNS list

ERNS ---------- Emergency Response Notification System

State- and tribal - equivalent NPL

RESPONSE ---------- State Response Sites

State and tribal landfill and/or solid waste disposal site lists

SWF/LF ---------- Solid Waste Information System

State and tribal leaking storage tank lists

LUST ---------- Geotracker's Leaking Underground Fuel Tank Report
SLIC ---------- Statewide SLIC Cases
INDIAN LUST ---------- Leaking Underground Storage Tanks on Indian Land

State and tribal registered storage tank lists

UST ---------- Active UST Facilities

AST ---- Aboveground Petroleum Storage Tank Facilities
INDIAN UST ---- Underground Storage Tanks on Indian Land
FEMA UST ---- Underground Storage Tank Listing

State and tribal voluntary cleanup sites

INDIAN VCP ---- Voluntary Cleanup Priority Listing

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS ---- A Listing of Brownfields Sites

Local Lists of Landfill / Solid Waste Disposal Sites

DEBRIS REGION 9 ---- Torres Martinez Reservation Illegal Dump Site Locations
ODI ---- Open Dump Inventory
SWRCY ---- Recycler Database
HAULERS ---- Registered Waste Tire Haulers Listing
INDIAN ODI ---- Report on the Status of Open Dumps on Indian Lands

Local Lists of Hazardous waste / Contaminated Sites

US CDL ---- Clandestine Drug Labs
HIST Cal-Sites ---- Historical Calsites Database
SCH ---- School Property Evaluation Program
Toxic Pits ---- Toxic Pits Cleanup Act Sites
CDL ---- Clandestine Drug Labs
US HIST CDL ---- National Clandestine Laboratory Register

Local Lists of Registered Storage Tanks

CA FID UST ---- Facility Inventory Database
HIST UST ---- Hazardous Substance Storage Container Database
SWEEPS UST ---- SWEEPS UST Listing

Local Land Records

LIENS 2 ---- CERCLA Lien Information
LIENS ---- Environmental Liens Listing
DEED ---- Deed Restriction Listing

Records of Emergency Release Reports

HMIRS ---- Hazardous Materials Information Reporting System
CHMIRS ---- California Hazardous Material Incident Report System
LDS ---- Land Disposal Sites Listing
MCS ---- Military Cleanup Sites Listing
SPILLS 90 ---- SPILLS 90 data from FirstSearch

Other Ascertainable Records

RCRA NonGen / NLR ---- RCRA - Non Generators

EXECUTIVE SUMMARY

DOT OPS	Incident and Accident Data
DOD	Department of Defense Sites
FUDS	Formerly Used Defense Sites
CONSENT	Superfund (CERCLA) Consent Decrees
ROD	Records Of Decision
UMTRA	Uranium Mill Tailings Sites
US MINES	Mines Master Index File
TRIS	Toxic Chemical Release Inventory System
TSCA	Toxic Substances Control Act
FTTS	FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
HIST FTTS	FIFRA/TSCA Tracking System Administrative Case Listing
SSTS	Section 7 Tracking Systems
ICIS	Integrated Compliance Information System
PADS	PCB Activity Database System
MLTS	Material Licensing Tracking System
RADINFO	Radiation Information Database
FINDS	Facility Index System/Facility Registry System
RAATS	RCRA Administrative Action Tracking System
RMP	Risk Management Plans
CA BOND EXP. PLAN	Bond Expenditure Plan
NPDES	NPDES Permits Listing
UIC	UIC Listing
HIST CORTESE	Hazardous Waste & Substance Site List
CUPA Listings	CUPA Resources List
Notify 65	Proposition 65 Records
DRYCLEANERS	Cleaner Facilities
WIP	Well Investigation Program Case List
ENF	Enforcement Action Listing
HAZNET	Facility and Manifest Data
EMI	Emissions Inventory Data
INDIAN RESERV	Indian Reservations
SCRD DRYCLEANERS	State Coalition for Remediation of Drycleaners Listing
US AIRS	Aerometric Information Retrieval System Facility Subsystem
PRP	Potentially Responsible Parties
2020 COR ACTION	2020 Corrective Action Program List
LEAD SMELTERS	Lead Smelter Sites
Financial Assurance	Financial Assurance Information Listing
PCB TRANSFORMER	PCB Transformer Registration Database
HWT	Registered Hazardous Waste Transporter Database
HWP	EnviroStor Permitted Facilities Listing
COAL ASH EPA	Coal Combustion Residues Surface Impoundments List
US FIN ASSUR	Financial Assurance Information
COAL ASH DOE	Steam-Electric Plant Operation Data
WDS	Waste Discharge System
EPA WATCH LIST	EPA WATCH LIST
PROC	Certified Processors Database
MWMP	Medical Waste Management Program Listing

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP	EDR Proprietary Manufactured Gas Plants

EXECUTIVE SUMMARY

EDR US Hist Auto Stat ------- EDR Exclusive Historic Gas Stations
EDR US Hist Cleaners ------- EDR Exclusive Historic Dry Cleaners

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA LUST ------- Recovered Government Archive Leaking Underground Storage Tank

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were identified in the following databases.

Elevations have been determined from the USGS Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified. Sites with an elevation equal to or higher than the target property have been differentiated below from sites with an elevation lower than the target property.
Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

Unmappable (orphan) sites are not considered in the foregoing analysis.

STANDARD ENVIRONMENTAL RECORDS

State- and tribal - equivalent CERCLIS

ENVIROSTOR: The Department of Toxic Substances Control's (DTSC's) Site Mitigation and Brownfields Reuse Program's (SMBRP's) EnviroStor database identifes sites that have known contamination or sites for which there may be reasons to investigate further. The database includes the following site types: Federal Superfund sites (National Priorities List (NPL)); State Response, including Military Facilities and State Superfund; Voluntary Cleanup; and School sites. EnviroStor provides similar information to the information that was available in CalSites, and provides additional site information, including, but not limited to, identification of formerly-contaminated properties that have been released for reuse, properties where environmental deed restrictions have been recorded to prevent inappropriate land uses, and risk characterization information that is used to assess potential impacts to public health and the environment at contaminated sites.

A review of the ENVIROSTOR list, as provided by EDR, and dated 11/06/2013 has revealed that there is 1 ENVIROSTOR site within approximately 1 mile of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
LODI ENERGY CENTER Status: No Further Action	***12745 NORTH THORNTON RO***	***E 1/4 - 1/2 (0.273 mi.)***	***A2***	***61***

State and tribal voluntary cleanup sites

VCP: Contains low threat level properties with either confirmed or unconfirmed releases and the project proponents have request that DTSC oversee investigation and/or cleanup activities and have agreed to provide coverage for DTSC's costs.

A review of the VCP list, as provided by EDR, and dated 11/06/2013 has revealed that there is 1 VCP

site within approximately 0.5 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
LODI ENERGY CENTER	***12745 NORTH THORNTON RO***	***E 1/4 - 1/2 (0.273 mi.)***	***A2***	***61***

ADDITIONAL ENVIRONMENTAL RECORDS

Local Lists of Landfill / Solid Waste Disposal Sites

WMUDS/SWAT: The Waste Management Unit Database System is used for program tracking and inventory of waste management units. The source is the State Water Resources Control Board.

A review of the WMUDS/SWAT list, as provided by EDR, and dated 04/01/2000 has revealed that there is 1 WMUDS/SWAT site within approximately 0.5 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
SAN JOAQUIN AIR	(NEAR I-5 AND HARNEY LN	ENE 1/4 - 1/2 (0.423 mi.)	3	64

Other Ascertainable Records

Cortese: The sites for the list are designated by the State Water Resource Control Board (LUST), the Integrated Waste Board (SWF/LS), and the Department of Toxic Substances Control (Cal-Sites).

A review of the Cortese list, as provided by EDR, and dated 09/30/2013 has revealed that there is 1 Cortese site within approximately 0.5 miles of the target property.

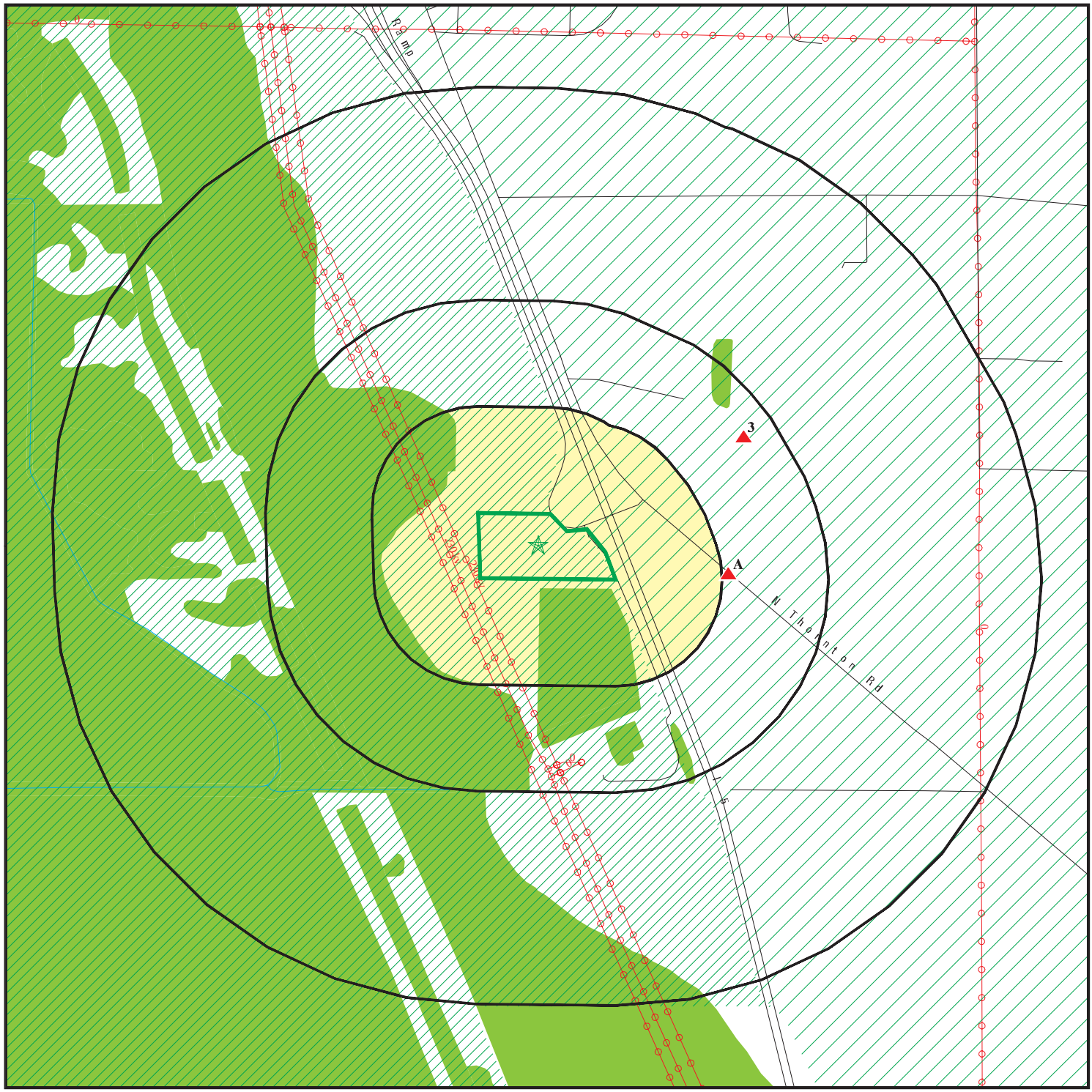
Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
WHITE SLOUGH WATER POLLUTION C	***12751 NORTH THORNTON RO***	***E 1/4 - 1/2 (0.265 mi.)***	***A1***	***8***

EXECUTIVE SUMMARY

Due to poor or inadequate address information, the following sites were not mapped. Count: 20 records.

Site Name	Database(s)
	RGA LUST
	RGA LUST
	RGA LUST
NCPA LODI ENERGY PROJECT	NPDES
WESTERN FARM SVC - LODI	FTTS, HIST FTTS, FINDS
COUNTRYSIDE LIQUORS & GAS	FINDS, UST
ALPINE HELICOPTER SVC INC	AST
LODI CENTRAL PLUME AREA	FINDS
LODI CENTRAL PLUME AREA	FINDS
CITY OF LODI PUBLIC WORKS DEPARTME	FINDS
CITY OF LODI - WELL #16	FINDS
LODI GROUNDWATER SITE	FINDS
LODI METAL TECH INC	FINDS
NCPA LODI - CT1	FINDS
LODI CITY LANDFILL	FINDS
NORTHERN CALIFORNIA POWER - LODI	FINDS
LODI	FINDS
AT&T LODI	FINDS
LODI PCE INVESTIGATION	SLIC
PS MARINA INVESTORS I	EMI

OVERVIEW MAP - 3827360.2s



0 1/4 1/2 1 Miles

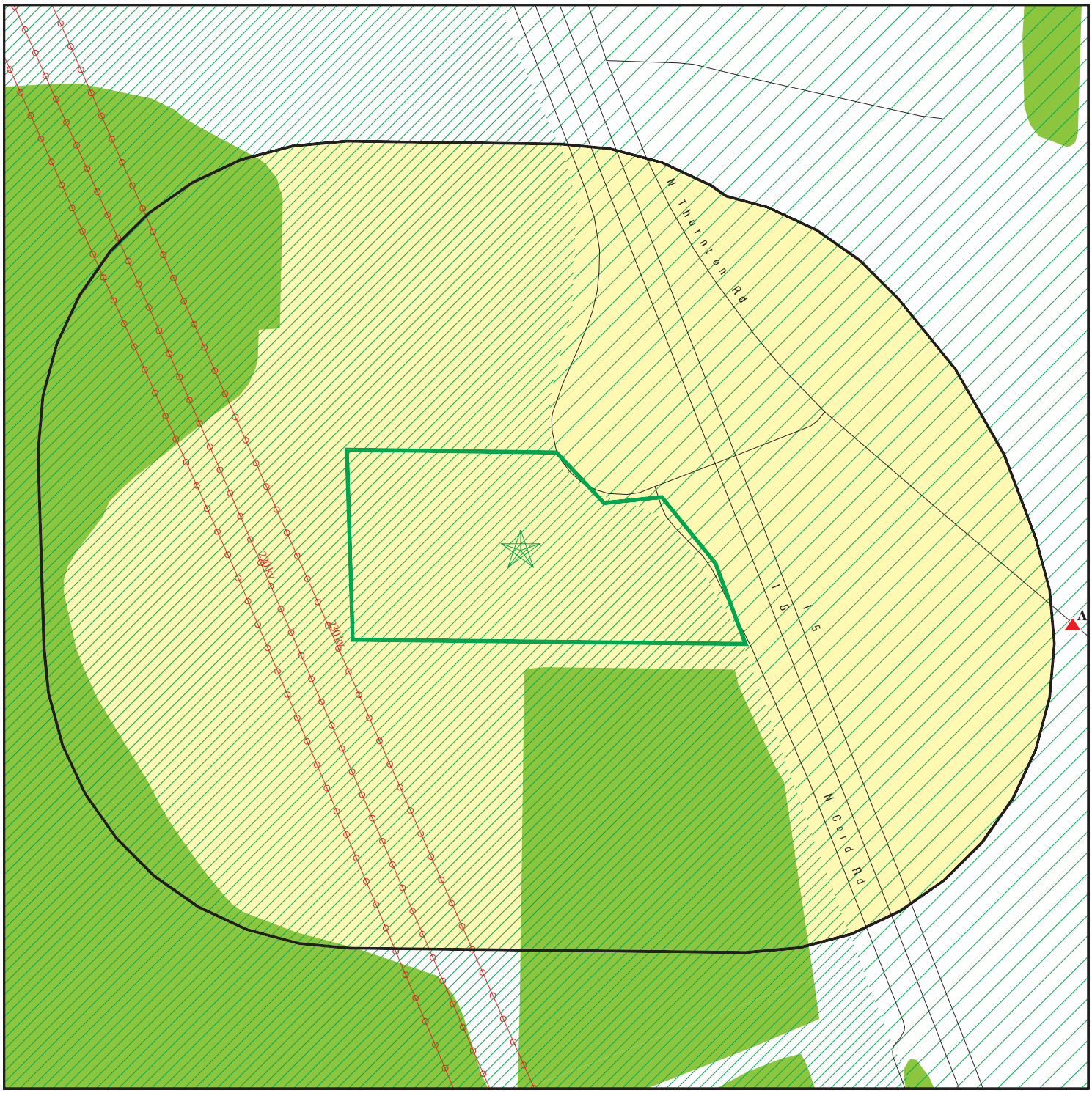
- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- National Priority List Sites
- Dept. Defense Sites
- Indian Reservations BIA
- Power transmission lines
- Oil & Gas pipelines from USGS
- 100-year flood zone
- 500-year flood zone
- National Wetland Inventory
- Areas of Concern

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Lodi Phase I ESA	CLIENT: ERM - West, Inc.
ADDRESS: 12755 N Thornton Rd Lodi CA 95242	CONTACT: Bailey Blosser
LAT/LONG: 38.0953 / 121.3895	INQUIRY #: 3827360.2s DATE: January 10, 2014 9:46 am

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DETAIL MAP - 3827360.2s



- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- Sensitive Receptors
- National Priority List Sites
- Dept. Defense Sites

0 1/16 1/8 1/4 Miles

- Indian Reservations BIA
- Power transmission lines
- Oil & Gas pipelines from USGS
- 100-year flood zone
- 500-year flood zone
- National Wetland Inventory
- Areas of Concern

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Lodi Phase I ESA	CLIENT: ERM - West, Inc.
ADDRESS: 12755 N Thornton Rd Lodi CA 95242	CONTACT: Bailey Blosser
LAT/LONG: 38.0953 / 121.3895	INQUIRY #: 3827360.2s DATE: January 10, 2014 9:48 am

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MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
STANDARD ENVIRONMENTAL RECORDS								
Federal NPL site list								
NPL	1.000		0	0	0	0	NR	0
Proposed NPL	1.000		0	0	0	0	NR	0
NPL LIENS	TP		NR	NR	NR	NR	NR	0
Federal Delisted NPL site list								
Delisted NPL	1.000		0	0	0	0	NR	0
Federal CERCLIS list								
CERCLIS	0.500		0	0	0	NR	NR	0
FEDERAL FACILITY	0.500		0	0	0	NR	NR	0
Federal CERCLIS NFRAP site List								
CERC-NFRAP	0.500		0	0	0	NR	NR	0
Federal RCRA CORRACTS facilities list								
CORRACTS	1.000		0	0	0	0	NR	0
Federal RCRA non-CORRACTS TSD facilities list								
RCRA-TSDF	0.500		0	0	0	NR	NR	0
Federal RCRA generators list								
RCRA-LQG	0.250		0	0	NR	NR	NR	0
RCRA-SQG	0.250		0	0	NR	NR	NR	0
RCRA-CESQG	0.250		0	0	NR	NR	NR	0
Federal institutional controls / engineering controls registries								
US ENG CONTROLS	0.500		0	0	0	NR	NR	0
US INST CONTROL	0.500		0	0	0	NR	NR	0
LUCIS	0.500		0	0	0	NR	NR	0
Federal ERNS list								
ERNS	TP		NR	NR	NR	NR	NR	0
State- and tribal - equivalent NPL								
RESPONSE	1.000		0	0	0	0	NR	0
State- and tribal - equivalent CERCLIS								
ENVIROSTOR	1.000		0	0	1	0	NR	1
State and tribal landfill and/or solid waste disposal site lists								
SWF/LF	0.500		0	0	0	NR	NR	0
State and tribal leaking storage tank lists								
LUST	0.500		0	0	0	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
SLIC	0.500		0	0	0	NR	NR	0
INDIAN LUST	0.500		0	0	0	NR	NR	0
State and tribal registered storage tank lists								
UST	0.250		0	0	NR	NR	NR	0
AST	0.250		0	0	NR	NR	NR	0
INDIAN UST	0.250		0	0	NR	NR	NR	0
FEMA UST	0.250		0	0	NR	NR	NR	0
State and tribal voluntary cleanup sites								
INDIAN VCP	0.500		0	0	0	NR	NR	0
VCP	0.500		0	0	1	NR	NR	1
ADDITIONAL ENVIRONMENTAL RECORDS								
Local Brownfield lists								
US BROWNFIELDS	0.500		0	0	0	NR	NR	0
Local Lists of Landfill / Solid Waste Disposal Sites								
DEBRIS REGION 9	0.500		0	0	0	NR	NR	0
ODI	0.500		0	0	0	NR	NR	0
WMUDS/SWAT	0.500		0	0	1	NR	NR	1
SWRCY	0.500		0	0	0	NR	NR	0
HAULERS	TP		NR	NR	NR	NR	NR	0
INDIAN ODI	0.500		0	0	0	NR	NR	0
Local Lists of Hazardous waste / Contaminated Sites								
US CDL	TP		NR	NR	NR	NR	NR	0
HIST Cal-Sites	1.000		0	0	0	0	NR	0
SCH	0.250		0	0	NR	NR	NR	0
Toxic Pits	1.000		0	0	0	0	NR	0
CDL	TP		NR	NR	NR	NR	NR	0
US HIST CDL	TP		NR	NR	NR	NR	NR	0
Local Lists of Registered Storage Tanks								
CA FID UST	0.250		0	0	NR	NR	NR	0
HIST UST	0.250		0	0	NR	NR	NR	0
SWEEPS UST	0.250		0	0	NR	NR	NR	0
Local Land Records								
LIENS 2	TP		NR	NR	NR	NR	NR	0
LIENS	TP		NR	NR	NR	NR	NR	0
DEED	0.500		0	0	0	NR	NR	0
Records of Emergency Release Reports								
HMIRS	TP		NR	NR	NR	NR	NR	0
CHMIRS	TP		NR	NR	NR	NR	NR	0
LDS	TP		NR	NR	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
MCS	TP		NR	NR	NR	NR	NR	0
SPILLS 90	TP		NR	NR	NR	NR	NR	0
Other Ascertainable Records								
RCRA NonGen / NLR	0.250		0	0	NR	NR	NR	0
DOT OPS	TP		NR	NR	NR	NR	NR	0
DOD	1.000		0	0	0	0	NR	0
FUDS	1.000		0	0	0	0	NR	0
CONSENT	1.000		0	0	0	0	NR	0
ROD	1.000		0	0	0	0	NR	0
UMTRA	0.500		0	0	0	NR	NR	0
US MINES	0.250		0	0	NR	NR	NR	0
TRIS	TP		NR	NR	NR	NR	NR	0
TSCA	TP		NR	NR	NR	NR	NR	0
FTTS	TP		NR	NR	NR	NR	NR	0
HIST FTTS	TP		NR	NR	NR	NR	NR	0
SSTS	TP		NR	NR	NR	NR	NR	0
ICIS	TP		NR	NR	NR	NR	NR	0
PADS	TP		NR	NR	NR	NR	NR	0
MLTS	TP		NR	NR	NR	NR	NR	0
RADINFO	TP		NR	NR	NR	NR	NR	0
FINDS	TP		NR	NR	NR	NR	NR	0
RAATS	TP		NR	NR	NR	NR	NR	0
RMP	TP		NR	NR	NR	NR	NR	0
CA BOND EXP. PLAN	1.000		0	0	0	0	NR	0
NPDES	TP		NR	NR	NR	NR	NR	0
UIC	TP		NR	NR	NR	NR	NR	0
Cortese	0.500		0	0	1	NR	NR	1
HIST CORTESE	0.500		0	0	0	NR	NR	0
CUPA Listings	0.250		0	0	NR	NR	NR	0
Notify 65	1.000		0	0	0	0	NR	0
DRYCLEANERS	0.250		0	0	NR	NR	NR	0
WIP	0.250		0	0	NR	NR	NR	0
ENF	TP		NR	NR	NR	NR	NR	0
HAZNET	TP		NR	NR	NR	NR	NR	0
EMI	TP		NR	NR	NR	NR	NR	0
INDIAN RESERV	1.000		0	0	0	0	NR	0
SCRD DRYCLEANERS	0.500		0	0	0	NR	NR	0
US AIRS	TP		NR	NR	NR	NR	NR	0
PRP	TP		NR	NR	NR	NR	NR	0
2020 COR ACTION	0.250		0	0	NR	NR	NR	0
LEAD SMELTERS	TP		NR	NR	NR	NR	NR	0
Financial Assurance	TP		NR	NR	NR	NR	NR	0
PCB TRANSFORMER	TP		NR	NR	NR	NR	NR	0
HWT	0.250		0	0	NR	NR	NR	0
HWP	1.000		0	0	0	0	NR	0
COAL ASH EPA	0.500		0	0	0	NR	NR	0
US FIN ASSUR	TP		NR	NR	NR	NR	NR	0
COAL ASH DOE	TP		NR	NR	NR	NR	NR	0
WDS	TP		NR	NR	NR	NR	NR	0
EPA WATCH LIST	TP		NR	NR	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
PROC	0.500		0	0	0	NR	NR	0
MWMP	0.250		0	0	NR	NR	NR	0
EDR HIGH RISK HISTORICAL RECORDS								
EDR Exclusive Records								
EDR MGP	1.000		0	0	0	0	NR	0
EDR US Hist Auto Stat	0.250		0	0	NR	NR	NR	0
EDR US Hist Cleaners	0.250		0	0	NR	NR	NR	0
EDR RECOVERED GOVERNMENT ARCHIVES								
Exclusive Recovered Govt. Archives								
RGA LUST	0.500		0	0	0	NR	NR	0

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

A1
East
1/4-1/2
0.265 mi.
1400 ft.

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY
12751 NORTH THORNTON ROAD
LODI, CA 95242
Site 1 of 2 in cluster A

NPDES **S106920509**
Cortese **N/A**
ENF
EMI

Relative:
Higher

Actual:
11 ft.

NPDES:

Npdes Number:	CA0079243
Facility Status:	Active
Agency Id:	11100
Region:	5S
Regulatory Measure Id:	333528
Order No:	R5-2007-0113
Regulatory Measure Type:	NPDES Permits
Place Id:	272444
WDID:	5B390103002
Program Type:	NPDMUNILRG
Adoption Date Of Regulatory Measure:	09/14/2007
Effective Date Of Regulatory Measure:	11/03/2007
Expiration Date Of Regulatory Measure:	09/01/2012
Termination Date Of Regulatory Measure:	Not reported
Discharge Name:	Lodi City
Discharge Address:	221 West Pine Street
Discharge City:	Lodi
Discharge State:	CA
Discharge Zip:	95240

Npdes Number:	CA0079243
Facility Status:	Active
Agency Id:	11100
Region:	5S
Regulatory Measure Id:	393806
Order No:	R5-2013-0125
Regulatory Measure Type:	NPDES Permits
Place Id:	272444
WDID:	5B390103002
Program Type:	NPDMUNILRG
Adoption Date Of Regulatory Measure:	10/04/2013
Effective Date Of Regulatory Measure:	11/23/2013
Expiration Date Of Regulatory Measure:	11/01/2018
Termination Date Of Regulatory Measure:	Not reported
Discharge Name:	Lodi City
Discharge Address:	221 West Pine Street
Discharge City:	Lodi
Discharge State:	CA
Discharge Zip:	95240

CORTESE:

Region:	CORTESE
Envirostor Id:	Not reported
Site/Facility Type:	Not reported
Cleanup Status:	Not reported
Status Date:	Not reported
Site Code:	Not reported
Latitude:	Not reported
Longitude:	Not reported
Owner:	Not reported
Enf Type:	Not reported
Swat R:	Not reported

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

Flag:	CORTESE
Order No:	R5-2000-0031
Waste Discharge System No:	Not reported
Effective Date:	01/28/2000
Region 2:	5S
WID Id:	5B390103002
Solid Waste Id No:	Not reported
Waste Management Uit Name:	Not reported

ENF:

Region:	5S
Facility Id:	272444
Agency Name:	Lodi City
Place Type:	Utility
Place Subtype:	Wastewater Treatment Facility
Facility Type:	Municipal/Domestic
Agency Type:	City Agency
# Of Agencies:	1
Place Latitude:	38.094431
Place Longitude:	-121.381226
SIC Code 1:	4952
SIC Desc 1:	Sewerage Systems
SIC Code 2:	Not reported
SIC Desc 2:	Not reported
SIC Code 3:	Not reported
SIC Desc 3:	Not reported
NAICS Code 1:	Not reported
NAICS Desc 1:	Not reported
NAICS Code 2:	Not reported
NAICS Desc 2:	Not reported
NAICS Code 3:	Not reported
NAICS Desc 3:	Not reported
# Of Places:	1
Source Of Facility:	Reg Meas
Design Flow:	8.5
Threat To Water Quality:	1
Complexity:	A
Pretreatment:	Y - POTW has EPA approved pretreatment program
Facility Waste Type:	Domestic wastewater
Facility Waste Type 2:	Not reported
Facility Waste Type 3:	Not reported
Facility Waste Type 4:	Not reported
Program:	NPDESWW
Program Category1:	NPDESWW
Program Category2:	NPDESWW
# Of Programs:	1
WDID:	5B390103002
Reg Measure Id:	333528
Reg Measure Type:	NPDES Permits
Region:	5S
Order #:	R5-2007-0113
Npdes# CA#:	CA0079243
Major-Minor:	Major
Npdes Type:	MUN
Reclamation:	2 - Producer-User
Dredge Fill Fee:	Not reported
301H:	N

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

Application Fee Amt Received:	10000
Status:	Active
Status Date:	01/22/2008
Effective Date:	11/03/2007
Expiration/Review Date:	09/01/2012
Termination Date:	Not reported
WDR Review - Amend:	Not reported
WDR Review - Revise/Renew:	Not reported
WDR Review - Rescind:	Not reported
WDR Review - No Action Required:	Not reported
WDR Review - Pending:	Not reported
WDR Review - Planned:	Not reported
Status Enrollee:	N
Individual/General:	I
Fee Code:	66 - NPDES Based on Flow
Direction/Voice:	Passive
Enforcement Id(EID):	345782
Region:	5S
Order / Resolution Number:	Not reported
Enforcement Action Type:	Notice of Violation
Effective Date:	05/15/2008
Adoption/Issuance Date:	05/15/2008
Achieve Date:	Not reported
Termination Date:	05/15/2008
ACL Issuance Date:	Not reported
EPL Issuance Date:	Not reported
Status:	Historical
Title:	NOV 05/15/2008 for Lodi City, White Slough Water Pollution Control Facility
Description:	NOV for effluent limitation violations of NPDES Orders 5-00-031, R5-2007-0113, and TSO R5-2007-0114 from 01/28/2000 to 12/31/2007. This violations are submit to MMPs and therefore will be included in an MMP Complaint after discharger reviews the list of violations for accuracy.
Program:	NPDESWW
Latest Milestone Completion Date:	Not reported
# Of Programs1:	1
Total Assessment Amount:	0
Initial Assessed Amount:	0
Liability $ Amount:	0
Project $ Amount:	0
Liability $ Paid:	0
Project $ Completed:	0
Total $ Paid/Completed Amount:	0
Region:	5S
Facility Id:	272444
Agency Name:	Lodi City
Place Type:	Utility
Place Subtype:	Wastewater Treatment Facility
Facility Type:	Municipal/Domestic
Agency Type:	City Agency
# Of Agencies:	1
Place Latitude:	38.094431
Place Longitude:	-121.381226
SIC Code 1:	4952

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

SIC Desc 1:	Sewerage Systems
SIC Code 2:	Not reported
SIC Desc 2:	Not reported
SIC Code 3:	Not reported
SIC Desc 3:	Not reported
NAICS Code 1:	Not reported
NAICS Desc 1:	Not reported
NAICS Code 2:	Not reported
NAICS Desc 2:	Not reported
NAICS Code 3:	Not reported
NAICS Desc 3:	Not reported
# Of Places:	1
Source Of Facility:	Reg Meas
Design Flow:	8.5
Threat To Water Quality:	1
Complexity:	A
Pretreatment:	Y - POTW has EPA approved pretreatment program
Facility Waste Type:	Domestic wastewater
Facility Waste Type 2:	Not reported
Facility Waste Type 3:	Not reported
Facility Waste Type 4:	Not reported
Program:	NPDESWW
Program Category1:	NPDESWW
Program Category2:	NPDESWW
# Of Programs:	1
WDID:	5B390103002
Reg Measure Id:	333528
Reg Measure Type:	NPDES Permits
Region:	5S
Order #:	R5-2007-0113
Npdes# CA#:	CA0079243
Major-Minor:	Major
Npdes Type:	MUN
Reclamation:	2 - Producer-User
Dredge Fill Fee:	Not reported
301H:	N
Application Fee Amt Received:	10000
Status:	Active
Status Date:	01/22/2008
Effective Date:	11/03/2007
Expiration/Review Date:	09/01/2012
Termination Date:	Not reported
WDR Review - Amend:	Not reported
WDR Review - Revise/Renew:	Not reported
WDR Review - Rescind:	Not reported
WDR Review - No Action Required:	Not reported
WDR Review - Pending:	Not reported
WDR Review - Planned:	Not reported
Status Enrollee:	N
Individual/General:	I
Fee Code:	66 - NPDES Based on Flow
Direction/Voice:	Passive
Enforcement Id(EID):	351020
Region:	5S
Order / Resolution Number:	R5-2008-0562
Enforcement Action Type:	Admin Civil Liability
Effective Date:	08/14/2008

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

Adoption/Issuance Date:	Not reported
Achieve Date:	Not reported
Termination Date:	09/10/2008
ACL Issuance Date:	08/14/2008
EPL Issuance Date:	Not reported
Status:	Historical
Title:	MMP Complaint R5-2008-0562 for Lodi City, White Slough Water Pollution Control
Description:	MMP Complaint issued in the amount of $21,000 for 7 non-serious effluent limitation violations from 1/1/2000 to 12/31/2007.
Program:	NPDESWW
Latest Milestone Completion Date:	2008-09-10
# Of Programs1:	1
Total Assessment Amount:	21000
Initial Assessed Amount:	21000
Liability $ Amount:	21000
Project $ Amount:	0
Liability $ Paid:	21000
Project $ Completed:	0
Total $ Paid/Completed Amount:	21000

Region:	5S
Facility Id:	272444
Agency Name:	Lodi City
Place Type:	Utility
Place Subtype:	Wastewater Treatment Facility
Facility Type:	Municipal/Domestic
Agency Type:	City Agency
# Of Agencies:	1
Place Latitude:	38.094431
Place Longitude:	-121.381226
SIC Code 1:	4952
SIC Desc 1:	Sewerage Systems
SIC Code 2:	Not reported
SIC Desc 2:	Not reported
SIC Code 3:	Not reported
SIC Desc 3:	Not reported
NAICS Code 1:	Not reported
NAICS Desc 1:	Not reported
NAICS Code 2:	Not reported
NAICS Desc 2:	Not reported
NAICS Code 3:	Not reported
NAICS Desc 3:	Not reported
# Of Places:	1
Source Of Facility:	Reg Meas
Design Flow:	8.5
Threat To Water Quality:	1
Complexity:	A
Pretreatment:	Y - POTW has EPA approved pretreatment program
Facility Waste Type:	Domestic wastewater
Facility Waste Type 2:	Not reported
Facility Waste Type 3:	Not reported
Facility Waste Type 4:	Not reported
Program:	NPDESWW
Program Category1:	NPDESWW
Program Category2:	NPDESWW

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

# Of Programs:	1
WDID:	5B390103002
Reg Measure Id:	333528
Reg Measure Type:	NPDES Permits
Region:	5S
Order #:	R5-2007-0113
Npdes# CA#:	CA0079243
Major-Minor:	Major
Npdes Type:	MUN
Reclamation:	2 - Producer-User
Dredge Fill Fee:	Not reported
301H:	N
Application Fee Amt Received:	10000
Status:	Active
Status Date:	01/22/2008
Effective Date:	11/03/2007
Expiration/Review Date:	09/01/2012
Termination Date:	Not reported
WDR Review - Amend:	Not reported
WDR Review - Revise/Renew:	Not reported
WDR Review - Rescind:	Not reported
WDR Review - No Action Required:	Not reported
WDR Review - Pending:	Not reported
WDR Review - Planned:	Not reported
Status Enrollee:	N
Individual/General:	I
Fee Code:	66 - NPDES Based on Flow
Direction/Voice:	Passive
Enforcement Id(EID):	368753
Region:	5S
Order / Resolution Number:	R5-2009-0555
Enforcement Action Type:	Admin Civil Liability
Effective Date:	07/16/2009
Adoption/Issuance Date:	Not reported
Achieve Date:	Not reported
Termination Date:	09/15/2009
ACL Issuance Date:	07/16/2009
EPL Issuance Date:	Not reported
Status:	Historical
Title:	MMPC R5-2009-0555 for Lodi City, White Slough Water Pollution Control Facility
Description:	MMP Compliant issued in the amount of $21,000 for 4 additional non-serious effluent limitation violations from 1/1/2000 to 12/31/2007 that were missed in MMPC R5-2008-0562 issued on 8/14/2008. Three more non-serious effluent limitation violations from 1/1/2008 to 3/31/2009 are included.
Program:	NPDESWW
Latest Milestone Completion Date:	2009-09-15
# Of Programs1:	1
Total Assessment Amount:	21000
Initial Assessed Amount:	21000
Liability $ Amount:	21000
Project $ Amount:	0
Liability $ Paid:	21000
Project $ Completed:	0
Total $ Paid/Completed Amount:	21000

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

Region:	5S
Facility Id:	272444
Agency Name:	Lodi City
Place Type:	Utility
Place Subtype:	Wastewater Treatment Facility
Facility Type:	Municipal/Domestic
Agency Type:	City Agency
# Of Agencies:	1
Place Latitude:	38.094431
Place Longitude:	-121.381226
SIC Code 1:	4952
SIC Desc 1:	Sewerage Systems
SIC Code 2:	Not reported
SIC Desc 2:	Not reported
SIC Code 3:	Not reported
SIC Desc 3:	Not reported
NAICS Code 1:	Not reported
NAICS Desc 1:	Not reported
NAICS Code 2:	Not reported
NAICS Desc 2:	Not reported
NAICS Code 3:	Not reported
NAICS Desc 3:	Not reported
# Of Places:	1
Source Of Facility:	Reg Meas
Design Flow:	8.5
Threat To Water Quality:	1
Complexity:	A
Pretreatment:	Y - POTW has EPA approved pretreatment program
Facility Waste Type:	Domestic wastewater
Facility Waste Type 2:	Not reported
Facility Waste Type 3:	Not reported
Facility Waste Type 4:	Not reported
Program:	NPDESWW
Program Category1:	NPDESWW
Program Category2:	NPDESWW
# Of Programs:	1
WDID:	5B390103002
Reg Measure Id:	333528
Reg Measure Type:	NPDES Permits
Region:	5S
Order #:	R5-2007-0113
Npdes# CA#:	CA0079243
Major-Minor:	Major
Npdes Type:	MUN
Reclamation:	2 - Producer-User
Dredge Fill Fee:	Not reported
301H:	N
Application Fee Amt Received:	10000
Status:	Active
Status Date:	01/22/2008
Effective Date:	11/03/2007
Expiration/Review Date:	09/01/2012
Termination Date:	Not reported
WDR Review - Amend:	Not reported
WDR Review - Revise/Renew:	Not reported
WDR Review - Rescind:	Not reported
WDR Review - No Action Required:	Not reported

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

WDR Review - Pending:	Not reported
WDR Review - Planned:	Not reported
Status Enrollee:	N
Individual/General:	I
Fee Code:	66 - NPDES Based on Flow
Direction/Voice:	Passive
Enforcement Id(EID):	372616
Region:	5S
Order / Resolution Number:	Not reported
Enforcement Action Type:	Notice of Violation
Effective Date:	10/01/2009
Adoption/Issuance Date:	10/01/2009
Achieve Date:	Not reported
Termination Date:	10/01/2009
ACL Issuance Date:	Not reported
EPL Issuance Date:	Not reported
Status:	Historical
Title:	NOV 10/01/2009 for Lodi City, White Slough Water Pollution Control Facility
Description:	Not reported
Program:	NPDESWW
Latest Milestone Completion Date:	Not reported
# Of Programs1:	1
Total Assessment Amount:	0
Initial Assessed Amount:	0
Liability $ Amount:	0
Project $ Amount:	0
Liability $ Paid:	0
Project $ Completed:	0
Total $ Paid/Completed Amount:	0

Region:	5S
Facility Id:	272444
Agency Name:	Lodi City
Place Type:	Utility
Place Subtype:	Wastewater Treatment Facility
Facility Type:	Municipal/Domestic
Agency Type:	City Agency
# Of Agencies:	1
Place Latitude:	38.094431
Place Longitude:	-121.381226
SIC Code 1:	4952
SIC Desc 1:	Sewerage Systems
SIC Code 2:	Not reported
SIC Desc 2:	Not reported
SIC Code 3:	Not reported
SIC Desc 3:	Not reported
NAICS Code 1:	Not reported
NAICS Desc 1:	Not reported
NAICS Code 2:	Not reported
NAICS Desc 2:	Not reported
NAICS Code 3:	Not reported
NAICS Desc 3:	Not reported
# Of Places:	1
Source Of Facility:	Reg Meas
Design Flow:	8.5
Threat To Water Quality:	1

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

Complexity:	A
Pretreatment:	Y - POTW has EPA approved pretreatment program
Facility Waste Type:	Domestic wastewater
Facility Waste Type 2:	Not reported
Facility Waste Type 3:	Not reported
Facility Waste Type 4:	Not reported
Program:	NPDESWW
Program Category1:	NPDESWW
Program Category2:	NPDESWW
# Of Programs:	1
WDID:	5B390103002
Reg Measure Id:	333528
Reg Measure Type:	NPDES Permits
Region:	5S
Order #:	R5-2007-0113
Npdes# CA#:	CA0079243
Major-Minor:	Major
Npdes Type:	MUN
Reclamation:	2 - Producer-User
Dredge Fill Fee:	Not reported
301H:	N
Application Fee Amt Received:	10000
Status:	Active
Status Date:	01/22/2008
Effective Date:	11/03/2007
Expiration/Review Date:	09/01/2012
Termination Date:	Not reported
WDR Review - Amend:	Not reported
WDR Review - Revise/Renew:	Not reported
WDR Review - Rescind:	Not reported
WDR Review - No Action Required:	Not reported
WDR Review - Pending:	Not reported
WDR Review - Planned:	Not reported
Status Enrollee:	N
Individual/General:	I
Fee Code:	66 - NPDES Based on Flow
Direction/Voice:	Passive
Enforcement Id(EID):	373215
Region:	5S
Order / Resolution Number:	Not reported
Enforcement Action Type:	Notice of Violation
Effective Date:	02/16/2010
Adoption/Issuance Date:	02/16/2010
Achieve Date:	Not reported
Termination Date:	02/16/2010
ACL Issuance Date:	Not reported
EPL Issuance Date:	Not reported
Status:	Historical
Title:	NOV 02/16/2010 for Lodi City, White Slough WPCF
Description:	Not reported
Program:	NPDESWW
Latest Milestone Completion Date:	Not reported
# Of Programs1:	1
Total Assessment Amount:	0
Initial Assessed Amount:	0
Liability $ Amount:	0
Project $ Amount:	0

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

Liability $ Paid:	0
Project $ Completed:	0
Total $ Paid/Completed Amount:	0
Region:	5S
Facility Id:	272444
Agency Name:	Lodi City
Place Type:	Utility
Place Subtype:	Wastewater Treatment Facility
Facility Type:	Municipal/Domestic
Agency Type:	City Agency
# Of Agencies:	1
Place Latitude:	38.094431
Place Longitude:	-121.381226
SIC Code 1:	4952
SIC Desc 1:	Sewerage Systems
SIC Code 2:	Not reported
SIC Desc 2:	Not reported
SIC Code 3:	Not reported
SIC Desc 3:	Not reported
NAICS Code 1:	Not reported
NAICS Desc 1:	Not reported
NAICS Code 2:	Not reported
NAICS Desc 2:	Not reported
NAICS Code 3:	Not reported
NAICS Desc 3:	Not reported
# Of Places:	1
Source Of Facility:	Reg Meas
Design Flow:	8.5
Threat To Water Quality:	1
Complexity:	A
Pretreatment:	Y - POTW has EPA approved pretreatment program
Facility Waste Type:	Domestic wastewater
Facility Waste Type 2:	Not reported
Facility Waste Type 3:	Not reported
Facility Waste Type 4:	Not reported
Program:	NPDESWW
Program Category1:	NPDESWW
Program Category2:	NPDESWW
# Of Programs:	1
WDID:	5B390103002
Reg Measure Id:	333528
Reg Measure Type:	NPDES Permits
Region:	5S
Order #:	R5-2007-0113
Npdes# CA#:	CA0079243
Major-Minor:	Major
Npdes Type:	MUN
Reclamation:	2 - Producer-User
Dredge Fill Fee:	Not reported
301H:	N
Application Fee Amt Received:	10000
Status:	Active
Status Date:	01/22/2008
Effective Date:	11/03/2007
Expiration/Review Date:	09/01/2012
Termination Date:	Not reported

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

WDR Review - Amend:	Not reported
WDR Review - Revise/Renew:	Not reported
WDR Review - Rescind:	Not reported
WDR Review - No Action Required:	Not reported
WDR Review - Pending:	Not reported
WDR Review - Planned:	Not reported
Status Enrollee:	N
Individual/General:	I
Fee Code:	66 - NPDES Based on Flow
Direction/Voice:	Passive
Enforcement Id(EID):	374785
Region:	Not reported
Order / Resolution Number:	Not reported
Enforcement Action Type:	Notice of Violation
Effective Date:	06/16/2010
Adoption/Issuance Date:	06/16/2010
Achieve Date:	Not reported
Termination Date:	06/16/2010
ACL Issuance Date:	Not reported
EPL Issuance Date:	Not reported
Status:	Historical
Title:	NOV 06/16/2010 for Lodi City, White Slough WPCF
Description:	April 2010 SMR does not fully comply with the MRP requirements.
Program:	NPDESWW
Latest Milestone Completion Date:	Not reported
# Of Programs1:	1
Total Assessment Amount:	0
Initial Assessed Amount:	0
Liability $ Amount:	0
Project $ Amount:	0
Liability $ Paid:	0
Project $ Completed:	0
Total $ Paid/Completed Amount:	0

Region:	5S
Facility Id:	272444
Agency Name:	Lodi City
Place Type:	Utility
Place Subtype:	Wastewater Treatment Facility
Facility Type:	Municipal/Domestic
Agency Type:	City Agency
# Of Agencies:	1
Place Latitude:	38.094431
Place Longitude:	-121.381226
SIC Code 1:	4952
SIC Desc 1:	Sewerage Systems
SIC Code 2:	Not reported
SIC Desc 2:	Not reported
SIC Code 3:	Not reported
SIC Desc 3:	Not reported
NAICS Code 1:	Not reported
NAICS Desc 1:	Not reported
NAICS Code 2:	Not reported
NAICS Desc 2:	Not reported
NAICS Code 3:	Not reported
NAICS Desc 3:	Not reported

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

# Of Places:	1
Source Of Facility:	Reg Meas
Design Flow:	8.5
Threat To Water Quality:	1
Complexity:	A
Pretreatment:	Y - POTW has EPA approved pretreatment program
Facility Waste Type:	Domestic wastewater
Facility Waste Type 2:	Not reported
Facility Waste Type 3:	Not reported
Facility Waste Type 4:	Not reported
Program:	NPDESWW
Program Category1:	NPDESWW
Program Category2:	NPDESWW
# Of Programs:	1
WDID:	5B390103002
Reg Measure Id:	333528
Reg Measure Type:	NPDES Permits
Region:	5S
Order #:	R5-2007-0113
Npdes# CA#:	CA0079243
Major-Minor:	Major
Npdes Type:	MUN
Reclamation:	2 - Producer-User
Dredge Fill Fee:	Not reported
301H:	N
Application Fee Amt Received:	10000
Status:	Active
Status Date:	01/22/2008
Effective Date:	11/03/2007
Expiration/Review Date:	09/01/2012
Termination Date:	Not reported
WDR Review - Amend:	Not reported
WDR Review - Revise/Renew:	Not reported
WDR Review - Rescind:	Not reported
WDR Review - No Action Required:	Not reported
WDR Review - Pending:	Not reported
WDR Review - Planned:	Not reported
Status Enrollee:	N
Individual/General:	I
Fee Code:	66 - NPDES Based on Flow
Direction/Voice:	Passive
Enforcement Id(EID):	374793
Region:	5S
Order / Resolution Number:	Not reported
Enforcement Action Type:	Notice of Violation
Effective Date:	05/11/2010
Adoption/Issuance Date:	05/11/2010
Achieve Date:	Not reported
Termination Date:	05/11/2010
ACL Issuance Date:	Not reported
EPL Issuance Date:	Not reported
Status:	Historical
Title:	NOV 05/11/2010 for Lodi City, White Slough WPCF
Description:	March 2010 SMR does not fully comply with the MRP requirements.
Program:	NPDESWW
Latest Milestone Completion Date:	Not reported

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

# Of Programs1:	1
Total Assessment Amount:	0
Initial Assessed Amount:	0
Liability $ Amount:	0
Project $ Amount:	0
Liability $ Paid:	0
Project $ Completed:	0
Total $ Paid/Completed Amount:	0
Region:	5S
Facility Id:	272444
Agency Name:	Lodi City
Place Type:	Utility
Place Subtype:	Wastewater Treatment Facility
Facility Type:	Municipal/Domestic
Agency Type:	City Agency
# Of Agencies:	1
Place Latitude:	38.094431
Place Longitude:	-121.381226
SIC Code 1:	4952
SIC Desc 1:	Sewerage Systems
SIC Code 2:	Not reported
SIC Desc 2:	Not reported
SIC Code 3:	Not reported
SIC Desc 3:	Not reported
NAICS Code 1:	Not reported
NAICS Desc 1:	Not reported
NAICS Code 2:	Not reported
NAICS Desc 2:	Not reported
NAICS Code 3:	Not reported
NAICS Desc 3:	Not reported
# Of Places:	1
Source Of Facility:	Reg Meas
Design Flow:	8.5
Threat To Water Quality:	1
Complexity:	A
Pretreatment:	Y - POTW has EPA approved pretreatment program
Facility Waste Type:	Domestic wastewater
Facility Waste Type 2:	Not reported
Facility Waste Type 3:	Not reported
Facility Waste Type 4:	Not reported
Program:	NPDESWW
Program Category1:	NPDESWW
Program Category2:	NPDESWW
# Of Programs:	1
WDID:	5B390103002
Reg Measure Id:	333528
Reg Measure Type:	NPDES Permits
Region:	5S
Order #:	R5-2007-0113
Npdes# CA#:	CA0079243
Major-Minor:	Major
Npdes Type:	MUN
Reclamation:	2 - Producer-User
Dredge Fill Fee:	Not reported
301H:	N
Application Fee Amt Received:	10000

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

Status:	Active
Status Date:	01/22/2008
Effective Date:	11/03/2007
Expiration/Review Date:	09/01/2012
Termination Date:	Not reported
WDR Review - Amend:	Not reported
WDR Review - Revise/Renew:	Not reported
WDR Review - Rescind:	Not reported
WDR Review - No Action Required:	Not reported
WDR Review - Pending:	Not reported
WDR Review - Planned:	Not reported
Status Enrollee:	N
Individual/General:	I
Fee Code:	66 - NPDES Based on Flow
Direction/Voice:	Passive
Enforcement Id(EID):	374820
Region:	5S
Order / Resolution Number:	Not reported
Enforcement Action Type:	Notice of Violation
Effective Date:	04/20/2010
Adoption/Issuance Date:	04/20/2010
Achieve Date:	Not reported
Termination Date:	04/20/2010
ACL Issuance Date:	Not reported
EPL Issuance Date:	Not reported
Status:	Historical
Title:	NOV 04/20/2010 for Lodi City White Slough WPCF
Description:	February 2010 SMR does not fully comply with the MRP requirements.
Program:	NPDESWW
Latest Milestone Completion Date:	Not reported
# Of Programs1:	1
Total Assessment Amount:	0
Initial Assessed Amount:	0
Liability $ Amount:	0
Project $ Amount:	0
Liability $ Paid:	0
Project $ Completed:	0
Total $ Paid/Completed Amount:	0

Region:	5S
Facility Id:	272444
Agency Name:	Lodi City
Place Type:	Utility
Place Subtype:	Wastewater Treatment Facility
Facility Type:	Municipal/Domestic
Agency Type:	City Agency
# Of Agencies:	1
Place Latitude:	38.094431
Place Longitude:	-121.381226
SIC Code 1:	4952
SIC Desc 1:	Sewerage Systems
SIC Code 2:	Not reported
SIC Desc 2:	Not reported
SIC Code 3:	Not reported
SIC Desc 3:	Not reported
NAICS Code 1:	Not reported

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

NAICS Desc 1:	Not reported
NAICS Code 2:	Not reported
NAICS Desc 2:	Not reported
NAICS Code 3:	Not reported
NAICS Desc 3:	Not reported
# Of Places:	1
Source Of Facility:	Reg Meas
Design Flow:	8.5
Threat To Water Quality:	1
Complexity:	A
Pretreatment:	Y - POTW has EPA approved pretreatment program
Facility Waste Type:	Domestic wastewater
Facility Waste Type 2:	Not reported
Facility Waste Type 3:	Not reported
Facility Waste Type 4:	Not reported
Program:	NPDESWW
Program Category1:	NPDESWW
Program Category2:	NPDESWW
# Of Programs:	1
WDID:	5B390103002
Reg Measure Id:	333528
Reg Measure Type:	NPDES Permits
Region:	5S
Order #:	R5-2007-0113
Npdes# CA#:	CA0079243
Major-Minor:	Major
Npdes Type:	MUN
Reclamation:	2 - Producer-User
Dredge Fill Fee:	Not reported
301H:	N
Application Fee Amt Received:	10000
Status:	Active
Status Date:	01/22/2008
Effective Date:	11/03/2007
Expiration/Review Date:	09/01/2012
Termination Date:	Not reported
WDR Review - Amend:	Not reported
WDR Review - Revise/Renew:	Not reported
WDR Review - Rescind:	Not reported
WDR Review - No Action Required:	Not reported
WDR Review - Pending:	Not reported
WDR Review - Planned:	Not reported
Status Enrollee:	N
Individual/General:	I
Fee Code:	66 - NPDES Based on Flow
Direction/Voice:	Passive
Enforcement Id(EID):	374843
Region:	5S
Order / Resolution Number:	Not reported
Enforcement Action Type:	Notice of Violation
Effective Date:	03/17/2010
Adoption/Issuance Date:	03/17/2010
Achieve Date:	Not reported
Termination Date:	03/17/2010
ACL Issuance Date:	Not reported
EPL Issuance Date:	Not reported
Status:	Historical

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

Title:	NOV 03/17/2010 for Lodi City White Slough WPCF
Description:	January 2010 SMR does not fully comply with the MRP requirements.
Program:	NPDESWW
Latest Milestone Completion Date:	Not reported
# Of Programs1:	1
Total Assessment Amount:	0
Initial Assessed Amount:	0
Liability $ Amount:	0
Project $ Amount:	0
Liability $ Paid:	0
Project $ Completed:	0
Total $ Paid/Completed Amount:	0
Region:	5S
Facility Id:	272444
Agency Name:	Lodi City
Place Type:	Utility
Place Subtype:	Wastewater Treatment Facility
Facility Type:	Municipal/Domestic
Agency Type:	City Agency
# Of Agencies:	1
Place Latitude:	38.094431
Place Longitude:	-121.381226
SIC Code 1:	4952
SIC Desc 1:	Sewerage Systems
SIC Code 2:	Not reported
SIC Desc 2:	Not reported
SIC Code 3:	Not reported
SIC Desc 3:	Not reported
NAICS Code 1:	Not reported
NAICS Desc 1:	Not reported
NAICS Code 2:	Not reported
NAICS Desc 2:	Not reported
NAICS Code 3:	Not reported
NAICS Desc 3:	Not reported
# Of Places:	1
Source Of Facility:	Reg Meas
Design Flow:	8.5
Threat To Water Quality:	1
Complexity:	A
Pretreatment:	Y - POTW has EPA approved pretreatment program
Facility Waste Type:	Domestic wastewater
Facility Waste Type 2:	Not reported
Facility Waste Type 3:	Not reported
Facility Waste Type 4:	Not reported
Program:	NPDESWW
Program Category1:	NPDESWW
Program Category2:	NPDESWW
# Of Programs:	1
WDID:	5B390103002
Reg Measure Id:	333528
Reg Measure Type:	NPDES Permits
Region:	5S
Order #:	R5-2007-0113
Npdes# CA#:	CA0079243
Major-Minor:	Major

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

Npdes Type:	MUN
Reclamation:	2 - Producer-User
Dredge Fill Fee:	Not reported
301H:	N
Application Fee Amt Received:	10000
Status:	Active
Status Date:	01/22/2008
Effective Date:	11/03/2007
Expiration/Review Date:	09/01/2012
Termination Date:	Not reported
WDR Review - Amend:	Not reported
WDR Review - Revise/Renew:	Not reported
WDR Review - Rescind:	Not reported
WDR Review - No Action Required:	Not reported
WDR Review - Pending:	Not reported
WDR Review - Planned:	Not reported
Status Enrollee:	N
Individual/General:	I
Fee Code:	66 - NPDES Based on Flow
Direction/Voice:	Passive
Enforcement Id(EID):	375157
Region:	5S
Order / Resolution Number:	Not reported
Enforcement Action Type:	Notice of Violation
Effective Date:	07/21/2010
Adoption/Issuance Date:	07/21/2010
Achieve Date:	Not reported
Termination Date:	07/21/2010
ACL Issuance Date:	Not reported
EPL Issuance Date:	Not reported
Status:	Historical
Title:	NOV 07/21/2010 for Lodi City, White Slough Water Pollution Control Facility
Description:	May 2010 SMR does not fully comply with the MRP requirements.
Program:	NPDESWW
Latest Milestone Completion Date:	Not reported
# Of Programs1:	1
Total Assessment Amount:	0
Initial Assessed Amount:	0
Liability $ Amount:	0
Project $ Amount:	0
Liability $ Paid:	0
Project $ Completed:	0
Total $ Paid/Completed Amount:	0
Region:	5S
Facility Id:	272444
Agency Name:	Lodi City
Place Type:	Utility
Place Subtype:	Wastewater Treatment Facility
Facility Type:	Municipal/Domestic
Agency Type:	City Agency
# Of Agencies:	1
Place Latitude:	38.094431
Place Longitude:	-121.381226
SIC Code 1:	4952

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

SIC Desc 1:	Sewerage Systems
SIC Code 2:	Not reported
SIC Desc 2:	Not reported
SIC Code 3:	Not reported
SIC Desc 3:	Not reported
NAICS Code 1:	Not reported
NAICS Desc 1:	Not reported
NAICS Code 2:	Not reported
NAICS Desc 2:	Not reported
NAICS Code 3:	Not reported
NAICS Desc 3:	Not reported
# Of Places:	1
Source Of Facility:	Reg Meas
Design Flow:	8.5
Threat To Water Quality:	1
Complexity:	A
Pretreatment:	Y - POTW has EPA approved pretreatment program
Facility Waste Type:	Domestic wastewater
Facility Waste Type 2:	Not reported
Facility Waste Type 3:	Not reported
Facility Waste Type 4:	Not reported
Program:	NPDESWW
Program Category1:	NPDESWW
Program Category2:	NPDESWW
# Of Programs:	1
WDID:	5B390103002
Reg Measure Id:	333528
Reg Measure Type:	NPDES Permits
Region:	5S
Order #:	R5-2007-0113
Npdes# CA#:	CA0079243
Major-Minor:	Major
Npdes Type:	MUN
Reclamation:	2 - Producer-User
Dredge Fill Fee:	Not reported
301H:	N
Application Fee Amt Received:	10000
Status:	Active
Status Date:	01/22/2008
Effective Date:	11/03/2007
Expiration/Review Date:	09/01/2012
Termination Date:	Not reported
WDR Review - Amend:	Not reported
WDR Review - Revise/Renew:	Not reported
WDR Review - Rescind:	Not reported
WDR Review - No Action Required:	Not reported
WDR Review - Pending:	Not reported
WDR Review - Planned:	Not reported
Status Enrollee:	N
Individual/General:	I
Fee Code:	66 - NPDES Based on Flow
Direction/Voice:	Passive
Enforcement Id(EID):	375540
Region:	5S
Order / Resolution Number:	Not reported
Enforcement Action Type:	Notice of Violation
Effective Date:	08/06/2010

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

Adoption/Issuance Date:	08/06/2010
Achieve Date:	Not reported
Termination Date:	08/06/2010
ACL Issuance Date:	Not reported
EPL Issuance Date:	Not reported
Status:	Historical
Title:	NOV 08/06/2010 for Lodi City, White Slough WPCF
Description:	While inspection on 23 March 2010 it was noticed that Standard Provisions, Provisions IV.B.1 and B.2 and Provision III in WDRs Attachment D were violated.
Program:	NPDESWW
Latest Milestone Completion Date:	Not reported
# Of Programs1:	1
Total Assessment Amount:	0
Initial Assessed Amount:	0
Liability $ Amount:	0
Project $ Amount:	0
Liability $ Paid:	0
Project $ Completed:	0
Total $ Paid/Completed Amount:	0

Region:	5S
Facility Id:	272444
Agency Name:	Lodi City
Place Type:	Utility
Place Subtype:	Wastewater Treatment Facility
Facility Type:	Municipal/Domestic
Agency Type:	City Agency
# Of Agencies:	1
Place Latitude:	38.094431
Place Longitude:	-121.381226
SIC Code 1:	4952
SIC Desc 1:	Sewerage Systems
SIC Code 2:	Not reported
SIC Desc 2:	Not reported
SIC Code 3:	Not reported
SIC Desc 3:	Not reported
NAICS Code 1:	Not reported
NAICS Desc 1:	Not reported
NAICS Code 2:	Not reported
NAICS Desc 2:	Not reported
NAICS Code 3:	Not reported
NAICS Desc 3:	Not reported
# Of Places:	1
Source Of Facility:	Reg Meas
Design Flow:	8.5
Threat To Water Quality:	1
Complexity:	A
Pretreatment:	Y - POTW has EPA approved pretreatment program
Facility Waste Type:	Domestic wastewater
Facility Waste Type 2:	Not reported
Facility Waste Type 3:	Not reported
Facility Waste Type 4:	Not reported
Program:	NPDESWW
Program Category1:	NPDESWW
Program Category2:	NPDESWW
# Of Programs:	1

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

WDID:	5B390103002
Reg Measure Id:	333528
Reg Measure Type:	NPDES Permits
Region:	5S
Order #:	R5-2007-0113
Npdes# CA#:	CA0079243
Major-Minor:	Major
Npdes Type:	MUN
Reclamation:	2 - Producer-User
Dredge Fill Fee:	Not reported
301H:	N
Application Fee Amt Received:	10000
Status:	Active
Status Date:	01/22/2008
Effective Date:	11/03/2007
Expiration/Review Date:	09/01/2012
Termination Date:	Not reported
WDR Review - Amend:	Not reported
WDR Review - Revise/Renew:	Not reported
WDR Review - Rescind:	Not reported
WDR Review - No Action Required:	Not reported
WDR Review - Pending:	Not reported
WDR Review - Planned:	Not reported
Status Enrollee:	N
Individual/General:	I
Fee Code:	66 - NPDES Based on Flow
Direction/Voice:	Passive
Enforcement Id(EID):	379181
Region:	5S
Order / Resolution Number:	Not reported
Enforcement Action Type:	Notice of Violation
Effective Date:	05/13/2011
Adoption/Issuance Date:	05/13/2011
Achieve Date:	Not reported
Termination Date:	05/13/2011
ACL Issuance Date:	Not reported
EPL Issuance Date:	Not reported
Status:	Historical
Title:	NOV 05/13/2011 for Lodi City White Slough WPCF
Description:	Inspection found violations of WDR requirements.
Program:	NPDESWW
Latest Milestone Completion Date:	Not reported
# Of Programs1:	1
Total Assessment Amount:	0
Initial Assessed Amount:	0
Liability $ Amount:	0
Project $ Amount:	0
Liability $ Paid:	0
Project $ Completed:	0
Total $ Paid/Completed Amount:	0

Region:	5S
Facility Id:	272444
Agency Name:	Lodi City
Place Type:	Utility
Place Subtype:	Wastewater Treatment Facility
Facility Type:	Municipal/Domestic

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

Agency Type:	City Agency
# Of Agencies:	1
Place Latitude:	38.094431
Place Longitude:	-121.381226
SIC Code 1:	4952
SIC Desc 1:	Sewerage Systems
SIC Code 2:	Not reported
SIC Desc 2:	Not reported
SIC Code 3:	Not reported
SIC Desc 3:	Not reported
NAICS Code 1:	Not reported
NAICS Desc 1:	Not reported
NAICS Code 2:	Not reported
NAICS Desc 2:	Not reported
NAICS Code 3:	Not reported
NAICS Desc 3:	Not reported
# Of Places:	1
Source Of Facility:	Reg Meas
Design Flow:	8.5
Threat To Water Quality:	1
Complexity:	A
Pretreatment:	Y - POTW has EPA approved pretreatment program
Facility Waste Type:	Domestic wastewater
Facility Waste Type 2:	Not reported
Facility Waste Type 3:	Not reported
Facility Waste Type 4:	Not reported
Program:	NPDESWW
Program Category1:	NPDESWW
Program Category2:	NPDESWW
# Of Programs:	1
WDID:	5B390103002
Reg Measure Id:	333528
Reg Measure Type:	NPDES Permits
Region:	5S
Order #:	R5-2007-0113
Npdes# CA#:	CA0079243
Major-Minor:	Major
Npdes Type:	MUN
Reclamation:	2 - Producer-User
Dredge Fill Fee:	Not reported
301H:	N
Application Fee Amt Received:	10000
Status:	Active
Status Date:	01/22/2008
Effective Date:	11/03/2007
Expiration/Review Date:	09/01/2012
Termination Date:	Not reported
WDR Review - Amend:	Not reported
WDR Review - Revise/Renew:	Not reported
WDR Review - Rescind:	Not reported
WDR Review - No Action Required:	Not reported
WDR Review - Pending:	Not reported
WDR Review - Planned:	Not reported
Status Enrollee:	N
Individual/General:	I
Fee Code:	66 - NPDES Based on Flow
Direction/Voice:	Passive

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

Enforcement Id(EID):	379453
Region:	5S
Order / Resolution Number:	Not reported
Enforcement Action Type:	Notice of Violation
Effective Date:	05/20/2011
Adoption/Issuance Date:	05/20/2011
Achieve Date:	Not reported
Termination Date:	05/20/2011
ACL Issuance Date:	Not reported
EPL Issuance Date:	Not reported
Status:	Historical
Title:	NOV 05/20/2011 for Lodi City White Slough WPCF
Description:	During the monitoring periods February 2011 and March 2011 the discharge violated the limitations contained in the WDRs.
Program:	NPDESWW
Latest Milestone Completion Date:	Not reported
# Of Programs1:	1
Total Assessment Amount:	0
Initial Assessed Amount:	0
Liability $ Amount:	0
Project $ Amount:	0
Liability $ Paid:	0
Project $ Completed:	0
Total $ Paid/Completed Amount:	0

Region:	5S
Facility Id:	272444
Agency Name:	Lodi City
Place Type:	Utility
Place Subtype:	Wastewater Treatment Facility
Facility Type:	Municipal/Domestic
Agency Type:	City Agency
# Of Agencies:	1
Place Latitude:	38.094431
Place Longitude:	-121.381226
SIC Code 1:	4952
SIC Desc 1:	Sewerage Systems
SIC Code 2:	Not reported
SIC Desc 2:	Not reported
SIC Code 3:	Not reported
SIC Desc 3:	Not reported
NAICS Code 1:	Not reported
NAICS Desc 1:	Not reported
NAICS Code 2:	Not reported
NAICS Desc 2:	Not reported
NAICS Code 3:	Not reported
NAICS Desc 3:	Not reported
# Of Places:	1
Source Of Facility:	Reg Meas
Design Flow:	8.5
Threat To Water Quality:	1
Complexity:	A
Pretreatment:	Y - POTW has EPA approved pretreatment program
Facility Waste Type:	Domestic wastewater
Facility Waste Type 2:	Not reported
Facility Waste Type 3:	Not reported

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

Facility Waste Type 4:	Not reported
Program:	NPDESWW
Program Category1:	NPDESWW
Program Category2:	NPDESWW
# Of Programs:	1
WDID:	5B390103002
Reg Measure Id:	333528
Reg Measure Type:	NPDES Permits
Region:	5S
Order #:	R5-2007-0113
Npdes# CA#:	CA0079243
Major-Minor:	Major
Npdes Type:	MUN
Reclamation:	2 - Producer-User
Dredge Fill Fee:	Not reported
301H:	N
Application Fee Amt Received:	10000
Status:	Active
Status Date:	01/22/2008
Effective Date:	11/03/2007
Expiration/Review Date:	09/01/2012
Termination Date:	Not reported
WDR Review - Amend:	Not reported
WDR Review - Revise/Renew:	Not reported
WDR Review - Rescind:	Not reported
WDR Review - No Action Required:	Not reported
WDR Review - Pending:	Not reported
WDR Review - Planned:	Not reported
Status Enrollee:	N
Individual/General:	I
Fee Code:	66 - NPDES Based on Flow
Direction/Voice:	Passive
Enforcement Id(EID):	379857
Region:	5S
Order / Resolution Number:	Not reported
Enforcement Action Type:	Notice of Violation
Effective Date:	06/22/2011
Adoption/Issuance Date:	06/22/2011
Achieve Date:	Not reported
Termination Date:	06/22/2011
ACL Issuance Date:	Not reported
EPL Issuance Date:	Not reported
Status:	Historical
Title:	NOV 06/22/2011 for Lodi City White Slough WPCF
Description:	Not reported
Program:	NPDESWW
Latest Milestone Completion Date:	Not reported
# Of Programs1:	1
Total Assessment Amount:	0
Initial Assessed Amount:	0
Liability $ Amount:	0
Project $ Amount:	0
Liability $ Paid:	0
Project $ Completed:	0
Total $ Paid/Completed Amount:	0

Region:	5S

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

Facility Id:	272444
Agency Name:	Lodi City
Place Type:	Utility
Place Subtype:	Wastewater Treatment Facility
Facility Type:	Municipal/Domestic
Agency Type:	City Agency
# Of Agencies:	1
Place Latitude:	38.094431
Place Longitude:	-121.381226
SIC Code 1:	4952
SIC Desc 1:	Sewerage Systems
SIC Code 2:	Not reported
SIC Desc 2:	Not reported
SIC Code 3:	Not reported
SIC Desc 3:	Not reported
NAICS Code 1:	Not reported
NAICS Desc 1:	Not reported
NAICS Code 2:	Not reported
NAICS Desc 2:	Not reported
NAICS Code 3:	Not reported
NAICS Desc 3:	Not reported
# Of Places:	1
Source Of Facility:	Reg Meas
Design Flow:	8.5
Threat To Water Quality:	1
Complexity:	A
Pretreatment:	Y - POTW has EPA approved pretreatment program
Facility Waste Type:	Domestic wastewater
Facility Waste Type 2:	Not reported
Facility Waste Type 3:	Not reported
Facility Waste Type 4:	Not reported
Program:	NPDESWW
Program Category1:	NPDESWW
Program Category2:	NPDESWW
# Of Programs:	1
WDID:	5B390103002
Reg Measure Id:	333528
Reg Measure Type:	NPDES Permits
Region:	5S
Order #:	R5-2007-0113
Npdes# CA#:	CA0079243
Major-Minor:	Major
Npdes Type:	MUN
Reclamation:	2 - Producer-User
Dredge Fill Fee:	Not reported
301H:	N
Application Fee Amt Received:	10000
Status:	Active
Status Date:	01/22/2008
Effective Date:	11/03/2007
Expiration/Review Date:	09/01/2012
Termination Date:	Not reported
WDR Review - Amend:	Not reported
WDR Review - Revise/Renew:	Not reported
WDR Review - Rescind:	Not reported
WDR Review - No Action Required:	Not reported
WDR Review - Pending:	Not reported

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

WDR Review - Planned:	Not reported
Status Enrollee:	N
Individual/General:	I
Fee Code:	66 - NPDES Based on Flow
Direction/Voice:	Passive
Enforcement Id(EID):	385185
Region:	5S
Order / Resolution Number:	Not reported
Enforcement Action Type:	Notice of Violation
Effective Date:	05/14/2012
Adoption/Issuance Date:	05/14/2012
Achieve Date:	Not reported
Termination Date:	05/14/2012
ACL Issuance Date:	Not reported
EPL Issuance Date:	Not reported
Status:	Historical
Title:	NOV 05/14/2012 for Lodi City White Slough WPCF
Description:	Central Valley Water Board staff conducted an inspection of the City of Lodi White Slough Water Pollution Control Facility on 29 March 2012 to determine compliance with Waste Discharge Requirements Order R5-2007-0113.
Program:	NPDESWW
Latest Milestone Completion Date:	Not reported
# Of Programs1:	1
Total Assessment Amount:	0
Initial Assessed Amount:	0
Liability $ Amount:	0
Project $ Amount:	0
Liability $ Paid:	0
Project $ Completed:	0
Total $ Paid/Completed Amount:	0

Region:	5S
Facility Id:	272444
Agency Name:	Lodi City
Place Type:	Utility
Place Subtype:	Wastewater Treatment Facility
Facility Type:	Municipal/Domestic
Agency Type:	City Agency
# Of Agencies:	1
Place Latitude:	38.094431
Place Longitude:	-121.381226
SIC Code 1:	4952
SIC Desc 1:	Sewerage Systems
SIC Code 2:	Not reported
SIC Desc 2:	Not reported
SIC Code 3:	Not reported
SIC Desc 3:	Not reported
NAICS Code 1:	Not reported
NAICS Desc 1:	Not reported
NAICS Code 2:	Not reported
NAICS Desc 2:	Not reported
NAICS Code 3:	Not reported
NAICS Desc 3:	Not reported
# Of Places:	1
Source Of Facility:	Reg Meas
Design Flow:	8.5

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

Threat To Water Quality:	1
Complexity:	A
Pretreatment:	Y - POTW has EPA approved pretreatment program
Facility Waste Type:	Domestic wastewater
Facility Waste Type 2:	Not reported
Facility Waste Type 3:	Not reported
Facility Waste Type 4:	Not reported
Program:	NPDESWW
Program Category1:	NPDESWW
Program Category2:	NPDESWW
# Of Programs:	1
WDID:	5B390103002
Reg Measure Id:	333528
Reg Measure Type:	NPDES Permits
Region:	5S
Order #:	R5-2007-0113
Npdes# CA#:	CA0079243
Major-Minor:	Major
Npdes Type:	MUN
Reclamation:	2 - Producer-User
Dredge Fill Fee:	Not reported
301H:	N
Application Fee Amt Received:	10000
Status:	Active
Status Date:	01/22/2008
Effective Date:	11/03/2007
Expiration/Review Date:	09/01/2012
Termination Date:	Not reported
WDR Review - Amend:	Not reported
WDR Review - Revise/Renew:	Not reported
WDR Review - Rescind:	Not reported
WDR Review - No Action Required:	Not reported
WDR Review - Pending:	Not reported
WDR Review - Planned:	Not reported
Status Enrollee:	N
Individual/General:	I
Fee Code:	66 - NPDES Based on Flow
Direction/Voice:	Passive
Enforcement Id(EID):	387603
Region:	5S
Order / Resolution Number:	Not reported
Enforcement Action Type:	Notice of Violation
Effective Date:	09/20/2012
Adoption/Issuance Date:	09/20/2012
Achieve Date:	Not reported
Termination Date:	09/20/2012
ACL Issuance Date:	Not reported
EPL Issuance Date:	Not reported
Status:	Historical
Title:	NOV 09/20/2012 for Lodi City White Slough WPCF
Description:	During the monitoring periods July 2011, August 2011, September 2011, Third Quarter 2011, October 2011, November 2011, December 2011, Fourth Quarter 2011, Annual 2011, January 2012, February 2012, March 2012, First Quarter 2012, April 2012, May 2012, June 2012, July 2012, and Second Quarter 2012 the discharge violated the limitations contained in the WDRs.

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

Program:	NPDESWW
Latest Milestone Completion Date:	Not reported
# Of Programs1:	1
Total Assessment Amount:	0
Initial Assessed Amount:	0
Liability $ Amount:	0
Project $ Amount:	0
Liability $ Paid:	0
Project $ Completed:	0
Total $ Paid/Completed Amount:	0
Region:	5S
Facility Id:	272444
Agency Name:	Lodi City
Place Type:	Utility
Place Subtype:	Wastewater Treatment Facility
Facility Type:	Municipal/Domestic
Agency Type:	City Agency
# Of Agencies:	1
Place Latitude:	38.094431
Place Longitude:	-121.381226
SIC Code 1:	4952
SIC Desc 1:	Sewerage Systems
SIC Code 2:	Not reported
SIC Desc 2:	Not reported
SIC Code 3:	Not reported
SIC Desc 3:	Not reported
NAICS Code 1:	Not reported
NAICS Desc 1:	Not reported
NAICS Code 2:	Not reported
NAICS Desc 2:	Not reported
NAICS Code 3:	Not reported
NAICS Desc 3:	Not reported
# Of Places:	1
Source Of Facility:	Reg Meas
Design Flow:	8.5
Threat To Water Quality:	1
Complexity:	A
Pretreatment:	Y - POTW has EPA approved pretreatment program
Facility Waste Type:	Domestic wastewater
Facility Waste Type 2:	Not reported
Facility Waste Type 3:	Not reported
Facility Waste Type 4:	Not reported
Program:	NPDESWW
Program Category1:	NPDESWW
Program Category2:	NPDESWW
# Of Programs:	1
WDID:	5B390103002
Reg Measure Id:	333528
Reg Measure Type:	NPDES Permits
Region:	5S
Order #:	R5-2007-0113
Npdes# CA#:	CA0079243
Major-Minor:	Major
Npdes Type:	MUN
Reclamation:	2 - Producer-User
Dredge Fill Fee:	Not reported

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

301H:	N
Application Fee Amt Received:	10000
Status:	Active
Status Date:	01/22/2008
Effective Date:	11/03/2007
Expiration/Review Date:	09/01/2012
Termination Date:	Not reported
WDR Review - Amend:	Not reported
WDR Review - Revise/Renew:	Not reported
WDR Review - Rescind:	Not reported
WDR Review - No Action Required:	Not reported
WDR Review - Pending:	Not reported
WDR Review - Planned:	Not reported
Status Enrollee:	N
Individual/General:	I
Fee Code:	66 - NPDES Based on Flow
Direction/Voice:	Passive
Enforcement Id(EID):	388767
Region:	5S
Order / Resolution Number:	Not reported
Enforcement Action Type:	Notice of Violation
Effective Date:	01/03/2013
Adoption/Issuance Date:	01/03/2013
Achieve Date:	Not reported
Termination Date:	01/03/2013
ACL Issuance Date:	Not reported
EPL Issuance Date:	Not reported
Status:	Historical
Title:	NOV 01/03/2013 for Lodi City White Slough WPCF
Description:	During the monitoring periods August 2012, September 2012, and October 2012 the discharge violated the limitations contained in the WDRs.
Program:	NPDESWW
Latest Milestone Completion Date:	Not reported
# Of Programs1:	1
Total Assessment Amount:	0
Initial Assessed Amount:	0
Liability $ Amount:	0
Project $ Amount:	0
Liability $ Paid:	0
Project $ Completed:	0
Total $ Paid/Completed Amount:	0

Region:	5S
Facility Id:	272444
Agency Name:	Lodi City
Place Type:	Utility
Place Subtype:	Wastewater Treatment Facility
Facility Type:	Municipal/Domestic
Agency Type:	City Agency
# Of Agencies:	1
Place Latitude:	38.094431
Place Longitude:	-121.381226
SIC Code 1:	4952
SIC Desc 1:	Sewerage Systems
SIC Code 2:	Not reported
SIC Desc 2:	Not reported

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

SIC Code 3:	Not reported
SIC Desc 3:	Not reported
NAICS Code 1:	Not reported
NAICS Desc 1:	Not reported
NAICS Code 2:	Not reported
NAICS Desc 2:	Not reported
NAICS Code 3:	Not reported
NAICS Desc 3:	Not reported
# Of Places:	1
Source Of Facility:	Reg Meas
Design Flow:	8.5
Threat To Water Quality:	1
Complexity:	A
Pretreatment:	Y - POTW has EPA approved pretreatment program
Facility Waste Type:	Domestic wastewater
Facility Waste Type 2:	Not reported
Facility Waste Type 3:	Not reported
Facility Waste Type 4:	Not reported
Program:	NPDESWW
Program Category1:	NPDESWW
Program Category2:	NPDESWW
# Of Programs:	1
WDID:	5B390103002
Reg Measure Id:	333528
Reg Measure Type:	NPDES Permits
Region:	5S
Order #:	R5-2007-0113
Npdes# CA#:	CA0079243
Major-Minor:	Major
Npdes Type:	MUN
Reclamation:	2 - Producer-User
Dredge Fill Fee:	Not reported
301H:	N
Application Fee Amt Received:	10000
Status:	Active
Status Date:	01/22/2008
Effective Date:	11/03/2007
Expiration/Review Date:	09/01/2012
Termination Date:	Not reported
WDR Review - Amend:	Not reported
WDR Review - Revise/Renew:	Not reported
WDR Review - Rescind:	Not reported
WDR Review - No Action Required:	Not reported
WDR Review - Pending:	Not reported
WDR Review - Planned:	Not reported
Status Enrollee:	N
Individual/General:	I
Fee Code:	66 - NPDES Based on Flow
Direction/Voice:	Passive
Enforcement Id(EID):	388768
Region:	5S
Order / Resolution Number:	Not reported
Enforcement Action Type:	Notice of Violation
Effective Date:	01/04/2013
Adoption/Issuance Date:	01/04/2013
Achieve Date:	Not reported
Termination Date:	01/04/2013

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

ACL Issuance Date:	Not reported
EPL Issuance Date:	Not reported
Status:	Historical
Title:	NOV 01/04/2013 for Lodi City White Slough WPCF
Description:	The Discharger reported two spills occurring on 28 September 2012 and 30 November 2012. The City of Lodi has violated Discharge Prohibition of WDRs Order R5-2007-0113 and Standard Provision I.D.
Program:	NPDESWW
Latest Milestone Completion Date:	Not reported
# Of Programs1:	1
Total Assessment Amount:	0
Initial Assessed Amount:	0
Liability $ Amount:	0
Project $ Amount:	0
Liability $ Paid:	0
Project $ Completed:	0
Total $ Paid/Completed Amount:	0

Region:	5S
Facility Id:	272444
Agency Name:	Lodi City
Place Type:	Utility
Place Subtype:	Wastewater Treatment Facility
Facility Type:	Municipal/Domestic
Agency Type:	City Agency
# Of Agencies:	1
Place Latitude:	38.094431
Place Longitude:	-121.381226
SIC Code 1:	4952
SIC Desc 1:	Sewerage Systems
SIC Code 2:	Not reported
SIC Desc 2:	Not reported
SIC Code 3:	Not reported
SIC Desc 3:	Not reported
NAICS Code 1:	Not reported
NAICS Desc 1:	Not reported
NAICS Code 2:	Not reported
NAICS Desc 2:	Not reported
NAICS Code 3:	Not reported
NAICS Desc 3:	Not reported
# Of Places:	1
Source Of Facility:	Reg Meas
Design Flow:	8.5
Threat To Water Quality:	1
Complexity:	A
Pretreatment:	Y - POTW has EPA approved pretreatment program
Facility Waste Type:	Domestic wastewater
Facility Waste Type 2:	Not reported
Facility Waste Type 3:	Not reported
Facility Waste Type 4:	Not reported
Program:	NPDESWW
Program Category1:	NPDESWW
Program Category2:	NPDESWW
# Of Programs:	1
WDID:	5B390103002
Reg Measure Id:	333528

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

Reg Measure Type:	NPDES Permits
Region:	5S
Order #:	R5-2007-0113
Npdes# CA#:	CA0079243
Major-Minor:	Major
Npdes Type:	MUN
Reclamation:	2 - Producer-User
Dredge Fill Fee:	Not reported
301H:	N
Application Fee Amt Received:	10000
Status:	Active
Status Date:	01/22/2008
Effective Date:	11/03/2007
Expiration/Review Date:	09/01/2012
Termination Date:	Not reported
WDR Review - Amend:	Not reported
WDR Review - Revise/Renew:	Not reported
WDR Review - Rescind:	Not reported
WDR Review - No Action Required:	Not reported
WDR Review - Pending:	Not reported
WDR Review - Planned:	Not reported
Status Enrollee:	N
Individual/General:	I
Fee Code:	66 - NPDES Based on Flow
Direction/Voice:	Passive
Enforcement Id(EID):	388973
Region:	5S
Order / Resolution Number:	R5-2013-0509
Enforcement Action Type:	Admin Civil Liability
Effective Date:	01/11/2013
Adoption/Issuance Date:	Not reported
Achieve Date:	Not reported
Termination Date:	01/29/2013
ACL Issuance Date:	01/11/2013
EPL Issuance Date:	Not reported
Status:	Historical
Title:	ACL R5-2013-0509 for Lodi City
Description:	MMP Complaint issued in the amount of $9,000 for 3 serious effluent limitation violations from 04/01/2009 to 09/30/2012.
Program:	NPDESWW
Latest Milestone Completion Date:	2013-01-29
# Of Programs1:	1
Total Assessment Amount:	9000
Initial Assessed Amount:	9000
Liability $ Amount:	9000
Project $ Amount:	0
Liability $ Paid:	9000
Project $ Completed:	0
Total $ Paid/Completed Amount:	9000
Region:	5S
Facility Id:	272444
Agency Name:	Lodi City
Place Type:	Utility
Place Subtype:	Wastewater Treatment Facility
Facility Type:	Municipal/Domestic

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

Agency Type:	City Agency
# Of Agencies:	1
Place Latitude:	38.094431
Place Longitude:	-121.381226
SIC Code 1:	4952
SIC Desc 1:	Sewerage Systems
SIC Code 2:	Not reported
SIC Desc 2:	Not reported
SIC Code 3:	Not reported
SIC Desc 3:	Not reported
NAICS Code 1:	Not reported
NAICS Desc 1:	Not reported
NAICS Code 2:	Not reported
NAICS Desc 2:	Not reported
NAICS Code 3:	Not reported
NAICS Desc 3:	Not reported
# Of Places:	1
Source Of Facility:	Reg Meas
Design Flow:	8.5
Threat To Water Quality:	1
Complexity:	A
Pretreatment:	Y - POTW has EPA approved pretreatment program
Facility Waste Type:	Domestic wastewater
Facility Waste Type 2:	Not reported
Facility Waste Type 3:	Not reported
Facility Waste Type 4:	Not reported
Program:	NPDESWW
Program Category1:	NPDESWW
Program Category2:	NPDESWW
# Of Programs:	1
WDID:	5B390103002
Reg Measure Id:	333528
Reg Measure Type:	NPDES Permits
Region:	5S
Order #:	R5-2007-0113
Npdes# CA#:	CA0079243
Major-Minor:	Major
Npdes Type:	MUN
Reclamation:	2 - Producer-User
Dredge Fill Fee:	Not reported
301H:	N
Application Fee Amt Received:	10000
Status:	Active
Status Date:	01/22/2008
Effective Date:	11/03/2007
Expiration/Review Date:	09/01/2012
Termination Date:	Not reported
WDR Review - Amend:	Not reported
WDR Review - Revise/Renew:	Not reported
WDR Review - Rescind:	Not reported
WDR Review - No Action Required:	Not reported
WDR Review - Pending:	Not reported
WDR Review - Planned:	Not reported
Status Enrollee:	N
Individual/General:	I
Fee Code:	66 - NPDES Based on Flow
Direction/Voice:	Passive

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

Enforcement Id(EID):	389688
Region:	5S
Order / Resolution Number:	Not reported
Enforcement Action Type:	Notice of Violation
Effective Date:	03/14/2013
Adoption/Issuance Date:	03/14/2013
Achieve Date:	Not reported
Termination Date:	03/14/2013
ACL Issuance Date:	Not reported
EPL Issuance Date:	Not reported
Status:	Historical
Title:	NOV 03/14/2013 for Lodi City White Slough WPCF
Description:	The inspection was conducted on 13 February 2013 by PG Environmental, LLC, a USEPA contractor, to evaluate compliance with the WDRs. The inspection found seven of nine areas evaluated to be satisfactory and two areas to be marginal.
Program:	NPDESWW
Latest Milestone Completion Date:	Not reported
# Of Programs1:	1
Total Assessment Amount:	0
Initial Assessed Amount:	0
Liability $ Amount:	0
Project $ Amount:	0
Liability $ Paid:	0
Project $ Completed:	0
Total $ Paid/Completed Amount:	0

Region:	5S
Facility Id:	272444
Agency Name:	Lodi City
Place Type:	Utility
Place Subtype:	Wastewater Treatment Facility
Facility Type:	Municipal/Domestic
Agency Type:	City Agency
# Of Agencies:	1
Place Latitude:	38.094431
Place Longitude:	-121.381226
SIC Code 1:	4952
SIC Desc 1:	Sewerage Systems
SIC Code 2:	Not reported
SIC Desc 2:	Not reported
SIC Code 3:	Not reported
SIC Desc 3:	Not reported
NAICS Code 1:	Not reported
NAICS Desc 1:	Not reported
NAICS Code 2:	Not reported
NAICS Desc 2:	Not reported
NAICS Code 3:	Not reported
NAICS Desc 3:	Not reported
# Of Places:	1
Source Of Facility:	Reg Meas
Design Flow:	8.5
Threat To Water Quality:	1
Complexity:	A
Pretreatment:	Y - POTW has EPA approved pretreatment program
Facility Waste Type:	Domestic wastewater

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

Facility Waste Type 2:	Not reported
Facility Waste Type 3:	Not reported
Facility Waste Type 4:	Not reported
Program:	NPDESWW
Program Category1:	NPDESWW
Program Category2:	NPDESWW
# Of Programs:	1
WDID:	5B390103002
Reg Measure Id:	333528
Reg Measure Type:	NPDES Permits
Region:	5S
Order #:	R5-2007-0113
Npdes# CA#:	CA0079243
Major-Minor:	Major
Npdes Type:	MUN
Reclamation:	2 - Producer-User
Dredge Fill Fee:	Not reported
301H:	N
Application Fee Amt Received:	10000
Status:	Active
Status Date:	01/22/2008
Effective Date:	11/03/2007
Expiration/Review Date:	09/01/2012
Termination Date:	Not reported
WDR Review - Amend:	Not reported
WDR Review - Revise/Renew:	Not reported
WDR Review - Rescind:	Not reported
WDR Review - No Action Required:	Not reported
WDR Review - Pending:	Not reported
WDR Review - Planned:	Not reported
Status Enrollee:	N
Individual/General:	I
Fee Code:	66 - NPDES Based on Flow
Direction/Voice:	Passive
Enforcement Id(EID):	392530
Region:	5S
Order / Resolution Number:	Not reported
Enforcement Action Type:	Notice of Violation
Effective Date:	07/23/2013
Adoption/Issuance Date:	07/23/2013
Achieve Date:	Not reported
Termination Date:	07/23/2013
ACL Issuance Date:	Not reported
EPL Issuance Date:	Not reported
Status:	Historical
Title:	NOV 07/23/2013 for Lodi City White Slough WPCF
Description:	During the monitoring periods November 2012, December 2012, Annual 2012, Fourth Quarter 2012, January 2013, February 2013, March 2013, April 2013, May 2013, and First Quarter 2013, the discharge violated the limitations contained in the WDRs.
Program:	NPDESWW
Latest Milestone Completion Date:	Not reported
# Of Programs1:	1
Total Assessment Amount:	0
Initial Assessed Amount:	0
Liability $ Amount:	0

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

Project $ Amount:	0
Liability $ Paid:	0
Project $ Completed:	0
Total $ Paid/Completed Amount:	0
Region:	5S
Facility Id:	272444
Agency Name:	Lodi City
Place Type:	Utility
Place Subtype:	Wastewater Treatment Facility
Facility Type:	Municipal/Domestic
Agency Type:	City Agency
# Of Agencies:	1
Place Latitude:	38.094431
Place Longitude:	-121.381226
SIC Code 1:	4952
SIC Desc 1:	Sewerage Systems
SIC Code 2:	Not reported
SIC Desc 2:	Not reported
SIC Code 3:	Not reported
SIC Desc 3:	Not reported
NAICS Code 1:	Not reported
NAICS Desc 1:	Not reported
NAICS Code 2:	Not reported
NAICS Desc 2:	Not reported
NAICS Code 3:	Not reported
NAICS Desc 3:	Not reported
# Of Places:	1
Source Of Facility:	Reg Meas
Design Flow:	8.5
Threat To Water Quality:	1
Complexity:	A
Pretreatment:	Y - POTW has EPA approved pretreatment program
Facility Waste Type:	Domestic wastewater
Facility Waste Type 2:	Not reported
Facility Waste Type 3:	Not reported
Facility Waste Type 4:	Not reported
Program:	NPDESWW
Program Category1:	NPDESWW
Program Category2:	NPDESWW
# Of Programs:	1
WDID:	5B390103002
Reg Measure Id:	147733
Reg Measure Type:	NPDES Permits
Region:	5S
Order #:	R5-2000-0031
Npdes# CA#:	CA0079243
Major-Minor:	Major
Npdes Type:	MUN
Reclamation:	2 - Producer-User
Dredge Fill Fee:	Not reported
301H:	N
Application Fee Amt Received:	10000
Status:	Historical
Status Date:	11/01/2011
Effective Date:	01/28/2000
Expiration/Review Date:	01/01/2005

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

Termination Date:	09/13/2007
WDR Review - Amend:	Not reported
WDR Review - Revise/Renew:	Not reported
WDR Review - Rescind:	Not reported
WDR Review - No Action Required:	Not reported
WDR Review - Pending:	Not reported
WDR Review - Planned:	Not reported
Status Enrollee:	N
Individual/General:	I
Fee Code:	66 - NPDES Based on Flow
Direction/Voice:	Passive
Enforcement Id(EID):	231066
Region:	5S
Order / Resolution Number:	Not reported
Enforcement Action Type:	Notice of Violation
Effective Date:	03/21/2000
Adoption/Issuance Date:	03/21/2000
Achieve Date:	Not reported
Termination Date:	03/21/2000
ACL Issuance Date:	Not reported
EPL Issuance Date:	Not reported
Status:	Historical
Title:	NOV 03/21/2000 for Lodi City, White Slough Water Pollution Control
Description:	NOV--sent 21 March 2000 requesting technical report for information concerning 3-4 January 2000 chlorine excursion.
Program:	NPDESWW
Latest Milestone Completion Date:	2000-04-27
# Of Programs1:	1
Total Assessment Amount:	0
Initial Assessed Amount:	0
Liability $ Amount:	0
Project $ Amount:	0
Liability $ Paid:	0
Project $ Completed:	0
Total $ Paid/Completed Amount:	0

Region:	5S
Facility Id:	272444
Agency Name:	Lodi City
Place Type:	Utility
Place Subtype:	Wastewater Treatment Facility
Facility Type:	Municipal/Domestic
Agency Type:	City Agency
# Of Agencies:	1
Place Latitude:	38.094431
Place Longitude:	-121.381226
SIC Code 1:	4952
SIC Desc 1:	Sewerage Systems
SIC Code 2:	Not reported
SIC Desc 2:	Not reported
SIC Code 3:	Not reported
SIC Desc 3:	Not reported
NAICS Code 1:	Not reported
NAICS Desc 1:	Not reported
NAICS Code 2:	Not reported
NAICS Desc 2:	Not reported
NAICS Code 3:	Not reported

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

NAICS Desc 3:	Not reported
# Of Places:	1
Source Of Facility:	Reg Meas
Design Flow:	8.5
Threat To Water Quality:	1
Complexity:	A
Pretreatment:	Y - POTW has EPA approved pretreatment program
Facility Waste Type:	Domestic wastewater
Facility Waste Type 2:	Not reported
Facility Waste Type 3:	Not reported
Facility Waste Type 4:	Not reported
Program:	NPDESWW
Program Category1:	NPDESWW
Program Category2:	NPDESWW
# Of Programs:	1
WDID:	5B390103002
Reg Measure Id:	147733
Reg Measure Type:	NPDES Permits
Region:	5S
Order #:	R5-2000-0031
Npdes# CA#:	CA0079243
Major-Minor:	Major
Npdes Type:	MUN
Reclamation:	2 - Producer-User
Dredge Fill Fee:	Not reported
301H:	N
Application Fee Amt Received:	10000
Status:	Historical
Status Date:	11/01/2011
Effective Date:	01/28/2000
Expiration/Review Date:	01/01/2005
Termination Date:	09/13/2007
WDR Review - Amend:	Not reported
WDR Review - Revise/Renew:	Not reported
WDR Review - Rescind:	Not reported
WDR Review - No Action Required:	Not reported
WDR Review - Pending:	Not reported
WDR Review - Planned:	Not reported
Status Enrollee:	N
Individual/General:	I
Fee Code:	66 - NPDES Based on Flow
Direction/Voice:	Passive
Enforcement Id(EID):	231280
Region:	5S
Order / Resolution Number:	R5-2000-0515
Enforcement Action Type:	Admin Civil Liability
Effective Date:	06/09/2000
Adoption/Issuance Date:	Not reported
Achieve Date:	Not reported
Termination Date:	Not reported
ACL Issuance Date:	06/09/2000
EPL Issuance Date:	Not reported
Status:	Historical
Title:	MMP Complaint R5-2000-0515 for Lodi City, White Slough Water Pollution Control
Description:	ACL complaint issued in response to 3-4 January 2000 chlorine residual release. City of Lodi has waived right to

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

	public hearing (responded 26 June 2000) and is preparing proposal for SEP to be completed within 60 days.
Program:	NPDESWW
Latest Milestone Completion Date:	2003-01-22
# Of Programs1:	1
Total Assessment Amount:	20000
Initial Assessed Amount:	0
Liability $ Amount:	10000
Project $ Amount:	0
Liability $ Paid:	10000
Project $ Completed:	0
Total $ Paid/Completed Amount:	20000
Region:	5S
Facility Id:	272444
Agency Name:	Lodi City
Place Type:	Utility
Place Subtype:	Wastewater Treatment Facility
Facility Type:	Municipal/Domestic
Agency Type:	City Agency
# Of Agencies:	1
Place Latitude:	38.094431
Place Longitude:	-121.381226
SIC Code 1:	4952
SIC Desc 1:	Sewerage Systems
SIC Code 2:	Not reported
SIC Desc 2:	Not reported
SIC Code 3:	Not reported
SIC Desc 3:	Not reported
NAICS Code 1:	Not reported
NAICS Desc 1:	Not reported
NAICS Code 2:	Not reported
NAICS Desc 2:	Not reported
NAICS Code 3:	Not reported
NAICS Desc 3:	Not reported
# Of Places:	1
Source Of Facility:	Reg Meas
Design Flow:	8.5
Threat To Water Quality:	1
Complexity:	A
Pretreatment:	Y - POTW has EPA approved pretreatment program
Facility Waste Type:	Domestic wastewater
Facility Waste Type 2:	Not reported
Facility Waste Type 3:	Not reported
Facility Waste Type 4:	Not reported
Program:	NPDESWW
Program Category1:	NPDESWW
Program Category2:	NPDESWW
# Of Programs:	1
WDID:	5B390103002
Reg Measure Id:	147733
Reg Measure Type:	NPDES Permits
Region:	5S
Order #:	R5-2000-0031
Npdes# CA#:	CA0079243
Major-Minor:	Major
Npdes Type:	MUN

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

Reclamation:	2 - Producer-User
Dredge Fill Fee:	Not reported
301H:	N
Application Fee Amt Received:	10000
Status:	Historical
Status Date:	11/01/2011
Effective Date:	01/28/2000
Expiration/Review Date:	01/01/2005
Termination Date:	09/13/2007
WDR Review - Amend:	Not reported
WDR Review - Revise/Renew:	Not reported
WDR Review - Rescind:	Not reported
WDR Review - No Action Required:	Not reported
WDR Review - Pending:	Not reported
WDR Review - Planned:	Not reported
Status Enrollee:	N
Individual/General:	I
Fee Code:	66 - NPDES Based on Flow
Direction/Voice:	Passive
Enforcement Id(EID):	231350
Region:	5S
Order / Resolution Number:	Not reported
Enforcement Action Type:	Oral Communication
Effective Date:	06/28/2000
Adoption/Issuance Date:	06/28/2000
Achieve Date:	Not reported
Termination Date:	06/28/2000
ACL Issuance Date:	Not reported
EPL Issuance Date:	Not reported
Status:	Historical
Title:	Oral 06/28/2000 for Lodi City, White Slough Water Pollution Control
Description:	Informal enforcement by telephone conversation with Public Works Director and Assistant WW Superintencent. Requested that influent and industrial influent flow meters be repaired.
Program:	NPDESWW
Latest Milestone Completion Date:	Not reported
# Of Programs1:	1
Total Assessment Amount:	0
Initial Assessed Amount:	0
Liability $ Amount:	0
Project $ Amount:	0
Liability $ Paid:	0
Project $ Completed:	0
Total $ Paid/Completed Amount:	0

Region:	5S
Facility Id:	272444
Agency Name:	Lodi City
Place Type:	Utility
Place Subtype:	Wastewater Treatment Facility
Facility Type:	Municipal/Domestic
Agency Type:	City Agency
# Of Agencies:	1
Place Latitude:	38.094431
Place Longitude:	-121.381226
SIC Code 1:	4952

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

SIC Desc 1:	Sewerage Systems
SIC Code 2:	Not reported
SIC Desc 2:	Not reported
SIC Code 3:	Not reported
SIC Desc 3:	Not reported
NAICS Code 1:	Not reported
NAICS Desc 1:	Not reported
NAICS Code 2:	Not reported
NAICS Desc 2:	Not reported
NAICS Code 3:	Not reported
NAICS Desc 3:	Not reported
# Of Places:	1
Source Of Facility:	Reg Meas
Design Flow:	8.5
Threat To Water Quality:	1
Complexity:	A
Pretreatment:	Y - POTW has EPA approved pretreatment program
Facility Waste Type:	Domestic wastewater
Facility Waste Type 2:	Not reported
Facility Waste Type 3:	Not reported
Facility Waste Type 4:	Not reported
Program:	NPDESWW
Program Category1:	NPDESWW
Program Category2:	NPDESWW
# Of Programs:	1
WDID:	5B390103002
Reg Measure Id:	147733
Reg Measure Type:	NPDES Permits
Region:	5S
Order #:	R5-2000-0031
Npdes# CA#:	CA0079243
Major-Minor:	Major
Npdes Type:	MUN
Reclamation:	2 - Producer-User
Dredge Fill Fee:	Not reported
301H:	N
Application Fee Amt Received:	10000
Status:	Historical
Status Date:	11/01/2011
Effective Date:	01/28/2000
Expiration/Review Date:	01/01/2005
Termination Date:	09/13/2007
WDR Review - Amend:	Not reported
WDR Review - Revise/Renew:	Not reported
WDR Review - Rescind:	Not reported
WDR Review - No Action Required:	Not reported
WDR Review - Pending:	Not reported
WDR Review - Planned:	Not reported
Status Enrollee:	N
Individual/General:	I
Fee Code:	66 - NPDES Based on Flow
Direction/Voice:	Passive
Enforcement Id(EID):	231814
Region:	5S
Order / Resolution Number:	Not reported
Enforcement Action Type:	Oral Communication
Effective Date:	07/31/2000

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

Adoption/Issuance Date:	07/31/2000
Achieve Date:	Not reported
Termination Date:	07/31/2000
ACL Issuance Date:	Not reported
EPL Issuance Date:	Not reported
Status:	Historical
Title:	Oral 07/31/2000 for Lodi City, White Slough Water Pollution Control
Description:	Discharger verbally informed of deficiencies?asked to correct in July's DSMR.
Program:	NPDESWW
Latest Milestone Completion Date:	2000-09-04
# Of Programs1:	1
Total Assessment Amount:	0
Initial Assessed Amount:	0
Liability $ Amount:	0
Project $ Amount:	0
Liability $ Paid:	0
Project $ Completed:	0
Total $ Paid/Completed Amount:	0

Region:	5S
Facility Id:	272444
Agency Name:	Lodi City
Place Type:	Utility
Place Subtype:	Wastewater Treatment Facility
Facility Type:	Municipal/Domestic
Agency Type:	City Agency
# Of Agencies:	1
Place Latitude:	38.094431
Place Longitude:	-121.381226
SIC Code 1:	4952
SIC Desc 1:	Sewerage Systems
SIC Code 2:	Not reported
SIC Desc 2:	Not reported
SIC Code 3:	Not reported
SIC Desc 3:	Not reported
NAICS Code 1:	Not reported
NAICS Desc 1:	Not reported
NAICS Code 2:	Not reported
NAICS Desc 2:	Not reported
NAICS Code 3:	Not reported
NAICS Desc 3:	Not reported
# Of Places:	1
Source Of Facility:	Reg Meas
Design Flow:	8.5
Threat To Water Quality:	1
Complexity:	A
Pretreatment:	Y - POTW has EPA approved pretreatment program
Facility Waste Type:	Domestic wastewater
Facility Waste Type 2:	Not reported
Facility Waste Type 3:	Not reported
Facility Waste Type 4:	Not reported
Program:	NPDESWW
Program Category1:	NPDESWW
Program Category2:	NPDESWW
# Of Programs:	1
WDID:	5B390103002

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

Reg Measure Id:	147733
Reg Measure Type:	NPDES Permits
Region:	5S
Order #:	R5-2000-0031
Npdes# CA#:	CA0079243
Major-Minor:	Major
Npdes Type:	MUN
Reclamation:	2 - Producer-User
Dredge Fill Fee:	Not reported
301H:	N
Application Fee Amt Received:	10000
Status:	Historical
Status Date:	11/01/2011
Effective Date:	01/28/2000
Expiration/Review Date:	01/01/2005
Termination Date:	09/13/2007
WDR Review - Amend:	Not reported
WDR Review - Revise/Renew:	Not reported
WDR Review - Rescind:	Not reported
WDR Review - No Action Required:	Not reported
WDR Review - Pending:	Not reported
WDR Review - Planned:	Not reported
Status Enrollee:	N
Individual/General:	I
Fee Code:	66 - NPDES Based on Flow
Direction/Voice:	Passive
Enforcement Id(EID):	231847
Region:	5S
Order / Resolution Number:	Not reported
Enforcement Action Type:	Oral Communication
Effective Date:	11/29/2000
Adoption/Issuance Date:	11/29/2000
Achieve Date:	Not reported
Termination Date:	11/29/2000
ACL Issuance Date:	Not reported
EPL Issuance Date:	Not reported
Status:	Historical
Title:	Oral 11/29/2000 for Lodi City, White Slough Water Pollution Control
Description:	E-mail correspondence 11/29/2000 sent to discharger asking for status and description of any outstanding monitoring. Requested schedule for all upcoming priority pollutants and OP pesticide monitoring.<CR><CR>Monitoring data was misfiled - data sent.
Program:	NPDESWW
Latest Milestone Completion Date:	2000-12-04
# Of Programs1:	1
Total Assessment Amount:	0
Initial Assessed Amount:	0
Liability $ Amount:	0
Project $ Amount:	0
Liability $ Paid:	0
Project $ Completed:	0
Total $ Paid/Completed Amount:	0
Region:	5S
Facility Id:	272444
Agency Name:	Lodi City

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

Place Type:	Utility
Place Subtype:	Wastewater Treatment Facility
Facility Type:	Municipal/Domestic
Agency Type:	City Agency
# Of Agencies:	1
Place Latitude:	38.094431
Place Longitude:	-121.381226
SIC Code 1:	4952
SIC Desc 1:	Sewerage Systems
SIC Code 2:	Not reported
SIC Desc 2:	Not reported
SIC Code 3:	Not reported
SIC Desc 3:	Not reported
NAICS Code 1:	Not reported
NAICS Desc 1:	Not reported
NAICS Code 2:	Not reported
NAICS Desc 2:	Not reported
NAICS Code 3:	Not reported
NAICS Desc 3:	Not reported
# Of Places:	1
Source Of Facility:	Reg Meas
Design Flow:	8.5
Threat To Water Quality:	1
Complexity:	A
Pretreatment:	Y - POTW has EPA approved pretreatment program
Facility Waste Type:	Domestic wastewater
Facility Waste Type 2:	Not reported
Facility Waste Type 3:	Not reported
Facility Waste Type 4:	Not reported
Program:	NPDESWW
Program Category1:	NPDESWW
Program Category2:	NPDESWW
# Of Programs:	1
WDID:	5B390103002
Reg Measure Id:	147733
Reg Measure Type:	NPDES Permits
Region:	5S
Order #:	R5-2000-0031
Npdes# CA#:	CA0079243
Major-Minor:	Major
Npdes Type:	MUN
Reclamation:	2 - Producer-User
Dredge Fill Fee:	Not reported
301H:	N
Application Fee Amt Received:	10000
Status:	Historical
Status Date:	11/01/2011
Effective Date:	01/28/2000
Expiration/Review Date:	01/01/2005
Termination Date:	09/13/2007
WDR Review - Amend:	Not reported
WDR Review - Revise/Renew:	Not reported
WDR Review - Rescind:	Not reported
WDR Review - No Action Required:	Not reported
WDR Review - Pending:	Not reported
WDR Review - Planned:	Not reported
Status Enrollee:	N

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

Individual/General:	I
Fee Code:	66 - NPDES Based on Flow
Direction/Voice:	Passive
Enforcement Id(EID):	231954
Region:	5S
Order / Resolution Number:	Not reported
Enforcement Action Type:	Oral Communication
Effective Date:	03/05/2001
Adoption/Issuance Date:	03/05/2001
Achieve Date:	Not reported
Termination Date:	03/05/2001
ACL Issuance Date:	Not reported
EPL Issuance Date:	Not reported
Status:	Historical
Title:	Oral 03/05/2001 for Lodi City, White Slough Water Pollution Control
Description:	E-mail correspondence with discharger 5 March 2001 re: missing priority pollutants and organo-phosphate pesticide results in Dec 2000 DSMR and missing annual standard minerals analysis.
Program:	NPDESWW
Latest Milestone Completion Date:	Not reported
# Of Programs1:	1
Total Assessment Amount:	0
Initial Assessed Amount:	0
Liability $ Amount:	0
Project $ Amount:	0
Liability $ Paid:	0
Project $ Completed:	0
Total $ Paid/Completed Amount:	0

Region:	5S
Facility Id:	272444
Agency Name:	Lodi City
Place Type:	Utility
Place Subtype:	Wastewater Treatment Facility
Facility Type:	Municipal/Domestic
Agency Type:	City Agency
# Of Agencies:	1
Place Latitude:	38.094431
Place Longitude:	-121.381226
SIC Code 1:	4952
SIC Desc 1:	Sewerage Systems
SIC Code 2:	Not reported
SIC Desc 2:	Not reported
SIC Code 3:	Not reported
SIC Desc 3:	Not reported
NAICS Code 1:	Not reported
NAICS Desc 1:	Not reported
NAICS Code 2:	Not reported
NAICS Desc 2:	Not reported
NAICS Code 3:	Not reported
NAICS Desc 3:	Not reported
# Of Places:	1
Source Of Facility:	Reg Meas
Design Flow:	8.5
Threat To Water Quality:	1
Complexity:	A

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

Pretreatment:	Y - POTW has EPA approved pretreatment program
Facility Waste Type:	Domestic wastewater
Facility Waste Type 2:	Not reported
Facility Waste Type 3:	Not reported
Facility Waste Type 4:	Not reported
Program:	NPDESWW
Program Category1:	NPDESWW
Program Category2:	NPDESWW
# Of Programs:	1
WDID:	5B390103002
Reg Measure Id:	147733
Reg Measure Type:	NPDES Permits
Region:	5S
Order #:	R5-2000-0031
Npdes# CA#:	CA0079243
Major-Minor:	Major
Npdes Type:	MUN
Reclamation:	2 - Producer-User
Dredge Fill Fee:	Not reported
301H:	N
Application Fee Amt Received:	10000
Status:	Historical
Status Date:	11/01/2011
Effective Date:	01/28/2000
Expiration/Review Date:	01/01/2005
Termination Date:	09/13/2007
WDR Review - Amend:	Not reported
WDR Review - Revise/Renew:	Not reported
WDR Review - Rescind:	Not reported
WDR Review - No Action Required:	Not reported
WDR Review - Pending:	Not reported
WDR Review - Planned:	Not reported
Status Enrollee:	N
Individual/General:	I
Fee Code:	66 - NPDES Based on Flow
Direction/Voice:	Passive
Enforcement Id(EID):	242463
Region:	5S
Order / Resolution Number:	Not reported
Enforcement Action Type:	13267 Letter
Effective Date:	08/20/2003
Adoption/Issuance Date:	08/20/2003
Achieve Date:	Not reported
Termination Date:	Not reported
ACL Issuance Date:	Not reported
EPL Issuance Date:	Not reported
Status:	Active
Title:	13267 Letter 8/20/2008 for Lodi City, White Slough Water Pollution Control
Description:	Odors observed during inspection and two complaints received, MRP violations on not submitting required information, and signs and fences were not present at discharge location and around areas receiving undisinfected secondary effluent.
Program:	NPDESWW
Latest Milestone Completion Date:	Not reported
# Of Programs1:	1

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

Total Assessment Amount:	0
Initial Assessed Amount:	0
Liability $ Amount:	0
Project $ Amount:	0
Liability $ Paid:	0
Project $ Completed:	0
Total $ Paid/Completed Amount:	0
Region:	5S
Facility Id:	272444
Agency Name:	Lodi City
Place Type:	Utility
Place Subtype:	Wastewater Treatment Facility
Facility Type:	Municipal/Domestic
Agency Type:	City Agency
# Of Agencies:	1
Place Latitude:	38.094431
Place Longitude:	-121.381226
SIC Code 1:	4952
SIC Desc 1:	Sewerage Systems
SIC Code 2:	Not reported
SIC Desc 2:	Not reported
SIC Code 3:	Not reported
SIC Desc 3:	Not reported
NAICS Code 1:	Not reported
NAICS Desc 1:	Not reported
NAICS Code 2:	Not reported
NAICS Desc 2:	Not reported
NAICS Code 3:	Not reported
NAICS Desc 3:	Not reported
# Of Places:	1
Source Of Facility:	Reg Meas
Design Flow:	8.5
Threat To Water Quality:	1
Complexity:	A
Pretreatment:	Y - POTW has EPA approved pretreatment program
Facility Waste Type:	Domestic wastewater
Facility Waste Type 2:	Not reported
Facility Waste Type 3:	Not reported
Facility Waste Type 4:	Not reported
Program:	NPDESWW
Program Category1:	NPDESWW
Program Category2:	NPDESWW
# Of Programs:	1
WDID:	5B390103002
Reg Measure Id:	147733
Reg Measure Type:	NPDES Permits
Region:	5S
Order #:	R5-2000-0031
Npdes# CA#:	CA0079243
Major-Minor:	Major
Npdes Type:	MUN
Reclamation:	2 - Producer-User
Dredge Fill Fee:	Not reported
301H:	N
Application Fee Amt Received:	10000
Status:	Historical

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

Status Date:	11/01/2011
Effective Date:	01/28/2000
Expiration/Review Date:	01/01/2005
Termination Date:	09/13/2007
WDR Review - Amend:	Not reported
WDR Review - Revise/Renew:	Not reported
WDR Review - Rescind:	Not reported
WDR Review - No Action Required:	Not reported
WDR Review - Pending:	Not reported
WDR Review - Planned:	Not reported
Status Enrollee:	N
Individual/General:	I
Fee Code:	66 - NPDES Based on Flow
Direction/Voice:	Passive
Enforcement Id(EID):	250992
Region:	5S
Order / Resolution Number:	Not reported
Enforcement Action Type:	Oral Communication
Effective Date:	02/26/2004
Adoption/Issuance Date:	02/26/2004
Achieve Date:	Not reported
Termination Date:	02/26/2004
ACL Issuance Date:	Not reported
EPL Issuance Date:	Not reported
Status:	Historical
Title:	Verbal 02/26/2004 for Lodi City, White Slough Water Pollution Control
Description:	Discharger was not submitting receiving water visual monitoring
Program:	NPDESWW
Latest Milestone Completion Date:	Not reported
# Of Programs1:	1
Total Assessment Amount:	0
Initial Assessed Amount:	0
Liability $ Amount:	0
Project $ Amount:	0
Liability $ Paid:	0
Project $ Completed:	0
Total $ Paid/Completed Amount:	0

Region:	5S
Facility Id:	272444
Agency Name:	Lodi City
Place Type:	Utility
Place Subtype:	Wastewater Treatment Facility
Facility Type:	Municipal/Domestic
Agency Type:	City Agency
# Of Agencies:	1
Place Latitude:	38.094431
Place Longitude:	-121.381226
SIC Code 1:	4952
SIC Desc 1:	Sewerage Systems
SIC Code 2:	Not reported
SIC Desc 2:	Not reported
SIC Code 3:	Not reported
SIC Desc 3:	Not reported
NAICS Code 1:	Not reported
NAICS Desc 1:	Not reported

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

NAICS Code 2:	Not reported
NAICS Desc 2:	Not reported
NAICS Code 3:	Not reported
NAICS Desc 3:	Not reported
# Of Places:	1
Source Of Facility:	Reg Meas
Design Flow:	8.5
Threat To Water Quality:	1
Complexity:	A
Pretreatment:	Y - POTW has EPA approved pretreatment program
Facility Waste Type:	Domestic wastewater
Facility Waste Type 2:	Not reported
Facility Waste Type 3:	Not reported
Facility Waste Type 4:	Not reported
Program:	NPDESWW
Program Category1:	NPDESWW
Program Category2:	NPDESWW
# Of Programs:	1
WDID:	5B390103002
Reg Measure Id:	147733
Reg Measure Type:	NPDES Permits
Region:	5S
Order #:	R5-2000-0031
Npdes# CA#:	CA0079243
Major-Minor:	Major
Npdes Type:	MUN
Reclamation:	2 - Producer-User
Dredge Fill Fee:	Not reported
301H:	N
Application Fee Amt Received:	10000
Status:	Historical
Status Date:	11/01/2011
Effective Date:	01/28/2000
Expiration/Review Date:	01/01/2005
Termination Date:	09/13/2007
WDR Review - Amend:	Not reported
WDR Review - Revise/Renew:	Not reported
WDR Review - Rescind:	Not reported
WDR Review - No Action Required:	Not reported
WDR Review - Pending:	Not reported
WDR Review - Planned:	Not reported
Status Enrollee:	N
Individual/General:	I
Fee Code:	66 - NPDES Based on Flow
Direction/Voice:	Passive
Enforcement Id(EID):	222135
Region:	5S
Order / Resolution Number:	R5-1996-0076
Enforcement Action Type:	Clean-up and Abatement Order
Effective Date:	11/01/1996
Adoption/Issuance Date:	11/01/1996
Achieve Date:	1997-05-01
Termination Date:	Not reported
ACL Issuance Date:	Not reported
EPL Issuance Date:	Not reported
Status:	Historical
Title:	CAO R5-1996-0076 for Lodi City, White Slough Water Pollution Control

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

Description:	REQUIRING TO MAKE SEPTIC SYSTEM INOPERABLE BY 12/31/96
Program:	NPDESWW
Latest Milestone Completion Date:	1997-05-01
# Of Programs1:	1
Total Assessment Amount:	0
Initial Assessed Amount:	0
Liability $ Amount:	0
Project $ Amount:	0
Liability $ Paid:	0
Project $ Completed:	0
Total $ Paid/Completed Amount:	0
Region:	5S
Facility Id:	272444
Agency Name:	Lodi City
Place Type:	Utility
Place Subtype:	Wastewater Treatment Facility
Facility Type:	Municipal/Domestic
Agency Type:	City Agency
# Of Agencies:	1
Place Latitude:	38.094431
Place Longitude:	-121.381226
SIC Code 1:	4952
SIC Desc 1:	Sewerage Systems
SIC Code 2:	Not reported
SIC Desc 2:	Not reported
SIC Code 3:	Not reported
SIC Desc 3:	Not reported
NAICS Code 1:	Not reported
NAICS Desc 1:	Not reported
NAICS Code 2:	Not reported
NAICS Desc 2:	Not reported
NAICS Code 3:	Not reported
NAICS Desc 3:	Not reported
# Of Places:	1
Source Of Facility:	Reg Meas
Design Flow:	8.5
Threat To Water Quality:	1
Complexity:	A
Pretreatment:	Y - POTW has EPA approved pretreatment program
Facility Waste Type:	Domestic wastewater
Facility Waste Type 2:	Not reported
Facility Waste Type 3:	Not reported
Facility Waste Type 4:	Not reported
Program:	NPDESWW
Program Category1:	NPDESWW
Program Category2:	NPDESWW
# Of Programs:	1
WDID:	5B390103002
Reg Measure Id:	147733
Reg Measure Type:	NPDES Permits
Region:	5S
Order #:	R5-2000-0031
Npdes# CA#:	CA0079243
Major-Minor:	Major
Npdes Type:	MUN
Reclamation:	2 - Producer-User

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

Dredge Fill Fee:	Not reported
301H:	N
Application Fee Amt Received:	10000
Status:	Historical
Status Date:	11/01/2011
Effective Date:	01/28/2000
Expiration/Review Date:	01/01/2005
Termination Date:	09/13/2007
WDR Review - Amend:	Not reported
WDR Review - Revise/Renew:	Not reported
WDR Review - Rescind:	Not reported
WDR Review - No Action Required:	Not reported
WDR Review - Pending:	Not reported
WDR Review - Planned:	Not reported
Status Enrollee:	N
Individual/General:	I
Fee Code:	66 - NPDES Based on Flow
Direction/Voice:	Passive
Enforcement Id(EID):	251887
Region:	5S
Order / Resolution Number:	R5-2004-0043
Enforcement Action Type:	Clean-up and Abatement Order
Effective Date:	04/22/2004
Adoption/Issuance Date:	04/22/2004
Achieve Date:	Not reported
Termination Date:	Not reported
ACL Issuance Date:	Not reported
EPL Issuance Date:	Not reported
Status:	Active
Title:	CAO R5-2004-0043 for Lodi City, White Slough Water Pollution Control
Description:	CAO issued to investigate the discharges of wastes of dry cleaning and printing operations, to cleanup the waste, and abate the effects of the discharges of waste in conformance with State Board Resolution 92-49.
Program:	NPDESWW
Latest Milestone Completion Date:	Not reported
# Of Programs1:	1
Total Assessment Amount:	0
Initial Assessed Amount:	0
Liability $ Amount:	0
Project $ Amount:	0
Liability $ Paid:	0
Project $ Completed:	0
Total $ Paid/Completed Amount:	0

Region:	5S
Facility Id:	272444
Agency Name:	Not reported
Place Type:	Utility
Place Subtype:	Wastewater Treatment Facility
Facility Type:	Municipal/Domestic
Agency Type:	Not reported
# Of Agencies:	Not reported
Place Latitude:	38.094431
Place Longitude:	-121.381226
SIC Code 1:	4952
SIC Desc 1:	Sewerage Systems

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

SIC Code 2:	Not reported
SIC Desc 2:	Not reported
SIC Code 3:	Not reported
SIC Desc 3:	Not reported
NAICS Code 1:	Not reported
NAICS Desc 1:	Not reported
NAICS Code 2:	Not reported
NAICS Desc 2:	Not reported
NAICS Code 3:	Not reported
NAICS Desc 3:	Not reported
# Of Places:	1
Source Of Facility:	Enf Action
Design Flow:	Not reported
Threat To Water Quality:	Not reported
Complexity:	Not reported
Pretreatment:	Not reported
Facility Waste Type:	Not reported
Facility Waste Type 2:	Not reported
Facility Waste Type 3:	Not reported
Facility Waste Type 4:	Not reported
Program:	Not reported
Program Category1:	Not reported
Program Category2:	NPDESWW
# Of Programs:	Not reported
WDID:	Not reported
Reg Measure Id:	Not reported
Reg Measure Type:	Not reported
Region:	Not reported
Order #:	Not reported
Npdes# CA#:	Not reported
Major-Minor:	Not reported
Npdes Type:	Not reported
Reclamation:	Not reported
Dredge Fill Fee:	Not reported
301H:	Not reported
Application Fee Amt Received:	Not reported
Status:	Not reported
Status Date:	Not reported
Effective Date:	Not reported
Expiration/Review Date:	Not reported
Termination Date:	Not reported
WDR Review - Amend:	Not reported
WDR Review - Revise/Renew:	Not reported
WDR Review - Rescind:	Not reported
WDR Review - No Action Required:	Not reported
WDR Review - Pending:	Not reported
WDR Review - Planned:	Not reported
Status Enrollee:	Not reported
Individual/General:	Not reported
Fee Code:	Not reported
Direction/Voice:	Not reported
Enforcement Id(EID):	339873
Region:	5S
Order / Resolution Number:	R5-2007-0114
Enforcement Action Type:	Time Schedule Order
Effective Date:	11/03/2007
Adoption/Issuance Date:	09/14/2007

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

Achieve Date:	Not reported
Termination Date:	04/12/2013
ACL Issuance Date:	Not reported
EPL Issuance Date:	Not reported
Status:	Historical
Title:	TSO R5-2007-0114 for Lodi City, White Slough Water Pollution Control Facility
Description:	TSO adopted to allow discharger time to comply with requirements prescribed in NPDES Permit Order No. R5-2007-0113.
Program:	NPDESWW
Latest Milestone Completion Date:	Not reported
# Of Programs1:	1
Total Assessment Amount:	0
Initial Assessed Amount:	0
Liability $ Amount:	0
Project $ Amount:	0
Liability $ Paid:	0
Project $ Completed:	0
Total $ Paid/Completed Amount:	0

EMI:

Year:	2003
County Code:	39
Air Basin:	SJV
Facility ID:	3404
Air District Name:	SJU
SIC Code:	4952
Air District Name:	SAN JOAQUIN VALLEY UNIFIED APCD
Community Health Air Pollution Info System:	Not reported
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	0
Reactive Organic Gases Tons/Yr:	0
Carbon Monoxide Emissions Tons/Yr:	0
NOX - Oxides of Nitrogen Tons/Yr:	0
SOX - Oxides of Sulphur Tons/Yr:	0
Particulate Matter Tons/Yr:	0
Part. Matter 10 Micrometers & Smllr Tons/Yr:	0

Year:	2004
County Code:	39
Air Basin:	SJV
Facility ID:	3404
Air District Name:	SJU
SIC Code:	4952
Air District Name:	SAN JOAQUIN VALLEY UNIFIED APCD
Community Health Air Pollution Info System:	Not reported
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	3.02378E-05
Reactive Organic Gases Tons/Yr:	1.996E-05
Carbon Monoxide Emissions Tons/Yr:	0.00037425
NOX - Oxides of Nitrogen Tons/Yr:	0.00017964
SOX - Oxides of Sulphur Tons/Yr:	0.0047405
Particulate Matter Tons/Yr:	5.988E-05
Part. Matter 10 Micrometers & Smllr Tons/Yr:	5.988E-05

Year:	2005

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

County Code:	39
Air Basin:	SJV
Facility ID:	3404
Air District Name:	SJU
SIC Code:	4952
Air District Name:	SAN JOAQUIN VALLEY UNIFIED APCD
Community Health Air Pollution Info System:	Not reported
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	.0000302378416124608
Reactive Organic Gases Tons/Yr:	.0000199599992483854
Carbon Monoxide Emissions Tons/Yr:	.000374249985907226
NOX - Oxides of Nitrogen Tons/Yr:	.0001796399932354688
SOX - Oxides of Sulphur Tons/Yr:	.00474049982149154
Particulate Matter Tons/Yr:	.0000598799977451562
Part. Matter 10 Micrometers & Smllr Tons/Yr:	.0000598799977451562

Year:	2006
County Code:	39
Air Basin:	SJV
Facility ID:	3404
Air District Name:	SJU
SIC Code:	4952
Air District Name:	SAN JOAQUIN VALLEY UNIFIED APCD
Community Health Air Pollution Info System:	Not reported
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	.2238776702445707303
Reactive Organic Gases Tons/Yr:	.1931779217086728637
Carbon Monoxide Emissions Tons/Yr:	.000560249991249293
NOX - Oxides of Nitrogen Tons/Yr:	.0002066699967719619
SOX - Oxides of Sulphur Tons/Yr:	.00027352649572771
Particulate Matter Tons/Yr:	.0000597599990665912
Part. Matter 10 Micrometers & Smllr Tons/Yr:	.0000597599990665912

Year:	2007
County Code:	39
Air Basin:	SJV
Facility ID:	3404
Air District Name:	SJU
SIC Code:	4952
Air District Name:	SAN JOAQUIN VALLEY UNIFIED APCD
Community Health Air Pollution Info System:	Not reported
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	.2401846139371395091
Reactive Organic Gases Tons/Yr:	.2068240667960856312
Carbon Monoxide Emissions Tons/Yr:	.018228390000414604
NOX - Oxides of Nitrogen Tons/Yr:	.4318759646133901993
SOX - Oxides of Sulphur Tons/Yr:	.0009646924425945614
Particulate Matter Tons/Yr:	.0069504492778435692
Part. Matter 10 Micrometers & Smllr Tons/Yr:	.0067845007671428538

Year:	2008
County Code:	39
Air Basin:	SJV
Facility ID:	3404
Air District Name:	SJU
SIC Code:	4952
Air District Name:	SAN JOAQUIN VALLEY UNIFIED APCD

WHITE SLOUGH WATER POLLUTION CONTROL FACILITY (Continued) **S106920509**

Community Health Air Pollution Info System:	Not reported
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	.1947236569089773855
Reactive Organic Gases Tons/Yr:	.1675869561054068551
Carbon Monoxide Emissions Tons/Yr:	.018394833763657173
NOX - Oxides of Nitrogen Tons/Yr:	.4319309238674338418
SOX - Oxides of Sulphur Tons/Yr:	.0073689150396133756
Particulate Matter Tons/Yr:	.0069451572785631164
Part. Matter 10 Micrometers & Smllr Tons/Yr:	.0067792087678624010

Year:	2009
County Code:	39
Air Basin:	SJV
Facility ID:	3404
Air District Name:	SJU
SIC Code:	4952
Air District Name:	SAN JOAQUIN VALLEY UNIFIED APCD
Community Health Air Pollution Info System:	Not reported
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	0.194723656908977
Reactive Organic Gases Tons/Yr:	0.167586956105406
Carbon Monoxide Emissions Tons/Yr:	1.8394833763657099E-2
NOX - Oxides of Nitrogen Tons/Yr:	0.43193092386743298
SOX - Oxides of Sulphur Tons/Yr:	7.3689150396133701E-3
Particulate Matter Tons/Yr:	6.9451572785631096E-3
Part. Matter 10 Micrometers & Smllr Tons/Yr:	6.7792087678623996E-3

Year:	2010
County Code:	39
Air Basin:	SJV
Facility ID:	3404
Air District Name:	SJU
SIC Code:	4952
Air District Name:	SAN JOAQUIN VALLEY UNIFIED APCD
Community Health Air Pollution Info System:	Not reported
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	1.40109084446628
Reactive Organic Gases Tons/Yr:	1.2085484419999999
Carbon Monoxide Emissions Tons/Yr:	7.035646377
NOX - Oxides of Nitrogen Tons/Yr:	1.7216659459999999
SOX - Oxides of Sulphur Tons/Yr:	0.43742060199999999
Particulate Matter Tons/Yr:	0.50009440760655699
Part. Matter 10 Micrometers & Smllr Tons/Yr:	0.49992842399999998

A2 **LODI ENERGY CENTER** **NPDES** **S110042436**
East **12745 NORTH THORNTON ROAD** **VCP** **N/A**
1/4-1/2 **LODI, CA 95240** **ENVIROSTOR**
0.273 mi.
1444 ft. **Site 2 of 2 in cluster A**

Relative:
Higher

Actual:
11 ft.

NPDES:

Npdes Number:	CAS000002
Facility Status:	Active
Agency Id:	0
Region:	5S
Regulatory Measure Id:	405821
Order No:	2009-0009-DWQ
Regulatory Measure Type:	Enrollee

LODI ENERGY CENTER (Continued) **S110042436**

Place Id:	Not reported
WDID:	5S39C359296
Program Type:	Construction
Adoption Date Of Regulatory Measure:	Not reported
Effective Date Of Regulatory Measure:	07/29/2010
Expiration Date Of Regulatory Measure:	Not reported
Termination Date Of Regulatory Measure:	Not reported
Discharge Name:	Northern California Power Agency
Discharge Address:	12745 NORTH THORNTON ROAD
Discharge City:	LODI
Discharge State:	California
Discharge Zip:	95242

VCP:

Facility ID:	60001169
Site Type:	Voluntary Cleanup
Site Type Detail:	Voluntary Cleanup
Site Mgmt. Req.:	NONE SPECIFIED
Acres:	4.4
National Priorities List:	NO
Cleanup Oversight Agencies:	SMBRP
Lead Agency:	SMBRP
Lead Agency Description:	DTSC - Site Cleanup Program
Project Manager:	Maria Gillette
Supervisor:	Steven Becker
Division Branch:	Cleanup Sacramento
Site Code:	102011
Assembly:	13
Senate:	05
Special Programs Code:	Voluntary Cleanup Program
Status:	No Further Action
Status Date:	02/24/2010
Restricted Use:	NO
Funding:	Responsible Party
Lat/Long:	38.08738 / -121.3890
APN:	NONE SPECIFIED
Past Use:	AGRICULTURAL - ROW CROPS, WASTE - SEWAGE TREATMENT PLANT, WASTE - SEWAGE TREATMENT PONDS, WASTE WATER PONDS
Potential COC:	NONE SPECIFIED,31000
Confirmed COC:	31000
Potential Description:	SOIL
Alias Name:	102011
Alias Type:	Project Code (Site Code)
Alias Name:	60001169
Alias Type:	Envirostor ID Number

Completed Info:

Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	Preliminary Endangerment Assessment Workplan
Completed Date:	09/03/2009
Comments:	Not reported
Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	Preliminary Endangerment Assessment Report
Completed Date:	12/10/2009

LODI ENERGY CENTER (Continued) **S110042436**

Comments: DTSC issues No Further Action (NFA) Letter for the Site property.

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: No Further Action Letter
Completed Date: 12/10/2009
Comments: Not reported

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Voluntary Cleanup Agreement
Completed Date: 09/03/2009
Comments: Not reported

Future Area Name: Not reported
Future Sub Area Name: Not reported
Future Document Type: Not reported
Future Due Date: Not reported
Schedule Area Name: Not reported
Schedule Sub Area Name: Not reported
Schedule Document Type: Not reported
Schedule Due Date: Not reported
Schedule Revised Date: Not reported

ENVIROSTOR:
Site Type: Voluntary Cleanup
Site Type Detailed: Voluntary Cleanup
Acres: 4.4
NPL: NO
Regulatory Agencies: SMBRP
Lead Agency: SMBRP
Program Manager: Maria Gillette
Supervisor: Steven Becker
Division Branch: Cleanup Sacramento
Facility ID: 60001169
Site Code: 102011
Assembly: 13
Senate: 05
Special Program: Voluntary Cleanup Program
Status: No Further Action
Status Date: 02/24/2010
Restricted Use: NO
Site Mgmt. Req.: NONE SPECIFIED
Funding: Responsible Party
Latitude: 38.08738
Longitude: -121.3890
APN: NONE SPECIFIED
Past Use: AGRICULTURAL - ROW CROPS, WASTE - SEWAGE TREATMENT PLANT, WASTE - SEWAGE TREATMENT PONDS, WASTE WATER PONDS
Potential COC: NONE SPECIFIED, No Contaminants found
Confirmed COC: NONE SPECIFIED, No Contaminants found, No Contaminants found
Potential Description: SOIL
Alias Name: 102011
Alias Type: Project Code (Site Code)
Alias Name: 60001169
Alias Type: Envirostor ID Number

LODI ENERGY CENTER (Continued) **S110042436**

Completed Info:

Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	Preliminary Endangerment Assessment Workplan
Completed Date:	09/03/2009
Comments:	Not reported
Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	Preliminary Endangerment Assessment Report
Completed Date:	12/10/2009
Comments:	DTSC issues No Further Action (NFA) Letter for the Site property.
Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	No Further Action Letter
Completed Date:	12/10/2009
Comments:	Not reported
Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	Voluntary Cleanup Agreement
Completed Date:	09/03/2009
Comments:	Not reported
Future Area Name:	Not reported
Future Sub Area Name:	Not reported
Future Document Type:	Not reported
Future Due Date:	Not reported
Schedule Area Name:	Not reported
Schedule Sub Area Name:	Not reported
Schedule Document Type:	Not reported
Schedule Due Date:	Not reported
Schedule Revised Date:	Not reported

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3 **SAN JOAQUIN AIR** **WMUDS/SWAT** **S103442230**
ENE **(NEAR I-5 AND HARNEY LN)** **N/A**
1/4-1/2 **, CA**
0.423 mi.
2236 ft.

Relative:
Higher

Actual:
12 ft.

WMUDS/SWAT:

Edit Date:	Not reported
Complexity:	Not reported
Primary Waste:	Washwater Waste (Product washwater wastes: E.G., photo reuse wastewater, vegetable washwater)
Primary Waste Type:	Designated/Influent or Solid Wastes that pose a significant threat to water quality because of their high concentrations (E.G., BOD, Hardness, TRF, Chloride). 'Manageable' hazardous wastes (E.G., inorganic salts and heavy metals) are included in this category.
Secondary Waste:	Not reported
Secondary Waste Type:	Not reported
Base Meridian:	Not reported
NPID:	Not reported
Tonnage:	0
Regional Board ID:	Not reported
Municipal Solid Waste:	False

SAN JOAQUIN AIR (Continued) **S103442230**

Superorder:	False
Open To Public:	False
Waste List:	False
Agency Type:	Private
Agency Name:	SAN JOAQUIN AIR
Agency Department:	Not reported
Agency Address:	12145 N. DEVRIES RD
Agency City,St,Zip:	LODI CA 95240
Agency Contact:	AL TROGLIN
Agency Telephone:	2094647196
Land Owner Name:	Not reported
Land Owner Address:	Not reported
Land Owner City,St,Zip:	Not reported
Land Owner Contact:	Not reported
Land Owner Phone:	Not reported
Region:	5S
Facility Type:	Agricultural - Facility that treats and/or disposes of the wastes associated with confined and concentrated animal feeding, confined animal feeding, confined animal holding, confined and concentrated aquatic animal production facilities, and aquaculture. the treatment and/or disposal of agricultural return water is included in this category.
Facility Description:	Not reported
Facility Telephone:	Not reported
SWAT Facility Name:	Not reported
Primary SIC:	0721
Secondary SIC:	Not reported
Comments:	Not reported
Last Facility Editors:	Not reported
Waste Discharge System:	True
Solid Waste Assessment Test Program:	False
Toxic Pits Cleanup Act Program:	False
Resource Conservation Recovery Act:	False
Department of Defence:	False
Solid Waste Assessment Test Program:	Not reported
Threat to Water Quality:	Not reported
Sub Chapter 15:	True
Regional Board Project Officer:	CMH
Number of WMUDS at Facility:	1
Section Range:	Not reported
RCRA Facility:	Not reported
Waste Discharge Requirements:	A
Self-Monitoring Rept. Frequency:	No Reporting Requirements
Waste Discharge System ID:	5B395080N01
Solid Waste Information ID:	Not reported

Count: 20 records. ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
LODI	1010729147	LODI CENTRAL PLUME AREA	70 ACRES CENTRD INTER CHURCH &		FINDS
LODI	1010729146	LODI CENTRAL PLUME AREA	APPROX 70 ACRES OF CHURCH AND		FINDS
LODI	1015961183	CITY OF LODI PUBLIC WORKS DEPARTME	CENTURY BLVD / CHEROKEE LANE		FINDS
LODI	1011992220	CITY OF LODI - WELL #16	CENTURY BLVD & CANAL		FINDS
LODI	S106230408	LODI PCE INVESTIGATION	CHURCH ST, LODI AVE, MOKELUMNE		SLIC
LODI	1010729148	LODI GROUNDWATER SITE	CITY OF LODI		FINDS
LODI	S114239415		800 EAST HIGHWAY 12		RGA LUST
LODI	S114219765		3049 WEST HIGHWAY 12		RGA LUST
LODI	S114199924		13889 WEST HIGHWAY 12		RGA LUST
LODI	S113752179	PS MARINA INVESTORS I	14900 W HIGHWAY 12	95242	EMI
LODI	A100340072	ALPINE HELICOPTER SVC INC	11001 W HWY 12	95242	AST
LODI	1008198714	COUNTRYSIDE LIQUORS & GAS	14971 N HWY 88	95240	FINDS, UST
LODI	S111292238	NCPA LODI ENERGY PROJECT	INTERSECTION OF DEVIRES AND AR	95242	NPDES
LODI	1015901723	LODI METAL TECH INC	214 S KELLEY ST		FINDS
LODI	1009322143	WESTERN FARM SVC - LODI	6042 E. KETTLEMAN RD.		FTTS, HIST FTTS, FINDS
LODI	1008201903	NCPA LODI - CT1	LOWER SACRAMENTO & TURNER RD		FINDS
LODI	1006828759	LODI CITY LANDFILL	N OF THE INTERSECTION OF AWAIN		FINDS
LODI	1016095449	NORTHERN CALIFORNIA POWER - LODI	12751 NORTH THORTON ROAD		FINDS
LODI	1011989739	LODI	UNKNOWN		FINDS
LODI	1011992216	AT&T LODI	J110 W. TURNER RD		FINDS

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Number of Days to Update: Provides confirmation that EDR is reporting records that have been updated within 90 days from the date the government agency made the information available to the public.

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL: National Priority List

National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 04/26/2013
Date Data Arrived at EDR: 05/09/2013
Date Made Active in Reports: 07/10/2013
Number of Days to Update: 62

Source: EPA
Telephone: N/A
Last EDR Contact: 01/21/2014
Next Scheduled EDR Contact: 04/21/2014
Data Release Frequency: Quarterly

NPL Site Boundaries

Sources:

EPA's Environmental Photographic Interpretation Center (EPIC)
Telephone: 202-564-7333

EPA Region 1
Telephone 617-918-1143

EPA Region 6
Telephone: 214-655-6659

EPA Region 3
Telephone 215-814-5418

EPA Region 7
Telephone: 913-551-7247

EPA Region 4
Telephone 404-562-8033

EPA Region 8
Telephone: 303-312-6774

EPA Region 5
Telephone 312-886-6686

EPA Region 9
Telephone: 415-947-4246

EPA Region 10
Telephone 206-553-8665

Proposed NPL: Proposed National Priority List Sites

A site that has been proposed for listing on the National Priorities List through the issuance of a proposed rule in the Federal Register. EPA then accepts public comments on the site, responds to the comments, and places on the NPL those sites that continue to meet the requirements for listing.

Date of Government Version: 04/26/2013
Date Data Arrived at EDR: 05/09/2013
Date Made Active in Reports: 07/10/2013
Number of Days to Update: 62

Source: EPA
Telephone: N/A
Last EDR Contact: 01/09/2014
Next Scheduled EDR Contact: 04/21/2014
Data Release Frequency: Quarterly

NPL LIENS: Federal Superfund Liens

Federal Superfund Liens. Under the authority granted the USEPA by CERCLA of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner received notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/1991
Date Data Arrived at EDR: 02/02/1994
Date Made Active in Reports: 03/30/1994
Number of Days to Update: 56

Source: EPA
Telephone: 202-564-4267
Last EDR Contact: 08/15/2011
Next Scheduled EDR Contact: 11/28/2011
Data Release Frequency: No Update Planned

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Federal Delisted NPL site list

DELISTED NPL: National Priority List Deletions

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 04/26/2013
Date Data Arrived at EDR: 05/09/2013
Date Made Active in Reports: 07/10/2013
Number of Days to Update: 62

Source: EPA
Telephone: N/A
Last EDR Contact: 01/09/2014
Next Scheduled EDR Contact: 04/21/2014
Data Release Frequency: Quarterly

Federal CERCLIS list

CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System

CERCLIS contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLIS contains sites which are either proposed to or on the National Priorities List (NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 04/26/2013
Date Data Arrived at EDR: 05/29/2013
Date Made Active in Reports: 08/09/2013
Number of Days to Update: 72

Source: EPA
Telephone: 703-412-9810
Last EDR Contact: 11/11/2013
Next Scheduled EDR Contact: 03/10/2014
Data Release Frequency: Quarterly

FEDERAL FACILITY: Federal Facility Site Information listing

A listing of National Priority List (NPL) and Base Realignment and Closure (BRAC) sites found in the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) Database where EPA Federal Facilities Restoration and Reuse Office is involved in cleanup activities.

Date of Government Version: 05/31/2013
Date Data Arrived at EDR: 07/08/2013
Date Made Active in Reports: 12/06/2013
Number of Days to Update: 151

Source: Environmental Protection Agency
Telephone: 703-603-8704
Last EDR Contact: 10/11/2013
Next Scheduled EDR Contact: 01/20/2014
Data Release Frequency: Varies

Federal CERCLIS NFRAP site List

CERCLIS-NFRAP: CERCLIS No Further Remedial Action Planned

Archived sites are sites that have been removed and archived from the inventory of CERCLIS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list this site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. This decision does not necessarily mean that there is no hazard associated with a given site; it only means that, based upon available information, the location is not judged to be a potential NPL site.

Date of Government Version: 04/26/2013
Date Data Arrived at EDR: 05/29/2013
Date Made Active in Reports: 08/09/2013
Number of Days to Update: 72

Source: EPA
Telephone: 703-412-9810
Last EDR Contact: 11/11/2013
Next Scheduled EDR Contact: 03/10/2014
Data Release Frequency: Quarterly

Federal RCRA CORRACTS facilities list

CORRACTS: Corrective Action Report

CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 09/10/2013
Date Data Arrived at EDR: 10/02/2013
Date Made Active in Reports: 12/16/2013
Number of Days to Update: 75

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 01/02/2014
Next Scheduled EDR Contact: 04/14/2014
Data Release Frequency: Quarterly

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF: RCRA - Treatment, Storage and Disposal

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Transporters are individuals or entities that move hazardous waste from the generator offsite to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

Date of Government Version: 09/10/2013
Date Data Arrived at EDR: 10/02/2013
Date Made Active in Reports: 12/16/2013
Number of Days to Update: 75

Source: Environmental Protection Agency
Telephone: (415) 495-8895
Last EDR Contact: 01/02/2014
Next Scheduled EDR Contact: 04/14/2014
Data Release Frequency: Quarterly

Federal RCRA generators list

RCRA-LQG: RCRA - Large Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month.

Date of Government Version: 09/10/2013
Date Data Arrived at EDR: 10/02/2013
Date Made Active in Reports: 12/16/2013
Number of Days to Update: 75

Source: Environmental Protection Agency
Telephone: (415) 495-8895
Last EDR Contact: 01/02/2014
Next Scheduled EDR Contact: 04/14/2014
Data Release Frequency: Quarterly

RCRA-SQG: RCRA - Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

Date of Government Version: 09/10/2013
Date Data Arrived at EDR: 10/02/2013
Date Made Active in Reports: 12/16/2013
Number of Days to Update: 75

Source: Environmental Protection Agency
Telephone: (415) 495-8895
Last EDR Contact: 01/02/2014
Next Scheduled EDR Contact: 04/14/2014
Data Release Frequency: Quarterly

RCRA-CESQG: RCRA - Conditionally Exempt Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

Date of Government Version: 09/10/2013
Date Data Arrived at EDR: 10/02/2013
Date Made Active in Reports: 12/16/2013
Number of Days to Update: 75

Source: Environmental Protection Agency
Telephone: (415) 495-8895
Last EDR Contact: 01/02/2014
Next Scheduled EDR Contact: 04/14/2014
Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Federal institutional controls / engineering controls registries

US ENG CONTROLS: Engineering Controls Sites List

A listing of sites with engineering controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.

Date of Government Version: 06/17/2013
Date Data Arrived at EDR: 06/21/2013
Date Made Active in Reports: 10/03/2013
Number of Days to Update: 104

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 12/09/2013
Next Scheduled EDR Contact: 03/24/2014
Data Release Frequency: Varies

US INST CONTROL: Sites with Institutional Controls

A listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

Date of Government Version: 06/17/2013
Date Data Arrived at EDR: 06/21/2013
Date Made Active in Reports: 10/03/2013
Number of Days to Update: 104

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 12/09/2013
Next Scheduled EDR Contact: 03/24/2014
Data Release Frequency: Varies

LUCIS: Land Use Control Information System

LUCIS contains records of land use control information pertaining to the former Navy Base Realignment and Closure properties.

Date of Government Version: 08/20/2013
Date Data Arrived at EDR: 08/23/2013
Date Made Active in Reports: 11/01/2013
Number of Days to Update: 70

Source: Department of the Navy
Telephone: 843-820-7326
Last EDR Contact: 11/18/2013
Next Scheduled EDR Contact: 03/03/2014
Data Release Frequency: Varies

Federal ERNS list

ERNS: Emergency Response Notification System

Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 09/30/2013
Date Data Arrived at EDR: 10/01/2013
Date Made Active in Reports: 12/06/2013
Number of Days to Update: 66

Source: National Response Center, United States Coast Guard
Telephone: 202-267-2180
Last EDR Contact: 12/30/2013
Next Scheduled EDR Contact: 04/14/2014
Data Release Frequency: Annually

State- and tribal - equivalent NPL

RESPONSE: State Response Sites

Identifies confirmed release sites where DTSC is involved in remediation, either in a lead or oversight capacity. These confirmed release sites are generally high-priority and high potential risk.

Date of Government Version: 11/06/2013
Date Data Arrived at EDR: 11/06/2013
Date Made Active in Reports: 12/03/2013
Number of Days to Update: 27

Source: Department of Toxic Substances Control
Telephone: 916-323-3400
Last EDR Contact: 11/06/2013
Next Scheduled EDR Contact: 02/17/2014
Data Release Frequency: Quarterly

State- and tribal - equivalent CERCLIS

ENVIROSTOR: EnviroStor Database

The Department of Toxic Substances Control's (DTSC's) Site Mitigation and Brownfields Reuse Program's (SMBRP's) EnviroStor database identifes sites that have known contamination or sites for which there may be reasons to investigate further. The database includes the following site types: Federal Superfund sites (National Priorities List (NPL)); State Response, including Military Facilities and State Superfund; Voluntary Cleanup; and School sites. EnviroStor provides similar information to the information that was available in CalSites, and provides additional site information, including, but not limited to, identification of formerly-contaminated properties that have been released for reuse, properties where environmental deed restrictions have been recorded to prevent inappropriate land uses, and risk characterization information that is used to assess potential impacts to public health and the environment at contaminated sites.

Date of Government Version: 11/06/2013
Date Data Arrived at EDR: 11/06/2013
Date Made Active in Reports: 12/03/2013
Number of Days to Update: 27

Source: Department of Toxic Substances Control
Telephone: 916-323-3400
Last EDR Contact: 11/06/2013
Next Scheduled EDR Contact: 02/17/2014
Data Release Frequency: Quarterly

State and tribal landfill and/or solid waste disposal site lists

SWF/LF (SWIS): Solid Waste Information System

Active, Closed and Inactive Landfills. SWF/LF records typically contain an inve ntory of solid waste disposal facilities or landfills. These may be active or i nactive facilities or open dumps that failed to meet RCRA Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 11/18/2013
Date Data Arrived at EDR: 11/21/2013
Date Made Active in Reports: 01/02/2014
Number of Days to Update: 42

Source: Department of Resources Recycling and Recovery
Telephone: 916-341-6320
Last EDR Contact: 11/21/2013
Next Scheduled EDR Contact: 03/03/2014
Data Release Frequency: Quarterly

State and tribal leaking storage tank lists

LUST REG 5: Leaking Underground Storage Tank Database

Leaking Underground Storage Tank locations. Alameda, Alpine, Amador, Butte, Colusa, Contra Costa, Calveras, El Dorado, Fresno, Glenn, Kern, Kings, Lake, Lassen, Madera, Mariposa, Merced, Modoc, Napa, Nevada, Placer, Plumas, Sacramento, San Joaquin, Shasta, Solano, Stanislaus, Sutter, Tehama, Tulare, Tuolumne, Yolo, Yuba counties.

Date of Government Version: 07/01/2008
Date Data Arrived at EDR: 07/22/2008
Date Made Active in Reports: 07/31/2008
Number of Days to Update: 9

Source: California Regional Water Quality Control Board Central Valley Region (5)
Telephone: 916-464-4834
Last EDR Contact: 07/01/2011
Next Scheduled EDR Contact: 10/17/2011
Data Release Frequency: No Update Planned

LUST REG 4: Underground Storage Tank Leak List

Los Angeles, Ventura counties. For more current information, please refer to the State Water Resources Control Board's LUST database.

Date of Government Version: 09/07/2004
Date Data Arrived at EDR: 09/07/2004
Date Made Active in Reports: 10/12/2004
Number of Days to Update: 35

Source: California Regional Water Quality Control Board Los Angeles Region (4)
Telephone: 213-576-6710
Last EDR Contact: 09/06/2011
Next Scheduled EDR Contact: 12/19/2011
Data Release Frequency: No Update Planned

LUST REG 3: Leaking Underground Storage Tank Database

Leaking Underground Storage Tank locations. Monterey, San Benito, San Luis Obispo, Santa Barbara, Santa Cruz counties.

Date of Government Version: 05/19/2003
Date Data Arrived at EDR: 05/19/2003
Date Made Active in Reports: 06/02/2003
Number of Days to Update: 14

Source: California Regional Water Quality Control Board Central Coast Region (3)
Telephone: 805-542-4786
Last EDR Contact: 07/18/2011
Next Scheduled EDR Contact: 10/31/2011
Data Release Frequency: No Update Planned

LUST REG 2: Fuel Leak List

Leaking Underground Storage Tank locations. Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, Sonoma counties.

Date of Government Version: 09/30/2004
Date Data Arrived at EDR: 10/20/2004
Date Made Active in Reports: 11/19/2004
Number of Days to Update: 30

Source: California Regional Water Quality Control Board San Francisco Bay Region (2)
Telephone: 510-622-2433
Last EDR Contact: 09/19/2011
Next Scheduled EDR Contact: 01/02/2012
Data Release Frequency: Quarterly

LUST REG 1: Active Toxic Site Investigation

Del Norte, Humboldt, Lake, Mendocino, Modoc, Siskiyou, Sonoma, Trinity counties. For more current information, please refer to the State Water Resources Control Board's LUST database.

Date of Government Version: 02/01/2001
Date Data Arrived at EDR: 02/28/2001
Date Made Active in Reports: 03/29/2001
Number of Days to Update: 29

Source: California Regional Water Quality Control Board North Coast (1)
Telephone: 707-570-3769
Last EDR Contact: 08/01/2011
Next Scheduled EDR Contact: 11/14/2011
Data Release Frequency: No Update Planned

LUST: Geotracker's Leaking Underground Fuel Tank Report

Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state. For more information on a particular leaking underground storage tank sites, please contact the appropriate regulatory agency.

Date of Government Version: 12/16/2013
Date Data Arrived at EDR: 12/17/2013
Date Made Active in Reports: 01/04/2014
Number of Days to Update: 18

Source: State Water Resources Control Board
Telephone: see region list
Last EDR Contact: 12/17/2013
Next Scheduled EDR Contact: 03/31/2014
Data Release Frequency: Quarterly

LUST REG 6L: Leaking Underground Storage Tank Case Listing

For more current information, please refer to the State Water Resources Control Board's LUST database.

Date of Government Version: 09/09/2003
Date Data Arrived at EDR: 09/10/2003
Date Made Active in Reports: 10/07/2003
Number of Days to Update: 27

Source: California Regional Water Quality Control Board Lahontan Region (6)
Telephone: 530-542-5572
Last EDR Contact: 09/12/2011
Next Scheduled EDR Contact: 12/26/2011
Data Release Frequency: No Update Planned

LUST REG 8: Leaking Underground Storage Tanks

California Regional Water Quality Control Board Santa Ana Region (8). For more current information, please refer to the State Water Resources Control Board's LUST database.

Date of Government Version: 02/14/2005
Date Data Arrived at EDR: 02/15/2005
Date Made Active in Reports: 03/28/2005
Number of Days to Update: 41

Source: California Regional Water Quality Control Board Santa Ana Region (8)
Telephone: 909-782-4496
Last EDR Contact: 08/15/2011
Next Scheduled EDR Contact: 11/28/2011
Data Release Frequency: Varies

LUST REG 7: Leaking Underground Storage Tank Case Listing

Leaking Underground Storage Tank locations. Imperial, Riverside, San Diego, Santa Barbara counties.

Date of Government Version: 02/26/2004
Date Data Arrived at EDR: 02/26/2004
Date Made Active in Reports: 03/24/2004
Number of Days to Update: 27

Source: California Regional Water Quality Control Board Colorado River Basin Region (7)
Telephone: 760-776-8943
Last EDR Contact: 08/01/2011
Next Scheduled EDR Contact: 11/14/2011
Data Release Frequency: No Update Planned

LUST REG 6V: Leaking Underground Storage Tank Case Listing
Leaking Underground Storage Tank locations. Inyo, Kern, Los Angeles, Mono, San Bernardino counties.

Date of Government Version: 06/07/2005
Date Data Arrived at EDR: 06/07/2005
Date Made Active in Reports: 06/29/2005
Number of Days to Update: 22

Source: California Regional Water Quality Control Board Victorville Branch Office (6)
Telephone: 760-241-7365
Last EDR Contact: 09/12/2011
Next Scheduled EDR Contact: 12/26/2011
Data Release Frequency: No Update Planned

LUST REG 9: Leaking Underground Storage Tank Report
Orange, Riverside, San Diego counties. For more current information, please refer to the State Water Resources Control Board's LUST database.

Date of Government Version: 03/01/2001
Date Data Arrived at EDR: 04/23/2001
Date Made Active in Reports: 05/21/2001
Number of Days to Update: 28

Source: California Regional Water Quality Control Board San Diego Region (9)
Telephone: 858-637-5595
Last EDR Contact: 09/26/2011
Next Scheduled EDR Contact: 01/09/2012
Data Release Frequency: No Update Planned

SLIC: Statewide SLIC Cases
The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 10/16/2013
Date Data Arrived at EDR: 10/17/2013
Date Made Active in Reports: 11/27/2013
Number of Days to Update: 41

Source: State Water Resources Control Board
Telephone: 866-480-1028
Last EDR Contact: 12/17/2013
Next Scheduled EDR Contact: 03/31/2014
Data Release Frequency: Varies

SLIC REG 1: Active Toxic Site Investigations
The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 04/03/2003
Date Data Arrived at EDR: 04/07/2003
Date Made Active in Reports: 04/25/2003
Number of Days to Update: 18

Source: California Regional Water Quality Control Board, North Coast Region (1)
Telephone: 707-576-2220
Last EDR Contact: 08/01/2011
Next Scheduled EDR Contact: 11/14/2011
Data Release Frequency: No Update Planned

SLIC REG 2: Spills, Leaks, Investigation & Cleanup Cost Recovery Listing
The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 09/30/2004
Date Data Arrived at EDR: 10/20/2004
Date Made Active in Reports: 11/19/2004
Number of Days to Update: 30

Source: Regional Water Quality Control Board San Francisco Bay Region (2)
Telephone: 510-286-0457
Last EDR Contact: 09/19/2011
Next Scheduled EDR Contact: 01/02/2012
Data Release Frequency: Quarterly

SLIC REG 3: Spills, Leaks, Investigation & Cleanup Cost Recovery Listing
The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 05/18/2006
Date Data Arrived at EDR: 05/18/2006
Date Made Active in Reports: 06/15/2006
Number of Days to Update: 28

Source: California Regional Water Quality Control Board Central Coast Region (3)
Telephone: 805-549-3147
Last EDR Contact: 07/18/2011
Next Scheduled EDR Contact: 10/31/2011
Data Release Frequency: Semi-Annually

SLIC REG 4: Spills, Leaks, Investigation & Cleanup Cost Recovery Listing
The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 11/17/2004
Date Data Arrived at EDR: 11/18/2004
Date Made Active in Reports: 01/04/2005
Number of Days to Update: 47

Source: Region Water Quality Control Board Los Angeles Region (4)
Telephone: 213-576-6600
Last EDR Contact: 07/01/2011
Next Scheduled EDR Contact: 10/17/2011
Data Release Frequency: Varies

SLIC REG 5: Spills, Leaks, Investigation & Cleanup Cost Recovery Listing
The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 04/01/2005
Date Data Arrived at EDR: 04/05/2005
Date Made Active in Reports: 04/21/2005
Number of Days to Update: 16

Source: Regional Water Quality Control Board Central Valley Region (5)
Telephone: 916-464-3291
Last EDR Contact: 09/12/2011
Next Scheduled EDR Contact: 12/26/2011
Data Release Frequency: Semi-Annually

SLIC REG 6V: Spills, Leaks, Investigation & Cleanup Cost Recovery Listing
The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 05/24/2005
Date Data Arrived at EDR: 05/25/2005
Date Made Active in Reports: 06/16/2005
Number of Days to Update: 22

Source: Regional Water Quality Control Board, Victorville Branch
Telephone: 619-241-6583
Last EDR Contact: 08/15/2011
Next Scheduled EDR Contact: 11/28/2011
Data Release Frequency: Semi-Annually

SLIC REG 6L: SLIC Sites
The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 09/07/2004
Date Data Arrived at EDR: 09/07/2004
Date Made Active in Reports: 10/12/2004
Number of Days to Update: 35

Source: California Regional Water Quality Control Board, Lahontan Region
Telephone: 530-542-5574
Last EDR Contact: 08/15/2011
Next Scheduled EDR Contact: 11/28/2011
Data Release Frequency: No Update Planned

SLIC REG 7: SLIC List
The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 11/24/2004
Date Data Arrived at EDR: 11/29/2004
Date Made Active in Reports: 01/04/2005
Number of Days to Update: 36

Source: California Regional Quality Control Board, Colorado River Basin Region
Telephone: 760-346-7491
Last EDR Contact: 08/01/2011
Next Scheduled EDR Contact: 11/14/2011
Data Release Frequency: No Update Planned

SLIC REG 8: Spills, Leaks, Investigation & Cleanup Cost Recovery Listing
The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 04/03/2008
Date Data Arrived at EDR: 04/03/2008
Date Made Active in Reports: 04/14/2008
Number of Days to Update: 11

Source: California Region Water Quality Control Board Santa Ana Region (8)
Telephone: 951-782-3298
Last EDR Contact: 09/12/2011
Next Scheduled EDR Contact: 12/26/2011
Data Release Frequency: Semi-Annually

SLIC REG 9: Spills, Leaks, Investigation & Cleanup Cost Recovery Listing
The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 09/10/2007
Date Data Arrived at EDR: 09/11/2007
Date Made Active in Reports: 09/28/2007
Number of Days to Update: 17

Source: California Regional Water Quality Control Board San Diego Region (9)
Telephone: 858-467-2980
Last EDR Contact: 08/08/2011
Next Scheduled EDR Contact: 11/21/2011
Data Release Frequency: Annually

INDIAN LUST R6: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in New Mexico and Oklahoma.

Date of Government Version: 09/12/2011
Date Data Arrived at EDR: 09/13/2011
Date Made Active in Reports: 11/11/2011
Number of Days to Update: 59

Source: EPA Region 6
Telephone: 214-665-6597
Last EDR Contact: 10/28/2013
Next Scheduled EDR Contact: 02/11/2014
Data Release Frequency: Varies

INDIAN LUST R7: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Iowa, Kansas, and Nebraska

Date of Government Version: 08/27/2013
Date Data Arrived at EDR: 08/27/2013
Date Made Active in Reports: 11/01/2013
Number of Days to Update: 66

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 10/28/2013
Next Scheduled EDR Contact: 02/11/2014
Data Release Frequency: Varies

INDIAN LUST R9: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Arizona, California, New Mexico and Nevada

Date of Government Version: 03/01/2013
Date Data Arrived at EDR: 03/01/2013
Date Made Active in Reports: 04/12/2013
Number of Days to Update: 42

Source: Environmental Protection Agency
Telephone: 415-972-3372
Last EDR Contact: 10/28/2013
Next Scheduled EDR Contact: 02/11/2014
Data Release Frequency: Quarterly

INDIAN LUST R5: Leaking Underground Storage Tanks on Indian Land
Leaking underground storage tanks located on Indian Land in Michigan, Minnesota and Wisconsin.

Date of Government Version: 08/20/2013
Date Data Arrived at EDR: 08/23/2013
Date Made Active in Reports: 11/01/2013
Number of Days to Update: 70

Source: EPA, Region 5
Telephone: 312-886-7439
Last EDR Contact: 10/28/2013
Next Scheduled EDR Contact: 02/11/2014
Data Release Frequency: Varies

INDIAN LUST R1: Leaking Underground Storage Tanks on Indian Land
A listing of leaking underground storage tank locations on Indian Land.

Date of Government Version: 02/01/2013
Date Data Arrived at EDR: 05/01/2013
Date Made Active in Reports: 11/01/2013
Number of Days to Update: 184

Source: EPA Region 1
Telephone: 617-918-1313
Last EDR Contact: 11/01/2013
Next Scheduled EDR Contact: 02/11/2014
Data Release Frequency: Varies

INDIAN LUST R4: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Florida, Mississippi and North Carolina.

Date of Government Version: 08/01/2013
Date Data Arrived at EDR: 08/02/2013
Date Made Active in Reports: 11/01/2013
Number of Days to Update: 91

Source: EPA Region 4
Telephone: 404-562-8677
Last EDR Contact: 10/28/2013
Next Scheduled EDR Contact: 02/11/2014
Data Release Frequency: Semi-Annually

INDIAN LUST R10: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Alaska, Idaho, Oregon and Washington.

Date of Government Version: 11/06/2013
Date Data Arrived at EDR: 11/07/2013
Date Made Active in Reports: 12/06/2013
Number of Days to Update: 29

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 10/28/2013
Next Scheduled EDR Contact: 02/11/2014
Data Release Frequency: Quarterly

INDIAN LUST R8: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming.

Date of Government Version: 08/27/2012
Date Data Arrived at EDR: 08/28/2012
Date Made Active in Reports: 10/16/2012
Number of Days to Update: 49

Source: EPA Region 8
Telephone: 303-312-6271
Last EDR Contact: 10/28/2013
Next Scheduled EDR Contact: 02/11/2014
Data Release Frequency: Quarterly

State and tribal registered storage tank lists

UST: Active UST Facilities
Active UST facilities gathered from the local regulatory agencies

Date of Government Version: 12/16/2013
Date Data Arrived at EDR: 12/17/2013
Date Made Active in Reports: 01/07/2014
Number of Days to Update: 21

Source: SWRCB
Telephone: 916-341-5851
Last EDR Contact: 12/17/2013
Next Scheduled EDR Contact: 03/31/2014
Data Release Frequency: Semi-Annually

AST: Aboveground Petroleum Storage Tank Facilities
A listing of aboveground storage tank petroleum storage tank locations.

Date of Government Version: 08/01/2009
Date Data Arrived at EDR: 09/10/2009
Date Made Active in Reports: 10/01/2009
Number of Days to Update: 21

Source: California Environmental Protection Agency
Telephone: 916-327-5092
Last EDR Contact: 01/03/2014
Next Scheduled EDR Contact: 04/21/2014
Data Release Frequency: Quarterly

INDIAN UST R1: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 1 (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont and ten Tribal Nations).

Date of Government Version: 09/28/2012
Date Data Arrived at EDR: 11/07/2012
Date Made Active in Reports: 04/12/2013
Number of Days to Update: 156

Source: EPA, Region 1
Telephone: 617-918-1313
Last EDR Contact: 11/01/2014
Next Scheduled EDR Contact: 02/11/2014
Data Release Frequency: Varies

INDIAN UST R4: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee and Tribal Nations)

Date of Government Version: 08/01/2013
Date Data Arrived at EDR: 08/02/2013
Date Made Active in Reports: 11/01/2013
Number of Days to Update: 91

Source: EPA Region 4
Telephone: 404-562-9424
Last EDR Contact: 10/28/2013
Next Scheduled EDR Contact: 02/11/2014
Data Release Frequency: Semi-Annually

INDIAN UST R5: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 5 (Michigan, Minnesota and Wisconsin and Tribal Nations).

Date of Government Version: 08/20/2013
Date Data Arrived at EDR: 08/23/2013
Date Made Active in Reports: 11/01/2013
Number of Days to Update: 70

Source: EPA Region 5
Telephone: 312-886-6136
Last EDR Contact: 10/28/2013
Next Scheduled EDR Contact: 02/11/2014
Data Release Frequency: Varies

INDIAN UST R6: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 6 (Louisiana, Arkansas, Oklahoma, New Mexico, Texas and 65 Tribes).

Date of Government Version: 05/10/2011
Date Data Arrived at EDR: 05/11/2011
Date Made Active in Reports: 06/14/2011
Number of Days to Update: 34

Source: EPA Region 6
Telephone: 214-665-7591
Last EDR Contact: 10/28/2013
Next Scheduled EDR Contact: 02/11/2014
Data Release Frequency: Semi-Annually

INDIAN UST R7: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 7 (Iowa, Kansas, Missouri, Nebraska, and 9 Tribal Nations).

Date of Government Version: 12/31/2012
Date Data Arrived at EDR: 02/28/2013
Date Made Active in Reports: 04/12/2013
Number of Days to Update: 43

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 10/28/2013
Next Scheduled EDR Contact: 02/11/2014
Data Release Frequency: Varies

INDIAN UST R9: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 9 (Arizona, California, Hawaii, Nevada, the Pacific Islands, and Tribal Nations).

Date of Government Version: 07/29/2013
Date Data Arrived at EDR: 07/30/2013
Date Made Active in Reports: 12/06/2013
Number of Days to Update: 129

Source: EPA Region 9
Telephone: 415-972-3368
Last EDR Contact: 10/28/2013
Next Scheduled EDR Contact: 02/11/2014
Data Release Frequency: Quarterly

INDIAN UST R10: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 10 (Alaska, Idaho, Oregon, Washington, and Tribal Nations).

Date of Government Version: 02/05/2013
Date Data Arrived at EDR: 02/06/2013
Date Made Active in Reports: 04/12/2013
Number of Days to Update: 65

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 10/28/2013
Next Scheduled EDR Contact: 02/11/2014
Data Release Frequency: Quarterly

INDIAN UST R8: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming and 27 Tribal Nations).

Date of Government Version: 07/29/2013
Date Data Arrived at EDR: 08/01/2013
Date Made Active in Reports: 11/01/2013
Number of Days to Update: 92

Source: EPA Region 8
Telephone: 303-312-6137
Last EDR Contact: 10/28/2013
Next Scheduled EDR Contact: 02/11/2014
Data Release Frequency: Quarterly

FEMA UST: Underground Storage Tank Listing
A listing of all FEMA owned underground storage tanks.

Date of Government Version: 01/01/2010
Date Data Arrived at EDR: 02/16/2010
Date Made Active in Reports: 04/12/2010
Number of Days to Update: 55
Source: FEMA
Telephone: 202-646-5797
Last EDR Contact: 10/17/2013
Next Scheduled EDR Contact: 01/27/2014
Data Release Frequency: Varies

State and tribal voluntary cleanup sites

VCP: Voluntary Cleanup Program Properties
Contains low threat level properties with either confirmed or unconfirmed releases and the project proponents have request that DTSC oversee investigation and/or cleanup activities and have agreed to provide coverage for DTSC's costs.

Date of Government Version: 11/06/2013
Date Data Arrived at EDR: 11/06/2013
Date Made Active in Reports: 12/03/2013
Number of Days to Update: 27
Source: Department of Toxic Substances Control
Telephone: 916-323-3400
Last EDR Contact: 11/06/2013
Next Scheduled EDR Contact: 02/17/2014
Data Release Frequency: Quarterly

INDIAN VCP R1: Voluntary Cleanup Priority Listing
A listing of voluntary cleanup priority sites located on Indian Land located in Region 1.

Date of Government Version: 09/17/2013
Date Data Arrived at EDR: 10/01/2013
Date Made Active in Reports: 12/06/2013
Number of Days to Update: 66
Source: EPA, Region 1
Telephone: 617-918-1102
Last EDR Contact: 01/03/2014
Next Scheduled EDR Contact: 04/14/2014
Data Release Frequency: Varies

INDIAN VCP R7: Voluntary Cleanup Priority Lisitng
A listing of voluntary cleanup priority sites located on Indian Land located in Region 7.

Date of Government Version: 03/20/2008
Date Data Arrived at EDR: 04/22/2008
Date Made Active in Reports: 05/19/2008
Number of Days to Update: 27
Source: EPA, Region 7
Telephone: 913-551-7365
Last EDR Contact: 04/20/2009
Next Scheduled EDR Contact: 07/20/2009
Data Release Frequency: Varies

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS: A Listing of Brownfields Sites
Brownfields are real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Cleaning up and reinvesting in these properties takes development pressures off of undeveloped, open land, and both improves and protects the environment. Assessment, Cleanup and Redevelopment Exchange System (ACRES) stores information reported by EPA Brownfields grant recipients on brownfields properties assessed or cleaned up with grant funding as well as information on Targeted Brownfields Assessments performed by EPA Regions. A listing of ACRES Brownfield sites is obtained from Cleanups in My Community. Cleanups in My Community provides information on Brownfields properties for which information is reported back to EPA, as well as areas served by Brownfields grant programs.

Date of Government Version: 09/24/2013
Date Data Arrived at EDR: 09/24/2013
Date Made Active in Reports: 12/06/2013
Number of Days to Update: 73
Source: Environmental Protection Agency
Telephone: 202-566-2777
Last EDR Contact: 12/24/2013
Next Scheduled EDR Contact: 04/07/2014
Data Release Frequency: Semi-Annually

Local Lists of Landfill / Solid Waste Disposal Sites

ODI: Open Dump Inventory
An open dump is defined as a disposal facility that does not comply with one or more of the Part 257 or Part 258 Subtitle D Criteria.

Date of Government Version: 06/30/1985
Date Data Arrived at EDR: 08/09/2004
Date Made Active in Reports: 09/17/2004
Number of Days to Update: 39
Source: Environmental Protection Agency
Telephone: 800-424-9346
Last EDR Contact: 06/09/2004
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

DEBRIS REGION 9: Torres Martinez Reservation Illegal Dump Site Locations
A listing of illegal dump sites location on the Torres Martinez Indian Reservation located in eastern Riverside County and northern Imperial County, California.

Date of Government Version: 01/12/2009
Date Data Arrived at EDR: 05/07/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 137
Source: EPA, Region 9
Telephone: 415-947-4219
Last EDR Contact: 10/28/2013
Next Scheduled EDR Contact: 02/11/2014
Data Release Frequency: No Update Planned

WMUDS/SWAT: Waste Management Unit Database
Waste Management Unit Database System. WMUDS is used by the State Water Resources Control Board staff and the Regional Water Quality Control Boards for program tracking and inventory of waste management units. WMUDS is composed of the following databases: Facility Information, Scheduled Inspections Information, Waste Management Unit Information, SWAT Program Information, SWAT Report Summary Information, SWAT Report Summary Data, Chapter 15 (formerly Subchapter 15) Information, Chapter 15 Monitoring Parameters, TPCA Program Information, RCRA Program Information, Closure Information, and Interested Parties Information.

Date of Government Version: 04/01/2000
Date Data Arrived at EDR: 04/10/2000
Date Made Active in Reports: 05/10/2000
Number of Days to Update: 30
Source: State Water Resources Control Board
Telephone: 916-227-4448
Last EDR Contact: 11/08/2013
Next Scheduled EDR Contact: 02/24/2014
Data Release Frequency: No Update Planned

SWRCY: Recycler Database
A listing of recycling facilities in California.

Date of Government Version: 12/16/2013
Date Data Arrived at EDR: 12/17/2013
Date Made Active in Reports: 01/07/2014
Number of Days to Update: 21
Source: Department of Conservation
Telephone: 916-323-3836
Last EDR Contact: 12/17/2013
Next Scheduled EDR Contact: 03/31/2014
Data Release Frequency: Quarterly

HAULERS: Registered Waste Tire Haulers Listing
A listing of registered waste tire haulers.

Date of Government Version: 11/20/2013
Date Data Arrived at EDR: 11/25/2013
Date Made Active in Reports: 12/31/2013
Number of Days to Update: 36
Source: Integrated Waste Management Board
Telephone: 916-341-6422
Last EDR Contact: 11/18/2013
Next Scheduled EDR Contact: 03/03/2014
Data Release Frequency: Varies

INDIAN ODI: Report on the Status of Open Dumps on Indian Lands
Location of open dumps on Indian land.

Date of Government Version: 12/31/1998
Date Data Arrived at EDR: 12/03/2007
Date Made Active in Reports: 01/24/2008
Number of Days to Update: 52
Source: Environmental Protection Agency
Telephone: 703-308-8245
Last EDR Contact: 11/04/2013
Next Scheduled EDR Contact: 02/17/2014
Data Release Frequency: Varies

Local Lists of Hazardous waste / Contaminated Sites

US CDL: Clandestine Drug Labs

A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 08/06/2013
Date Data Arrived at EDR: 09/11/2013
Date Made Active in Reports: 10/03/2013
Number of Days to Update: 22

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 12/05/2013
Next Scheduled EDR Contact: 03/17/2014
Data Release Frequency: Quarterly

HIST CAL-SITES: Calsites Database

The Calsites database contains potential or confirmed hazardous substance release properties. In 1996, California EPA reevaluated and significantly reduced the number of sites in the Calsites database. No longer updated by the state agency. It has been replaced by ENVIROSTOR.

Date of Government Version: 08/08/2005
Date Data Arrived at EDR: 08/03/2006
Date Made Active in Reports: 08/24/2006
Number of Days to Update: 21

Source: Department of Toxic Substance Control
Telephone: 916-323-3400
Last EDR Contact: 02/23/2009
Next Scheduled EDR Contact: 05/25/2009
Data Release Frequency: No Update Planned

SCH: School Property Evaluation Program

This category contains proposed and existing school sites that are being evaluated by DTSC for possible hazardous materials contamination. In some cases, these properties may be listed in the CalSites category depending on the level of threat to public health and safety or the environment they pose.

Date of Government Version: 11/06/2013
Date Data Arrived at EDR: 11/06/2013
Date Made Active in Reports: 12/03/2013
Number of Days to Update: 27

Source: Department of Toxic Substances Control
Telephone: 916-323-3400
Last EDR Contact: 11/06/2013
Next Scheduled EDR Contact: 02/17/2014
Data Release Frequency: Quarterly

TOXIC PITS: Toxic Pits Cleanup Act Sites

Toxic PITS Cleanup Act Sites. TOXIC PITS identifies sites suspected of containing hazardous substances where cleanup has not yet been completed.

Date of Government Version: 07/01/1995
Date Data Arrived at EDR: 08/30/1995
Date Made Active in Reports: 09/26/1995
Number of Days to Update: 27

Source: State Water Resources Control Board
Telephone: 916-227-4364
Last EDR Contact: 01/26/2009
Next Scheduled EDR Contact: 04/27/2009
Data Release Frequency: No Update Planned

CDL: Clandestine Drug Labs

A listing of drug lab locations. Listing of a location in this database does not indicate that any illegal drug lab materials were or were not present there, and does not constitute a determination that the location either requires or does not require additional cleanup work.

Date of Government Version: 06/30/2013
Date Data Arrived at EDR: 09/03/2013
Date Made Active in Reports: 10/10/2013
Number of Days to Update: 37

Source: Department of Toxic Substances Control
Telephone: 916-255-6504
Last EDR Contact: 12/26/2013
Next Scheduled EDR Contact: 04/14/2014
Data Release Frequency: Varies

US HIST CDL: National Clandestine Laboratory Register

A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 09/01/2007
Date Data Arrived at EDR: 11/19/2008
Date Made Active in Reports: 03/30/2009
Number of Days to Update: 131

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 03/23/2009
Next Scheduled EDR Contact: 06/22/2009
Data Release Frequency: No Update Planned

Local Lists of Registered Storage Tanks

CA FID UST: Facility Inventory Database

The Facility Inventory Database (FID) contains a historical listing of active and inactive underground storage tank locations from the State Water Resource Control Board. Refer to local/county source for current data.

Date of Government Version: 10/31/1994
Date Data Arrived at EDR: 09/05/1995
Date Made Active in Reports: 09/29/1995
Number of Days to Update: 24

Source: California Environmental Protection Agency
Telephone: 916-341-5851
Last EDR Contact: 12/28/1998
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

UST MENDOCINO: Mendocino County UST Database

A listing of underground storage tank locations in Mendocino County.

Date of Government Version: 09/23/2009
Date Data Arrived at EDR: 09/23/2009
Date Made Active in Reports: 10/01/2009
Number of Days to Update: 8

Source: Department of Public Health
Telephone: 707-463-4466
Last EDR Contact: 12/02/2013
Next Scheduled EDR Contact: 03/17/2014
Data Release Frequency: Annually

HIST UST: Hazardous Substance Storage Container Database

The Hazardous Substance Storage Container Database is a historical listing of UST sites. Refer to local/county source for current data.

Date of Government Version: 10/15/1990
Date Data Arrived at EDR: 01/25/1991
Date Made Active in Reports: 02/12/1991
Number of Days to Update: 18

Source: State Water Resources Control Board
Telephone: 916-341-5851
Last EDR Contact: 07/26/2001
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

SWEEPS UST: SWEEPS UST Listing

Statewide Environmental Evaluation and Planning System. This underground storage tank listing was updated and maintained by a company contacted by the SWRCB in the early 1990's. The listing is no longer updated or maintained. The local agency is the contact for more information on a site on the SWEEPS list.

Date of Government Version: 06/01/1994
Date Data Arrived at EDR: 07/07/2005
Date Made Active in Reports: 08/11/2005
Number of Days to Update: 35

Source: State Water Resources Control Board
Telephone: N/A
Last EDR Contact: 06/03/2005
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

Local Land Records

LIENS 2: CERCLA Lien Information

A Federal CERCLA ('Superfund') lien can exist by operation of law at any site or property at which EPA has spent Superfund monies. These monies are spent to investigate and address releases and threatened releases of contamination. CERCLIS provides information as to the identity of these sites and properties.

Date of Government Version: 02/06/2013
Date Data Arrived at EDR: 04/25/2013
Date Made Active in Reports: 05/10/2013
Number of Days to Update: 15

Source: Environmental Protection Agency
Telephone: 202-564-6023
Last EDR Contact: 11/13/2013
Next Scheduled EDR Contact: 02/11/2014
Data Release Frequency: Varies

LIENS: Environmental Liens Listing

A listing of property locations with environmental liens for California where DTSC is a lien holder.

Date of Government Version: 10/08/2013
Date Data Arrived at EDR: 10/15/2013
Date Made Active in Reports: 11/27/2013
Number of Days to Update: 43

Source: Department of Toxic Substances Control
Telephone: 916-323-3400
Last EDR Contact: 12/09/2013
Next Scheduled EDR Contact: 03/24/2014
Data Release Frequency: Varies

DEED: Deed Restriction Listing

Site Mitigation and Brownfields Reuse Program Facility Sites with Deed Restrictions & Hazardous Waste Management Program Facility Sites with Deed / Land Use Restriction. The DTSC Site Mitigation and Brownfields Reuse Program (SMBRP) list includes sites cleaned up under the program's oversight and generally does not include current or former hazardous waste facilities that required a hazardous waste facility permit. The list represents deed restrictions that are active. Some sites have multiple deed restrictions. The DTSC Hazardous Waste Management Program (HWMP) has developed a list of current or former hazardous waste facilities that have a recorded land use restriction at the local county recorder's office. The land use restrictions on this list were required by the DTSC HWMP as a result of the presence of hazardous substances that remain on site after the facility (or part of the facility) has been closed or cleaned up. The types of land use restriction include deed notice, deed restriction, or a land use restriction that binds current and future owners.

Date of Government Version: 12/09/2013
Date Data Arrived at EDR: 12/10/2013
Date Made Active in Reports: 01/03/2014
Number of Days to Update: 24

Source: DTSC and SWRCB
Telephone: 916-323-3400
Last EDR Contact: 12/10/2013
Next Scheduled EDR Contact: 03/24/2014
Data Release Frequency: Semi-Annually

Records of Emergency Release Reports

HMIRS: Hazardous Materials Information Reporting System

Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 09/30/2013
Date Data Arrived at EDR: 10/01/2013
Date Made Active in Reports: 12/16/2013
Number of Days to Update: 76

Source: U.S. Department of Transportation
Telephone: 202-366-4555
Last EDR Contact: 01/03/2014
Next Scheduled EDR Contact: 01/13/2014
Data Release Frequency: Annually

CHMIRS: California Hazardous Material Incident Report System

California Hazardous Material Incident Reporting System. CHMIRS contains information on reported hazardous material incidents (accidental releases or spills).

Date of Government Version: 10/14/2013
Date Data Arrived at EDR: 10/30/2013
Date Made Active in Reports: 12/03/2013
Number of Days to Update: 34

Source: Office of Emergency Services
Telephone: 916-845-8400
Last EDR Contact: 10/30/2013
Next Scheduled EDR Contact: 02/11/2014
Data Release Frequency: Varies

LDS: Land Disposal Sites Listing

The Land Disposal program regulates of waste discharge to land for treatment, storage and disposal in waste management units.

Date of Government Version: 12/16/2013
Date Data Arrived at EDR: 12/17/2013
Date Made Active in Reports: 01/04/2014
Number of Days to Update: 18

Source: State Water Qualilty Control Board
Telephone: 866-480-1028
Last EDR Contact: 12/17/2013
Next Scheduled EDR Contact: 03/31/2014
Data Release Frequency: Quarterly

MCS: Military Cleanup Sites Listing

The State Water Resources Control Board and nine Regional Water Quality Control Boards partner with the Department of Defense (DoD) through the Defense and State Memorandum of Agreement (DSMOA) to oversee the investigation and remediation of water quality issues at military facilities.

Date of Government Version: 12/16/2013
Date Data Arrived at EDR: 12/17/2013
Date Made Active in Reports: 01/04/2014
Number of Days to Update: 18

Source: State Water Resources Control Board
Telephone: 866-480-1028
Last EDR Contact: 12/17/2013
Next Scheduled EDR Contact: 03/31/2014
Data Release Frequency: Quarterly

SPILLS 90: SPILLS90 data from FirstSearch

Spills 90 includes those spill and release records available exclusively from FirstSearch databases. Typically, they may include chemical, oil and/or hazardous substance spills recorded after 1990. Duplicate records that are already included in EDR incident and release records are not included in Spills 90.

Date of Government Version: 06/06/2012
Date Data Arrived at EDR: 01/03/2013
Date Made Active in Reports: 02/22/2013
Number of Days to Update: 50

Source: FirstSearch
Telephone: N/A
Last EDR Contact: 01/03/2013
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

Other Ascertainable Records

RCRA NonGen / NLR: RCRA - Non Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

Date of Government Version: 09/10/2013
Date Data Arrived at EDR: 10/02/2013
Date Made Active in Reports: 12/16/2013
Number of Days to Update: 75

Source: Environmental Protection Agency
Telephone: (415) 495-8895
Last EDR Contact: 01/02/2014
Next Scheduled EDR Contact: 04/14/2014
Data Release Frequency: Varies

DOT OPS: Incident and Accident Data

Department of Transporation, Office of Pipeline Safety Incident and Accident data.

Date of Government Version: 07/31/2012
Date Data Arrived at EDR: 08/07/2012
Date Made Active in Reports: 09/18/2012
Number of Days to Update: 42

Source: Department of Transporation, Office of Pipeline Safety
Telephone: 202-366-4595
Last EDR Contact: 11/06/2013
Next Scheduled EDR Contact: 02/17/2014
Data Release Frequency: Varies

DOD: Department of Defense Sites

This data set consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 11/10/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 62

Source: USGS
Telephone: 888-275-8747
Last EDR Contact: 10/18/2013
Next Scheduled EDR Contact: 01/27/2014
Data Release Frequency: Semi-Annually

FUDS: Formerly Used Defense Sites

The listing includes locations of Formerly Used Defense Sites properties where the US Army Corps of Engineers is actively working or will take necessary cleanup actions.

Date of Government Version: 12/31/2011
Date Data Arrived at EDR: 02/26/2013
Date Made Active in Reports: 03/13/2013
Number of Days to Update: 15

Source: U.S. Army Corps of Engineers
Telephone: 202-528-4285
Last EDR Contact: 12/13/2013
Next Scheduled EDR Contact: 03/24/2014
Data Release Frequency: Varies

CONSENT: Superfund (CERCLA) Consent Decrees

Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: 06/30/2013
Date Data Arrived at EDR: 08/07/2013
Date Made Active in Reports: 10/03/2013
Number of Days to Update: 57

Source: Department of Justice, Consent Decree Library
Telephone: Varies
Last EDR Contact: 12/26/2013
Next Scheduled EDR Contact: 04/14/2014
Data Release Frequency: Varies

ROD: Records Of Decision

Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 04/26/2013
Date Data Arrived at EDR: 06/11/2013
Date Made Active in Reports: 11/01/2013
Number of Days to Update: 143

Source: EPA
Telephone: 703-416-0223
Last EDR Contact: 12/12/2013
Next Scheduled EDR Contact: 03/24/2014
Data Release Frequency: Annually

UMTRA: Uranium Mill Tailings Sites

Uranium ore was mined by private companies for federal government use in national defense programs. When the mills shut down, large piles of the sand-like material (mill tailings) remain after uranium has been extracted from the ore. Levels of human exposure to radioactive materials from the piles are low; however, in some cases tailings were used as construction materials before the potential health hazards of the tailings were recognized.

Date of Government Version: 09/14/2010
Date Data Arrived at EDR: 10/07/2011
Date Made Active in Reports: 03/01/2012
Number of Days to Update: 146

Source: Department of Energy
Telephone: 505-845-0011
Last EDR Contact: 11/26/2013
Next Scheduled EDR Contact: 03/10/2014
Data Release Frequency: Varies

US MINES: Mines Master Index File

Contains all mine identification numbers issued for mines active or opened since 1971. The data also includes violation information.

Date of Government Version: 08/01/2013
Date Data Arrived at EDR: 09/05/2013
Date Made Active in Reports: 10/03/2013
Number of Days to Update: 28

Source: Department of Labor, Mine Safety and Health Administration
Telephone: 303-231-5959
Last EDR Contact: 12/06/2013
Next Scheduled EDR Contact: 03/17/2014
Data Release Frequency: Semi-Annually

TRIS: Toxic Chemical Release Inventory System

Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/2011
Date Data Arrived at EDR: 07/31/2013
Date Made Active in Reports: 09/13/2013
Number of Days to Update: 44

Source: EPA
Telephone: 202-566-0250
Last EDR Contact: 11/27/2013
Next Scheduled EDR Contact: 03/10/2014
Data Release Frequency: Annually

TSCA: Toxic Substances Control Act

Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/2006
Date Data Arrived at EDR: 09/29/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 64

Source: EPA
Telephone: 202-260-5521
Last EDR Contact: 12/26/2013
Next Scheduled EDR Contact: 04/07/2014
Data Release Frequency: Every 4 Years

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25

Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Telephone: 202-566-1667
Last EDR Contact: 11/21/2013
Next Scheduled EDR Contact: 03/10/2014
Data Release Frequency: Quarterly

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

A listing of FIFRA/TSCA Tracking System (FTTS) inspections and enforcements.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25

Source: EPA
Telephone: 202-566-1667
Last EDR Contact: 11/21/2014
Next Scheduled EDR Contact: 03/10/2014
Data Release Frequency: Quarterly

HIST FTTS: FIFRA/TSCA Tracking System Administrative Case Listing

A complete administrative case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2007
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

HIST FTTS INSP: FIFRA/TSCA Tracking System Inspection & Enforcement Case Listing

A complete inspection and enforcement case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2008
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

SSTS: Section 7 Tracking Systems

Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 12/10/2010
Date Made Active in Reports: 02/25/2011
Number of Days to Update: 77

Source: EPA
Telephone: 202-564-4203
Last EDR Contact: 10/28/2013
Next Scheduled EDR Contact: 02/11/2014
Data Release Frequency: Annually

ICIS: Integrated Compliance Information System

The Integrated Compliance Information System (ICIS) supports the information needs of the national enforcement and compliance program as well as the unique needs of the National Pollutant Discharge Elimination System (NPDES) program.

Date of Government Version: 07/20/2011
Date Data Arrived at EDR: 11/10/2011
Date Made Active in Reports: 01/10/2012
Number of Days to Update: 61

Source: Environmental Protection Agency
Telephone: 202-564-5088
Last EDR Contact: 10/09/2014
Next Scheduled EDR Contact: 01/27/2014
Data Release Frequency: Quarterly

PADS: PCB Activity Database System

PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 06/01/2013
Date Data Arrived at EDR: 07/17/2013
Date Made Active in Reports: 11/01/2013
Number of Days to Update: 107

Source: EPA
Telephone: 202-566-0500
Last EDR Contact: 10/18/2013
Next Scheduled EDR Contact: 01/27/2014
Data Release Frequency: Annually

MLTS: Material Licensing Tracking System

MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 07/22/2013
Date Data Arrived at EDR: 08/02/2013
Date Made Active in Reports: 11/01/2013
Number of Days to Update: 91

Source: Nuclear Regulatory Commission
Telephone: 301-415-7169
Last EDR Contact: 12/09/2013
Next Scheduled EDR Contact: 03/24/2014
Data Release Frequency: Quarterly

RADINFO: Radiation Information Database

The Radiation Information Database (RADINFO) contains information about facilities that are regulated by U.S. Environmental Protection Agency (EPA) regulations for radiation and radioactivity.

Date of Government Version: 09/30/2013
Date Data Arrived at EDR: 10/09/2013
Date Made Active in Reports: 11/01/2013
Number of Days to Update: 23

Source: Environmental Protection Agency
Telephone: 202-343-9775
Last EDR Contact: 10/09/2013
Next Scheduled EDR Contact: 01/20/2014
Data Release Frequency: Quarterly

FINDS: Facility Index System/Facility Registry System

Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 03/08/2013
Date Data Arrived at EDR: 03/21/2013
Date Made Active in Reports: 07/10/2013
Number of Days to Update: 111

Source: EPA
Telephone: (415) 947-8000
Last EDR Contact: 12/10/2013
Next Scheduled EDR Contact: 03/24/2014
Data Release Frequency: Quarterly

RAATS: RCRA Administrative Action Tracking System

RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/1995
Date Data Arrived at EDR: 07/03/1995
Date Made Active in Reports: 08/07/1995
Number of Days to Update: 35

Source: EPA
Telephone: 202-564-4104
Last EDR Contact: 06/02/2008
Next Scheduled EDR Contact: 09/01/2008
Data Release Frequency: No Update Planned

RMP: Risk Management Plans

When Congress passed the Clean Air Act Amendments of 1990, it required EPA to publish regulations and guidance for chemical accident prevention at facilities using extremely hazardous substances. The Risk Management Program Rule (RMP Rule) was written to implement Section 112(r) of these amendments. The rule, which built upon existing industry codes and standards, requires companies of all sizes that use certain flammable and toxic substances to develop a Risk Management Program, which includes a(n): Hazard assessment that details the potential effects of an accidental release, an accident history of the last five years, and an evaluation of worst-case and alternative accidental releases; Prevention program that includes safety precautions and maintenance, monitoring, and employee training measures; and Emergency response program that spells out emergency health care, employee training measures and procedures for informing the public and response agencies (e.g the fire department) should an accident occur.

Date of Government Version: 05/08/2012
Date Data Arrived at EDR: 05/25/2012
Date Made Active in Reports: 07/10/2012
Number of Days to Update: 46

Source: Environmental Protection Agency
Telephone: 202-564-8600
Last EDR Contact: 10/28/2013
Next Scheduled EDR Contact: 02/11/2014
Data Release Frequency: Varies

BRS: Biennial Reporting System

The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/2011
Date Data Arrived at EDR: 02/26/2013
Date Made Active in Reports: 04/19/2013
Number of Days to Update: 52

Source: EPA/NTIS
Telephone: 800-424-9346
Last EDR Contact: 11/25/2013
Next Scheduled EDR Contact: 03/10/2014
Data Release Frequency: Biennially

CA BOND EXP. PLAN: Bond Expenditure Plan

Department of Health Services developed a site-specific expenditure plan as the basis for an appropriation of Hazardous Substance Cleanup Bond Act funds. It is not updated.

Date of Government Version: 01/01/1989
Date Data Arrived at EDR: 07/27/1994
Date Made Active in Reports: 08/02/1994
Number of Days to Update: 6

Source: Department of Health Services
Telephone: 916-255-2118
Last EDR Contact: 05/31/1994
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

NPDES: NPDES Permits Listing

A listing of NPDES permits, including stormwater.

Date of Government Version: 11/19/2013
Date Data Arrived at EDR: 11/21/2013
Date Made Active in Reports: 01/02/2014
Number of Days to Update: 42

Source: State Water Resources Control Board
Telephone: 916-445-9379
Last EDR Contact: 11/21/2013
Next Scheduled EDR Contact: 03/03/2014
Data Release Frequency: Quarterly

UIC: UIC Listing
A listing of wells identified as underground injection wells, in the California Oil and Gas Wells database.

Date of Government Version: 09/25/2013
Date Data Arrived at EDR: 12/17/2013
Date Made Active in Reports: 01/07/2014
Number of Days to Update: 21
Source: Deaprtment of Conservation
Telephone: 916-445-2408
Last EDR Contact: 12/17/2013
Next Scheduled EDR Contact: 03/31/2014
Data Release Frequency: Varies

CORTESE: "Cortese" Hazardous Waste & Substances Sites List
The sites for the list are designated by the State Water Resource Control Board (LUST), the Integrated Waste Board (SWF/LS), and the Department of Toxic Substances Control (Cal-Sites).

Date of Government Version: 09/30/2013
Date Data Arrived at EDR: 10/01/2013
Date Made Active in Reports: 11/26/2013
Number of Days to Update: 56
Source: CAL EPA/Office of Emergency Information
Telephone: 916-323-3400
Last EDR Contact: 12/31/2013
Next Scheduled EDR Contact: 04/14/2014
Data Release Frequency: Quarterly

HIST CORTESE: Hazardous Waste & Substance Site List
The sites for the list are designated by the State Water Resource Control Board [LUST], the Integrated Waste Board [SWF/LS], and the Department of Toxic Substances Control [CALSITES]. This listing is no longer updated by the state agency.

Date of Government Version: 04/01/2001
Date Data Arrived at EDR: 01/22/2009
Date Made Active in Reports: 04/08/2009
Number of Days to Update: 76
Source: Department of Toxic Substances Control
Telephone: 916-323-3400
Last EDR Contact: 01/22/2009
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

NOTIFY 65: Proposition 65 Records
Listings of all Proposition 65 incidents reported to counties by the State Water Resources Control Board and the Regional Water Quality Control Board. This database is no longer updated by the reporting agency.

Date of Government Version: 10/21/1993
Date Data Arrived at EDR: 11/01/1993
Date Made Active in Reports: 11/19/1993
Number of Days to Update: 18
Source: State Water Resources Control Board
Telephone: 916-445-3846
Last EDR Contact: 12/17/2013
Next Scheduled EDR Contact: 04/07/2014
Data Release Frequency: No Update Planned

DRYCLEANERS: Cleaner Facilities
A list of drycleaner related facilities that have EPA ID numbers. These are facilities with certain SIC codes: power laundries, family and commercial; garment pressing and cleaner's agents; linen supply; coin-operated laundries and cleaning; drycleaning plants, except rugs; carpet and upholster cleaning; industrial launderers; laundry and garment services.

Date of Government Version: 09/10/2013
Date Data Arrived at EDR: 09/11/2013
Date Made Active in Reports: 10/16/2013
Number of Days to Update: 35
Source: Department of Toxic Substance Control
Telephone: 916-327-4498
Last EDR Contact: 12/09/2013
Next Scheduled EDR Contact: 03/24/2014
Data Release Frequency: Annually

WIP: Well Investigation Program Case List
Well Investigation Program case in the San Gabriel and San Fernando Valley area.

Date of Government Version: 07/03/2009
Date Data Arrived at EDR: 07/21/2009
Date Made Active in Reports: 08/03/2009
Number of Days to Update: 13
Source: Los Angeles Water Quality Control Board
Telephone: 213-576-6726
Last EDR Contact: 12/26/2013
Next Scheduled EDR Contact: 04/14/2014
Data Release Frequency: Varies

ENF: Enforcement Action Listing

A listing of Water Board Enforcement Actions. Formal is everything except Oral/Verbal Communication, Notice of Violation, Expedited Payment Letter, and Staff Enforcement Letter.

Date of Government Version: 08/09/2013
Date Data Arrived at EDR: 08/13/2013
Date Made Active in Reports: 10/08/2013
Number of Days to Update: 56

Source: State Water Resoruces Control Board
Telephone: 916-445-9379
Last EDR Contact: 11/08/2013
Next Scheduled EDR Contact: 02/11/2014
Data Release Frequency: Varies

HAZNET: Facility and Manifest Data

Facility and Manifest Data. The data is extracted from the copies of hazardous waste manifests received each year by the DTSC. The annual volume of manifests is typically 700,000 - 1,000,000 annually, representing approximately 350,000 - 500,000 shipments. Data are from the manifests submitted without correction, and therefore many contain some invalid values for data elements such as generator ID, TSD ID, waste category, and disposal method.

Date of Government Version: 12/31/2012
Date Data Arrived at EDR: 07/16/2013
Date Made Active in Reports: 08/26/2013
Number of Days to Update: 41

Source: California Environmental Protection Agency
Telephone: 916-255-1136
Last EDR Contact: 10/15/2013
Next Scheduled EDR Contact: 01/27/2014
Data Release Frequency: Annually

EMI: Emissions Inventory Data

Toxics and criteria pollutant emissions data collected by the ARB and local air pollution agencies.

Date of Government Version: 12/31/2010
Date Data Arrived at EDR: 06/25/2013
Date Made Active in Reports: 08/22/2013
Number of Days to Update: 58

Source: California Air Resources Board
Telephone: 916-322-2990
Last EDR Contact: 12/26/2013
Next Scheduled EDR Contact: 04/07/2014
Data Release Frequency: Varies

INDIAN RESERV: Indian Reservations

This map layer portrays Indian administered lands of the United States that have any area equal to or greater than 640 acres.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 12/08/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 34

Source: USGS
Telephone: 202-208-3710
Last EDR Contact: 10/18/2013
Next Scheduled EDR Contact: 01/27/2014
Data Release Frequency: Semi-Annually

SCRD DRYCLEANERS: State Coalition for Remediation of Drycleaners Listing

The State Coalition for Remediation of Drycleaners was established in 1998, with support from the U.S. EPA Office of Superfund Remediation and Technology Innovation. It is comprised of representatives of states with established drycleaner remediation programs. Currently the member states are Alabama, Connecticut, Florida, Illinois, Kansas, Minnesota, Missouri, North Carolina, Oregon, South Carolina, Tennessee, Texas, and Wisconsin.

Date of Government Version: 03/07/2011
Date Data Arrived at EDR: 03/09/2011
Date Made Active in Reports: 05/02/2011
Number of Days to Update: 54

Source: Environmental Protection Agency
Telephone: 615-532-8599
Last EDR Contact: 11/18/2013
Next Scheduled EDR Contact: 02/03/2014
Data Release Frequency: Varies

WDS: Waste Discharge System

Sites which have been issued waste discharge requirements.

Date of Government Version: 06/19/2007
Date Data Arrived at EDR: 06/20/2007
Date Made Active in Reports: 06/29/2007
Number of Days to Update: 9

Source: State Water Resources Control Board
Telephone: 916-341-5227
Last EDR Contact: 11/21/2013
Next Scheduled EDR Contact: 03/10/2014
Data Release Frequency: Quarterly

2020 COR ACTION: 2020 Corrective Action Program List

The EPA has set ambitious goals for the RCRA Corrective Action program by creating the 2020 Corrective Action Universe. This RCRA cleanup baseline includes facilities expected to need corrective action. The 2020 universe contains a wide variety of sites. Some properties are heavily contaminated while others were contaminated but have since been cleaned up. Still others have not been fully investigated yet, and may require little or no remediation. Inclusion in the 2020 Universe does not necessarily imply failure on the part of a facility to meet its RCRA obligations.

Date of Government Version: 11/11/2011
Date Data Arrived at EDR: 05/18/2012
Date Made Active in Reports: 05/25/2012
Number of Days to Update: 7

Source: Environmental Protection Agency
Telephone: 703-308-4044
Last EDR Contact: 11/15/2013
Next Scheduled EDR Contact: 02/24/2014
Data Release Frequency: Varies

LEAD SMELTER 2: Lead Smelter Sites

A list of several hundred sites in the U.S. where secondary lead smelting was done from 1931and 1964. These sites may pose a threat to public health through ingestion or inhalation of contaminated soil or dust

Date of Government Version: 04/05/2001
Date Data Arrived at EDR: 10/27/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 36

Source: American Journal of Public Health
Telephone: 703-305-6451
Last EDR Contact: 12/02/2009
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

LEAD SMELTER 1: Lead Smelter Sites

A listing of former lead smelter site locations.

Date of Government Version: 01/29/2013
Date Data Arrived at EDR: 02/14/2013
Date Made Active in Reports: 02/27/2013
Number of Days to Update: 13

Source: Environmental Protection Agency
Telephone: 703-603-8787
Last EDR Contact: 01/03/2014
Next Scheduled EDR Contact: 04/21/2014
Data Release Frequency: Varies

Financial Assurance 2: Financial Assurance Information Listing

A listing of financial assurance information for solid waste facilities. Financial assurance is intended to ensure that resources are available to pay for the cost of closure, post-closure care, and corrective measures if the owner or operator of a regulated facility is unable or unwilling to pay.

Date of Government Version: 11/18/2013
Date Data Arrived at EDR: 11/19/2013
Date Made Active in Reports: 12/31/2013
Number of Days to Update: 42

Source: California Integrated Waste Management Board
Telephone: 916-341-6066
Last EDR Contact: 11/18/2013
Next Scheduled EDR Contact: 03/03/2014
Data Release Frequency: Varies

Financial Assurance 1: Financial Assurance Information Listing

Financial Assurance information

Date of Government Version: 10/31/2013
Date Data Arrived at EDR: 11/06/2013
Date Made Active in Reports: 12/03/2013
Number of Days to Update: 27

Source: Department of Toxic Substances Control
Telephone: 916-255-3628
Last EDR Contact: 10/25/2013
Next Scheduled EDR Contact: 02/11/2014
Data Release Frequency: Varies

HWT: Registered Hazardous Waste Transporter Database

A listing of hazardous waste transporters. In California, unless specifically exempted, it is unlawful for any person to transport hazardous wastes unless the person holds a valid registration issued by DTSC. A hazardous waste transporter registration is valid for one year and is assigned a unique registration number.

Date of Government Version: 10/15/2013
Date Data Arrived at EDR: 10/15/2013
Date Made Active in Reports: 11/27/2013
Number of Days to Update: 43

Source: Department of Toxic Substances Control
Telephone: 916-440-7145
Last EDR Contact: 10/15/2013
Next Scheduled EDR Contact: 01/27/2014
Data Release Frequency: Quarterly

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

HWP: EnviroStor Permitted Facilities Listing
Detailed information on permitted hazardous waste facilities and corrective action ("cleanups") tracked in EnviroStor.

Date of Government Version: 11/25/2013
Date Data Arrived at EDR: 11/26/2013
Date Made Active in Reports: 12/31/2013
Number of Days to Update: 35
Source: Department of Toxic Substances Control
Telephone: 916-323-3400
Last EDR Contact: 11/26/2013
Next Scheduled EDR Contact: 03/10/2014
Data Release Frequency: Quarterly

PCB TRANSFORMER: PCB Transformer Registration Database
The database of PCB transformer registrations that includes all PCB registration submittals.

Date of Government Version: 02/01/2011
Date Data Arrived at EDR: 10/19/2011
Date Made Active in Reports: 01/10/2012
Number of Days to Update: 83
Source: Environmental Protection Agency
Telephone: 202-566-0517
Last EDR Contact: 11/01/2013
Next Scheduled EDR Contact: 02/11/2014
Data Release Frequency: Varies

US AIRS MINOR: Air Facility System Data
A listing of minor source facilities.

Date of Government Version: 10/23/2013
Date Data Arrived at EDR: 11/06/2013
Date Made Active in Reports: 12/06/2013
Number of Days to Update: 30
Source: EPA
Telephone: 202-564-5962
Last EDR Contact: 12/26/2013
Next Scheduled EDR Contact: 04/14/2014
Data Release Frequency: Annually

US AIRS (AFS): Aerometric Information Retrieval System Facility Subsystem (AFS)
The database is a sub-system of Aerometric Information Retrieval System (AIRS). AFS contains compliance data on air pollution point sources regulated by the U.S. EPA and/or state and local air regulatory agencies. This information comes from source reports by various stationary sources of air pollution, such as electric power plants, steel mills, factories, and universities, and provides information about the air pollutants they produce. Action, air program, air program pollutant, and general level plant data. It is used to track emissions and compliance data from industrial plants.

Date of Government Version: 10/23/2013
Date Data Arrived at EDR: 11/06/2013
Date Made Active in Reports: 12/06/2013
Number of Days to Update: 30
Source: EPA
Telephone: 202-564-5962
Last EDR Contact: 12/26/2013
Next Scheduled EDR Contact: 04/14/2014
Data Release Frequency: Annually

COAL ASH EPA: Coal Combustion Residues Surface Impoundments List
A listing of coal combustion residues surface impoundments with high hazard potential ratings.

Date of Government Version: 08/17/2010
Date Data Arrived at EDR: 01/03/2011
Date Made Active in Reports: 03/21/2011
Number of Days to Update: 77
Source: Environmental Protection Agency
Telephone: N/A
Last EDR Contact: 12/13/2013
Next Scheduled EDR Contact: 03/24/2014
Data Release Frequency: Varies

US FIN ASSUR: Financial Assurance Information
All owners and operators of facilities that treat, store, or dispose of hazardous waste are required to provide proof that they will have sufficient funds to pay for the clean up, closure, and post-closure care of their facilities.

Date of Government Version: 10/28/2013
Date Data Arrived at EDR: 10/29/2013
Date Made Active in Reports: 12/06/2013
Number of Days to Update: 38
Source: Environmental Protection Agency
Telephone: 202-566-1917
Last EDR Contact: 11/18/2013
Next Scheduled EDR Contact: 03/03/2014
Data Release Frequency: Quarterly

FEDLAND: Federal and Indian Lands

Federally and Indian administrated lands of the United States. Lands included are administrated by: Army Corps of Engineers, Bureau of Reclamation, National Wild and Scenic River, National Wildlife Refuge, Public Domain Land, Wilderness, Wilderness Study Area, Wildlife Management Area, Bureau of Indian Affairs, Bureau of Land Management, Department of Justice, Forest Service, Fish and Wildlife Service, National Park Service.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 02/06/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 339

Source: U.S. Geological Survey
Telephone: 888-275-8747
Last EDR Contact: 10/18/2013
Next Scheduled EDR Contact: 01/27/2014
Data Release Frequency: N/A

PRP: Potentially Responsible Parties

A listing of verified Potentially Responsible Parties

Date of Government Version: 04/15/2013
Date Data Arrived at EDR: 07/03/2013
Date Made Active in Reports: 09/13/2013
Number of Days to Update: 72

Source: EPA
Telephone: 202-564-6023
Last EDR Contact: 01/02/2014
Next Scheduled EDR Contact: 04/14/2014
Data Release Frequency: Quarterly

EPA WATCH LIST: EPA WATCH LIST

EPA maintains a "Watch List" to facilitate dialogue between EPA, state and local environmental agencies on enforcement matters relating to facilities with alleged violations identified as either significant or high priority. Being on the Watch List does not mean that the facility has actually violated the law only that an investigation by EPA or a state or local environmental agency has led those organizations to allege that an unproven violation has in fact occurred. Being on the Watch List does not represent a higher level of concern regarding the alleged violations that were detected, but instead indicates cases requiring additional dialogue between EPA, state and local agencies - primarily because of the length of time the alleged violation has gone unaddressed or unresolved.

Date of Government Version: 06/30/2013
Date Data Arrived at EDR: 08/13/2013
Date Made Active in Reports: 09/13/2013
Number of Days to Update: 31

Source: Environmental Protection Agency
Telephone: 617-520-3000
Last EDR Contact: 11/15/2013
Next Scheduled EDR Contact: 02/24/2014
Data Release Frequency: Quarterly

PROC: Certified Processors Database

A listing of certified processors.

Date of Government Version: 12/16/2013
Date Data Arrived at EDR: 12/17/2013
Date Made Active in Reports: 01/07/2014
Number of Days to Update: 21

Source: Department of Conservation
Telephone: 916-323-3836
Last EDR Contact: 12/17/2013
Next Scheduled EDR Contact: 03/31/2014
Data Release Frequency: Quarterly

MWMP: Medical Waste Management Program Listing

The Medical Waste Management Program (MWMP) ensures the proper handling and disposal of medical waste by permitting and inspecting medical waste Offsite Treatment Facilities (PDF) and Transfer Stations (PDF) throughout the state. MWMP also oversees all Medical Waste Transporters.

Date of Government Version: 09/20/2013
Date Data Arrived at EDR: 12/11/2013
Date Made Active in Reports: 01/04/2014
Number of Days to Update: 24

Source: Department of Public Health
Telephone: 916-558-1784
Last EDR Contact: 12/09/2013
Next Scheduled EDR Contact: 03/24/2014
Data Release Frequency: Varies

COAL ASH DOE: Sleam-Electric Plan Operation Data

A listing of power plants that store ash in surface ponds.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 08/07/2009
Date Made Active in Reports: 10/22/2009
Number of Days to Update: 76

Source: Department of Energy
Telephone: 202-586-8719
Last EDR Contact: 12/10/2013
Next Scheduled EDR Contact: 03/24/2014
Data Release Frequency: Varies

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP: EDR Proprietary Manufactured Gas Plants

The EDR Proprietary Manufactured Gas Plant Database includes records of coal gas plants (manufactured gas plants) compiled by EDR's researchers. Manufactured gas sites were used in the United States from the 1800's to 1950's to produce a gas that could be distributed and used as fuel. These plants used whale oil, rosin, coal, or a mixture of coal, oil, and water that also produced a significant amount of waste. Many of the byproducts of the gas production, such as coal tar (oily waste containing volatile and non-volatile chemicals), sludges, oils and other compounds are potentially hazardous to human health and the environment. The byproduct from this process was frequently disposed of directly at the plant site and can remain or spread slowly, serving as a continuous source of soil and groundwater contamination.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

EDR US Hist Auto Stat: EDR Exclusive Historic Gas Stations

EDR has searched selected national collections of business directories and has collected listings of potential gas station/filling station/service station sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include gas station/filling station/service station establishments. The categories reviewed included, but were not limited to gas, gas station, gasoline station, filling station, auto, automobile repair, auto service station, service station, etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR US Hist Cleaners: EDR Exclusive Historic Dry Cleaners

EDR has searched selected national collections of business directories and has collected listings of potential dry cleaner sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include dry cleaning establishments. The categories reviewed included, but were not limited to dry cleaners, cleaners, laundry, laundromat, cleaning/laundry, wash & dry etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR US Hist Cleaners: EDR Proprietary Historic Dry Cleaners - Cole

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: N/A
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR US Hist Auto Stat: EDR Proprietary Historic Gas Stations - Cole

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: N/A
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA LUST: Recovered Government Archive Leaking Underground Storage Tank

The EDR Recovered Government Archive Leaking Underground Storage Tank database provides a list of LUST incidents derived from historical databases and includes many records that no longer appear in current government lists.

Date of Government Version: N/A
Date Data Arrived at EDR: 07/01/2013
Date Made Active in Reports: 12/30/2013
Number of Days to Update: 182

Source: EDR
Telephone: N/A
Last EDR Contact: 06/01/2012
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

COUNTY RECORDS

ALAMEDA COUNTY:

Contaminated Sites

A listing of contaminated sites overseen by the Toxic Release Program (oil and groundwater contamination from chemical releases and spills) and the Leaking Underground Storage Tank Program (soil and ground water contamination from leaking petroleum USTs).

Date of Government Version: 11/13/2013
Date Data Arrived at EDR: 11/15/2013
Date Made Active in Reports: 12/16/2013
Number of Days to Update: 31

Source: Alameda County Environmental Health Services
Telephone: 510-567-6700
Last EDR Contact: 12/30/2013
Next Scheduled EDR Contact: 04/14/2014
Data Release Frequency: Semi-Annually

Underground Tanks

Underground storage tank sites located in Alameda county.

Date of Government Version: 11/13/2013
Date Data Arrived at EDR: 11/15/2013
Date Made Active in Reports: 12/31/2013
Number of Days to Update: 46

Source: Alameda County Environmental Health Services
Telephone: 510-567-6700
Last EDR Contact: 12/30/2013
Next Scheduled EDR Contact: 04/14/2014
Data Release Frequency: Semi-Annually

AMADOR COUNTY:

CUPA Facility List

Cupa Facility List

Date of Government Version: 12/05/2013
Date Data Arrived at EDR: 12/10/2013
Date Made Active in Reports: 01/03/2014
Number of Days to Update: 24

Source: Amador County Environmental Health
Telephone: 209-223-6439
Last EDR Contact: 12/09/2013
Next Scheduled EDR Contact: 03/24/2014
Data Release Frequency: Varies

BUTTE COUNTY:

CUPA Facility Listing
Cupa facility list.

Date of Government Version: 08/01/2013
Date Data Arrived at EDR: 08/02/2013
Date Made Active in Reports: 08/22/2013
Number of Days to Update: 20

Source: Public Health Department
Telephone: 530-538-7149
Last EDR Contact: 10/09/2013
Next Scheduled EDR Contact: 01/27/2014
Data Release Frequency: No Update Planned

CALVERAS COUNTY:

CUPA Facility Listing
Cupa Facility Listing

Date of Government Version: 09/30/2013
Date Data Arrived at EDR: 10/01/2013
Date Made Active in Reports: 11/26/2013
Number of Days to Update: 56

Source: Calveras County Environmental Health
Telephone: 209-754-6399
Last EDR Contact: 12/30/2013
Next Scheduled EDR Contact: 04/14/2014
Data Release Frequency: Quarterly

COLUSA COUNTY:

CUPA Facility List
Cupa facility list.

Date of Government Version: 06/20/2013
Date Data Arrived at EDR: 07/01/2013
Date Made Active in Reports: 08/09/2013
Number of Days to Update: 39

Source: Health & Human Services
Telephone: 530-458-0396
Last EDR Contact: 11/15/2013
Next Scheduled EDR Contact: 02/24/2014
Data Release Frequency: Varies

CONTRA COSTA COUNTY:

Site List
List includes sites from the underground tank, hazardous waste generator and business plan/2185 programs.

Date of Government Version: 11/18/2013
Date Data Arrived at EDR: 11/19/2013
Date Made Active in Reports: 12/31/2013
Number of Days to Update: 42

Source: Contra Costa Health Services Department
Telephone: 925-646-2286
Last EDR Contact: 11/04/2013
Next Scheduled EDR Contact: 02/17/2014
Data Release Frequency: Semi-Annually

DEL NORTE COUNTY:

CUPA Facility List
Cupa Facility list

Date of Government Version: 01/09/2013
Date Data Arrived at EDR: 01/10/2013
Date Made Active in Reports: 02/25/2013
Number of Days to Update: 46

Source: Del Norte County Environmental Health Division
Telephone: 707-465-0426
Last EDR Contact: 11/04/2013
Next Scheduled EDR Contact: 02/17/2014
Data Release Frequency: Varies

EL DORADO COUNTY:

CUPA Facility List
CUPA facility list.

Date of Government Version: 08/20/2013
Date Data Arrived at EDR: 08/23/2013
Date Made Active in Reports: 10/08/2013
Number of Days to Update: 46

Source: El Dorado County Environmental Management Department
Telephone: 530-621-6623
Last EDR Contact: 11/04/2013
Next Scheduled EDR Contact: 02/17/2014
Data Release Frequency: Varies

FRESNO COUNTY:

CUPA Resources List
Certified Unified Program Agency. CUPA's are responsible for implementing a unified hazardous materials and hazardous waste management regulatory program. The agency provides oversight of businesses that deal with hazardous materials, operate underground storage tanks or aboveground storage tanks.

Date of Government Version: 09/30/2013
Date Data Arrived at EDR: 10/16/2013
Date Made Active in Reports: 11/27/2013
Number of Days to Update: 42

Source: Dept. of Community Health
Telephone: 559-445-3271
Last EDR Contact: 10/09/2013
Next Scheduled EDR Contact: 01/27/2014
Data Release Frequency: Semi-Annually

HUMBOLDT COUNTY:

CUPA Facility List
CUPA facility list.

Date of Government Version: 12/16/2013
Date Data Arrived at EDR: 12/17/2013
Date Made Active in Reports: 01/07/2014
Number of Days to Update: 21

Source: Humboldt County Environmental Health
Telephone: N/A
Last EDR Contact: 11/20/2013
Next Scheduled EDR Contact: 03/10/2014
Data Release Frequency: Varies

IMPERIAL COUNTY:

CUPA Facility List
Cupa facility list.

Date of Government Version: 11/06/2013
Date Data Arrived at EDR: 11/06/2013
Date Made Active in Reports: 12/04/2013
Number of Days to Update: 28

Source: San Diego Border Field Office
Telephone: 760-339-2777
Last EDR Contact: 10/28/2013
Next Scheduled EDR Contact: 02/11/2014
Data Release Frequency: Varies

INYO COUNTY:

CUPA Facility List
Cupa facility list.

Date of Government Version: 09/10/2013
Date Data Arrived at EDR: 09/11/2013
Date Made Active in Reports: 10/14/2013
Number of Days to Update: 33

Source: Inyo County Environmental Health Services
Telephone: 760-878-0238
Last EDR Contact: 12/09/2013
Next Scheduled EDR Contact: 03/10/2014
Data Release Frequency: Varies

KERN COUNTY:

Underground Storage Tank Sites & Tank Listing
Kern County Sites and Tanks Listing.

Date of Government Version: 08/31/2010
Date Data Arrived at EDR: 09/01/2010
Date Made Active in Reports: 09/30/2010
Number of Days to Update: 29

Source: Kern County Environment Health Services Department
Telephone: 661-862-8700
Last EDR Contact: 11/08/2013
Next Scheduled EDR Contact: 02/24/2014
Data Release Frequency: Quarterly

KINGS COUNTY:

CUPA Facility List
A listing of sites included in the county's Certified Unified Program Agency database. California's Secretary for Environmental Protection established the unified hazardous materials and hazardous waste regulatory program as required by chapter 6.11 of the California Health and Safety Code. The Unified Program consolidates the administration, permits, inspections, and enforcement activities.

Date of Government Version: 12/12/2013
Date Data Arrived at EDR: 12/13/2013
Date Made Active in Reports: 01/07/2014
Number of Days to Update: 25

Source: Kings County Department of Public Health
Telephone: 559-584-1411
Last EDR Contact: 12/09/2013
Next Scheduled EDR Contact: 03/10/2014
Data Release Frequency: Varies

LAKE COUNTY:

CUPA Facility List
Cupa facility list

Date of Government Version: 01/23/2013
Date Data Arrived at EDR: 01/25/2013
Date Made Active in Reports: 02/27/2013
Number of Days to Update: 33

Source: Lake County Environmental Health
Telephone: 707-263-1164
Last EDR Contact: 10/21/2013
Next Scheduled EDR Contact: 02/03/2014
Data Release Frequency: Varies

LOS ANGELES COUNTY:

San Gabriel Valley Areas of Concern
San Gabriel Valley areas where VOC contamination is at or above the MCL as designated by region 9 EPA office.

Date of Government Version: 03/30/2009
Date Data Arrived at EDR: 03/31/2009
Date Made Active in Reports: 10/23/2009
Number of Days to Update: 206

Source: EPA Region 9
Telephone: 415-972-3178
Last EDR Contact: 12/17/2013
Next Scheduled EDR Contact: 04/07/2014
Data Release Frequency: No Update Planned

HMS: Street Number List
Industrial Waste and Underground Storage Tank Sites.

Date of Government Version: 03/28/2013
Date Data Arrived at EDR: 06/17/2013
Date Made Active in Reports: 08/21/2013
Number of Days to Update: 65

Source: Department of Public Works
Telephone: 626-458-3517
Last EDR Contact: 10/09/2013
Next Scheduled EDR Contact: 01/27/2014
Data Release Frequency: Semi-Annually

List of Solid Waste Facilities
Solid Waste Facilities in Los Angeles County.

Date of Government Version: 10/21/2013
Date Data Arrived at EDR: 10/22/2013
Date Made Active in Reports: 11/27/2013
Number of Days to Update: 36

Source: La County Department of Public Works
Telephone: 818-458-5185
Last EDR Contact: 10/22/2013
Next Scheduled EDR Contact: 02/03/2014
Data Release Frequency: Varies

City of Los Angeles Landfills

Landfills owned and maintained by the City of Los Angeles.

Date of Government Version: 03/05/2009
Date Data Arrived at EDR: 03/10/2009
Date Made Active in Reports: 04/08/2009
Number of Days to Update: 29

Source: Engineering & Construction Division
Telephone: 213-473-7869
Last EDR Contact: 07/17/2013
Next Scheduled EDR Contact: 11/04/2013
Data Release Frequency: Varies

Site Mitigation List

Industrial sites that have had some sort of spill or complaint.

Date of Government Version: 01/30/2013
Date Data Arrived at EDR: 02/21/2013
Date Made Active in Reports: 03/25/2013
Number of Days to Update: 32

Source: Community Health Services
Telephone: 323-890-7806
Last EDR Contact: 10/21/2013
Next Scheduled EDR Contact: 02/03/2014
Data Release Frequency: Annually

City of El Segundo Underground Storage Tank

Underground storage tank sites located in El Segundo city.

Date of Government Version: 10/21/2013
Date Data Arrived at EDR: 10/25/2013
Date Made Active in Reports: 11/27/2013
Number of Days to Update: 33

Source: City of El Segundo Fire Department
Telephone: 310-524-2236
Last EDR Contact: 10/21/2013
Next Scheduled EDR Contact: 02/03/2014
Data Release Frequency: Semi-Annually

City of Long Beach Underground Storage Tank

Underground storage tank sites located in the city of Long Beach.

Date of Government Version: 03/28/2003
Date Data Arrived at EDR: 10/23/2003
Date Made Active in Reports: 11/26/2003
Number of Days to Update: 34

Source: City of Long Beach Fire Department
Telephone: 562-570-2563
Last EDR Contact: 10/28/2013
Next Scheduled EDR Contact: 02/11/2014
Data Release Frequency: Annually

City of Torrance Underground Storage Tank

Underground storage tank sites located in the city of Torrance.

Date of Government Version: 07/15/2013
Date Data Arrived at EDR: 07/18/2013
Date Made Active in Reports: 08/20/2013
Number of Days to Update: 33

Source: City of Torrance Fire Department
Telephone: 310-618-2973
Last EDR Contact: 10/09/2013
Next Scheduled EDR Contact: 01/27/2014
Data Release Frequency: Semi-Annually

MADERA COUNTY:

CUPA Facility List

A listing of sites included in the county's Certified Unified Program Agency database. California's Secretary for Environmental Protection established the unified hazardous materials and hazardous waste regulatory program as required by chapter 6.11 of the California Health and Safety Code. The Unified Program consolidates the administration, permits, inspections, and enforcement activities.

Date of Government Version: 09/20/2013
Date Data Arrived at EDR: 09/24/2013
Date Made Active in Reports: 10/18/2013
Number of Days to Update: 24

Source: Madera County Environmental Health
Telephone: 559-675-7823
Last EDR Contact: 11/20/2013
Next Scheduled EDR Contact: 03/10/2014
Data Release Frequency: Varies

MARIN COUNTY:

Underground Storage Tank Sites
Currently permitted USTs in Marin County.

Date of Government Version: 10/07/2013
Date Data Arrived at EDR: 10/09/2013
Date Made Active in Reports: 11/26/2013
Number of Days to Update: 48

Source: Public Works Department Waste Management
Telephone: 415-499-6647
Last EDR Contact: 01/03/2014
Next Scheduled EDR Contact: 04/21/2014
Data Release Frequency: Semi-Annually

MERCED COUNTY:

CUPA Facility List
CUPA facility list.

Date of Government Version: 08/23/2013
Date Data Arrived at EDR: 08/27/2013
Date Made Active in Reports: 10/08/2013
Number of Days to Update: 42

Source: Merced County Environmental Health
Telephone: 209-381-1094
Last EDR Contact: 11/20/2013
Next Scheduled EDR Contact: 03/10/2014
Data Release Frequency: Varies

MONO COUNTY:

CUPA Facility List
CUPA Facility List

Date of Government Version: 12/02/2013
Date Data Arrived at EDR: 12/03/2013
Date Made Active in Reports: 01/02/2014
Number of Days to Update: 30

Source: Mono County Health Department
Telephone: 760-932-5580
Last EDR Contact: 12/02/2013
Next Scheduled EDR Contact: 03/17/2014
Data Release Frequency: Varies

MONTEREY COUNTY:

CUPA Facility Listing
CUPA Program listing from the Environmental Health Division.

Date of Government Version: 09/11/2013
Date Data Arrived at EDR: 09/12/2013
Date Made Active in Reports: 10/14/2013
Number of Days to Update: 32

Source: Monterey County Health Department
Telephone: 831-796-1297
Last EDR Contact: 11/20/2013
Next Scheduled EDR Contact: 03/10/2014
Data Release Frequency: Varies

NAPA COUNTY:

Sites With Reported Contamination
A listing of leaking underground storage tank sites located in Napa county.

Date of Government Version: 12/05/2011
Date Data Arrived at EDR: 12/06/2011
Date Made Active in Reports: 02/07/2012
Number of Days to Update: 63

Source: Napa County Department of Environmental Management
Telephone: 707-253-4269
Last EDR Contact: 12/02/2013
Next Scheduled EDR Contact: 03/17/2014
Data Release Frequency: No Update Planned

Closed and Operating Underground Storage Tank Sites
Underground storage tank sites located in Napa county.

Date of Government Version: 01/15/2008
Date Data Arrived at EDR: 01/16/2008
Date Made Active in Reports: 02/08/2008
Number of Days to Update: 23

Source: Napa County Department of Environmental Management
Telephone: 707-253-4269
Last EDR Contact: 12/02/2013
Next Scheduled EDR Contact: 03/17/2014
Data Release Frequency: No Update Planned

NEVADA COUNTY:

CUPA Facility List
CUPA facility list.

Date of Government Version: 11/06/2013
Date Data Arrived at EDR: 11/07/2013
Date Made Active in Reports: 12/04/2013
Number of Days to Update: 27

Source: Community Development Agency
Telephone: 530-265-1467
Last EDR Contact: 11/04/2013
Next Scheduled EDR Contact: 02/17/2014
Data Release Frequency: Varies

ORANGE COUNTY:

List of Industrial Site Cleanups
Petroleum and non-petroleum spills.

Date of Government Version: 11/04/2013
Date Data Arrived at EDR: 11/13/2013
Date Made Active in Reports: 12/04/2013
Number of Days to Update: 21

Source: Health Care Agency
Telephone: 714-834-3446
Last EDR Contact: 11/08/2013
Next Scheduled EDR Contact: 02/24/2014
Data Release Frequency: Annually

List of Underground Storage Tank Cleanups
Orange County Underground Storage Tank Cleanups (LUST).

Date of Government Version: 11/04/2013
Date Data Arrived at EDR: 11/13/2013
Date Made Active in Reports: 12/04/2013
Number of Days to Update: 21

Source: Health Care Agency
Telephone: 714-834-3446
Last EDR Contact: 11/08/2013
Next Scheduled EDR Contact: 02/24/2014
Data Release Frequency: Quarterly

List of Underground Storage Tank Facilities
Orange County Underground Storage Tank Facilities (UST).

Date of Government Version: 11/04/2013
Date Data Arrived at EDR: 11/13/2013
Date Made Active in Reports: 12/04/2013
Number of Days to Update: 21

Source: Health Care Agency
Telephone: 714-834-3446
Last EDR Contact: 11/08/2013
Next Scheduled EDR Contact: 02/24/2014
Data Release Frequency: Quarterly

PLACER COUNTY:

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Master List of Facilities
List includes aboveground tanks, underground tanks and cleanup sites.

Date of Government Version: 12/09/2013
Date Data Arrived at EDR: 12/10/2013
Date Made Active in Reports: 01/07/2014
Number of Days to Update: 28
Source: Placer County Health and Human Services
Telephone: 530-745-2363
Last EDR Contact: 12/09/2013
Next Scheduled EDR Contact: 03/24/2014
Data Release Frequency: Semi-Annually

RIVERSIDE COUNTY:

Listing of Underground Tank Cleanup Sites
Riverside County Underground Storage Tank Cleanup Sites (LUST).

Date of Government Version: 10/10/2013
Date Data Arrived at EDR: 10/22/2013
Date Made Active in Reports: 11/27/2013
Number of Days to Update: 36
Source: Department of Environmental Health
Telephone: 951-358-5055
Last EDR Contact: 12/19/2013
Next Scheduled EDR Contact: 04/07/2014
Data Release Frequency: Quarterly

Underground Storage Tank Tank List
Underground storage tank sites located in Riverside county.

Date of Government Version: 10/10/2013
Date Data Arrived at EDR: 10/22/2013
Date Made Active in Reports: 11/27/2013
Number of Days to Update: 36
Source: Department of Environmental Health
Telephone: 951-358-5055
Last EDR Contact: 12/19/2013
Next Scheduled EDR Contact: 04/07/2014
Data Release Frequency: Quarterly

SACRAMENTO COUNTY:

Toxic Site Clean-Up List
List of sites where unauthorized releases of potentially hazardous materials have occurred.

Date of Government Version: 08/05/2013
Date Data Arrived at EDR: 10/10/2013
Date Made Active in Reports: 11/26/2013
Number of Days to Update: 47
Source: Sacramento County Environmental Management
Telephone: 916-875-8406
Last EDR Contact: 01/06/2014
Next Scheduled EDR Contact: 04/21/2014
Data Release Frequency: Quarterly

Master Hazardous Materials Facility List
Any business that has hazardous materials on site - hazardous material storage sites, underground storage tanks, waste generators.

Date of Government Version: 08/05/2013
Date Data Arrived at EDR: 10/10/2013
Date Made Active in Reports: 11/26/2013
Number of Days to Update: 47
Source: Sacramento County Environmental Management
Telephone: 916-875-8406
Last EDR Contact: 01/06/2014
Next Scheduled EDR Contact: 04/21/2014
Data Release Frequency: Quarterly

SAN BERNARDINO COUNTY:

Hazardous Material Permits
This listing includes underground storage tanks, medical waste handlers/generators, hazardous materials handlers, hazardous waste generators, and waste oil generators/handlers.

Date of Government Version: 11/26/2013
Date Data Arrived at EDR: 11/27/2013
Date Made Active in Reports: 12/31/2013
Number of Days to Update: 34

Source: San Bernardino County Fire Department Hazardous Materials Division
Telephone: 909-387-3041
Last EDR Contact: 11/08/2013
Next Scheduled EDR Contact: 02/24/2014
Data Release Frequency: Quarterly

SAN DIEGO COUNTY:

Hazardous Materials Management Division Database

The database includes: HE58 - This report contains the business name, site address, business phone number, establishment 'H' permit number, type of permit, and the business status. HE17 - In addition to providing the same information provided in the HE58 listing, HE17 provides inspection dates, violations received by the establishment, hazardous waste generated, the quantity, method of storage, treatment/disposal of waste and the hauler, and information on underground storage tanks. Unauthorized Release List - Includes a summary of environmental contamination cases in San Diego County (underground tank cases, non-tank cases, groundwater contamination, and soil contamination are included.)

Date of Government Version: 09/23/2013
Date Data Arrived at EDR: 09/24/2013
Date Made Active in Reports: 10/17/2013
Number of Days to Update: 23

Source: Hazardous Materials Management Division
Telephone: 619-338-2268
Last EDR Contact: 12/09/2013
Next Scheduled EDR Contact: 03/24/2014
Data Release Frequency: Quarterly

Solid Waste Facilities

San Diego County Solid Waste Facilities.

Date of Government Version: 10/31/2013
Date Data Arrived at EDR: 11/19/2013
Date Made Active in Reports: 12/31/2013
Number of Days to Update: 42

Source: Department of Health Services
Telephone: 619-338-2209
Last EDR Contact: 11/18/2013
Next Scheduled EDR Contact: 02/11/2014
Data Release Frequency: Varies

Environmental Case Listing

The listing contains all underground tank release cases and projects pertaining to properties contaminated with hazardous substances that are actively under review by the Site Assessment and Mitigation Program.

Date of Government Version: 03/23/2010
Date Data Arrived at EDR: 06/15/2010
Date Made Active in Reports: 07/09/2010
Number of Days to Update: 24

Source: San Diego County Department of Environmental Health
Telephone: 619-338-2371
Last EDR Contact: 12/09/2013
Next Scheduled EDR Contact: 03/24/2014
Data Release Frequency: No Update Planned

SAN FRANCISCO COUNTY:

Local Oversite Facilities

A listing of leaking underground storage tank sites located in San Francisco county.

Date of Government Version: 09/19/2008
Date Data Arrived at EDR: 09/19/2008
Date Made Active in Reports: 09/29/2008
Number of Days to Update: 10

Source: Department Of Public Health San Francisco County
Telephone: 415-252-3920
Last EDR Contact: 11/08/2013
Next Scheduled EDR Contact: 02/24/2014
Data Release Frequency: Quarterly

Underground Storage Tank Information

Underground storage tank sites located in San Francisco county.

Date of Government Version: 11/29/2010
Date Data Arrived at EDR: 03/10/2011
Date Made Active in Reports: 03/15/2011
Number of Days to Update: 5

Source: Department of Public Health
Telephone: 415-252-3920
Last EDR Contact: 11/08/2013
Next Scheduled EDR Contact: 02/24/2014
Data Release Frequency: Quarterly

SAN JOAQUIN COUNTY:

San Joaquin Co. UST
A listing of underground storage tank locations in San Joaquin county.

Date of Government Version: 12/18/2013
Date Data Arrived at EDR: 12/19/2013
Date Made Active in Reports: 01/08/2014
Number of Days to Update: 20

Source: Environmental Health Department
Telephone: N/A
Last EDR Contact: 12/17/2013
Next Scheduled EDR Contact: 04/07/2014
Data Release Frequency: Semi-Annually

SAN LUIS OBISPO COUNTY:

CUPA Facility List
Cupa Facility List.

Date of Government Version: 08/26/2013
Date Data Arrived at EDR: 08/27/2013
Date Made Active in Reports: 10/10/2013
Number of Days to Update: 44

Source: San Luis Obispo County Public Health Department
Telephone: 805-781-5596
Last EDR Contact: 11/20/2013
Next Scheduled EDR Contact: 03/10/2014
Data Release Frequency: Varies

SAN MATEO COUNTY:

Business Inventory
List includes Hazardous Materials Business Plan, hazardous waste generators, and underground storage tanks.

Date of Government Version: 10/01/2013
Date Data Arrived at EDR: 10/08/2013
Date Made Active in Reports: 11/26/2013
Number of Days to Update: 49

Source: San Mateo County Environmental Health Services Division
Telephone: 650-363-1921
Last EDR Contact: 12/16/2013
Next Scheduled EDR Contact: 03/31/2014
Data Release Frequency: Annually

Fuel Leak List
A listing of leaking underground storage tank sites located in San Mateo county.

Date of Government Version: 12/12/2013
Date Data Arrived at EDR: 12/17/2013
Date Made Active in Reports: 01/07/2014
Number of Days to Update: 21

Source: San Mateo County Environmental Health Services Division
Telephone: 650-363-1921
Last EDR Contact: 12/12/2013
Next Scheduled EDR Contact: 03/31/2014
Data Release Frequency: Semi-Annually

SANTA BARBARA COUNTY:

CUPA Facility Listing
CUPA Program Listing from the Environmental Health Services division.

Date of Government Version: 09/08/2011
Date Data Arrived at EDR: 09/09/2011
Date Made Active in Reports: 10/07/2011
Number of Days to Update: 28

Source: Santa Barbara County Public Health Department
Telephone: 805-686-8167
Last EDR Contact: 11/21/2013
Next Scheduled EDR Contact: 03/10/2014
Data Release Frequency: Varies

SANTA CLARA COUNTY:

Cupa Facility List
Cupa facility list

Date of Government Version: 09/03/2013
Date Data Arrived at EDR: 09/04/2013
Date Made Active in Reports: 10/10/2013
Number of Days to Update: 36

Source: Department of Environmental Health
Telephone: 408-918-1973
Last EDR Contact: 12/02/2013
Next Scheduled EDR Contact: 03/17/2014
Data Release Frequency: Varies

HIST LUST - Fuel Leak Site Activity Report
A listing of open and closed leaking underground storage tanks. This listing is no longer updated by the county. Leaking underground storage tanks are now handled by the Department of Environmental Health.

Date of Government Version: 03/29/2005
Date Data Arrived at EDR: 03/30/2005
Date Made Active in Reports: 04/21/2005
Number of Days to Update: 22

Source: Santa Clara Valley Water District
Telephone: 408-265-2600
Last EDR Contact: 03/23/2009
Next Scheduled EDR Contact: 06/22/2009
Data Release Frequency: No Update Planned

LOP Listing
A listing of leaking underground storage tanks located in Santa Clara county.

Date of Government Version: 12/02/2013
Date Data Arrived at EDR: 12/03/2013
Date Made Active in Reports: 01/02/2014
Number of Days to Update: 30

Source: Department of Environmental Health
Telephone: 408-918-3417
Last EDR Contact: 12/02/2013
Next Scheduled EDR Contact: 03/17/2014
Data Release Frequency: Annually

Hazardous Material Facilities
Hazardous material facilities, including underground storage tank sites.

Date of Government Version: 11/12/2013
Date Data Arrived at EDR: 11/15/2013
Date Made Active in Reports: 01/03/2014
Number of Days to Update: 49

Source: City of San Jose Fire Department
Telephone: 408-535-7694
Last EDR Contact: 11/08/2013
Next Scheduled EDR Contact: 02/24/2014
Data Release Frequency: Annually

SANTA CRUZ COUNTY:

CUPA Facility List
CUPA facility listing.

Date of Government Version: 12/09/2013
Date Data Arrived at EDR: 12/10/2013
Date Made Active in Reports: 01/03/2014
Number of Days to Update: 24

Source: Santa Cruz County Environmental Health
Telephone: 831-464-2761
Last EDR Contact: 12/09/2013
Next Scheduled EDR Contact: 03/10/2014
Data Release Frequency: Varies

SHASTA COUNTY:

CUPA Facility List
Cupa Facility List.

Date of Government Version: 12/03/2013
Date Data Arrived at EDR: 12/04/2013
Date Made Active in Reports: 01/02/2014
Number of Days to Update: 29

Source: Shasta County Department of Resource Management
Telephone: 530-225-5789
Last EDR Contact: 11/21/2013
Next Scheduled EDR Contact: 03/10/2014
Data Release Frequency: Varies

SOLANO COUNTY:

Leaking Underground Storage Tanks
A listing of leaking underground storage tank sites located in Solano county.

Date of Government Version: 12/16/2013
Date Data Arrived at EDR: 12/18/2013
Date Made Active in Reports: 01/08/2014
Number of Days to Update: 21

Source: Solano County Department of Environmental Management
Telephone: 707-784-6770
Last EDR Contact: 12/12/2013
Next Scheduled EDR Contact: 03/31/2014
Data Release Frequency: Quarterly

Underground Storage Tanks
Underground storage tank sites located in Solano county.

Date of Government Version: 12/16/2013
Date Data Arrived at EDR: 12/19/2013
Date Made Active in Reports: 01/08/2014
Number of Days to Update: 20

Source: Solano County Department of Environmental Management
Telephone: 707-784-6770
Last EDR Contact: 12/12/2013
Next Scheduled EDR Contact: 03/31/2014
Data Release Frequency: Quarterly

SONOMA COUNTY:

Cupa Facility List
Cupa Facility list

Date of Government Version: 09/30/2013
Date Data Arrived at EDR: 10/01/2013
Date Made Active in Reports: 11/26/2013
Number of Days to Update: 56

Source: County of Sonoma Fire & Emergency Services Department
Telephone: 707-565-1174
Last EDR Contact: 12/30/2013
Next Scheduled EDR Contact: 04/14/2014
Data Release Frequency: Varies

Leaking Underground Storage Tank Sites
A listing of leaking underground storage tank sites located in Sonoma county.

Date of Government Version: 10/01/2013
Date Data Arrived at EDR: 10/02/2013
Date Made Active in Reports: 11/26/2013
Number of Days to Update: 55

Source: Department of Health Services
Telephone: 707-565-6565
Last EDR Contact: 12/30/2013
Next Scheduled EDR Contact: 04/14/2014
Data Release Frequency: Quarterly

SUTTER COUNTY:

Underground Storage Tanks
Underground storage tank sites located in Sutter county.

Date of Government Version: 12/10/2013
Date Data Arrived at EDR: 12/11/2013
Date Made Active in Reports: 01/04/2014
Number of Days to Update: 24

Source: Sutter County Department of Agriculture
Telephone: 530-822-7500
Last EDR Contact: 12/09/2013
Next Scheduled EDR Contact: 03/24/2014
Data Release Frequency: Semi-Annually

TUOLUMNE COUNTY:

CUPA Facility List
Cupa facility list

Date of Government Version: 11/04/2013
Date Data Arrived at EDR: 11/06/2013
Date Made Active in Reports: 12/04/2013
Number of Days to Update: 28

Source: Divison of Environmental Health
Telephone: 209-533-5633
Last EDR Contact: 10/28/2013
Next Scheduled EDR Contact: 02/11/2014
Data Release Frequency: Varies

VENTURA COUNTY:

Business Plan, Hazardous Waste Producers, and Operating Underground Tanks

The BWT list indicates by site address whether the Environmental Health Division has Business Plan (B), Waste Producer (W), and/or Underground Tank (T) information.

Date of Government Version: 08/19/2013
Date Data Arrived at EDR: 08/27/2013
Date Made Active in Reports: 10/10/2013
Number of Days to Update: 44

Source: Ventura County Environmental Health Division
Telephone: 805-654-2813
Last EDR Contact: 11/19/2013
Next Scheduled EDR Contact: 03/03/2014
Data Release Frequency: Quarterly

Inventory of Illegal Abandoned and Inactive Sites

Ventura County Inventory of Closed, Illegal Abandoned, and Inactive Sites.

Date of Government Version: 12/01/2011
Date Data Arrived at EDR: 12/01/2011
Date Made Active in Reports: 01/19/2012
Number of Days to Update: 49

Source: Environmental Health Division
Telephone: 805-654-2813
Last EDR Contact: 01/03/2014
Next Scheduled EDR Contact: 04/21/2014
Data Release Frequency: Annually

Listing of Underground Tank Cleanup Sites

Ventura County Underground Storage Tank Cleanup Sites (LUST).

Date of Government Version: 05/29/2008
Date Data Arrived at EDR: 06/24/2008
Date Made Active in Reports: 07/31/2008
Number of Days to Update: 37

Source: Environmental Health Division
Telephone: 805-654-2813
Last EDR Contact: 11/19/2013
Next Scheduled EDR Contact: 03/03/2014
Data Release Frequency: Quarterly

Medical Waste Program List

To protect public health and safety and the environment from potential exposure to disease causing agents, the Environmental Health Division Medical Waste Program regulates the generation, handling, storage, treatment and disposal of medical waste throughout the County.

Date of Government Version: 10/02/2013
Date Data Arrived at EDR: 10/30/2013
Date Made Active in Reports: 11/27/2013
Number of Days to Update: 28

Source: Ventura County Resource Management Agency
Telephone: 805-654-2813
Last EDR Contact: 10/28/2013
Next Scheduled EDR Contact: 02/11/2014
Data Release Frequency: Quarterly

Underground Tank Closed Sites List

Ventura County Operating Underground Storage Tank Sites (UST)/Underground Tank Closed Sites List.

Date of Government Version: 11/26/2013
Date Data Arrived at EDR: 12/18/2013
Date Made Active in Reports: 01/08/2014
Number of Days to Update: 21

Source: Environmental Health Division
Telephone: 805-654-2813
Last EDR Contact: 12/16/2013
Next Scheduled EDR Contact: 03/31/2014
Data Release Frequency: Quarterly

YOLO COUNTY:

Underground Storage Tank Comprehensive Facility Report

Underground storage tank sites located in Yolo county.

Date of Government Version: 12/18/2013
Date Data Arrived at EDR: 12/24/2013
Date Made Active in Reports: 01/08/2014
Number of Days to Update: 15

Source: Yolo County Department of Health
Telephone: 530-666-8646
Last EDR Contact: 12/17/2013
Next Scheduled EDR Contact: 04/07/2014
Data Release Frequency: Annually

YUBA COUNTY:

CUPA Facility List
CUPA facility listing for Yuba County.

Date of Government Version: 12/06/2013
Date Data Arrived at EDR: 12/10/2013
Date Made Active in Reports: 01/04/2014
Number of Days to Update: 25

Source: Yuba County Environmental Health Department
Telephone: 530-749-7523
Last EDR Contact: 12/06/2013
Next Scheduled EDR Contact: 02/17/2014
Data Release Frequency: Varies

OTHER DATABASE(S)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

CT MANIFEST: Hazardous Waste Manifest Data
Facility and manifest data. Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a tsd facility.

Date of Government Version: 07/30/2013
Date Data Arrived at EDR: 08/19/2013
Date Made Active in Reports: 10/03/2013
Number of Days to Update: 45

Source: Department of Energy & Environmental Protection
Telephone: 860-424-3375
Last EDR Contact: 11/22/2013
Next Scheduled EDR Contact: 03/03/2014
Data Release Frequency: Annually

NJ MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2011
Date Data Arrived at EDR: 07/19/2012
Date Made Active in Reports: 08/28/2012
Number of Days to Update: 40

Source: Department of Environmental Protection
Telephone: N/A
Last EDR Contact: 10/18/2013
Next Scheduled EDR Contact: 01/27/2014
Data Release Frequency: Annually

NY MANIFEST: Facility and Manifest Data
Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a TSD facility.

Date of Government Version: 11/01/2013
Date Data Arrived at EDR: 11/07/2013
Date Made Active in Reports: 11/18/2013
Number of Days to Update: 11

Source: Department of Environmental Conservation
Telephone: 518-402-8651
Last EDR Contact: 11/07/2013
Next Scheduled EDR Contact: 02/17/2014
Data Release Frequency: Annually

PA MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2012
Date Data Arrived at EDR: 07/24/2013
Date Made Active in Reports: 08/19/2013
Number of Days to Update: 26

Source: Department of Environmental Protection
Telephone: 717-783-8990
Last EDR Contact: 10/21/2013
Next Scheduled EDR Contact: 02/03/2014
Data Release Frequency: Annually

RI MANIFEST: Manifest information
Hazardous waste manifest information

Date of Government Version: 12/31/2012
Date Data Arrived at EDR: 06/21/2013
Date Made Active in Reports: 08/05/2013
Number of Days to Update: 45

Source: Department of Environmental Management
Telephone: 401-222-2797
Last EDR Contact: 11/25/2013
Next Scheduled EDR Contact: 03/10/2014
Data Release Frequency: Annually

WI MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2012
Date Data Arrived at EDR: 08/09/2013
Date Made Active in Reports: 09/27/2013
Number of Days to Update: 49

Source: Department of Natural Resources
Telephone: N/A
Last EDR Contact: 12/11/2013
Next Scheduled EDR Contact: 03/31/2014
Data Release Frequency: Annually

Oil/Gas Pipelines: This data was obtained by EDR from the USGS in 1994. It is referred to by USGS as GeoData Digital Line Graphs from 1:100,000-Scale Maps. It was extracted from the transportation category including some oil, but primarily gas pipelines.

Electric Power Transmission Line Data
Source: Rextag Strategies Corp.
Telephone: (281) 769-2247
U.S. Electric Transmission and Power Plants Systems Digital GIS Data

Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

AHA Hospitals:
Source: American Hospital Association, Inc.
Telephone: 312-280-5991
The database includes a listing of hospitals based on the American Hospital Association's annual survey of hospitals.

Medical Centers: Provider of Services Listing
Source: Centers for Medicare & Medicaid Services
Telephone: 410-786-3000
A listing of hospitals with Medicare provider number, produced by Centers of Medicare & Medicaid Services, a federal agency within the U.S. Department of Health and Human Services.

Nursing Homes
Source: National Institutes of Health
Telephone: 301-594-6248
Information on Medicare and Medicaid certified nursing homes in the United States.

Public Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on elementary and secondary public education in the United States. It is a comprehensive, annual, national statistical database of all public elementary and secondary schools and school districts, which contains data that are comparable across all states.

Private Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on private school locations in the United States.

Daycare Centers: Licensed Facilities
Source: Department of Social Services
Telephone: 916-657-4041

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 2003 & 2011 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002 and 2005 from the U.S. Fish and Wildlife Service.

Scanned Digital USGS 7.5' Topographic Map (DRG)
Source: United States Geologic Survey
A digital raster graphic (DRG) is a scanned image of a U.S. Geological Survey topographic map. The map images are made by scanning published paper maps on high-resolution scanners. The raster image is georeferenced and fit to the Universal Transverse Mercator (UTM) projection.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

STREET AND ADDRESS INFORMATION

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GEOCHECK ®- PHYSICAL SETTING SOURCE ADDENDUM

TARGET PROPERTY ADDRESS

LODI PHASE I ESA
12755 N THORNTON RD
LODI, CA 95242

TARGET PROPERTY COORDINATES

Latitude (North):	38.0953 - 38° 5' 43.08''
Longitude (West):	121.3895 - 121° 23' 22.20''
Universal Tranverse Mercator:	Zone 10
UTM X (Meters):	641222.4
UTM Y (Meters):	4217407.5
Elevation:	7 ft. above sea level

USGS TOPOGRAPHIC MAP

Target Property Map:	38121-A4 TERMINOUS, CA
Most Recent Revision:	1993
East Map:	38121-A3 LODI SOUTH, CA
Most Recent Revision:	1976

EDR's GeoCheck Physical Setting Source Addendum is provided to assist the environmental professional in forming an opinion about the impact of potential contaminant migration.

Assessment of the impact of contaminant migration generally has two principal investigative components:

1. Groundwater flow direction, and
2. Groundwater flow velocity.

Groundwater flow direction may be impacted by surface topography, hydrology, hydrogeology, characteristics of the soil, and nearby wells. Groundwater flow velocity is generally impacted by the nature of the geologic strata.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW DIRECTION INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, such as surface topographic information, hydrologic information, hydrogeologic data collected on nearby properties, and regional groundwater flow information (from deep aquifers).

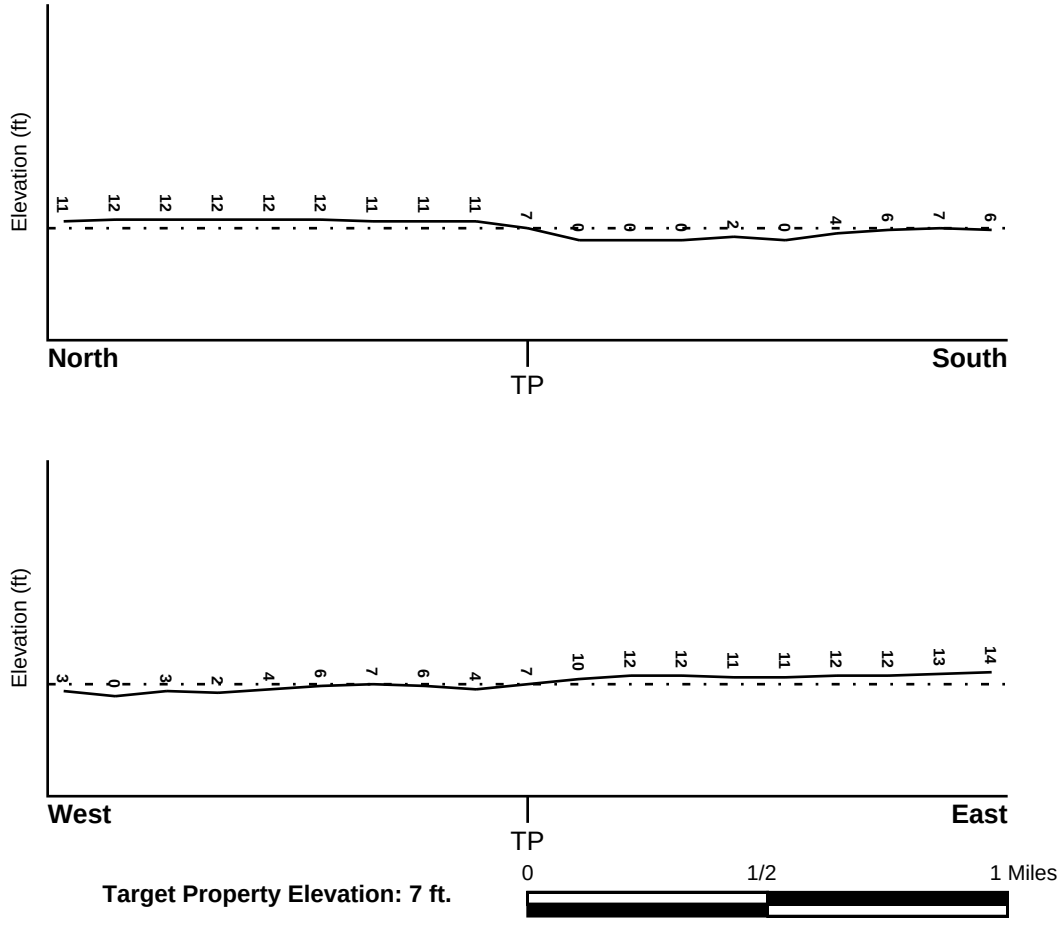
TOPOGRAPHIC INFORMATION

Surface topography may be indicative of the direction of surficial groundwater flow. This information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

TARGET PROPERTY TOPOGRAPHY

General Topographic Gradient: General SSW

SURROUNDING TOPOGRAPHY: ELEVATION PROFILES



Target Property Elevation: 7 ft.

Source: Topography has been determined from the USGS 7.5' Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

HYDROLOGIC INFORMATION

Surface water can act as a hydrologic barrier to groundwater flow. Such hydrologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Refer to the Physical Setting Source Map following this summary for hydrologic information (major waterways and bodies of water).

FEMA FLOOD ZONE

Target Property County	FEMA Flood Electronic Data
SAN JOAQUIN, CA	YES - refer to the Overview Map and Detail Map

Flood Plain Panel at Target Property: 06077C - FEMA DFIRM Flood data

Additional Panels in search area: Not Reported

NATIONAL WETLAND INVENTORY

NWI Quad at Target Property	NWI Electronic Data Coverage
TERMINOUS	YES - refer to the Overview Map and Detail Map

HYDROGEOLOGIC INFORMATION

Hydrogeologic information obtained by installation of wells on a specific site can often be an indicator of groundwater flow direction in the immediate area. Such hydrogeologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Site-Specific Hydrogeological Data*:

Search Radius:	1.25 miles
Status:	Not found

AQUIFLOW®

Search Radius: 1.000 Mile.

EDR has developed the AQUIFLOW Information System to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted by environmental professionals to regulatory authorities at select sites and has extracted the date of the report, groundwater flow direction as determined hydrogeologically, and the depth to water table.

MAP ID	LOCATION FROM TP	GENERAL DIRECTION GROUNDWATER FLOW
Not Reported		

* ©1996 Site−specific hydrogeological data gathered by CERCLIS Alerts, Inc., Bainbridge Island, WA. All rights reserved. All of the information and opinions presented are those of the cited EPA report(s), which were completed under a Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS) investigation.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW VELOCITY INFORMATION

Groundwater flow velocity information for a particular site is best determined by a qualified environmental professional using site specific geologic and soil strata data. If such data are not reasonably ascertainable, it may be necessary to rely on other sources of information, including geologic age identification, rock stratigraphic unit and soil characteristics data collected on nearby properties and regional soil information. In general, contaminant plumes move more quickly through sandy-gravelly types of soils than silty-clayey types of soils.

GEOLOGIC INFORMATION IN GENERAL AREA OF TARGET PROPERTY

Geologic information can be used by the environmental professional in forming an opinion about the relative speed at which contaminant migration may be occurring.

ROCK STRATIGRAPHIC UNIT

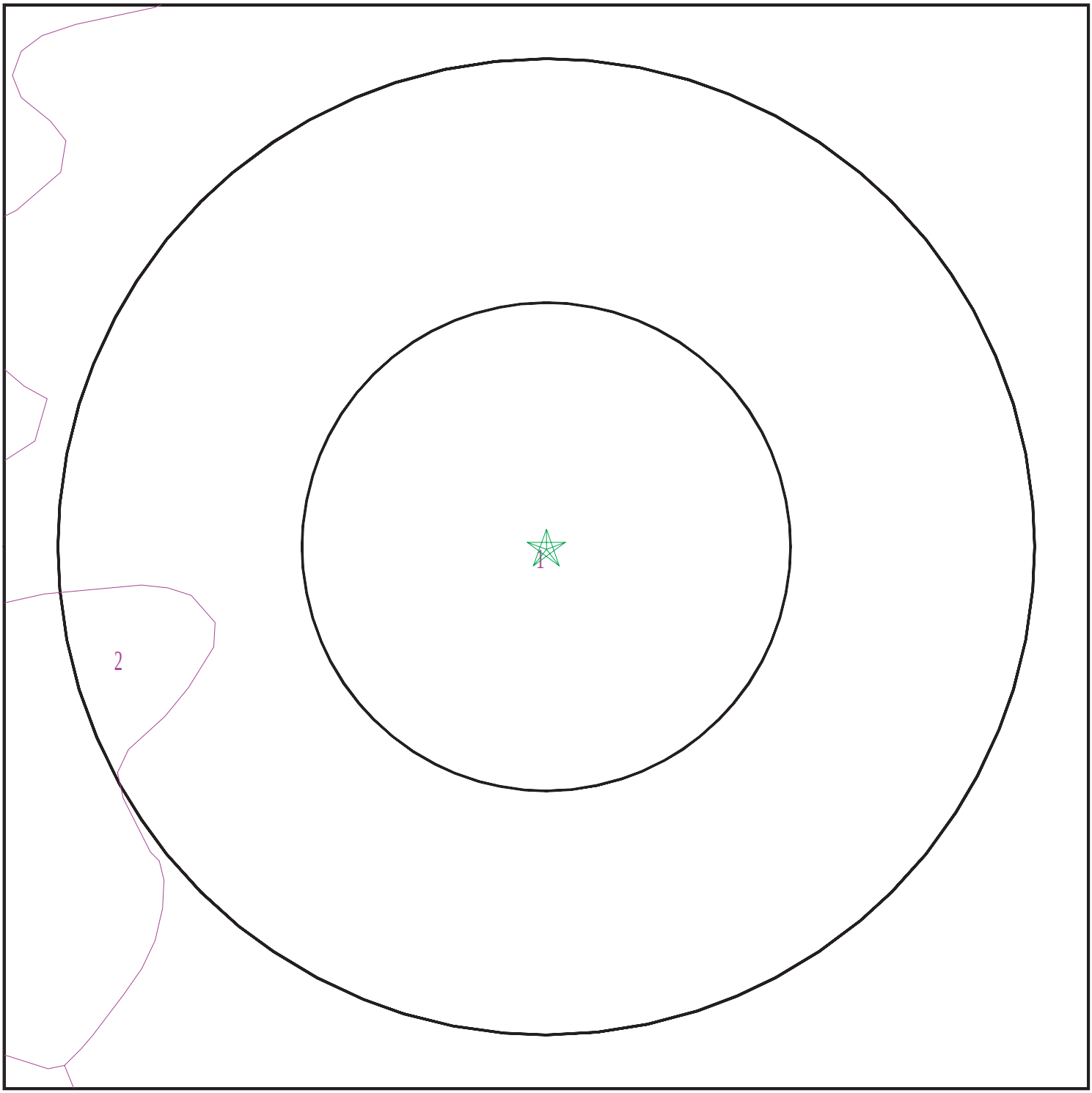
Era:	Cenozoic
System:	Quaternary
Series:	Quaternary
Code:	Q *(decoded above as Era, System & Series)*

GEOLOGIC AGE IDENTIFICATION

Category: Stratifed Sequence

Geologic Age and Rock Stratigraphic Unit Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - a digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

SSURGO SOIL MAP - 3827360.2s



Target Property
SSURGO Soil
Water

0 1/16 1/8 1/4 Miles

N

SITE NAME:	Lodi Phase I ESA	CLIENT:	ERM - West, Inc.
ADDRESS:	12755 N Thornton Rd Lodi CA 95242	CONTACT:	Bailey Blosser
LAT/LONG:	38.0953 / 121.3895	INQUIRY #:	3827360.2s
		DATE:	January 10, 2014 9:48 am

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GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

DOMINANT SOIL COMPOSITION IN GENERAL AREA OF TARGET PROPERTY

The U.S. Department of Agriculture's (USDA) Soil Conservation Service (SCS) leads the National Cooperative Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. The following information is based on Soil Conservation Service SSURGO data.

Soil Map ID: 1

Soil Component Name: DEVRIES

Soil Surface Texture: sandy loam

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Somewhat poorly drained

Hydric Status: Partially hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 152 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	12 inches	sandy loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 42 Min: 14	Max: 8.4 Min: 6.6
2	12 inches	27 inches	sandy loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 42 Min: 14	Max: 8.4 Min: 6.6
3	27 inches	79 inches	indurated	Not reported	Not reported	Max: 0 Min: 0	Max: Min:

Soil Map ID: 2

Soil Component Name: GUARD

Soil Surface Texture: clay loam

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Poorly drained

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Hydric Status: Partially hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 152 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	14 inches	clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 4 Min: 1.4	Max: 8.4 Min: 7.9
2	14 inches	72 inches	clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 1.4 Min: 0.42	Max: 8.4 Min: 7.9

LOCAL / REGIONAL WATER AGENCY RECORDS

EDR Local/Regional Water Agency records provide water well information to assist the environmental professional in assessing sources that may impact ground water flow direction, and in forming an opinion about the impact of contaminant migration on nearby drinking water wells.

WELL SEARCH DISTANCE INFORMATION

DATABASE	SEARCH DISTANCE (miles)
Federal USGS	1.000
Federal FRDS PWS	Nearest PWS within 1 mile
State Database	1.000

FEDERAL USGS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
A2	USGS40000186848	1/2 - 1 Mile SSE
3	USGS40000186861	1/2 - 1 Mile WSW
A4	USGS40000186846	1/2 - 1 Mile SSE
A5	USGS40000186847	1/2 - 1 Mile SSE

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

FEDERAL USGS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
6	USGS40000186832	1/2 - 1 Mile South
7	USGS40000186876	1/2 - 1 Mile WNW
B9	USGS40000186917	1/2 - 1 Mile NNE
10	USGS40000186943	1/2 - 1 Mile NNE

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No PWS System Found		

Note: PWS System location is not always the same as well location.

STATE DATABASE WELL INFORMATION

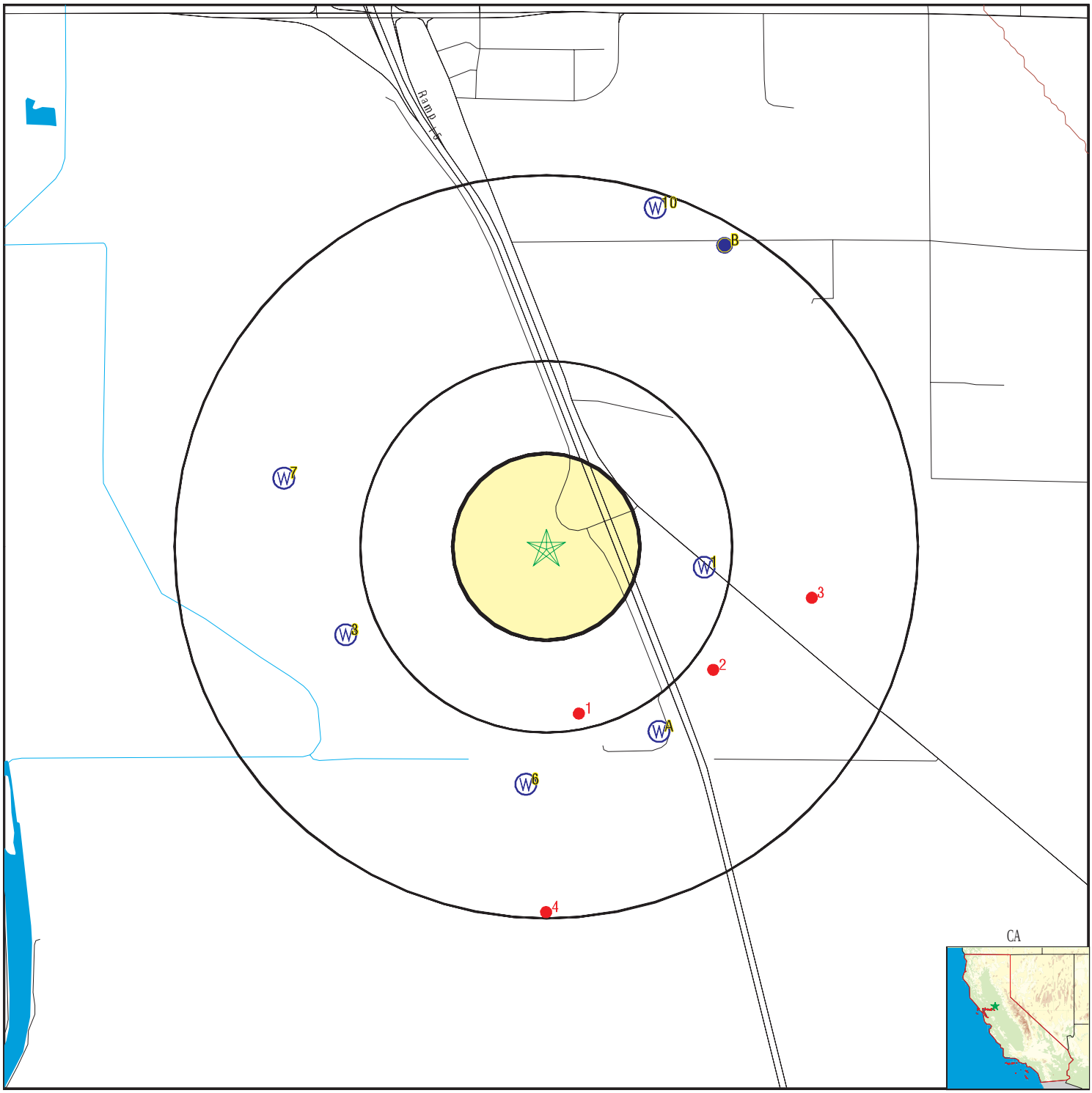
MAP ID	WELL ID	LOCATION FROM TP
1	CADW50000031063	1/4 - 1/2 Mile East
B8	CADW50000031073	1/2 - 1 Mile NNE

OTHER STATE DATABASE INFORMATION

STATE OIL/GAS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
1	CAOG9A000208635	1/4 - 1/2 Mile South
2	CAOG9A000208645	1/2 - 1 Mile SE
3	CAOG9A000208654	1/2 - 1 Mile East
4	CAOG9A000208602	1/2 - 1 Mile South

PHYSICAL SETTING SOURCE MAP - 3827360.2s



- County Boundary
- Major Roads
- Contour Lines
- Earthquake Fault Lines
- Earthquake epicenter, Richter 5 or greater
- Water Wells
- Public Water Supply Wells
- Cluster of Multiple Icons
- Groundwater Flow Direction
- GI Indeterminate Groundwater Flow at Location
- GV Groundwater Flow Varies at Location
- HD Closest Hydrogeological Data
- Oil, gas or related wells

SITE NAME:	Lodi Phase I ESA	CLIENT:	ERM - West, Inc.
ADDRESS:	12755 N Thornton Rd Lodi CA 95242	CONTACT:	Bailey Blosser
		INQUIRY #:	3827360.2s
LAT/LONG:	38.0953 / 121.3895	DATE:	January 10, 2014 9:48 am

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GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
Direction
Distance
Elevation | Database | EDR ID Number

1
East
1/4 - 1/2 Mile
Higher

CA WELLS **CADW50000031063**

Latitude :	38.0945		
Longitude :	121.3817		
Site code:	380945N1213817W001	Casgem sta:	03N05E24L001M
Local well:	Not Reported	Casgem s 1:	Unknown
County id:	39		
Basin cd:	5-22.01	Basin desc:	Eastern San Joaquin
Org unit n:	North Central Region Office	Site id:	CADW50000031063

A2
SSE
1/2 - 1 Mile
Lower

FED USGS **USGS40000186848**

Org. Identifier:	USGS-CA		
Formal name:	USGS California Water Science Center		
Monloc Identifier:	USGS-380518121230201		
Monloc name:	003N006E24N001M		
Monloc type:	Well		
Monloc desc:	Not Reported		
Huc code:	Not Reported	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	38.0883333
Longitude:	-121.384111	Sourcemap scale:	24000
Horiz Acc measure:	.5	Horiz Acc measure units:	seconds
Horiz Collection method:	Global positioning system (GPS), uncorrected		
Horiz coord refsys:	NAD83	Vert measure val:	8
Vert measure units:	feet	Vertacc measure val:	2.5
Vert accmeasure units:	feet		
Vertcollection method:	Interpolated from topographic map		
Vert coord refsys:	NAVD88	Countrycode:	US
Aquifername:	Central Valley aquifer system		
Formation type:	Not Reported		
Aquifer type:	Not Reported		
Construction date:	Not Reported	Welldepth:	Not Reported
Welldepth units:	Not Reported	Wellholedepth:	Not Reported
Wellholedepth units:	Not Reported		

Ground-water levels, Number of Measurements: 0

3
WSW
1/2 - 1 Mile
Lower

FED USGS **USGS40000186861**

Org. Identifier:	USGS-CA		
Formal name:	USGS California Water Science Center		
Monloc Identifier:	USGS-380531121235401		
Monloc name:	003N005E23L001M		
Monloc type:	Well		
Monloc desc:	Not Reported		
Huc code:	18040003	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	38.0918643
Longitude:	-121.3993943	Sourcemap scale:	24000

Horiz Acc measure:	1	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	Not Reported
Vert measure units:	Not Reported	Vertacc measure val:	Not Reported
Vert accmeasure units:	Not Reported		
Vertcollection method:	Not Reported		
Vert coord refsys:	Not Reported	Countrycode:	US
Aquifername:	Central Valley aquifer system		
Formation type:	Not Reported		
Aquifer type:	Not Reported		
Construction date:	Not Reported	Welldepth:	30
Welldepth units:	ft	Wellholedepth:	Not Reported
Wellholedepth units:	Not Reported		

Ground-water levels, Number of Measurements: 0

A4
SSE **FED USGS** **USGS40000186846**
1/2 - 1 Mile
Lower

Org. Identifier:	USGS-CA		
Formal name:	USGS California Water Science Center		
Monloc Identifier:	USGS-380517121225801		
Monloc name:	003N005E24P001M		
Monloc type:	Well		
Monloc desc:	Not Reported		
Huc code:	18040005	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	38.0879756
Longitude:	-121.3838384	Sourcemap scale:	24000
Horiz Acc measure:	1	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	7.00
Vert measure units:	feet	Vertacc measure val:	2.5
Vert accmeasure units:	feet		
Vertcollection method:	Interpolated from topographic map		
Vert coord refsys:	NGVD29	Countrycode:	US
Aquifername:	Central Valley aquifer system		
Formation type:	Not Reported		
Aquifer type:	Not Reported		
Construction date:	19700603	Welldepth:	142
Welldepth units:	ft	Wellholedepth:	176
Wellholedepth units:	ft		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1970-06-03	18.00	

A5
SSE **FED USGS** **USGS40000186847**
1/2 - 1 Mile
Lower

Org. Identifier:	USGS-CA		
Formal name:	USGS California Water Science Center		
Monloc Identifier:	USGS-380517121225802		
Monloc name:	003N005E24P002M		
Monloc type:	Well		
Monloc desc:	Not Reported		
Huc code:	18040005	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	38.0879756
Longitude:	-121.3838384	Sourcemap scale:	24000
Horiz Acc measure:	1	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	7.00
Vert measure units:	feet	Vertacc measure val:	2.5
Vert accmeasure units:	feet		
Vertcollection method:	Interpolated from topographic map		
Vert coord refsys:	NGVD29	Countrycode:	US
Aquifername:	Central Valley aquifer system		
Formation type:	Not Reported		
Aquifer type:	Not Reported		
Construction date:	19670629	Welldepth:	104
Welldepth units:	ft	Wellholedepth:	104
Wellholedepth units:	ft		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1967-06-29	8.50	

6
South
1/2 - 1 Mile
Lower

FED USGS **USGS40000186832**

Org. Identifier:	USGS-CA		
Formal name:	USGS California Water Science Center		
Monloc Identifier:	USGS-380510121232201		
Monloc name:	003N005E26A001M		
Monloc type:	Well		
Monloc desc:	Not Reported		
Huc code:	18040003	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	38.0860312
Longitude:	-121.3905052	Sourcemap scale:	24000
Horiz Acc measure:	1	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	Not Reported
Vert measure units:	Not Reported	Vertacc measure val:	Not Reported
Vert accmeasure units:	Not Reported		
Vertcollection method:	Not Reported		
Vert coord refsys:	Not Reported	Countrycode:	US
Aquifername:	Central Valley aquifer system		
Formation type:	Not Reported		

Aquifer type:	Not Reported		
Construction date:	Not Reported	Welldepth:	27
Welldepth units:	ft	Wellholedepth:	Not Reported
Wellholedepth units:	Not Reported		

Ground-water levels, Number of Measurements: 0

7
WNW **FED USGS** **USGS40000186876**
1/2 - 1 Mile
Lower

Org. Identifier:	USGS-CA		
Formal name:	USGS California Water Science Center		
Monloc Identifier:	USGS-380553121240501		
Monloc name:	003N005E23D001M		
Monloc type:	Well		
Monloc desc:	Not Reported		
Huc code:	18040003	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	38.0979752
Longitude:	-121.4024499	Sourcemap scale:	24000
Horiz Acc measure:	1	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	Not Reported
Vert measure units:	Not Reported	Vertacc measure val:	Not Reported
Vert accmeasure units:	Not Reported		
Vertcollection method:	Not Reported		
Vert coord refsys:	Not Reported	Countrycode:	US
Aquifername:	Central Valley aquifer system		
Formation type:	Not Reported		
Aquifer type:	Not Reported		
Construction date:	Not Reported	Welldepth:	30
Welldepth units:	ft	Wellholedepth:	Not Reported
Wellholedepth units:	Not Reported		

Ground-water levels, Number of Measurements: 0

B8
NNE **CA WELLS** **CADW50000031073**
1/2 - 1 Mile
Higher

Latitude :	38.107		
Longitude :	121.3806		
Site code:	381070N1213806W001	Casgem sta:	03N05E13L001M
Local well:	03N05E13L001	Casgem s 1:	Irrigation
County id:	39		
Basin cd:	5-22.01	Basin desc:	Eastern San Joaquin
Org unit n:	North Central Region Office	Site id:	CADW50000031073

B9
NNE **FED USGS** **USGS40000186917**
1/2 - 1 Mile
Higher

Org. Identifier:	USGS-CA		
Formal name:	USGS California Water Science Center		
Monloc Identifier:	USGS-380626121224701		
Monloc name:	003N005E13L001M		
Monloc type:	Well		
Monloc desc:	Not Reported		
Huc code:	18040005	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	38.1071417
Longitude:	-121.3807828	Sourcemap scale:	24000
Horiz Acc measure:	1	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	12.00
Vert measure units:	feet	Vertacc measure val:	2.5
Vert accmeasure units:	feet		
Vertcollection method:	Interpolated from topographic map		
Vert coord refsys:	NGVD29	Countrycode:	US
Aquifername:	Central Valley aquifer system		
Formation type:	Not Reported		
Aquifer type:	Not Reported		
Construction date:	Not Reported	Welldepth:	Not Reported
Welldepth units:	Not Reported	Wellholedepth:	65
Wellholedepth units:	ft		

Ground-water levels, Number of Measurements: 0

10
NNE
1/2 - 1 Mile
Higher

FED USGS **USGS40000186943**

Org. Identifier:	USGS-CA		
Formal name:	USGS California Water Science Center		
Monloc Identifier:	USGS-380631121225901		
Monloc name:	003N005E13M003M		
Monloc type:	Well		
Monloc desc:	Not Reported		
Huc code:	18040005	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	38.1085305
Longitude:	-121.3841163	Sourcemap scale:	24000
Horiz Acc measure:	1	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	12.00
Vert measure units:	feet	Vertacc measure val:	2.5
Vert accmeasure units:	feet		
Vertcollection method:	Interpolated from topographic map		
Vert coord refsys:	NGVD29	Countrycode:	US
Aquifername:	Central Valley aquifer system		
Formation type:	Not Reported		
Aquifer type:	Not Reported		
Construction date:	19650116	Welldepth:	76
Welldepth units:	ft	Wellholedepth:	102
Wellholedepth units:	ft		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1965-01-16	11.00	

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
Direction
Distance

Database EDR ID Number

1
South **OIL_GAS** **CAOG9A000208635**
1/4 - 1/2 Mile

Districtnu:	6	Apinumber:	07720568
Blmwell:	N	Redrillcan:	Not Reported
Dryhole:	Y	Wellstatus:	P
Operatorna:	Northern California Power Agncy		
Countyname:	San Joaquin	Fieldname:	Any Field
Areaname:	Any Area		
Section:	24		
Township:	03N	Range:	05E
Basemeridi:	MD	Elevation:	20
Locationde:	Not Reported		
Glat:	38.08879		
Glong:	-121.387891		
Gissourcec:	hud		
Comments:	Status Code 006		
Leasename:	Lodi Stig	Wellnumber:	1
Epawell:	N	Hydraulica:	N
Confidenti:	N	Spuddate:	30-DEC-99
Welldeptha:	Not Reported	Redrillfoo:	Not Reported
Abandonedd:	/ /	Completion:	/ /
Gissymbol:	PDH	Site id:	CAOG9A000208635

2
SE **OIL_GAS** **CAOG9A000208645**
1/2 - 1 Mile

Districtnu:	6	Apinumber:	07720290
Blmwell:	N	Redrillcan:	Not Reported
Dryhole:	Y	Wellstatus:	P
Operatorna:	Great Basins Petroleum Co.		
Countyname:	San Joaquin	Fieldname:	Any Field
Areaname:	Any Area		
Section:	24		
Township:	03N	Range:	05E
Basemeridi:	MD	Elevation:	Not Reported
Locationde:	Not Reported		
Glat:	38.0905		
Glong:	-121.381261		
Gissourcec:	hud		
Comments:	Status Code 006		
Leasename:	City of Lodi	Wellnumber:	1
Epawell:	N	Hydraulica:	N
Confidenti:	N	Spuddate:	30-DEC-99
Welldeptha:	Not Reported	Redrillfoo:	Not Reported
Abandonedd:	/ /	Completion:	/ /
Gissymbol:	PDH	Site id:	CAOG9A000208645

3
East **OIL_GAS** **CAOG9A000208654**
1/2 - 1 Mile

Districtnu:	6	Apinumber:	07720496
Blmwell:	N	Redrillcan:	Not Reported
Dryhole:	Y	Wellstatus:	P
Operatorna:	Maxus Exploration Company		
Countyname:	San Joaquin	Fieldname:	Any Field
Areaname:	Any Area		
Section:	24		
Township:	03N	Range:	05E
Basemeridi:	MD	Elevation:	19
Locationde:	Not Reported		
Glat:	38.09331		
Glong:	-121.37639		
Gissourcec:	hud		
Comments:	Status Code 006		
Leasename:	Red House Fee	Wellnumber:	65-24
Epawell:	N	Hydraulica:	N
Confidenti:	N	Spuddate:	30-DEC-99
Welldeptha:	Not Reported	Redrillfoo:	Not Reported
Abandonedd:	/ /	Completion:	/ /
Gissymbol:	PDH	Site id:	CAOG9A000208654

4
South **OIL_GAS** **CAOG9A000208602**
1/2 - 1 Mile

Districtnu:	6	Apinumber:	07700509
Blmwell:	N	Redrillcan:	Not Reported
Dryhole:	Y	Wellstatus:	P
Operatorna:	Federal Oil Company		
Countyname:	San Joaquin	Fieldname:	Any Field
Areaname:	Any Area		
Section:	26		
Township:	03N	Range:	05E
Basemeridi:	MD	Elevation:	Not Reported
Locationde:	Not Reported		
Glat:	38.08104		
Glong:	-121.389511		
Gissourcec:	hud		
Comments:	Status Code 006		
Leasename:	Federal Imeson	Wellnumber:	1
Epawell:	N	Hydraulica:	N
Confidenti:	N	Spuddate:	30-DEC-99
Welldeptha:	Not Reported	Redrillfoo:	Not Reported
Abandonedd:	/ /	Completion:	/ /
Gissymbol:	PDH	Site id:	CAOG9A000208602

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS
RADON

AREA RADON INFORMATION

State Database: CA Radon

Radon Test Results

Zipcode	Num Tests	> 4 pCi/L
95242	8	3

Federal EPA Radon Zone for SAN JOAQUIN County: 3

Note: Zone 1 indoor average level > 4 pCi/L.
: Zone 2 indoor average level >= 2 pCi/L and <= 4 pCi/L.
: Zone 3 indoor average level < 2 pCi/L.

Federal Area Radon Information for SAN JOAQUIN COUNTY, CA

Number of sites tested: 20

Area	Average Activity	% <4 pCi/L	% 4-20 pCi/L	% >20 pCi/L
Living Area - 1st Floor	2.530 pCi/L	90%	10%	0%
Living Area - 2nd Floor	Not Reported	Not Reported	Not Reported	Not Reported
Basement	2.050 pCi/L	100%	0%	0%

PHYSICAL SETTING SOURCE RECORDS SEARCHED

TOPOGRAPHIC INFORMATION

USGS 7.5' Digital Elevation Model (DEM)
Source: United States Geologic Survey
EDR acquired the USGS 7.5' Digital Elevation Model in 2002 and updated it in 2006. The 7.5 minute DEM corresponds to the USGS 1:24,000- and 1:25,000-scale topographic quadrangle maps. The DEM provides elevation data with consistent elevation units and projection.

Scanned Digital USGS 7.5' Topographic Map (DRG)
Source: United States Geologic Survey
A digital raster graphic (DRG) is a scanned image of a U.S. Geological Survey topographic map. The map images are made by scanning published paper maps on high-resolution scanners. The raster image is georeferenced and fit to the Universal Transverse Mercator (UTM) projection.

HYDROLOGIC INFORMATION

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 2003 & 2011 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002 and 2005 from the U.S. Fish and Wildlife Service.

HYDROGEOLOGIC INFORMATION

AQUIFLOW^{R} Information System
Source: EDR proprietary database of groundwater flow information
EDR has developed the AQUIFLOW Information System (AIS) to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted to regulatory authorities at select sites and has extracted the date of the report, hydrogeologically determined groundwater flow direction and depth to water table information.

GEOLOGIC INFORMATION

Geologic Age and Rock Stratigraphic Unit
Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

STATSGO: State Soil Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Services
The U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) leads the national Conservation Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps.

SSURGO: Soil Survey Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Services (NRCS)
Telephone: 800-672-5559
SSURGO is the most detailed level of mapping done by the Natural Resources Conservation Services, mapping scales generally range from 1:12,000 to 1:63,360. Field mapping methods using national standards are used to construct the soil maps in the Soil Survey Geographic (SSURGO) database. SSURGO digitizing duplicates the original soil survey maps. This level of mapping is designed for use by landowners, townships and county natural resource planning and management.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

LOCAL / REGIONAL WATER AGENCY RECORDS

FEDERAL WATER WELLS

PWS: Public Water Systems
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PWS ENF: Public Water Systems Violation and Enforcement Data
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SDWIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

USGS Water Wells: USGS National Water Inventory System (NWIS)
This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on wells, springs, and other sources of groundwater.

STATE RECORDS

Water Well Database
Source: Department of Water Resources
Telephone: 916-651-9648

California Drinking Water Quality Database
Source: Department of Public Health
Telephone: 916-324-2319
The database includes all drinking water compliance and special studies monitoring for the state of California since 1984. It consists of over 3,200,000 individual analyses along with well and water system information.

OTHER STATE DATABASE INFORMATION

California Oil and Gas Well Locations
Source: Department of Conservation
Telephone: 916-323-1779
Oil and Gas well locations in the state.

RADON

State Database: CA Radon
Source: Department of Health Services
Telephone: 916-324-2208
Radon Database for California

Area Radon Information
Source: USGS
Telephone: 703-356-4020
The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

EPA Radon Zones
Source: EPA
Telephone: 703-356-4020
Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

OTHER

Airport Landing Facilities: Private and public use landing facilities
Source: Federal Aviation Administration, 800-457-6656

Epicenters: World earthquake epicenters, Richter 5 or greater
Source: Department of Commerce, National Oceanic and Atmospheric Administration

California Earthquake Fault Lines: The fault lines displayed on EDR's Topographic map are digitized quaternary fault lines, prepared in 1975 by the United State Geological Survey. Additional information (also from 1975) regarding activity at specific fault lines comes from California's Preliminary Fault Activity Map prepared by the California Division of Mines and Geology.

STREET AND ADDRESS INFORMATION

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Appendix D
User Questionnaire

URGENT and CONFIDENTIAL RETURN TO **bailey.blosser@erm.com**

USER QUESTIONNAIRE for PHASE I ESA

AS REQUIRED by ASTM Standard E1527-13

To:	Bailey Blosser	From:	Mr. Benjamin Jordan
At:	ERM	At:	PG&E
Fax:	(925) 946-9968	Pages:	1
Phone:	(925) 482-3204	Date:	2-3-14

Site Name: Lodi Property

Address: I-5 and Highway 12, Lodi, California, 95242

The USER the Phase One ESA should provide the following information to ERM. Please fill in this form to the best of your ability, explaining any "Yes" answers on a separate sheet of paper. The User is not obligated to provide this information, however failure to provide the following will be listed in the Phase I ESA as a datagap. Please provide these answers prior to ERM's site visit.

1. **Environmental Cleanup Liens.** ASTM requires the User to check for environmental liens that may be filed or recorded against the subject property under federal, tribal, state or local law. Such liens might be listed in the "exceptions to coverage" in the property's title insurance commitment or policy. Failure to check for these liens could put your Landowner Liability Protections at risk.

   Have you checked for these environmental cleanup liens? ☐ Yes ☒ No
   Are you aware of any such liens against the subject property? ☐ Yes ☒ No

2. **Activity and Use Limitations (AULs).** These include engineering controls (e.g., slurry walls, caps) and land use restrictions or institutional controls (e.g., deed restrictions, covenants) that may be in place at the site or filed under federal, tribal, state or local law. The title commitment or policy might also list AULs.

   Are you aware of any possible AULs involving the subject site? ☐ Yes ☒ No

3. **Specialized Knowledge.** This involves personal knowledge or experience related to the subject property or nearby properties. For example, if you are involved in the same line of business as the current or former occupants of the property or an adjoining property, you would probably know of any chemicals, oil, degreasers, gasoline, or other hazardous substances commonly used in that type of business.

   Do you have any specialized knowledge that might indicate the past or present use or release of such substances on the subject or nearby properties? ☐ Yes ☒ No

4. ***Fair Market Value (FMV).*** *A purchase price significantly below FMV may indicate an environmental problem.* Please note that this question does not require an appraisal of the property. If the price is significantly below FMV, the User should consider whether it might be because contamination may be present at the property.

   Is the purchase price significantly below fair market value? ☐ Yes ☒ No

5. **Obvious Indicators.** This involves past or present spills, stains, releases, cleanups, etc. on or near the site.

   Do you know of any obvious indicators of possible contamination on or near the site? ☐ Yes ☒ No

6. **Common Knowledge.** Please use a separate sheet if necessary.

   a. Describe the past uses of the property: The property is active agricultural land.

   b. Describe any specific chemicals that may have been present at the property: _____

   c. Describe any other information that may help us identify possible contamination: _____

Ben J. 2-3-14

Your Signature **Date**

# of separate sheets attached: _____
Explain Yes answers on a separate sheet.

Appendix E
Professional Profiles

James B. Warner, P.G.

Partner



Mr. James Warner has 25 years of professional experience related to hazardous waste site investigation and remediation, legal services, environmental due diligence, water supply assessment and development, compliance, and strategic consulting. This experience includes projects in North America, South America, Asia, and Europe.

Mr. Warner has managed diverse hazardous waste site investigation and remediation projects under CERCLA, RCRA, State, and local regulatory programs. Sites include transportation facilities, industrial operations, refineries, chemical plants, mining operations, and military facilities. He specializes in state-of-the-art environmental investigation techniques, fate and transport evaluations, modeling, and data visualization focused on efficient and meaningful characterization to support effective risk-based closure, remedial strategy development, and regulatory negotiations. He has developed, implemented, operated, and optimized a wide range of remediation programs, including in situ and ex situ methods for different contaminants in diverse settings ranging from shallow fill material to deep fractured bedrock.

Mr. Warner has provided legal support for litigation and mediation involving industrial facilities and mining operations. He has developed legal strategies, written expert reports and submittals, given depositions, participated in cost recovery actions, and been involved with multiparty mediated settlements. He has a proven record of effective advocacy on behalf of parties he has represented. He has worked on several high profile sites involving PRP groups.

Mr. Warner has directed environmental due diligence evaluations for property and company acquisitions, water supply development projects, and compliance assurance programs for a wide range of clients, leading to successful business decisions, liability management, and resource management.

Professional Affiliations & Registrations

- Professional Geologist, California (#5314)
- National Groundwater Association
- California Groundwater Resources Association

Fields of Competence

- Remedial Investigation/Feasibility Study programs
- Strategic remedial planning
- Geologic and hydrogeologic site investigations
- Remediation system design, installation, and operation
- Groundwater flow and solute transport modeling
- Natural attenuation evaluations
- Computer applications for hydrogeologic investigations
- Water supply evaluation and development
- Risk assessment
- Regulatory compliance/negotiations
- Property redevelopment and transfer
- Litigation support
- Due diligence

Education

- M.S., Geology, Ohio University, 1985
- B.S., Geology, Ohio University, 1983

Publications

- Bjorklund, B, Warner, J., Chemburkar, A., Lake, K, and Moe, J. *Use of CPT/MIP to Optimize Remediation Design of a Zero Valent Iron Permeable Reactive Barrier* (Poster). The Sixth International Battelle Conference on Remediation of Chlorinated and Recalcitrant Compounds, Monterey, CA. May 2008
- Chemburkar, A, Dyer, R., Lind, D, Warner, J, Brown, D, Tisoncik, D. *Sequential Enhanced Bioremediation and Chemical Oxidation of Solvents and Hydrocarbons* (Poster). The Sixth International Battelle Conference on Remediation of Chlorinated and Recalcitrant Compounds, Monterey, CA. May 2008

Key Projects

Represented major airline in lawsuits related to subsurface contamination at airports (SEA, PDX, SFO, OAK, LAX). Other parties included Ports, airlines, and oil companies. Performed cost allocation evaluations and negotiations to settle disputes and assist client in successful resolution of liabilities with numerous parties.

Provided litigation support to mining company for suit related to groundwater and surface water impacts by arsenic and other inorganic contaminants at mine in Sierra Nevada Mother Lode District. Evaluated site conditions, mine history, reclamation requirements, and lawsuit to assist client in equitable settlement. Participated in mediated settlement.

Expert for aggregate/gold mining operation for lawsuit (California Water Code, Clean Water Act, and Proposition 65) by citizens group concerned about metals, TDS, and sediment impacts to Yuba River in Northern California. Developed effective defense strategy. Directed technical evaluations and fieldwork to address potential contaminant sources, groundwater-surface water impacts, mining operational history, and water use in area. Produced expert documents and rebuttals. Successfully addressed concerns and the lawsuit was dropped.

Expert for lawsuit between two major Silicon Valley chip manufacturers concerning responsibility for extensively commingled chlorinated VOC plumes. Directed fieldwork and evaluations to develop technically defensible past and future allocations based on observational data, groundwater flow and solute transport modeling, remediation costing, and operational histories. Generated expert reports and rebuttals. Reached favorable settlement on behalf of client.

Assisted airline in lawsuit concerning jet fuel plume at San Francisco International Airport involving other airlines and an oil company. Developed strategy, directed investigations, performed evaluations (history, sources, fate and transport, fuel forensics, remedial costing), and generated expert documents to define allocation position. Reached favorable mediated settlement that led to remediation as chosen consultant for cooperative PRP group. Remediation involves multiphase hydrocarbon recovery to restore groundwater, prevent worker exposure, and protect San Francisco Bay.

Provided litigation support to Southern California aerospace manufacturer for lawsuit involving insurer. Developed strategy and generated expert documents related to chlorinated VOC plumes. Conducted extensive investigations and modeling as part of team (including fate and transport researcher from UC Berkeley and other consultants) to support cost recovery from insurer. Case was successfully resolved with client receiving significant monetary settlement.

Represented Santa Barbara County as expert for citizen's lawsuit by homeowners near County landfill with chlorinated VOC plume in overburden and fractured bedrock. Homeowner's suit was based on water supply impacts, gas migration, and home value complaints. Project involved groundwater, outdoor air, and indoor air investigation, as well as risk assessment. Developed strategy and generated expert reports and rebuttals. Case was settled by County purchasing selected properties.

Provided litigation support for chemical manufacturer in California's Central Valley involving commingled chlorinated VOC, pesticide, and metals plumes with adjacent manufacturer. Supported strategy development based on previous RI/FS experience at site. Served as fact witness for depositions.

Developed financial reserve estimates for multiple remediation sites across the US for major airline in compliance with Sarbanes-Oxley protocols.

Managed environmental due diligence and remedial evaluations for Chevron in Southeast Asia and Latin America. Projects included Phase I ESAs for several shore-based logistics facilities that support off-shore oil platforms, as well as onshore exploration and production assets.

Managed third party review of a large scale remediation project for Chevron in the Middle East. Participated in expert team to evaluate investigation, risk assessment, and remedial planning and recommend future work.

Represented a utility on a South Pacific island responding to USEPA RFI and response actions for discharges of oil to the ocean. Conducted investigation to identify PRPs and respond to RFI. Managed SPCC and NPDES compliance projects for power generation facilities.

Directed ongoing investigation, risk assessment, and remediation project for a site in Hollister, California involving significant on-site and off-site TCE and perchlorate plumes. Project includes extensive investigation, remedial planning, source area remediation, groundwater containment system implementation, and replacement of water supplies for third party wells that have been impacted.

Investigated chlorinated VOCs in groundwater at Palo Alto, California Superfund Site. Investigated groundwater flow, conducted aquifer testing, and evaluated extraction well performance to assess contaminant migration and remediation effectiveness. Identified other responsible party and negotiated cost-sharing agreement. Negotiated remedial strategy with RWQCB and DTSC and implemented excavation/pump and treat remedy.

Performed investigations of 70 underground storage tank and fuel pipeline sites at U.S. Naval Air Stations in Northern California under RWQCB oversight, including Mare Island, Alameda, Crows Landing, and Skaggs Island. Investigated PCBs in soil and their potential to migrate to SF Bay.

Managed investigation, risk assessment, and remediation project for chlorinated VOC plume in fractured bedrock at maintenance center at San Francisco International Airport on behalf of airline under RWQCB oversight. Project involved extensive drilling, borehole geophysics, seismic reflection survey, aquifer testing, well survey, monitoring, modeling, risk assessment, in situ remediation microcosm testing, and DNAPL recovery. Primary concerns are potential impacts to water supply wells, vapor intrusion, and ecological receptors in San Francisco Bay. Negotiated MNA closure with RWQCB.

Directed investigation, risk assessment, and feasibility study for a chlorinated VOC plume under RWQCB oversight in Pleasant Hill, California for PRP group. Concerns include drinking water , indoor air, and ecological receptors. Project involves exterior investigation and modeling, complex potentially responsible party (PRP) negotiations, and high-profile public involvement. Negotiated final remedy involving SVE, chemical oxidation, and in situ permeable reactive barrier with zero valent iron.

Managed extensive investigation, risk assessment, and remediation of free phase and dissolved phase jet fuel in several active boarding areas at San Francisco International Airport for PRP group (oil company and airlines) under RWQCB oversight. Investigations involved drilling, geophysical surveys, extensive groundwater flow evaluations and aquifer testing, monitored natural attenuation assessments, and LNAPL and dissolved jet fuel monitoring. Remediation involved long-term pilot testing of free product recovery by skimming and high-vacuum extraction (HVE). Final remediation by mobile and fixed system HVE is underway.

Managed investigation and remediation of chlorinated solvents and Stoddard solvent (LNAPL and dissolved) in shallow aquifer at maintenance facility at San Francisco International Airport for airline under RWQCB oversight. Remediation includes LNAPL recovery by HVE and in situ dissolved cleanup by enhanced aerobic degradation and chemical oxidation.

Managed human health and ecological risk assessment for fill material containing lead along a Steelhead habitat stream and adjacent residential area for Sonoma County Water Agency. Developed closure plan and negotiated innovative capping remedy with the RWQCB, which incorporates bike path design as protective barrier to exposure and mobilization.

Performed large scale hydrogeologic/surface water evaluation for 90 MGD radial collector wellfield adjacent to river with endangered species on behalf of Sonoma County Water Agency. Conducted long term aquifer tests to evaluate production well capacities and optimize water use in light of site conditions, projected future demand, and other system constraints.

Managed Phase I/II ESAs related to water supply and storm water system upgrades in Sonoma and Marin Counties, on behalf of Sonoma County Water Agency.

Served as Principal-in-Charge for 5-year, on-call contract for BART light-commuter rail system, consisting of six task orders related to construction of transportation facilities in areas containing impacted soil and groundwater. Oversaw initial site assessment related to property acquisition, Phase II site investigations to determine material management and worker health and safety options, and procurement support.

Evaluated basin-wide effects of long term pumping from multiple municipal supply wells on the San Francisco Peninsula to assess sustainable water supply, potential for sea water intrusion, and potential for regional groundwater plumes to impact supply wells.

Evaluated sustainability of groundwater supplies in a large basin in Central Asia in support of the approval for a bottled water plant. Project was successful in receiving clearance and was constructed.

Managed investigation and risk assessment for shallow fuel hydrocarbon impacts at maintenance facility at San Francisco International Airport for airline under RWQCB oversight. Negotiated No Further Action for site.

Managed investigation, risk assessment, and site decommissioning for major maintenance facility at Oakland International Airport for airline under RWQCB and Alameda County oversight. Performed extensive drilling, aquifer testing, groundwater flow evaluations, fate and transport modeling, human health-ecological risk assessments, and waste disposal to assist with facility closure.

Managed investigation and risk assessment of jet fuel releases associated with fuel hydrant system and tank farm at Seattle-Tacoma International Airport for airline under Washington Department of Ecology oversight. Negotiated fuel system in-place closure and *No Further Action* for jet fuel in vadose zone.

Performed investigation of jet fuel releases at several active boarding areas at Los Angeles International Airport for ensure compliance with RWQCB requirements. Investigations involved subsurface evaluations and hydrostatic pressure testing of fuel hydrant systems. Performed risk evaluations and feasibility studies of remedial alternatives. Negotiated compliance with airport authority and RWQCB.

Investigated jet fuel release and impacts to subsurface pedestrian tunnel in active boarding area at Los Angeles International Airport. Performed extensive air monitoring and risk assessment to ensure worker and passenger safety. Negotiated with airport authority and responsible parties to facilitate mitigation of air quality impacts to tunnel to reduce risks related to jet fuel impacts.

Investigated fuel hydrocarbon and chlorinated solvent impacts to soil and groundwater at a large maintenance facility at Los Angeles International Airport. Project involves LNAPL recovery with skimmers and ongoing multiphase investigation.

Performed technical oversight of other consultants and represented client in PRP groups for investigation and remediation projects on behalf of airline for projects at Seattle-Tacoma International Airport, San Francisco International Airport, and Phoenix Sky Harbor International Airport.

Provided technical oversight for soil and groundwater investigations (fuel and solvent sites), aquifer testing, natural attenuation evaluations, groundwater modeling, pilot testing, and interim remedial actions at Portland Air National Guard Base, Portland International Airport, OR. Negotiated with Oregon DEQ.

Performed surface and groundwater impact study of a former dolomite mine near Sonora, CA. The mine includes surface and underground operations, and the primary concern was impacts to streams and groundwater. Generated report on liabilities that need to be addressed in reclamation.

Evaluated groundwater resources and environmental impacts for due diligence evaluation of water supply development projects in Republic of Tajikistan, Poland, Israel, Switzerland, Russia, Ukraine, India, Mexico, Guatemala, Argentina, Peru, Brazil, and Chile. Negotiated environmental requirements and financial terms with funding sources and governmental agencies involved in investments.

Provided technical direction in developing and implementing efficient subsurface investigation based on borehole geophysics to map fractures as preferential flow paths and to delineate plume for PRP group in Benicia, CA. Project involves investigation and remediation of chlorinated VOC plume.

Directed development and implementation of efficient subsurface investigation based on borehole geophysics to map fractures as preferential flow paths at transportation facility maintenance station in the Sierra Nevada. Used results to delineate plume and demonstrate that receptors (stream and private wells) were not at risk.

Investigated hydrogeologic conditions and occurrence of DNAPL and dissolved phase VOCs at rail yard in Sacramento, CA. Evaluated site stratigraphy, groundwater flow, and migration of VOCs via extensive drilling, geophysical surveys, aquifer testing, and monitoring. Implemented focused source and plume margin interim remedial measures to prevent further migration of VOCs in groundwater. Quantified natural attenuation of VOCs and developed coupled groundwater flow and solute transport model for Feasibility Study evaluations. Site involves extensive impacts and complex transient groundwater flow system connected to major rivers. Developed and negotiated cost-effective final remedy optimizing natural attenuation and active remediation with DTSC and RWQCB. Investigated and remediated multisource shallow hydrocarbon and metals (lead) contamination in soil. Environmental cleanup has led to large Brownfields redevelopment.

Investigated several leaking underground storage tank sites in Sierra Nevada region, CA. Sites characterized by gasoline constituents in fractured granite aquifer. Designed and implemented comprehensive approaches using outcrop fracture mapping, drilling, geophysical logging, and aquifer testing. Installed and operated combined soil vapor extraction and groundwater extraction remediation systems to attain site closure and *No Further Action* determinations under RWQCB oversight.

Provided investigation, hydrogeologic analysis, remediation, and strategic planning for major refinery involving several MTBE sources and pipeline leak of over 3 million gallons of gasoline in Bakersfield, CA. Conducted extensive investigation, geophysical surveys, well surveys, water well replacement, aquifer testing, pilot studies, and groundwater modeling. Prioritized resources and activities to focus on risk-based remediation and developed related $24-million environmental reserve budget. Optimized soil vapor extraction, LNAPL recovery, groundwater infiltration, and groundwater extraction to cost-effectively manage risks. Prioritized 37 sites at refinery to sequence remediation and closure as necessary. Completed due diligence and compliance projects as well. Facility under RWQCB oversight.

Performed investigation and interim and final remediation at Fresno-Yosemite International Airport, CA for PRP group. Concern was widespread TCE impacts to sole source aquifer in area of numerous public and private water supply wells. Oversight performed by RWQCB, DTSC, and DHS-ODW. Conducted expedited groundwater investigation to define extent of TCE to depth of 300 feet over several square miles. Conducted borehole geophysical surveys to define site conditions, extensive monitoring, natural attenuation evaluations, well surveys to locate numerous impacted and at-risk wells, water well replacement, and PRP searches. Participated in public meetings to address community concerns. Performed aquifer testing and developed groundwater modeling as input to engineering evaluation/cost analysis to optimize plume capture and replacement of lost water supply with 2,000-gpm wellhead treatment system for use in Fresno water supply system. Performed in situ chemical oxidation pilot study. Completed remedial investigation and feasibility study to define long-term plume management remedy, as well as developed Contingency Plan for monitoring and replacing at-risk water supply wells near the plume, as necessary.

Investigated soil, surface water, and groundwater degradation resulting from 180 tons of buried elemental phosphorus in wetlands. Assessed groundwater-surface water interactions and chemical fate and transport, including plant uptake. Prepared Removal Action Workplan to evaluate feasibility of remedial options. Negotiated in-place closure based on fate and transport analysis documenting immobility of phosphorus, saving client $6 million relative to excavation program originally proposed by DTSC.

Performed integrated hydrogeologic study of multilayer, coastal aquifer system at industrial landfill at Mare Island Naval Shipyard in Vallejo, CA. Used aquifer monitoring and testing to evaluate groundwater flow, tidal influences, and contaminant transport.

Performed and managed many Phase I/II ESA, due diligence projects for a wide range of properties and clients to document liabilities and facilitate property transfers.

Determined distributions and possible sources of hazardous organic and inorganic substances in soil and groundwater at chemical storage and transfer facility to assess real estate transaction liability.

Investigated metals, organic compounds, and naturally occurring chrysotile asbestos at proposed sewer construction site in San Francisco, CA. Determined potential human health risks and hazardous waste disposal requirements.

Geologist for U.S. Nuclear Regulatory Commission, providing evaluations of potential high-level radioactive waste repository sites throughout the US and in Germany. Used geologic, geophysical, and hydrologic data from Basalt Waste Isolation Project, Deaf Smith County bedded salt, and Yucca Mountain volcanic high-level radioactive waste repository sites to evaluate site licensing. Evaluated uranium mine tailings under UMTRA program for sites in the western US in light of reclamation requirements.

Intern geologist with USGS Eastern Minerals Division assessing disseminated gold deposits in the southern Appalachians.

Used stratigraphic and seismic reflection data to complete seismic modeling project and evaluate petroleum-producing potential of paleozoic carbonates in area of Midland Basin for major oil company.

Integrated lithologic/structural field data and petrographic analysis to characterize geology of area in southern New Brunswick, Canada for master's thesis.

Arun S. Chemburkar, P.E.

Technical Director



Mr. Arun Chemburkar has 25 years of professional experience in environmental engineering, risk management, and process safety management (PSM). He has particular expertise in the preparation of off-site consequence analysis, fugitive and accidental releases, process hazard analysis (using HAZOP, What-if and FMEA), and risk management plans for various facilities, such as liquefied natural gas (LNG) liquefaction, LNG storage, flammable liquids, semiconductor gases, and cogeneration facilities in California. He has also helped implement SVA programs for utilities and manufacturing facilities. In addition, he features experience in SARA Title III-313 and air emissions inventorying and reporting. He has provided engineering oversight in numerous HMBP/SPCC plans preparation and hazardous waste system/tank integrity assessments across western U.S.A.

Mr. Chemburkar also specializes in effective engineered solutions for contaminated soil and ground water, using innovative and emerging remedial treatment technologies as well as traditional systems. He has designed and installed over 50 engineering systems using soil vapor extraction/high vacuum extraction, air sparging, bioventing, chemical oxidation, catalytic and UV oxidation, oil/water separators, bioremediation, and landfarming at a variety of sites in California, Nevada, Oregon, Arizona, Minnesota, and Colorado. He has also provided engineering support for several Superfund site Remedial Investigation/Feasibility Study/Remedial Action Plan (RI/FS/RAP) projects for soil and ground water cleanup.

Professional Affiliations & Registrations

- Professional Engineer (Chemical), California (#CH4926) and Arizona (#CH28267)
- American Institute of Chemical Engineers

Fields of Competence

- Process hazard analysis
- HAZOP, FMEA and "What If" analysis
- Risk management/prevention
- Process safety management and planning
- Engineering system design, permitting, and construction
- SPCC, HMBP and integrity assessment
- Litigation support and cost allocation evaluation
- Security Vulnerability Assessments
- SARA Title III-313 and emissions inventory and reporting
- Site Remediation MACT

Education

- M.S. Environmental Engineering, Toxicology Option, New Jersey Institute of Technology, 1987
- B.S. Chemical Engineering, University of Baroda, India, 1984
- 40-Hour OSHA Hazardous Waste Operations and Emergency Response
- Process Hazard Analysis - Process Safety and Risk, American Institute of Chemical Engineers Training Course, 2001

Publications

- Arun Chemburkar, P.E. and John Koehler, Sc.D., Comparison *and Critical Review of Process Hazard Analysis Methods for Risk Management Plans at Flammable Fuel Storage Facilities.* To be presented at AWMA conference in Portland, OR. June 2008.
- Arun Chemburkar, P.E. and John Koehler, Sc.D., Implementation of Risk Management Plan and Process Safety Management Requirements at Clean Fuel Facilities. Presented at AWMA conference in Pittsburg, PA. 2007

Key Projects

Performed off-site consequence analysis of anhydrous hydrochloric acid release, prepared Risk Management Plan and helped develop PSM program for Scott Semiconductor gases facility in Fremont, CA. Conducted process hazard analysis for HCL, chlorine, silane, diborane and arsine gas cylinder filling and transfer processes performed at facility.

Managed and conducted regulatory review; off-site consequence analysis, process hazard analysis (using HAZOP, FMEA and What-If methods); and Risk Management Plan reports preparation, PSM manuals, and training program for three LNG liquefaction facilities in Northern California for PG&E.

Directed RMP update, PHA update, and SVA implementation for aqueous ammonia processes for NOx-control at three cogeneration facilities in Northern California for a confidential independent electric power generator.

Directed off-site consequence analysis of anhydrous ammonia, chlorine and HF acid release, and RMP preparation for two Applied Materials facilities in northern California.

Directed RMP update, PHA update, PSM program development for anhydrous ammonia processes consisting of NOx-control and refrigeration for a cogeneration facility in Northern California for a confidential independent electric power generator.

Performed off-site consequence analysis of hydrogen and ammonia storage at proposed cogeneration facility in Northern California for confidential independent electric power generator.

Directed or oversaw development of process safety and risk management programs, compliance audits, standard operating and maintenance procedures, conducted process hazards analyses, incident investigations program, for confidential cosmetics manufacturing facility in California.

Oversaw development of process safety and risk management programs, conducted compliance audits, and developed standard operating and maintenance procedures for refrigeration systems containing anhydrous ammonia for several industrial facilities in Northern California.

Directed RMP update and SVA implementation for ammonia refrigeration process for dry-ice manufacturing facility in Northern California for Airgas.

Project Director for a process safety management program compliance audit, at a rocket propulsion facility for a confidential client in California.

Led RMP/PSM engineering for comprehensive EHS audit program at a confidential client site, including process safety, at nine facilities for a major electric power generator on the West Coast. Participated in development of RMP/PSM plan at one facility.

Engineering oversight of hazardous waste system integrity assessment and SPCC program for a major airline at San Francisco International Airport.

Engineering oversight of HMBP and waste minimization program for a major utility in northern California.

Provided engineering support for a refiner y in Northern California for Site Remediation MACT compliance related services including - HAP estimation, initial compliance report, soil management guidance and semi-annual reporting.

Designed and installed four soil and ground water remediation systems in Western U.S. with remote sensing, supervisory control, and data acquisition (SCADA) capabilities. SCADA feature allowed ERM to streamline system operation, perform intelligent maintenance, and easy reporting.

Pilot tested, designed, and implemented several in situ chemical oxidation treatment systems composed of ozone sparging and permanganate/persulfate injections. Treated several sites in California, Oregon, and Colorado for chlorinated solvents and petroleum hydrocarbons.

Conducted pilot tests for UV oxidation to evaluate as viable remedial alternative for treatment of chlorinated VOCs at California Superfund rail yard site. Designed and successfully installed large PLC-controlled ground water and soil remediation system involving air stripping (135 gpm), vacuum extraction (500 scfm), and catalytic oxidation (1,200 scfm). System design and operation was evaluated for process safety adequacy using HAZOP method.

Developed integrated remedial program on conceptual level to address site-wide environmental problems and meet clients' strategic planning needs. Developed 5-year cash flow projection to address refinery's comprehensive environmental liability.

Bailey Blosser



Ms. Bailey Blosser is a Staff III Scientist with over three years of experience in the environmental consulting industry. Ms. Blosser works closely with the Mergers and Acquisitions (M&A) and Contaminated Site Management (CSM) practices within ERM. Her experience includes conducting Phase I and Phase II Environmental Site Assessments, groundwater sampling and monitoring programs, and soil, soil vapor, and groundwater investigations for transportation, manufacturing, and other industrial clients. She has planned and conducted investigation activities at ANG sites, airports, and distribution and manufacturing sites in Northern California.

Ms. Blosser has conducted numerous Phase I environmental assessments which are complied from site visits, personnel interviews, research of various agency records and historical documents. She has expertise in review of aerial photos, topographic maps, Sanborn Fire Insurance Maps, and agency record search reports that have allowed her to complete Phase I reports for each site. Clients include industry, consultants, attorneys, brokers, developers, and governmental agencies.

Ms. Blosser has also participated in sample collection and testing of drinking water for major airlines at San Francisco International Airport and Oakland International Airport. Ms. Blosser has provided construction oversight and conducted other miscellaneous field work. Additional experience includes participation in an impact site assessment study for the California High-Speed Train project and participation in an Environmental Impact Report for the Central California Coastal Seismic Imaging Project.

Fields of Competence

- Phase I and Phase II Environmental Site Assessments
- Regulatory compliance
- Hazardous waste, soil, and groundwater investigations
- Groundwater monitoring and remediation programs
- Drilling and sampling technologies
- Active and passive soil vapor sampling
- Data analysis
- Soil logging
- Construction oversight

Education

- BS, Environmental Science, University of California at Los Angeles, Los Angeles, CA 2008
- 40-hour Hazardous Waste Operations and Emergency Response training, August 6, 2009
- 8-Hour HAZWOPER Refresher, current

Languages

- English, native speaker
- Spanish, secondary language

Key Industry Sectors

- Manufacturing
- Biotechnology
- Real Estate, Redevelopment
- Commercial and Residential Properties
- Construction and Engineering
- Government
- Transportation

Key Projects

Company Confidential, Pleasant Hill, California
Assisted with site investigation activities involving a regional VOC groundwater plume in Pleasant Hill, CA. Multiple parties have contributed to the VOC groundwater plume, which extends beneath a residential neighborhood. Soil vapor and indoor air impacts have resulted in the residential neighborhood from the commingled VOC plume. Conducted soil vapor, indoor air, and groundwater sampling using helium shroud method for soil vapor, Summa canisters for indoor air, and passive diffusion samplers, low flow, and traditional techniques for groundwater.

California Air National Guard, Hayward, California
Participated in site investigation activities involving soil impacted by TPH, VOCs, Lead, and PAHs for Air National Guard property. Responsibilities included the oversight of direct push drilling activities and the logging and collection of soil for lab analyses. Coordinated and conducted large-scale quarterly groundwater monitoring events. Organized sampling schedules and field activities. Trained new personnel to perform sampling. Groundwater sampling techniques included using bailers and peristaltic pumps. Assisted in the preparation of quarterly groundwater monitoring reports.

KB Homes, Northern California
Conducted Phase I Environmental Site Assessments (ESAs) on developed and undeveloped properties throughout Northern California.

California High Speed Train – San Francisco to San Jose Section and San Jose to Merced Section, California
Conducted hazardous materials and environmental site assessments of a 50-mile north-south trending corridor proposed to be constructed in San Francisco, San Mateo, and Santa Clara Counties and a 125-mile east-west trending corridor proposed to be constructed in Santa Clara, Merced, and Madera Counties as part of the California High Speed Train Project. The project involved review, analysis and compilation of environmental information and multiple-day site reconnaissance's along the proposed corridor to observe site and surrounding areas. Managed staff, assigned project work, identified properties of potential environmental concern along the proposed corridor, and provided recommendations for additional investigation. Produced a comprehensive environmental report that identified areas of potential hazardous impact and provided recommendations for mitigation.

Benicia, California
Participated in site investigation activities involving TCE in groundwater at a warehouse facility in Benicia, California. Conducted groundwater sampling using bailers and passive diffusion bags for groundwater.

San Francisco International Airport, San Francisco, California
Oversaw field operation of mobile high-vacuum extraction system to recover LNAPL at active boarding areas of San Francisco International Airport for both the Airport Common and a major airline. Documented recovered LNAPL for reporting.

United Airlines Potable Water Testing, San Francisco, California
Participated in sample collection and testing of drinking water for a major airline at San Francisco International Airport.

Southwest Airlines Potable Water Testing, Oakland, California
Participated in sample collection and testing of drinking water for a major airline at Oakland International Airport.

Biotechnology Facilities, Northern California
Conducted Phase I ESAs on numerous biotech facilities throughout Northern California including Cisco and Ethicon-Endo, a subsidiary of Johnson & Johnson.

Pasadera Golf and Country Clubs, Monterey, California
Conducted a Phase I ESA for a 200-acre golf and country club in Monterey, California.

Gary Farrell Winery, Sonoma County, California
Conducted a Phase I ESA and limited regulatory compliance review of the Gary Farrell Winery in Healdsburg, California.

BlackRidge Real Estate Group, Southern California
Conducted multiple Phase I ESAs on developed properties throughout Southern California.

Baxa, Denver, Colorado
Conducted a Phase I ESA and limited regulatory compliance review of a medical device manufacturing facility located in Denver, Colorado. Conducted extensive site history research and communications with regulatory personnel.

Burke Industries, San Jose, California
Conducted a Phase I ESA for a company that manufactures rubber flooring and rubber wall boards. The Phase I involved extensive historical land use research, regulatory agency review, and review and summarization of site investigation reports, feasibility studies, monitoring reports, and human health risk assessments due to known soil and groundwater contamination on site from a neighboring facility.

MASCO Corporation, Northern California
Conducted Phase I ESAs, tenant exit reviews, and limited regulatory compliance reviews of various building products storage warehouses, commercial buildings, and facilities throughout the Bay Area.

Company Confidential, Northern California
Conducted numerous Phase I ESAs on developed and undeveloped properties including China Basin, commercial properties, and agricultural land throughout Northern California.

Centennial Corridor, California Department of Transportation, Bakersfield & Kern County, California
Conducted a hazardous materials and environmental site assessment for a 12-mile east-west trending corridor proposed to be constructed in Kern County to connect Interstate 5 with Highway 99 through the City of Bakersfield. Identified areas of potential hazardous material impact and provided recommendations for mitigation.

Turret Steel Industries, Northern California
Conducted Phase I ESA and limited regulatory compliance review of a steel bar storage and cutting warehouse in Dos Palos, California.

Sonoma County Water Agency and Sonoma Valley County Sanitation District, Northern California
Conducted hazardous materials and environmental site assessments as part of the Sonoma County wide effort to replace existing sewer lines and sewer trunk lines throughout Sonoma, California. The project involved review, analysis and compilation of environmental information, interview with site personnel, and multiple-day site reconnaissance's along the propose sewer replacement lines to observe site and surrounding areas. Identified properties of potential environmental concern along the existing sewer lines and produced a comprehensive environmental report that identified areas of potential hazardous impact and provided recommendations for mitigation. Follow-up work included preparing the proposals, scopes of works, and budget estimates to the client for Phase II ESAs.

PG&E, Northern California
Conducted numerous Phase I and Limited Phase II ESAs on undeveloped properties throughout Northern California.

Central California Coastal Seismic Imaging Project, San Luis Obispo, California
Assisted in the preparation of an Environmental Impact Report (EIR) on behalf of PG&E for the California State Lands Commission. Responsibilities included preparing the existing conditions and regulatory settings in the EIR, using CEQA guidelines. Other tasks included preparing the Aesthetics, Hazards and Hazardous Materials, and Traffic and Transportation sections in the EIR.

Sirna, San Francisco, California
Performed decontamination oversight work for a biotech facility in San Francisco, California.

Appendix 5.14B
Limited Soil Investigation, I-5 and Thornton Road, Lodi, San Joaquin County

Environmental Resources Management

1277 Treat Boulevard
Suite 500
Walnut Creek, CA 94597
(925) 946-0455
(925) 946-9968 (fax)
www.erm.com

24 February 2014

Ms. Anne P. Conner
Sr. Remediation Project Manager
Pacific Gas and Electric Company
3401 Crow Canyon Road
San Ramon, CA 94583

Subject: Limited Soil Investigation
I-5 Frontage Road and North Thornton Road
Lodi, San Joaquin County, California

Dear Ms. Conner:

ERM-West, Inc. (ERM) is pleased to present the final Limited Soil Investigation report for the approximately 25-acre Lodi Property located southwest of the I-5 Frontage Road and North Thornton Road intersection in Lodi, San Joaquin County, California. The Limited Soil Investigation was conducted in conformance with ERM's proposal dated 20 December 2013.

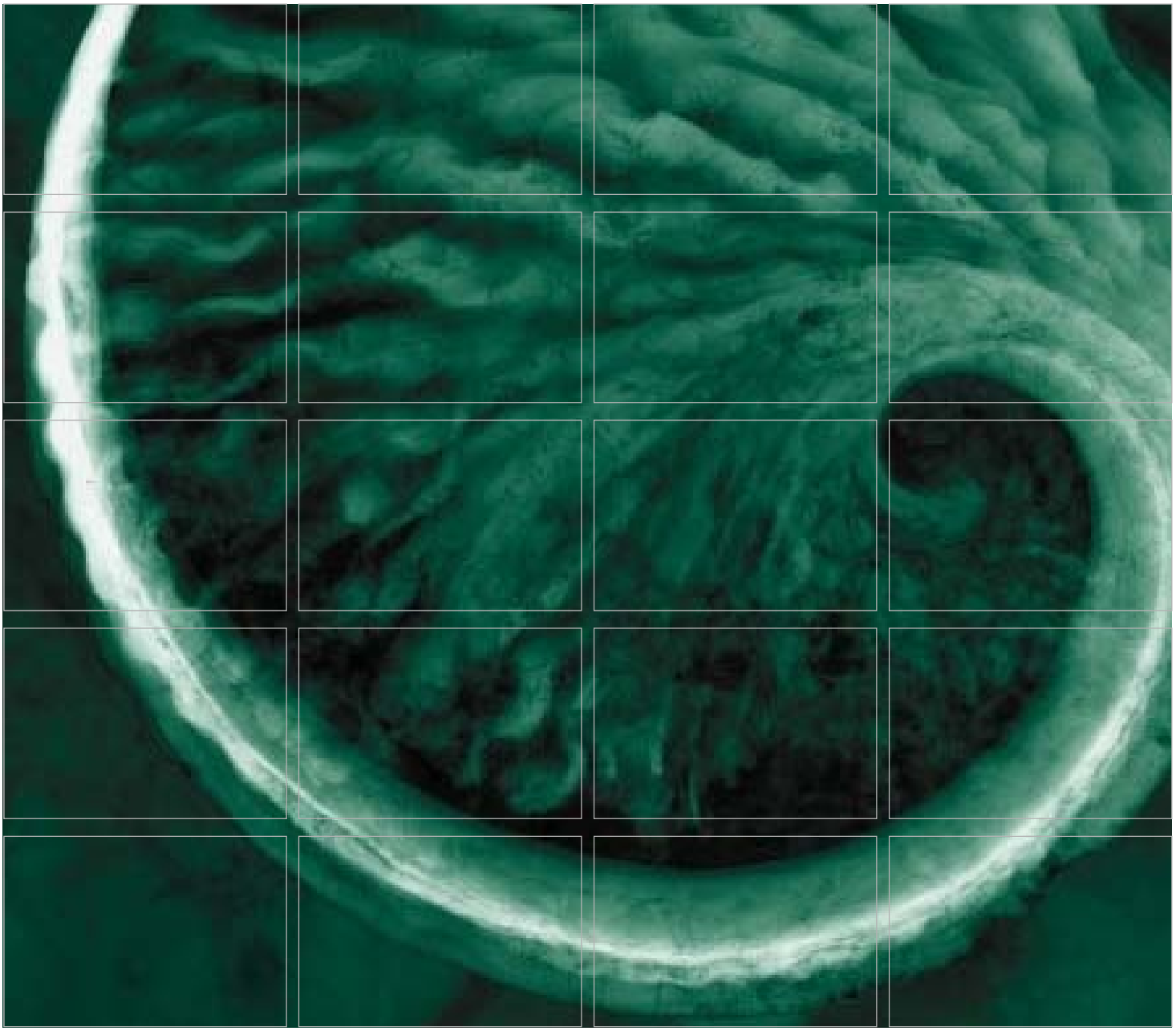
If you have any questions, or require additional information, please do not hesitate contact me at (925) 482-3204. ERM appreciates the opportunity to provide environmental services to PG&E.

Best Regards,

Bailey Blosser

Bailey Blosser
Project Manager

BWB/lhm/0231727.02.****



Limited Soil Investigation

City of Lodi Property
I-5 Frontage Road and North Thornton Road
Lodi, San Joaquin County, California

Prepared for:
Pacific Gas and Electric Company

February 2014

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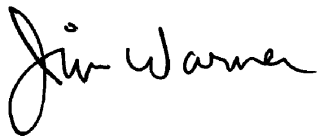
Pacific Gas and Electric Company

Limited Soil Investigation

City of Lodi Property
I-5 Frontage Road and North Thornton Road
Lodi, San Joaquin County, California

February 2014

Project No. 0231727



Jim Warner, P.G.
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B	*QA/QC Memorandum*

LIST OF ACRONYMS

APN	Assessor's Parcel Number
bgs	Below ground surface
Cal/EPA	California Environmental Protection Agency
CEL	Calscience Environmental Laboratories, Inc.
CHHSL	California Human Health Screening Level (Cal/EPA)
DWR	Department of Water Resources
EDR	Environmental Data Resources, Inc.
ERM	ERM-West, Inc.
ESA	Environmental Site Assessment
ESL	Environmental Screening Level
HASP	Health and Safety Plan
kV	kilovolt
mg/kg	Milligrams per kilogram
PCB	Polychlorinated biphenyls
PG&E	Pacific Gas and Electric Company
QA/QC	Quality Assurance/Quality Control
RSL	Regional Screening Level
RWQCB	San Francisco Bay Regional Water Quality Control Board
B-#	Soil Boring Location
USA	Underground Services Alert
USGS	United States Geological Survey
USEPA	United States Environmental Protection Agency

1.0 INTRODUCTION

This report presents the scope and findings of a limited soil investigation performed by ERM-West, Inc. (ERM) at the property located southwest of the I-5 Frontage Road and North Thornton Road intersection in Lodi, San Joaquin County, California (the "site" or "subject property"). The subject property consists of approximately 25 acres of agricultural land within the larger approximately 225 acre parcel identified as San Joaquin County Assessor's Office Assessor's Parcel Number (APN) 055-150-29.

The limited soil investigation, which was performed at the request of Pacific Gas and Electric Company (PG&E) in support of a potential transaction involving the subject property, included the collection of four soil samples within the 25 acre agricultural parcel at the subject property.

This report provides a background summary, describes the scope of work, and presents the sampling results. The limited soil investigation was performed following a Phase I Environmental Site Assessment (ESA) conducted by ERM at PG&E's request to assess potential environmental liabilities associated with surface and/or subsurface impacts from past and current operations at the subject property.

The Phase I ESA indicated that the subject property currently consists of agricultural land improved with a concrete irrigation canal located along the northern and eastern site boundary and a fence in disrepair located along the southern property boundary. No other structures or improvements are located within the site. According to information provided by site personnel, the majority of the subject property has historically been used as unimproved/agricultural land since at least 1894. ERM observed no surficial staining within the site and no other visual evidence of environmental concern was observed at the subject property during the site visit.

This limited soil investigation was conducted to determine if historical land use has impacted the subsurface of the subject property. Sampling locations were selected based on field observations during the Phase I ESA. The soil boring locations were proposed to be selected based on areas of environmental concern identified during the Phase I ESA. No visual impacts were identified so the soil boring locations were selected to accurately represent the site.

The scope of work included soil sampling as presented in ERM's proposal to PG&E dated 20 December 2013. The proposal was accepted by PG&E, and ERM conducted the Phase I ESA and this limited soil investigation under Master Services Agreement Contract No. 4400004065 between PG&E and ERM.

The following sections describe the site conditions, summarize the sampling and analysis activities conducted as part of the limited soil investigation, and present the analytical results. Figures and analytical results tables follow the main text. The laboratory analytical report is provided in Appendix A.

2.0 SITE SETTING

This section describes the general subject property location, site topography and hydrology, and the local geology and hydrogeology.

2.1 LOCATION

The subject property consists of approximately 25 acres of land located southwest of the intersection of I-5 Frontage Road and North Thornton Road in Lodi, San Joaquin County, California. The site includes the approximately 25 acre agricultural property which is located within the larger approximately 225 acre parcel identified with San Joaquin County Assessor's Office APN 055-150-29. The general location of the subject property and physiographic features of the surrounding area are shown on Figure 1, developed from the United States Geological Survey (USGS) 7.5-minute quadrangle for Terminous, California, dated 1993.

2.2 SITE DESCRIPTION

The subject property consists of approximately 25 acres of land located southwest of the intersection of I-5 Frontage Road and North Thornton Road in Lodi, San Joaquin County, California. The site includes the approximately 25 acre agricultural property which is located within the larger approximately 225 acre parcel identified with San Joaquin County Assessor's Office APN 055-150-29.

The 25 acre agricultural site occupies the eastern portion of the parcel and includes agricultural operations. With the exception of a concrete irrigation canal located along the northern and eastern site boundary and fence located along the southern property boundary, there are no other structures or improvements located within the site. According to information provided by site personnel, the majority of the subject property has historically been used as unimproved/agricultural land since at least 1894.

The subject property is situated in an agricultural area in Lodi, California. Adjacent properties and surrounding areas include a wastewater treatment facility and agricultural land to the south of the site, agricultural land and the I-5 Frontage Road to the north of the site, North Cord Road followed by I-5 to the east of the site, and agricultural land with 230

kilovolt (kV) power transmission lines to the west of the site. The site is accessible from the east off of North Cord Road.

A layout of the subject property is provided in Figure 2.

2.3 TOPOGRAPHY AND HYDROLOGY

The subject property is located in a generally flat area within the San Joaquin Valley and is situated at an average elevation of 7 feet above mean sea level. Based on site visit observations and topographic map review, the subject property is generally flat with a gently sloping topographic gradient towards the south-southwest. Based on site visit observations, storm water that falls within the substation area at the site either infiltrates into the ground or is captured on site and contained within the concrete irrigation canals. The closest surface water body to the subject property is an irrigation water retention pond located adjacent to the south of the site.

According to the EDR report, there are federal wetland areas identified adjacent to the south of the subject property within the vicinity of the irrigation water retention pond. Federal wetland areas were also identified to the east of the site. The subject property is located within the 100-year flood zone.

2.4 REGIONAL GEOLOGY AND HYDROGEOLOGY

Geologic and hydrogeologic information was obtained from the EDR report. According to the EDR report, bedrock beneath the site is typically of the Cenozoic Era and within the Quaternary Series. Soils beneath the site are listed as "Devries." Devries soils are characterized by somewhat poorly drained sandy loam with slow infiltration rates.

The California Department of Water Resources (DWR) Bulletin 118 provides an overview of the San Joaquin Valley Groundwater Basin and the Eastern San Joaquin Subbasin. In summary, sediments are primarily of Pliocene to Recent fine sands, clays, and gravels that were primarily deposited by the San Joaquin Delta. The average annual precipitation ranges from 11 to 25 inches. According to information provided GeoTracker, depth to groundwater beneath the subject property is expected to be approximately 15 feet below ground surface (bgs).

While ERM has not confirmed groundwater flow direction at the subject property, based on surface topography, it is expected groundwater flow

beneath the subject property is generally to the southwest. It is important to note that the groundwater flow direction can be influenced locally and regionally by the presence of local wetland features, surface topography, recharge and discharge areas, horizontal and vertical inconsistencies in the types and location of subsurface soils, and proximity to water pumping wells.

3.0 FIELD ACTIVITIES

The scope of the limited soil investigation included sampling at four soil boring (B) locations (B-1, B-2, B-3, and B-4) within the subject property. The soil boring locations were proposed to be selected based on areas of environmental concern identified during the Phase I ESA. No visual impacts were identified so the soil boring locations were selected to accurately represent the site. Soil boring locations are shown in Figure 2.

A site-specific Health and Safety Plan (HASP) was prepared summarizing the current conditions and activities planned during the limited soil investigation. All field staff reviewed the HASP prior to conducting work on site, and ERM's health and safety requirements were discussed with all ERM employees and site personnel during the morning tailgate meeting.

ERM implemented internal subsurface investigation policy and procedures prior to the collection of soil samples. In accordance with the ERM subsurface clearance policy, utility clearance using Underground Service Alert (USA) was not required due to the shallow depth (1 foot bgs) of the borings. Furthermore, Subsurface Survey private utility surveyors were not required to survey subsurface features and utilities at the site prior to sampling activities.

Sampling activities were performed on 29 January 2014. The investigation was limited in depth, with soil samples collected from 0.5 to 1.0 foot bgs. Field investigation activities and procedures are described below.

3.1 SOIL SAMPLING

Prior to sample collection, all sampling equipment was decontaminated with a Liquinox® soap and water wash, followed by a potable water and final deionized water rinse to prevent cross-contamination between sampling locations.

All four soil borings were advanced by hand augering to a depth of 0.5 foot bgs, and then one soil sample was collected at 0.5 to 1.0 foot bgs using a slide hammer from each boring. The soil samples were collected in a 6-inch, stainless-steel sleeve, sealed with Teflon tape, and capped on both ends. Each soil sample was placed in resealable plastic bag, and then placed in an ice-filled cooler. The soil borings were back-filled with soil.

Following sample collection activities, the samples were shipped under standard chain-of-custody protocol to Calscience Environmental Laboratories, Inc. (CEL), a California-certified laboratory in Garden Grove, California. The laboratory was instructed to analyze the soil samples collected from each boring location for the following parameters:

- Chlorinated Herbicides by United States Environmental Protection Agency (USEPA) Method 8151A; and
- Organochlorine Pesticides by USEPA Method 8081A.

The soil samples were analyzed as noted above on a standard 2-week turnaround time.

3.2 DATA ANALYSIS

One soil sample from each of the four boring locations was submitted to CEL for analysis. The analytical results for these samples are summarized in Tables 1 and 2. The complete laboratory report is provided in Appendix A.

ERM performed a data quality review of the analytical results in accordance with the *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*, October 1999, and *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, October 2004. The data quality review evaluated holding times, preservation methods, method blank sample results, laboratory control sample recoveries, and matrix and surrogate spike recoveries. Based on ERM's data quality review, the quality of the data generated during this investigation is acceptable for the preparation of technically defensible documents. A copy of the data quality assurance/quality control (QA/QC) review is provided in Appendix B.

4.0 INVESTIGATION RESULTS

This section summarizes ERM's observations regarding site-specific geologic and hydrologic conditions, and presents the results of the laboratory analyses.

4.1 GEOLOGY AND HYDROGEOLOGY

Shallow soils that were observed during the limited investigation consisted of moist sandy silts and clays. Groundwater was not encountered in the boreholes during sampling activities.

4.2 SOIL ANALYTICAL RESULTS

Soil analytical results are summarized on Tables 1 and 2 for each chemical class. Detectable concentrations are compared to the following compound-specific, risk-based screening levels:

- California Human Health Screening Levels (CHHSLs) from California Environmental Protection Agency (Cal/EPA) *Use of CHHSLs in Evaluation of Contaminated Properties*, as updated September 2010, for commercial/industrial land uses;
- Environmental Screening Levels (ESLs) for shallow soil (less than or equal to 3 meters bgs) where groundwater is a current or potential source of drinking water from the San Francisco Bay Regional Water Quality Control Board (RWQCB) *Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater*, as updated December 2013, for commercial/industrial land use; and
- Regional Screening Levels (RSLs) from USEPA Region IX online RSL table, as updated November 2013 for commercial/industrial land use.

As summarized in Section 3.1, soil samples were collected at four locations across the subject property. The complete laboratory reports are provided in Appendix A. The results for each chemical class are summarized below.

4.2.1 Chlorinated Herbicides in Site Soils

As shown in Table 1, chlorinated herbicides were not detected in the soil samples collected from the subject property. Reporting limits are less than the commercial/industrial ESLs for these constituents.

4.2.2 Organochlorine Pesticide Detections in Site Soils

As shown in Table 2, organochlorine pesticides were not detected above reporting limits in the site soil samples. Reporting limits are less than the commercial/industrial ESLs for these constituents.

5.0 SUMMARY AND CONCLUSIONS

The soil boring locations were proposed to be selected based on areas of environmental concern identified during the Phase I ESA. No visual impacts were identified so the soil boring locations were selected to accurately represent the site. Soil boring locations are shown in Figure 2. The results of the investigation were as follows:

- No visual or other evidence of impacts was observed during the field investigation.
- Chlorinated herbicides not detected above the laboratory reporting limits.
- Organochlorine pesticides were not detected above the laboratory reporting limits.

Screening levels for the industrial land use scenario are considered to be the most appropriate basis for evaluating the results based on current and projected land use. Detections below the screening levels are generally not considered threats to human health or the environment under the relevant land use.

The limited field investigation did not include sampling of soils at depths greater than 1 foot bgs, or of groundwater; thus the potential presence of chemical constituents in those media was not assessed. Due to the limited extent of the soil investigation, impact to deeper soils and/or groundwater due to historical site operations has not been assessed. However, the findings of the Phase I ESA and limited soil investigation do not indicate reason to suspect that deeper soils and/or groundwater have been significantly impacted by historical site operations. This conclusion is based on 1) the nature of historical site operations; 2) the lack of visual evidence of impacts during the Phase I ESA and limited soil investigation site visits and from a review of historical resources of the subject property; and 3) the lack of elevated detections in the surface soils.

6.0 REFERENCES

California Department of Water Resources (DWR). 2006. *California's Ground Water Bulletin 118, San Joaquin Valley Groundwater Basin, Eastern San Joaquin Subbasin.*

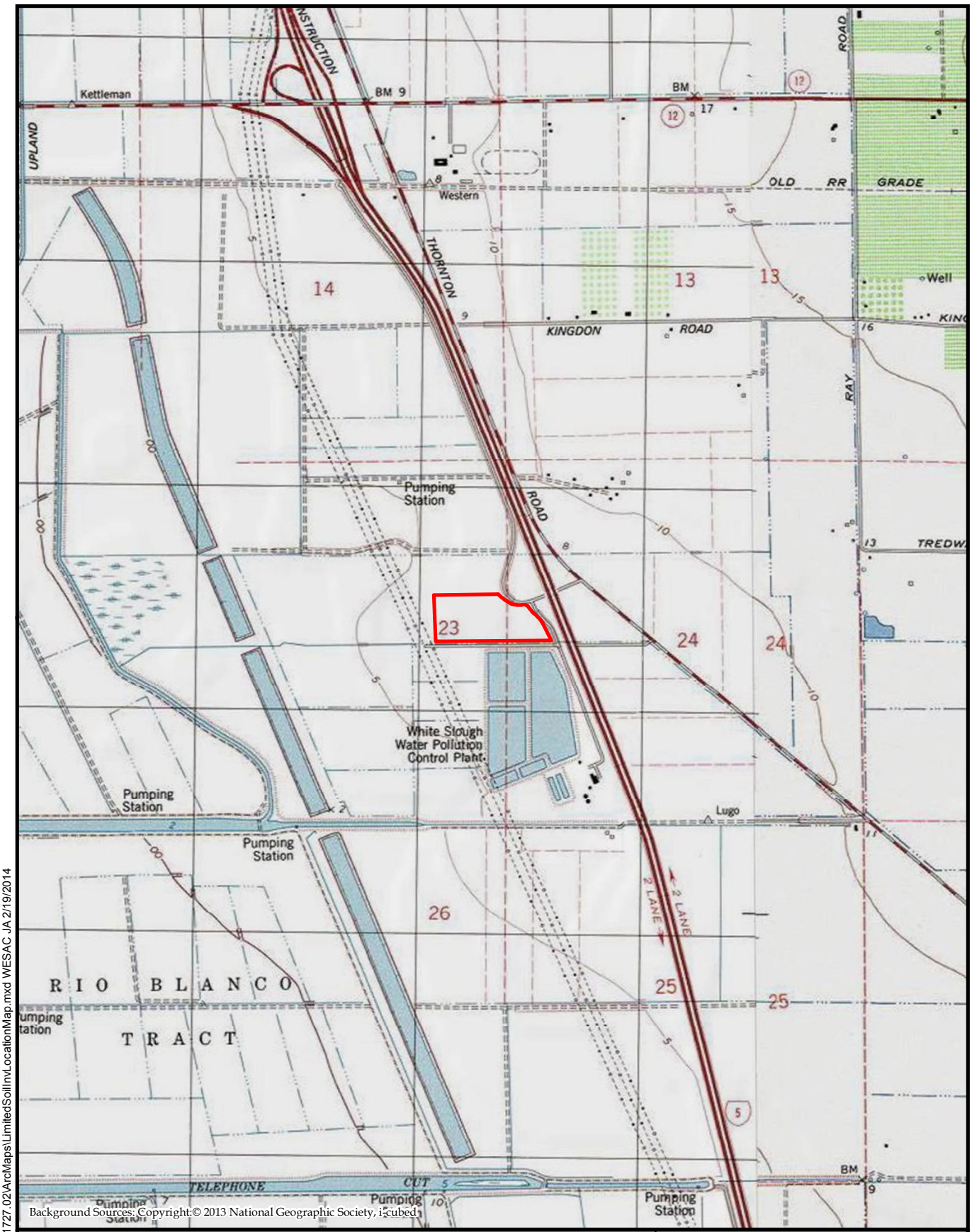
California Environmental Protection Agency (Cal/EPA). 2005. *Use of California Human Health Screening Levels (CHHSLs) in Evaluation of Contaminated Properties*. September 2010 update. Screening levels obtained at http://oehha.ca.gov/risk/chhsltable.html.

Environmental Data Resources, Inc. (EDR). 2014. *EDR Radius Map with GeoCheck®, Inquiry Number: 3827360.2s.*

Regional Water Quality Control Board, San Francisco Bay Region (RWQCB). 2013. *Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater*, December update.

USEPA, Region IX. 2013. *Online Regional Screening Level Table*, November update. Screening levels obtained from http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/docs/master_sl_table_run_NOV2013.pdf.

Figures



Legend

Site Boundary

N

0 24000

Scale in Inches

0 2000

Scale in Feet

1: 24000 USGS Quadrangle Name: Terminous

ERM

Figure 1
Limited Soil Investigation
North Thornton Road
Lodi, California 95242

PREPARED BY: JA (ERM)

Job No.: 0231727.02
File: LimitedSoilInvLocationMap.mxd

F:\GIS\Projects\Lodi\P0231727.02\ArcMaps\LimitedSoilInvLocationMap.mxd WESAC JA 2/19/2014



Legend

- Soil Boring Location
- Site Boundary

N

0 150 300

Scale in Feet

ERM

Figure 2
Limited Soil Investigation
North Thornton Road
Lodi, California 95242

PREPARED BY:
JA (ERM)

Job No.: 0231727.02
File: LimitedSoilInvSiteDetail.mxd

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Tables

Table 1
Chlorinated Herbicides in Soil
Detection Summary
I-5 Frontage Road and North Thornton Road
Lodi, San Joaquin County, California

Sample ID	Date	Dalapon	Dicamba	MCPP	MCPA	Dichlorprop	2,4-D	2,4,5-TP	2,4,5-T	2,4-DB	Dinoseb
	Industrial ESL	---	---	---	---	---	---	---	---	---	---
	Industrial CHHSL	---	---	---	---	---	*7,700*	---	*6,100*	---	---
	Industrial RSL	---	---	---	---	---	---	---	---	---	---
B-1	1/29/2014	<0.25	<0.010	<10	<10	<0.10	<0.10	<0.010	<0.010	<0.10	<0.050
B-2	1/29/2014	<0.25	<0.010	<10	<10	<0.10	<0.10	<0.010	<0.010	<0.10	<0.050
B-3	1/29/2014	<0.25	<0.010	<10	<10	<0.10	<0.10	<0.010	<0.010	<0.10	<0.050
B-4	1/29/2014	<0.25	<0.010	<10	<10	<0.10	<0.10	<0.010	<0.010	<0.10	<0.050

Notes:

All concentrations reported in milligrams per kilogram (mg/kg).

Samples were analyzed by USEPA Method 8151A.

Industrial ESL = Commercial/Industrial Environmental Screening Level (RWQCB, Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater, December 2013).

Industrial CHHSL = Industrial California Human Health Screening Level (Cal/EPA, Use of CHHSLs in Evaluation of Contaminated Properties, September 2010).

Industrial RSL = Commercial/Industrial Regional Screening Level (EPA Region 9 RSL Table; November 2013).

< = Compound not detected at or above the laboratory reporting limit.

--- = No screening level established.

MCPP = Methylchlorophenoxypropionic Acid

MCPA = 2-methyl-4-chlorophenoxyacetic Acid

2,4-D = 2,4-Dichlorophenoxyacetic Acid

2,4,5-TP = Silvex

2,4,5-T = 2,4,5-Trichlorophenoxyacetic Acid

2,4-DB = 4-butyric Acid

Table 2
Organochlorine Pesticides in Soil
Detection Summary
I-5 Frontage Road and North Thornton Road
Lodi, San Joaquin County, California

Sample ID	Date	Aldrin	Alpha-BHC	Beta-BHC	Chlordane	4,4'-DDD	4,4'-DDE	4,4'-DDT	Delta-BHC	Dieldrin	Endosulfan I	Endosulfan II	Endosulfan Sulfate	Endrin	Endrin Aldehyde	Endrin Ketone	Gamma-BHC	Heptachlor	Heptachlor Epoxide	Methoxychlor	Toxaphene
Industrial ESL		*0.13*	---	---	*1.7*	*10.0*	*4.0*	*4.0*	---	*0.0023*	*0.0046*	---	---	*0.00065*	---	---	*0.0098*	*0.013*	*0.014*	*19*	*0.00042*
Industrial CHHSL		*0.13*	---	---	*1.7*	*9.0*	*6.3*	*6.3*	---	*0.13*	---	---	---	*230*	---	---	*2.0*	*0.52*	---	*3,800*	*1.8*
Industrial RSL		*0.1*	*0.27*	*0.96*	*6.5*	*7.2*	*5.1*	*7.0*	---	*0.11*	*3,700*	---	---	*180*	---	---	*2.1*	*0.38*	*0.19*	*3,100*	*1.6*
B-1	1/29/2014	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	**0.0017 j**	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.10
B-2	1/29/2014	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.10
B-3	1/29/2014	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.099
B-4	1/29/2014	<0.005	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.10

Notes and Key:
All concentrations reported in milligrams per kilogram (mg/kg).
Samples were analyzed by USEPA Method 8081A.
Industrial ESL = Commercial/Industrial Environmental Screening Level (RWQCB, Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater, December 2013).
Industrial CHHSL = Industrial California Human Health Screening Level (Cal/EPA, Use of CHHSLs in Evaluation of Contaminated Properties, September 2010).
Industrial RSL = Commercial/Industrial Regional Screening Level (EPA Region 9 RSL Table; November 2013).
--- = No screening level established.
< = Compound not detected at or above the laboratory reporting limit.

Laboratory Qualifier
j = Analyte was detected at a concentration below the reporting limit and above the laboratory method detection limit. Reported value is estimated.

Appendix A
Laboratory Analytical Report

Calscience Environmental Laboratories, Inc.

CALSCIENCE

WORK ORDER NUMBER: 14-01-1762

The difference is service



AIR | SOIL | WATER | MARINE CHEMISTRY

Analytical Report For

Client: ERM - West, Inc.

Client Project Name: 0231727.02 / Phase I ESA

Attention: Lindsay Capitanich
2525 Natomas Park Drive, Suite 350
Sacramento, CA 95833-2936

Approved for release on 02/07/2014 by:
Danielle Gonsman
Project Manager

ResultLink

Email your PM

Calscience Environmental Laboratories, Inc. (Calscience) certifies that the test results provided in this report meet all NELAC requirements for parameters for which accreditation is required or available. Any exceptions to NELAC requirements are noted in the case narrative. The original report of subcontracted analyses, if any, is attached to this report. The results in this report are limited to the sample(s) tested and any reproduction thereof must be made in its entirety. The client or recipient of this report is specifically prohibited from making material changes to said report and, to the extent that such changes are made, Calscience is not responsible, legally or otherwise. The client or recipient agrees to indemnify Calscience for any defense to any litigation which may arise.

Calscience Environmental Laboratories, Inc.

Contents

Client Project Name: 0231727.02 / Phase I ESA
Work Order Number: 14-01-1762

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Calscience Environmental Laboratories, Inc.

Work Order Narrative

Work Order: 14-01-1762 Page 1 of 1

Condition Upon Receipt:

Samples were received under Chain of Custody (COC) on 01/30/14. They were assigned to Work Order 14-01-1762.

Unless otherwise noted on the Sample Receiving forms all samples were received in good condition and within the recommended EPA temperature criteria for the methods noted on the COC. The COC and Sample Receiving Documents are integral elements of the analytical report and are presented at the back of the report.

Holding Times:

All samples were analyzed within prescribed holding times (HT) and/or in accordance with the Calscience Sample Acceptance Policy unless otherwise noted in the analytical report and/or comprehensive case narrative, if required.

Any parameter identified in 40CFR Part 136.3 Table II that is designated as "analyze immediately" with a holding time of <= 15 minutes (40CFR-136.3 Table II, footnote 4), is considered a "field" test and the reported results will be qualified as being received outside of the stated holding time unless received at the laboratory within 15 minutes of the collection time.

Quality Control:

All quality control parameters (QC) were within established control limits except where noted in the QC summary forms or described further within this report.

Additional Comments:

Air - Sorbent-extracted air methods (EPA TO-4A, EPA TO-10, EPA TO-13A, EPA TO-17): Analytical results are converted from mass/sample basis to mass/volume basis using client-supplied air volumes.

New York NELAP air certification does not certify for all reported methods and analytes, reference the accredited items here: http://www.calscience.com/PDF/New_York.pdf

Solid - Unless otherwise indicated, solid sample data is reported on a wet weight basis, not corrected for % moisture. All QC results are always reported on a wet weight basis.

Subcontractor Information:

Unless otherwise noted below (or on the subcontract form), no samples were subcontracted.

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Calscience Environmental Laboratories, Inc.

Sample Summary

Client:	ERM - West, Inc. 2525 Natomas Park Drive, Suite 350 Sacramento, CA 95833-2936	Work Order:	14-01-1762
		Project Name:	0231727.02 / Phase I ESA
		PO Number:	
		Date/Time Received:	01/30/14 10:40
		Number of Containers:	4
Attn:	Lindsay Capitanich		

Sample Identification	Lab Number	Collection Date and Time	Number of Containers	Matrix
B-1	14-01-1762-1	01/29/14 10:00	1	Solid
B-2	14-01-1762-2	01/29/14 10:15	1	Solid
B-3	14-01-1762-3	01/29/14 10:40	1	Solid
B-4	14-01-1762-4	01/29/14 11:05	1	Solid

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Calscience Environmental Laboratories, Inc.

Analytical Report

ERM - West, Inc.
2525 Natomas Park Drive, Suite 350
Sacramento, CA 95833-2936

Date Received: 01/30/14
Work Order: 14-01-1762
Preparation: EPA 3545
Method: EPA 8081A
Units: ug/kg

Project: 0231727.02 / Phase I ESA

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
B-1	**14-01-1762-1-A**	**01/29/14 10:00**	**Solid**	**GC 51**	**01/31/14**	**02/05/14 13:02**	**140131L17**

Comment(s): - Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Aldrin	ND	5.0	1.6	1	
Alpha-BHC	ND	5.0	1.6	1	
Beta-BHC	ND	5.0	1.3	1	
Chlordane	ND	50	16	1	
4,4'-DDD	ND	5.0	1.6	1	
4,4'-DDE	ND	5.0	1.5	1	
4,4'-DDT	1.7	5.0	1.7	1	J
Delta-BHC	ND	5.0	1.3	1	
Dieldrin	ND	5.0	1.6	1	
Endosulfan I	ND	5.0	1.3	1	
Endosulfan II	ND	5.0	1.4	1	
Endosulfan Sulfate	ND	5.0	1.7	1	
Endrin	ND	5.0	1.8	1	
Endrin Aldehyde	ND	5.0	1.2	1	
Endrin Ketone	ND	5.0	1.7	1	
Gamma-BHC	ND	5.0	1.7	1	
Heptachlor	ND	5.0	1.6	1	
Heptachlor Epoxide	ND	5.0	1.8	1	
Methoxychlor	ND	5.0	1.6	1	
Toxaphene	ND	100	32	1	

Surrogate	Rec. (%)	Control Limits	Qualifiers
Decachlorobiphenyl	99	24-168	
2,4,5,6-Tetrachloro-m-Xylene	108	25-145	

Return to Contents

RL: Reporting Limit. DF: Dilution Factor. MDL: Method Detection Limit.

Calscience Environmental Laboratories, Inc.

Analytical Report

ERM - West, Inc.
2525 Natomas Park Drive, Suite 350
Sacramento, CA 95833-2936

Date Received: 01/30/14
Work Order: 14-01-1762
Preparation: EPA 3545
Method: EPA 8081A
Units: ug/kg

Project: 0231727.02 / Phase I ESA

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
B-2	**14-01-1762-2-A**	**01/29/14 10:15**	**Solid**	**GC 51**	**01/31/14**	**02/05/14 13:17**	**140131L17**

Comment(s): - Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Aldrin	ND	5.0	1.6	1	
Alpha-BHC	ND	5.0	1.6	1	
Beta-BHC	ND	5.0	1.3	1	
Chlordane	ND	50	16	1	
4,4'-DDD	ND	5.0	1.6	1	
4,4'-DDE	ND	5.0	1.5	1	
4,4'-DDT	ND	5.0	1.7	1	
Delta-BHC	ND	5.0	1.3	1	
Dieldrin	ND	5.0	1.6	1	
Endosulfan I	ND	5.0	1.3	1	
Endosulfan II	ND	5.0	1.4	1	
Endosulfan Sulfate	ND	5.0	1.7	1	
Endrin	ND	5.0	1.8	1	
Endrin Aldehyde	ND	5.0	1.2	1	
Endrin Ketone	ND	5.0	1.7	1	
Gamma-BHC	ND	5.0	1.7	1	
Heptachlor	ND	5.0	1.6	1	
Heptachlor Epoxide	ND	5.0	1.8	1	
Methoxychlor	ND	5.0	1.6	1	
Toxaphene	ND	100	32	1	

Surrogate	Rec. (%)	Control Limits	Qualifiers
Decachlorobiphenyl	81	24-168	
2,4,5,6-Tetrachloro-m-Xylene	79	25-145	

RL: Reporting Limit. DF: Dilution Factor. MDL: Method Detection Limit.

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Calscience Environmental Laboratories, Inc.

Analytical Report

ERM - West, Inc.
2525 Natomas Park Drive, Suite 350
Sacramento, CA 95833-2936

Date Received: 01/30/14
Work Order: 14-01-1762
Preparation: EPA 3545
Method: EPA 8081A
Units: ug/kg

Project: 0231727.02 / Phase I ESA

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
B-3	**14-01-1762-3-A**	**01/29/14 10:40**	**Solid**	**GC 51**	**01/31/14**	**02/05/14 13:31**	**140131L17**

Comment(s): - Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Aldrin	ND	5.0	1.6	1	
Alpha-BHC	ND	5.0	1.6	1	
Beta-BHC	ND	5.0	1.3	1	
Chlordane	ND	50	16	1	
4,4'-DDD	ND	5.0	1.6	1	
4,4'-DDE	ND	5.0	1.5	1	
4,4'-DDT	ND	5.0	1.7	1	
Delta-BHC	ND	5.0	1.3	1	
Dieldrin	ND	5.0	1.6	1	
Endosulfan I	ND	5.0	1.3	1	
Endosulfan II	ND	5.0	1.4	1	
Endosulfan Sulfate	ND	5.0	1.7	1	
Endrin	ND	5.0	1.8	1	
Endrin Aldehyde	ND	5.0	1.2	1	
Endrin Ketone	ND	5.0	1.7	1	
Gamma-BHC	ND	5.0	1.7	1	
Heptachlor	ND	5.0	1.6	1	
Heptachlor Epoxide	ND	5.0	1.8	1	
Methoxychlor	ND	5.0	1.6	1	
Toxaphene	ND	99	31	1	

Surrogate	Rec. (%)	Control Limits	Qualifiers
Decachlorobiphenyl	71	24-168	
2,4,5,6-Tetrachloro-m-Xylene	77	25-145	

RL: Reporting Limit. DF: Dilution Factor. MDL: Method Detection Limit.

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Calscience Environmental Laboratories, Inc.

Analytical Report

ERM - West, Inc.
2525 Natomas Park Drive, Suite 350
Sacramento, CA 95833-2936

Date Received: 01/30/14
Work Order: 14-01-1762
Preparation: EPA 3545
Method: EPA 8081A
Units: ug/kg

Project: 0231727.02 / Phase I ESA

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
B-4	**14-01-1762-4-A**	**01/29/14 11:05**	**Solid**	**GC 51**	**01/31/14**	**02/05/14 13:45**	**140131L17**

Comment(s): - Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Aldrin	ND	5.0	1.6	1	
Alpha-BHC	ND	5.0	1.6	1	
Beta-BHC	ND	5.0	1.3	1	
Chlordane	ND	50	16	1	
4,4'-DDD	ND	5.0	1.6	1	
4,4'-DDE	ND	5.0	1.5	1	
4,4'-DDT	ND	5.0	1.7	1	
Delta-BHC	ND	5.0	1.3	1	
Dieldrin	ND	5.0	1.7	1	
Endosulfan I	ND	5.0	1.3	1	
Endosulfan II	ND	5.0	1.4	1	
Endosulfan Sulfate	ND	5.0	1.7	1	
Endrin	ND	5.0	1.8	1	
Endrin Aldehyde	ND	5.0	1.2	1	
Endrin Ketone	ND	5.0	1.8	1	
Gamma-BHC	ND	5.0	1.7	1	
Heptachlor	ND	5.0	1.6	1	
Heptachlor Epoxide	ND	5.0	1.8	1	
Methoxychlor	ND	5.0	1.6	1	
Toxaphene	ND	100	32	1	

Surrogate	Rec. (%)	Control Limits	Qualifiers
Decachlorobiphenyl	67	24-168	
2,4,5,6-Tetrachloro-m-Xylene	68	25-145	

RL: Reporting Limit. DF: Dilution Factor. MDL: Method Detection Limit.

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Calscience Environmental Laboratories, Inc.

Analytical Report

ERM - West, Inc.
2525 Natomas Park Drive, Suite 350
Sacramento, CA 95833-2936

Date Received: 01/30/14
Work Order: 14-01-1762
Preparation: EPA 3545
Method: EPA 8081A
Units: ug/kg

Project: 0231727.02 / Phase I ESA

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
Method Blank	**099-12-537-1606**	**N/A**	**Solid**	**GC 51**	**01/31/14**	**02/05/14 12:34**	**140131L17**

Comment(s): - Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Aldrin	ND	5.0	1.6	1	
Alpha-BHC	ND	5.0	1.6	1	
Beta-BHC	ND	5.0	1.3	1	
Chlordane	ND	50	16	1	
4,4'-DDD	ND	5.0	1.6	1	
4,4'-DDE	ND	5.0	1.5	1	
4,4'-DDT	ND	5.0	1.7	1	
Delta-BHC	ND	5.0	1.3	1	
Dieldrin	ND	5.0	1.6	1	
Endosulfan I	ND	5.0	1.3	1	
Endosulfan II	ND	5.0	1.4	1	
Endosulfan Sulfate	ND	5.0	1.7	1	
Endrin	ND	5.0	1.8	1	
Endrin Aldehyde	ND	5.0	1.2	1	
Endrin Ketone	ND	5.0	1.7	1	
Gamma-BHC	ND	5.0	1.7	1	
Heptachlor	ND	5.0	1.6	1	
Heptachlor Epoxide	ND	5.0	1.8	1	
Methoxychlor	ND	5.0	1.6	1	
Toxaphene	ND	100	32	1	

Surrogate	Rec. (%)	Control Limits	Qualifiers
Decachlorobiphenyl	108	24-168	
2,4,5,6-Tetrachloro-m-Xylene	114	25-145	

Return to Contents

RL: Reporting Limit. DF: Dilution Factor. MDL: Method Detection Limit.

Calscience Environmental Laboratories, Inc.

Analytical Report

ERM - West, Inc.
2525 Natomas Park Drive, Suite 350
Sacramento, CA 95833-2936

Date Received: 01/30/14
Work Order: 14-01-1762
Preparation: EPA 8151A
Method: EPA 8151A
Units: ug/kg

Project: 0231727.02 / Phase I ESA

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
B-1	**14-01-1762-1-A**	**01/29/14 10:00**	**Solid**	**GC 40**	**01/31/14**	**02/05/14 19:47**	**140131L21**

Comment(s): - Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Dalapon	ND	250	73	1	
Dicamba	ND	10	1.2	1	
MCPP	ND	10000	3200	1	
MCPA	ND	10000	2100	1	
Dichlorprop	ND	100	17	1	
2,4-D	ND	100	14	1	
2,4,5-TP (Silvex)	ND	10	2.3	1	
2,4,5-T	ND	10	1.1	1	
2,4-DB	ND	100	16	1	
Dinoseb	ND	50	5.1	1	

Surrogate	Rec. (%)	Control Limits	Qualifiers
2,4-Dichlorophenylacetic acid	64	30-130	

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
B-2	**14-01-1762-2-A**	**01/29/14 10:15**	**Solid**	**GC 40**	**01/31/14**	**02/05/14 20:12**	**140131L21**

Comment(s): - Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Dalapon	ND	250	73	1	
Dicamba	ND	10	1.2	1	
MCPP	ND	10000	3100	1	
MCPA	ND	10000	2000	1	
Dichlorprop	ND	100	17	1	
2,4-D	ND	100	14	1	
2,4,5-TP (Silvex)	ND	10	2.3	1	
2,4,5-T	ND	10	1.1	1	
2,4-DB	ND	100	16	1	
Dinoseb	ND	50	5.1	1	

Surrogate	Rec. (%)	Control Limits	Qualifiers
2,4-Dichlorophenylacetic acid	65	30-130	

Return to Contents

RL: Reporting Limit. DF: Dilution Factor. MDL: Method Detection Limit.

Calscience Environmental Laboratories, Inc.

Analytical Report

ERM - West, Inc.
2525 Natomas Park Drive, Suite 350
Sacramento, CA 95833-2936

Date Received: 01/30/14
Work Order: 14-01-1762
Preparation: EPA 8151A
Method: EPA 8151A
Units: ug/kg

Project: 0231727.02 / Phase I ESA

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
B-3	**14-01-1762-3-A**	**01/29/14 10:40**	**Solid**	**GC 40**	**01/31/14**	**02/05/14 20:38**	**140131L21**

Comment(s): - Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Dalapon	ND	250	73	1	
Dicamba	ND	10	1.2	1	
MCPP	ND	10000	3200	1	
MCPA	ND	10000	2100	1	
Dichlorprop	ND	100	17	1	
2,4-D	ND	100	14	1	
2,4,5-TP (Silvex)	ND	10	2.3	1	
2,4,5-T	ND	10	1.1	1	
2,4-DB	ND	100	16	1	
Dinoseb	ND	50	5.1	1	

Surrogate	Rec. (%)	Control Limits	Qualifiers
2,4-Dichlorophenylacetic acid	61	30-130	

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
B-4	**14-01-1762-4-A**	**01/29/14 11:05**	**Solid**	**GC 40**	**01/31/14**	**02/05/14 21:04**	**140131L21**

Comment(s): - Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Dalapon	ND	250	73	1	
Dicamba	ND	10	1.2	1	
MCPP	ND	10000	3200	1	
MCPA	ND	10000	2100	1	
Dichlorprop	ND	100	17	1	
2,4-D	ND	100	14	1	
2,4,5-TP (Silvex)	ND	10	2.3	1	
2,4,5-T	ND	10	1.1	1	
2,4-DB	ND	100	16	1	
Dinoseb	ND	50	5.1	1	

Surrogate	Rec. (%)	Control Limits	Qualifiers
2,4-Dichlorophenylacetic acid	68	30-130	

Return to Contents

RL: Reporting Limit. DF: Dilution Factor. MDL: Method Detection Limit.

Calscience Environmental Laboratories, Inc.

Analytical Report

ERM - West, Inc.
2525 Natomas Park Drive, Suite 350
Sacramento, CA 95833-2936

Date Received: 01/30/14
Work Order: 14-01-1762
Preparation: EPA 8151A
Method: EPA 8151A
Units: ug/kg

Project: 0231727.02 / Phase I ESA

Client Sample Number	Lab Sample Number	Date/Time Collected	Matrix	Instrument	Date Prepared	Date/Time Analyzed	QC Batch ID
Method Blank	**095-01-033-1151**	**N/A**	**Solid**	**GC 40**	**01/31/14**	**02/05/14 18:29**	**140131L21**

Comment(s): - Results were evaluated to the MDL (DL), concentrations >= to the MDL (DL) but < RL (LOQ), if found, are qualified with a "J" flag.

Parameter	Result	RL	MDL	DF	Qualifiers
Dalapon	ND	250	73	1	
Dicamba	ND	10	1.2	1	
MCPP	ND	10000	3200	1	
MCPA	ND	10000	2100	1	
Dichlorprop	ND	100	17	1	
2,4-D	ND	100	14	1	
2,4,5-TP (Silvex)	ND	10	2.3	1	
2,4,5-T	ND	10	1.1	1	
2,4-DB	ND	100	16	1	
Dinoseb	ND	50	5.1	1	

Surrogate	Rec. (%)	Control Limits	Qualifiers
2,4-Dichlorophenylacetic acid	81	30-130	

Return to Contents

RL: Reporting Limit. DF: Dilution Factor. MDL: Method Detection Limit.

Calscience Environmental Laboratories, Inc.

Quality Control - Spike/Spike Duplicate

ERM - West, Inc.
2525 Natomas Park Drive, Suite 350
Sacramento, CA 95833-2936

Project: 0231727.02 / Phase I ESA

Date Received: 01/30/14
Work Order: 14-01-1762
Preparation: EPA 3545
Method: EPA 8081A

Quality Control Sample ID	Type	Matrix	Instrument	Date Prepared	Date Analyzed	MS/MSD Batch Number
B-4	**Sample**	**Solid**	**GC 51**	**01/31/14**	**02/05/14 13:45**	**140131S17**
B-4	**Matrix Spike**	**Solid**	**GC 51**	**01/31/14**	**02/05/14 14:57**	**140131S17**
B-4	**Matrix Spike Duplicate**	**Solid**	**GC 51**	**01/31/14**	**02/05/14 15:11**	**140131S17**

Parameter	Sample Conc.	Spike Added	MS Conc.	MS %Rec.	MSD Conc.	MSD %Rec.	%Rec. CL	RPD	RPD CL	Qualifiers
Aldrin	ND	25.00	15.21	61	13.99	56	50-135	8	0-25	
Alpha-BHC	ND	25.00	21.87	87	22.00	88	50-135	1	0-25	
Beta-BHC	ND	25.00	19.48	78	19.99	80	50-135	3	0-25	
4,4'-DDD	ND	25.00	16.66	67	15.62	62	50-135	6	0-25	
4,4'-DDE	ND	25.00	16.16	65	14.91	60	50-135	8	0-25	
4,4'-DDT	ND	25.00	17.55	70	16.39	66	50-135	7	0-25	
Delta-BHC	ND	25.00	21.59	86	22.46	90	50-135	4	0-25	
Dieldrin	ND	25.00	17.28	69	16.77	67	50-135	3	0-25	
Endosulfan I	ND	25.00	17.91	72	17.13	69	50-135	4	0-25	
Endosulfan II	ND	25.00	19.15	77	18.71	75	50-135	2	0-25	
Endosulfan Sulfate	ND	25.00	20.21	81	19.82	79	50-135	2	0-25	
Endrin	ND	25.00	19.30	77	18.83	75	50-135	2	0-25	
Endrin Aldehyde	ND	25.00	13.90	56	12.64	51	50-135	10	0-25	
Gamma-BHC	ND	25.00	21.17	85	21.55	86	50-135	2	0-25	
Heptachlor	ND	25.00	16.97	68	15.56	62	50-135	9	0-25	
Heptachlor Epoxide	ND	25.00	16.53	66	15.79	63	50-135	5	0-25	
Methoxychlor	ND	25.00	17.52	70	16.29	65	50-135	7	0-25	

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RPD: Relative Percent Difference. CL: Control Limits

Calscience Environmental Laboratories, Inc.

Quality Control - Spike/Spike Duplicate

ERM - West, Inc.
2525 Natomas Park Drive, Suite 350
Sacramento, CA 95833-2936

Project: 0231727.02 / Phase I ESA

Date Received: 01/30/14
Work Order: 14-01-1762
Preparation: EPA 8151A
Method: EPA 8151A

Quality Control Sample ID	Type	Matrix	Instrument	Date Prepared	Date Analyzed	MS/MSD Batch Number
B-4	**Sample**	**Solid**	**GC 40**	**01/31/14**	**02/05/14 21:04**	**140131S21**
B-4	**Matrix Spike**	**Solid**	**GC 40**	**01/31/14**	**02/05/14 18:55**	**140131S21**
B-4	**Matrix Spike Duplicate**	**Solid**	**GC 40**	**01/31/14**	**02/05/14 19:21**	**140131S21**

Parameter	Sample Conc.	Spike Added	MS Conc.	MS %Rec.	MSD Conc.	MSD %Rec.	%Rec. CL	RPD	RPD CL	Qualifiers
2,4-D	ND	400.0	277.2	69	258.7	65	30-130	7	0-30	
2,4,5-T	ND	40.00	28.10	70	27.30	68	30-130	3	0-30	
2,4-DB	ND	400.0	265.4	66	250.8	63	30-130	6	0-30	

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RPD: Relative Percent Difference. CL: Control Limits

Calscience Environmental Laboratories, Inc.

Quality Control - LCS

ERM - West, Inc.
2525 Natomas Park Drive, Suite 350
Sacramento, CA 95833-2936

Project: 0231727.02 / Phase I ESA

Date Received: 01/30/14
Work Order: 14-01-1762
Preparation: EPA 3545
Method: EPA 8081A

Quality Control Sample ID	Type	Matrix	Instrument	Date Prepared	Date Analyzed	LCS Batch Number
099-12-537-1606	**LCS**	**Solid**	**GC 51**	**01/31/14**	**02/05/14 12:48**	**140131L17**

Parameter	Spike Added	Conc. Recovered	LCS %Rec.	%Rec. CL	ME CL	Qualifiers
Aldrin	25.00	23.61	94	50-135	36-149	
Alpha-BHC	25.00	26.44	106	50-135	36-149	
Beta-BHC	25.00	24.11	96	50-135	36-149	
4,4'-DDD	25.00	23.40	94	50-135	36-149	
4,4'-DDE	25.00	23.85	95	50-135	36-149	
4,4'-DDT	25.00	26.37	105	50-135	36-149	
Delta-BHC	25.00	25.34	101	50-135	36-149	
Dieldrin	25.00	24.08	96	50-135	36-149	
Endosulfan I	25.00	24.51	98	50-135	36-149	
Endosulfan II	25.00	24.69	99	50-135	36-149	
Endosulfan Sulfate	25.00	24.93	100	50-135	36-149	
Endrin	25.00	26.82	107	50-135	36-149	
Endrin Aldehyde	25.00	24.63	99	50-135	36-149	
Gamma-BHC	25.00	26.26	105	50-135	36-149	
Heptachlor	25.00	25.53	102	50-135	36-149	
Heptachlor Epoxide	25.00	22.64	91	50-135	36-149	
Methoxychlor	25.00	25.18	101	50-135	36-149	

Total number of LCS compounds: 17
Total number of ME compounds: 0
Total number of ME compounds allowed: 1
LCS ME CL validation result: Pass

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RPD: Relative Percent Difference. CL: Control Limits

Calscience Environmental Laboratories, Inc.

Quality Control - LCS

ERM - West, Inc.
2525 Natomas Park Drive, Suite 350
Sacramento, CA 95833-2936

Project: 0231727.02 / Phase I ESA

Date Received: 01/30/14
Work Order: 14-01-1762
Preparation: EPA 8151A
Method: EPA 8151A

Quality Control Sample ID	Type	Matrix	Instrument	Date Prepared	Date Analyzed	LCS Batch Number
095-01-033-1151	**LCS**	**Solid**	**GC 40**	**01/31/14**	**02/05/14 18:03**	**140131L21**

Parameter	Spike Added	Conc. Recovered	LCS %Rec.	%Rec. CL	Qualifiers
2,4-D	400.0	422.7	106	30-130	
2,4,5-T	40.00	47.60	119	30-130	
2,4-DB	400.0	385.0	96	30-130	

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RPD: Relative Percent Difference. CL: Control Limits

Calscience Environmental Laboratories, Inc.

Glossary of Terms and Qualifiers

Work Order: 14-01-1762 Page 1 of 1

Qualifiers	Definition
*	See applicable analysis comment.
<	Less than the indicated value.
>	Greater than the indicated value.
1	Surrogate compound recovery was out of control due to a required sample dilution. Therefore, the sample data was reported without further clarification.
2	Surrogate compound recovery was out of control due to matrix interference. The associated method blank surrogate spike compound was in control and, therefore, the sample data was reported without further clarification.
3	Recovery of the Matrix Spike (MS) or Matrix Spike Duplicate (MSD) compound was out of control due to suspected matrix interference. The associated LCS recovery was in control.
4	The MS/MSD RPD was out of control due to suspected matrix interference.
5	The PDS/PDSD or PES/PESD associated with this batch of samples was out of control due to suspected matrix interference.
6	Surrogate recovery below the acceptance limit.
7	Surrogate recovery above the acceptance limit.
B	Analyte was present in the associated method blank.
BU	Sample analyzed after holding time expired.
BV	Sample received after holding time expired.
E	Concentration exceeds the calibration range.
ET	Sample was extracted past end of recommended max. holding time.
HD	The chromatographic pattern was inconsistent with the profile of the reference fuel standard.
HDH	The sample chromatographic pattern for TPH matches the chromatographic pattern of the specified standard but heavier hydrocarbons were also present (or detected).
HDL	The sample chromatographic pattern for TPH matches the chromatographic pattern of the specified standard but lighter hydrocarbons were also present (or detected).
J	Analyte was detected at a concentration below the reporting limit and above the laboratory method detection limit. Reported value is estimated.
JA	Analyte positively identified but quantitation is an estimate.
ME	LCS Recovery Percentage is within Marginal Exceedance (ME) Control Limit range (+/- 4 SD from the mean).
ND	Parameter not detected at the indicated reporting limit.
Q	Spike recovery and RPD control limits do not apply resulting from the parameter concentration in the sample exceeding the spike concentration by a factor of four or greater.
SG	The sample extract was subjected to Silica Gel treatment prior to analysis.
X	% Recovery and/or RPD out-of-range.
Z	Analyte presence was not confirmed by second column or GC/MS analysis.

Solid - Unless otherwise indicated, solid sample data is reported on a wet weight basis, not corrected for % moisture. All QC results are reported on a wet weight basis.

Any parameter identified in 40CFR Part 136.3 Table II that is designated as "analyze immediately" with a holding time of <= 15 minutes (40CFR-136.3 Table II, footnote 4), is considered a "field" test and the reported results will be qualified as being received outside of the stated holding time unless received at the laboratory within 15 minutes of the collection time.

A calculated total result (Example: Total Pesticides) is the summation of each component concentration and/or, if "J" flags are reported, estimated concentration. Component concentrations showing not detected (ND) are summed into the calculated total result as zero concentrations.

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ERM-West, Inc. • Sacramento, CA

CHAIN OF CUSTODY RECORD

Lab Job # 1058

PROJECT #	PROJECT NAME:	LOCATION:
0231727.02	Phase I ESA	Lodi, CA

SAMPLER'S NAME: (Print) Lindsay Capitanich (Signature) Lindsay Capitanich

RECEIVING LABORATORY: Calscience 7440 Lincoln Way, Garden Grove, Ca 92841

ANALYSIS REQUIRED

14-01-1762

Sample ID	DATE	TIME	SAMPLE TYPE	Total # of Bottles	Number of Preserved Bottles: HCl	NaOH	NHNO3	H2SO4	None	NHNO4	MEOH	Encore	Chlorinated Herbicides (8151A)	Organochlorine Pesticides (8081A)	Field Filtered	Field Filtered	Field Filtered	Field Filtered	Comments
1 B-1	1/29/14	1000	SO	1					X				X	X					
2 B-2		1015	SO	1					X				X	X					
3 B-3		1040	SO	1					X				X	X					
4 B-4		1105	SO	1					X				X	X					

Sample Type Codes

SO	Soil
W	Water
V	Vapor

Relinquished By (Signature)	DATE / TIME	Received By (Signature)	Relinquished By (Signature)	DATE / TIME	Received By (Signature)
Lindsay Capitanich	1/29/14 1600				
				1/30/14 1040	

Relinquished By (Signature)	DATE / TIME	Destroyed or shipped for return to site for: (Signature)	DATE / TIME

REMARKS:
Send Report to:
bailey.blosser@erm.com and
Lindsay.Capitanich@erm.com

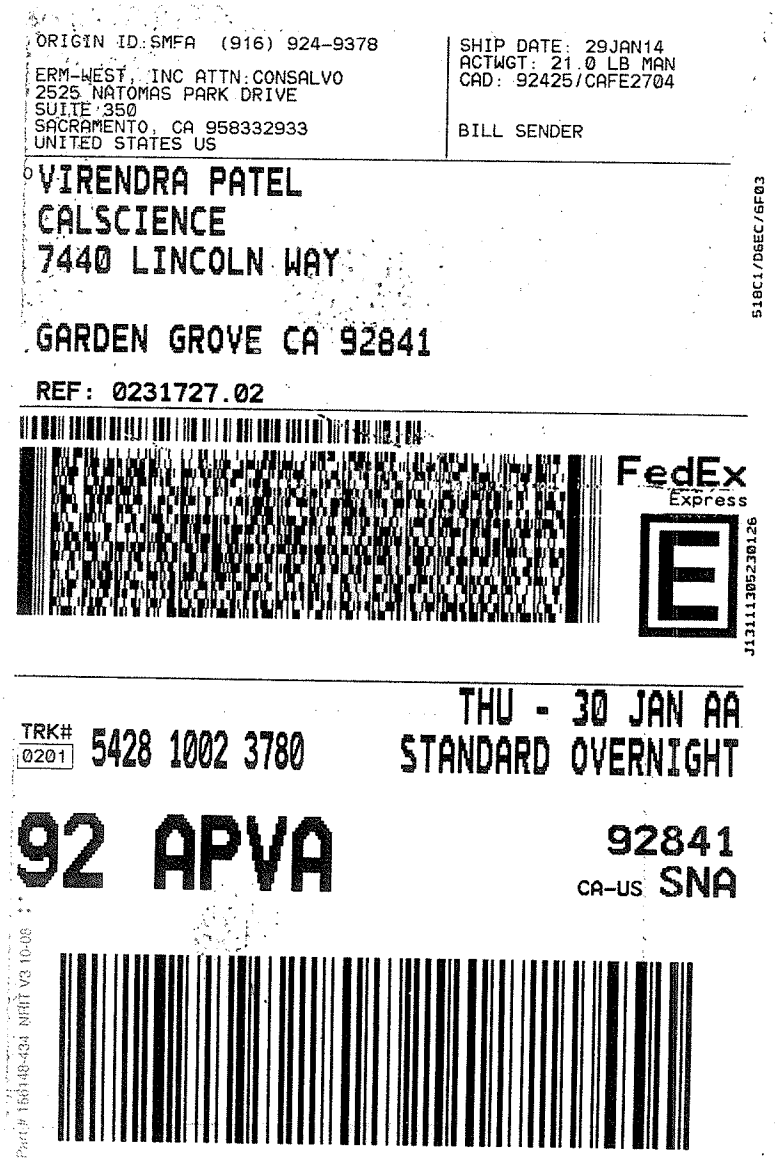
Distribution: **Original** – Accompanies Shipment; **Copy** – to Project Manager

X Standard Turnaround Time
____ 24 Hour Turnaround Time
____ Special Turnaround Time
____ Geotracker EDF Required
____ EDD Required
EDD Format ____
Global ID: ____

ERM-West, Inc.
2525 Natomas Park Drive, Suite 350
Sacramento, CA 95833
Phone: 916-924-9378
Fax: 916-920-9378

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FTH2



ORIGIN ID:SMFA (916) 924-9378

ERM-WEST, INC ATTN:CONSALVO
2525 NATOMAS PARK DRIVE
SUITE 350
SACRAMENTO, CA 958332933
UNITED STATES US

SHIP DATE: 29JAN14
ACTWGT: 21.0 LB MAN
CAD: 92425/CAFE2704

BILL SENDER

VIRENDRA PATEL
CALSCIENCE
7440 LINCOLN WAY

GARDEN GROVE CA 92841

REF: 0231727.02

516C1/D6EC/6F03

FedEx Express

J13111305230126

TRK# 0201 5428 1002 3780

THU - 30 JAN AA
STANDARD OVERNIGHT

92 APVA

92841
CA-US SNA

Part # 156148-434 NRIT V3 10-08

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Calscience Environmental Laboratories, Inc.

WORK ORDER #: 14-01-1761

SAMPLE RECEIPT FORM

Cooler 1 of 1

CLIENT: ERM

DATE: 01/30/14

TEMPERATURE: Thermometer ID: SC1 (Criteria: 0.0 °C – 6.0 °C, not frozen except sediment/tissue)

Temperature 2.8 °C - 0.3 °C (CF) = 2.5 °C ☑ Blank ☐ Sample

☐ Sample(s) outside temperature criteria (PM/APM contacted by: _____).

☐ Sample(s) outside temperature criteria but received on ice/chilled on same day of sampling.

☐ **Received at ambient temperature, placed on ice for transport by Courier.**

Ambient Temperature: ☐ Air ☐ Filter **Checked by:** LS

CUSTODY SEALS INTACT:

☐ Cooler ☐_____ ☐ No (Not Intact) ☑ Not Present ☐ N/A **Checked by:** LS

☐ Sample ☐_____ ☐ No (Not Intact) ☑ Not Present **Checked by:** SM6

SAMPLE CONDITION:	Yes	No	N/A
Chain-Of-Custody (COC) document(s) received with samples	☑	☐	☐
COC document(s) received complete	☑	☐	☐
☐ Collection date/time, matrix, and/or # of containers logged in based on sample labels.			
☐ No analysis requested. ☐ Not relinquished. ☐ No date/time relinquished.			
Sampler's name indicated on COC	☑	☐	☐
Sample container label(s) consistent with COC	☑	☐	☐
Sample container(s) intact and good condition	☑	☐	☐
Proper containers and sufficient volume for analyses requested	☑	☐	☐
Analyses received within holding time	☑	☐	☐
Aqueous samples received within 15-minute holding time			
☐ pH ☐ Residual Chlorine ☐ Dissolved Sulfides ☐ Dissolved Oxygen	☐	☐	☑
Proper preservation noted on COC or sample container	☐	☐	☑
☐ Unpreserved vials received for Volatiles analysis			
Volatile analysis container(s) free of headspace	☐	☐	☑
Tedlar bag(s) free of condensation	☐	☐	☑

CONTAINER TYPE:

Solid: ☐4ozCGJ ☐8ozCGJ ☐16ozCGJ ☑Sleeve (S) ☐EnCores® ☐TerraCores® ☐_____

Aqueous: ☐VOA ☐VOA**h** ☐VOA**na$_2$** ☐125AGB ☐125AGB**h** ☐125AGB**p** ☐1AGB ☐1AGB**na$_2$** ☐1AGB**s**

☐500AGB ☐500AGJ ☐500AGJ**s** ☐250AGB ☐250CGB ☐250CGB**s** ☐1PB ☐1PB**na** ☐500PB

☐250PB ☐250PB**n** ☐125PB ☐125PB**znna** ☐100PJ ☐100PJ**na$_2$** ☐_____ ☐_____ ☐_____

Air: ☐Tedlar® ☐Canister **Other:** ☐_____ **Trip Blank Lot#:**_____ **Labeled/Checked by:** SM6

Container: **C:** Clear **A:** Amber **P:** Plastic **G:** Glass **J:** Jar **B:** Bottle **Z:** Ziploc/Resealable Bag **E:** Envelope **Reviewed by:** SM

Preservative: **h:** HCL **n:** HNO_3 **na$_2$:** $Na_2S_2O_3$ **na:** NaOH **p:** H_3PO_4 **s:** H_2SO_4 **u:** Ultra-pure **znna:** $ZnAc_2$+NaOH **f:** Filtered **Scanned by:** SM

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Appendix B
QA/QC Memorandum

Memorandum

Environmental Resources Management

One Lakeshore Centre
3281 E. Guasti Road
Suite 300
Ontario, CA 91761
(909) 947-3500
(909) 947-3499 (fax)

To: Lindsay Capitanich

From: Jerry Rosby

Date: 11 February 2014

Subject: Data Review of Phase I ESA Lodi, CA Soil Samples Collected 29 January 2014

Project Number: 0231727.02

Data Package: Calscience Environmental Laboratories, Inc. Data Package: 14-01-1762

The quality of the data was assessed and any necessary qualifiers were applied following the *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review,* October 1999.

HOLDING TIME AND PRESERVATION EVALUATION

The samples were prepared and analyzed within the method prescribed time period from the date of collection. The sample shipments were received at the laboratory within the method prescribed temperature preservation requirements. None of the data were qualified based on holding time or temperature preservation exceedances.

BLANK EVALUATION

The method blank sample results were nondetected for each of the target analytes. None of the data required qualification based on blank results.

BLANK SPIKE EVALUATION

The laboratory control sample (LCS) recoveries were within the laboratory's limits of acceptance. The LCS recoveries indicate acceptable laboratory accuracy and precision.

MATRIX SPIKE EVALUATION

Project sample *B-4* was used for the matrix spike (MS)/matrix spike duplicate (MSD) analyses. The MS/MSD recoveries were within the laboratory's limits of acceptance, indicating acceptable laboratory accuracy and precision and minimal matrix interference.

SURROGATE SPIKE EVALUATION

The surrogate recoveries were within acceptable limits. No qualifications to the data were made. The surrogate recoveries indicate minimal matrix interference in the samples.

OVERALL ASSESSMENT

No data required rejection. All of the data can be used for decision-making purposes. The quality of the data generated during this investigation is acceptable for the preparation of technically defensible documents.